

# EUROPEAN JOURNAL OF PHYSICAL AND REHABILITATION MEDICINE

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European Society of Physical and Rehabilitation Medicine (ESPRM)  
European Union of Medical Specialists - Physical and Rehabilitation Medicine Section (UEMS - PRM)  
*In association with*  
International Society of Physical and Rehabilitation Medicine (ISPRM)

## WHITE BOOK ON PHYSICAL AND REHABILITATION MEDICINE IN EUROPE

European Physical and Rehabilitation Medicine Bodies Alliance



EDIZIONI MINERVA MEDICA

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# White Book on Physical and Rehabilitation Medicine in Europe

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# White Book on Physical and Rehabilitation Medicine in Europe Introductions, Executive Summary, and Methodology

European Physical and Rehabilitation Medicine Bodies Alliance

## ABSTRACT

The White Book (WB) of Physical and Rehabilitation Medicine (PRM) in Europe is produced by the 4 European PRM Bodies (European Academy of Rehabilitation Medicine – EARM, European Society of PRM – ESPRM, European Union of Medical Specialists – PRM Section, European College of PRM-ECPRM served by the European Union of Medical Specialists-PRM Board) and constitutes the reference book for PRM physicians in Europe. It has now reached its third edition; the first was published in 1989 and the second in 2006/2007. The WB has multiple purposes, including providing a unifying framework for European countries, to inform decision-makers on European and national level, to offer educational material for PRM trainees and physicians and information about PRM to the medical community, other rehabilitation professionals and the public.

The WB states the importance of PRM, a primary medical specialty that is present all over Europe, with a specific *corpus disciplinae*, a common background and history throughout Europe. PRM is internationally recognized and a partner of major international bodies, including the World Health Organization (WHO). PRM activities are strongly based on the documents of the United Nations (UN) and WHO, such as the Convention of the Rights of Persons with Disabilities (2006), the World Report on Disability (2011), the WHO Global Disability Action Plan 2014-2021 (2014) and the WHO initiative “Rehabilitation 2030: a call for action” (2017).

The WB is organized in 4 sections, 11 chapters and some appendices. The WB starts with basic definitions and concepts of PRM and continues with why rehabilitation is needed by individuals and society. Rehabilitation focuses not only on health conditions but also on functioning. Accordingly, PRM is the medical specialty that strives to improve functioning of people with a health condition or experiencing disability. The fundamentals of PRM, the history of the PRM specialty, and the structure and activities of PRM organizations in Europe are presented, followed by a thorough presentation of the practice of PRM, *i.e.* knowledge and skills of PRM physicians, the clinical field of competence of PRM, the place of the PRM specialty in the healthcare system and society, education and continuous professional development of PRM physicians, specificities and challenges of science and research in PRM. The WB concludes with the way forward for the specialty: challenges and perspectives for the future of PRM.

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**Key words:** Physical and Rehabilitation Medicine - Europe - Functioning - Disability.

## Foreword

The first edition of the White Book (WB) of PRM in Europe was written with the ambition of becoming a working instrument that would enable health sector authorities and teachers of medicine to take the necessary regulatory steps towards compulsory inclusion of PRM in medical studies, as well as to achieve effective, optimized harmonization of training of specialists in PRM in Europe.

The second edition of the WB of PRM in Europe aimed to ensure that PRM is seen as a significant European medical specialty, where high quality practitioners ensure good standards of care, practice based on scientific evidence and within their respective national contexts. This is achieved by defining the PRM special-

ty, its work, the competencies of its practitioners and its relationships to other medical disciplines and allied health professions.

Both editions of the White Book of PRM in Europe were well received not only by health professionals but also by policymakers who have widely used the information contained in the White Book for organizing rehabilitation delivery. Ten years after the release of the second edition, the European PRM bodies consider it timely to update the content of the White Book in order to illustrate how the specialty has developed and how recent trends are influencing practice.

The third edition of the White Book of PRM in Europe is produced by the European PRM Bodies Alliance (UEMS PRM Section, European College of PRM served by the UEMS PRM Board, ESPRM and EARM).



As the result of a joint effort by the representatives of these PRM bodies who are responsible for setting standards for PRM clinical practice, education, and scientific research in Europe, the White Book reflects different aspects essential for the development of appropriate, widely accessible, and sustainable rehabilitation care. It serves as the reference book for PRM physicians in Europe that guide their interactions with individuals with disability, with colleagues in other medical disciplines and health allied professionals, as well as in negotiations with respective national governments and national health system authorities.

This third edition of the White Book of PRM in Europe aims at:

- describing the work of the PRM specialty and its PRM physicians in a changing world of health care systems and shrinking resources;
- reacting and contributing to medical innovation;
- developing strategies to meet the challenge of scientific and technological advances;
- dealing with changing perspectives of disability;
- promoting and facilitating the autonomy of people with disabilities and their participation in everyday life;
- establishing itself as a reference for PRM practice and academic life for young health professionals (especially medical doctors in training);
- emphasizing a European perspective.

The White Book is organized in four sections, 11 chapters and some appendices. It is a “collective effort” by all delegates and members of the European Bodies. Its thoughtful and practical structure meticulously adhered to by the editors under the coordination of Prof. Stefano Negrini, will contribute to the White Book’s impact and successful implementation in PRM practice in Europe.

We wish to use this opportunity to congratulate all the authors who have contributed to the content of this important publication.

On behalf of the European PRM Bodies Alliance,  
the Presidents of the European PRM Bodies:

Xanthi Michail (European Academy of Rehabilitation Medicine)

Alain Delarque (European Society of Physical  
and Rehabilitation Medicine)

Nicolas Christodoulou (Physical and Rehabilitation Medicine)

Section of the European Union of Medical Specialists)

Maria Gabriella Ceravolo (European College of Physical  
and Rehabilitation Medicine)

## Preface

The White Book (WB) of Physical and Rehabilitation Medicine (PRM) in Europe has served as the reference book for PRM physicians in Europe since 1989, when the first edition was published by the Universidad Complutense of Madrid <sup>1</sup> upon the initiative of the European Academy of Rehabilitation Medicine (EARM), the Section of Physical Medicine and Rehabilitation of the European Union of Medical Specialists (UEMS), and the European Federation of Physical Medicine and Rehabilitation (EFPMR). This first edition is now of historical value, not only because the world has changed considerably since then, PRM has also evolved. Particularly, the terms of reference for the specialty has changed, reflecting the conceptual evolution of health according to World Health Organization’s (WHO) classifications — first in 1980 with the International Classification of Impairment, Disability and Health (ICIDH) <sup>2</sup> and then in 2001 with the International Classification of Functioning, Disability and Health (ICF).<sup>3</sup> This evolution is testified by the name of the specialty, now called PRM. Accordingly, the European Bodies involved have also changed: they now comprise the European Academy of Rehabilitation Medicine (EARM — ethical and “philosophical” function), the European Society of PRM (ESPRM — scientific function), the European Union of Medical Specialists Section (professional function) and the European College of PRM (served by UEMS PRM Board - educational function).

They produced the second edition in 2006, published at that time by Europa Medicophysica (now European Journal of PRM) <sup>4</sup> and the Journal of Rehabilitation Medicine.<sup>5</sup> In this third edition, the European PRM Bodies have come together under the umbrella name “European PRM Bodies Alliance,” to state a collaboration that has existed and has been growing for many years. The Alliance holds the intellectual property and copyrights for the WB as well as for its editions in the various languages.

Since the second edition of the WB, the United Nations (UN) Convention on the Rights of Persons with Disabilities (referred to “Convention” from now on) <sup>6</sup> has implemented the important Article 26 “Habilitation and Rehabilitation”.<sup>7</sup> For first time, rehabilitation is defined as one of the most important interventions to

“enable persons with disabilities to attain and maintain maximal independence, full physical, mental, social and vocational ability and full inclusion and participation in all aspects of life.” Consequently, the Convention urged sovereign states to “organise, strengthen and extend comprehensive habilitation and rehabilitation services and programs, particularly in the areas of health, employment, education and social services.” This Article also included “the development of initial and continuing training for professionals and staff working in habilitation and rehabilitation services.” For PRM, there are two important messages, which are: 1) access to rehabilitation is a human right and 2) training of highly qualified rehabilitation professionals are keys to contributing to the Convention’s goals.

Responding the Convention, WHO and the World Bank produced the World Report on Disability<sup>8</sup> in 2011, which relied on scientific evidence for the first time to describe the life experiences and situation of persons with disability and from which relevant recommendations were made. One of the main findings was that the prevalence of disability is higher than expected (amounting to around 15% of the world population). The WRD highlighted the contribution of rehabilitation to “a person achieving and maintaining optimal functioning in interaction with their environment.” The report described “Rehabilitation Medicine” as being “concerned with improving functioning through the diagnosis and treatment of health conditions, reducing impairments, and preventing or treating complications” and it highlighted the role of medical doctors with specific expertise in medical rehabilitation called “physiatrists, rehabilitation doctors, or physical and rehabilitation medicine specialists.” It also recognized that “Rehabilitation Medicine has shown positive outcomes, for example, in improving joint and limb function, pain management, wound healing, and psychosocial well-being”.

This “new” perspective of rehabilitation and PRM is underscored by the WHO Global Disability Action Plan 2014-2021, “Better Health for All People with Disabilities”, with its objective to “strengthen and extend rehabilitation, habilitation, assistive technology, assistance and support services, and community-based rehabilitation.” One of the success indicators for these goals is “the number of graduates from educational institutions per 10,000 people — by level and field of education”. In this indicator, PRM is explicitly mentioned.<sup>9</sup>

During the WB’s preparation, WHO launched “Rehabilitation 2030: a call for action”<sup>10</sup> in February 2017 involving over 200 stakeholders and at which the WHO Recommendations on rehabilitation in health systems were presented. These initiatives are meant to:

- draw attention to the increasing unmet needs for rehabilitation in the world;
- highlight the role of rehabilitation in achieving the Sustainable Development Goals proposed by the United Nations; and
- call for coordinated and concerted global action towards strengthening rehabilitation in health systems.

Common to all of these initiatives, the training of PRM physicians and improvements in the quality of care are internationally agreed goals to improve health-related rehabilitation services and to enable persons with health conditions experiencing, or likely to experience, disability to achieve and maintain optimal functioning in interaction with their environment. The European PRM Bodies have adopted these goals and this third edition of the WB on PRM in Europe aims to contribute to achieving these goals.

The objective of the WB is thus to describe from a European perspective, the work of the specialty of PRM and of PRM physicians in:

- a changing world of health care systems and shrinking funding;
- reacting and contributing to medical progress and technological innovation;
- developing strategies to meet the challenge of scientific and technological advances;
- dealing with changing perspectives of disability;
- promoting and facilitating the autonomy and participation of persons with disabilities in everyday life;
- being a didactic reference for PRM practice and academic life for young health professionals (especially medical doctors in training).

Consequently, the WB has multi-faceted values that start from the educational role for PRM physicians in training, to the unifying function for European states and to the political utility facing governments across Europe and the EU. These are important for PRM, whose role is sometimes not well understood, particularly from the perception of those outside the specialty. PRM is continually collaborating with other specialties and other rehabilitation professionals on health, education and research activities. This book

aims to clarify the role of PRM in collaboration with other:

- medical specialties on treating patients with health conditions that cross discipline lines, with consideration of PRM's focus on activity and participation;
- rehabilitation professionals who also address activity and participation problems experienced by patients, while keeping its unique medical role in diagnosis, functional assessment and prognosis and team management.

PRM is an independent primary medical specialty, present in almost all European countries, with specific specialist competences and a common background and history. Moreover, PRM is internationally recognized and a partner of major international bodies, including WHO, lending PRM influence in the UN's and WHO's activities. In light of this, the publication of the WB by all of the European PRM bodies is valuable for persons (especially those with a disability) living in Europe, for European PRM as a specialty, for healthcare planners and policymakers and for society in general.

All of these concepts as well as some new concepts will be expanded in this latest edition of the WB. This edition of the WB is much more of a "collective effort" compared to the previous editions — as already mentioned, the European PRM Bodies Alliance was established and its collaborative efforts brought this new edition of the WB to fruition. There is also a new methodological chapter outlining the methodology that guided the development of content in each chapter of the WB. Furthermore, the historical chapter reflects the aforementioned developments, and a conceptualization of the fundamentals of PRM as a specialty is introduced.

The WB is presented in four sections (the background of PRM, its organization and practice in Europe and the conclusions) with appendices (including the methods section). The WB starts with basic definitions (the concepts and the specialty) before looking at the relevance of rehabilitation to people with disabling conditions and to society (*i.e.* why it is needed). General rehabilitation, that is not specifically medical, is then introduced, followed by a transition to describing PRM, the medical specialty devoted to rehabilitating patients and persons with disabilities. The definition of PRM as a primary medical specialty (the core concepts) is presented along with its development (where PRM comes from) and organization (PRM activities and their representation) in

Europe. Moving to practice, the fundamentals of PRM (knowledge, skills and abilities of PRM physicians), the field of competence (PRM in practice) and the place in healthcare systems and society are discussed. Education of PRM in Europe (shaping the future) and science and research in PRM (challenges and specificities) are also reported before reaching the conclusions: the way forward for PRM in Europe (challenges and perspectives for the future).

This edition of the WB is a further important step for the future of the specialty of PRM, in Europe and beyond. It results from the work of the following stakeholders (also see the acknowledgment section in the appendix).

- the initiative and authorship of the 4 European PRM Bodies joined in a single productive Alliance,
- the coordination of 11 editors,
- the efforts of 38 first authors and 63 co-authors to produce 62 individual contributions,
- the voluntary work of 38 internal and 39 external reviewers,
- the consensus of 241 delegates and academicians of 36 European countries reached in 30 months of work.

The editors of the 3<sup>rd</sup> Edition of the White Book:  
Stefano Negrini, Pedro Cantista, Maria Gabriella Ceravolo,  
Nicolas Christodoulou, Alain Delarque,  
Christoph Gutenbrunner, Carlotte Kiekens,  
Saša Moslavac, Enrique Varela-Donoso,  
Anthony B. Ward, Mauro Zampolini

## Executive summary

### Overview

The third edition of the White Book (WB) of Physical and Rehabilitation Medicine (PRM) in Europe is produced by the European PRM Bodies Alliance including the European Academy of Rehabilitation Medicine (EARM), the European Society of PRM (ESPRM), the European Union of Medical Specialists (UEMS) PRM Section and the European College of PRM (served by the UEMS-PRM Board). It is the reference book for PRM physicians in Europe. It is dedicated to provide comprehensive information about PRM that is relevant for PRM physicians, other health professionals, health

care planners and other stakeholders, including those in European national governments. It also informs European governing bodies and the general public.

The WB informs about the importance of PRM for the individual patient or person experiencing disability and for society as a whole. It describes how PRM is a primary medical specialty, present in almost all European countries, with specific core competences and a common background and history throughout Europe.

The scope of PRM and its role in rehabilitation has a strong basis in the documents of the United Nations (UN) and World Health Organization (WHO), like WHO's International Classification of Functioning, Disability and Health (ICF) (2001), the UN Convention on the Rights of Persons with Disabilities (2006), the World Report on Disability (2011), the WHO Global Disability Action Plan 2014-2021 (2014) and the WHO initiative "Rehabilitation 2030: a call for action" (2017). PRM organizations are internationally recognized and have been working as a partner of major international organizations like the WHO.

The White Book has four sections and is presented in a series of 11 chapters, and appendices (that includes methodological notes). It starts by explaining basic definitions and concepts of PRM, the relevance of PRM for people and society and the definitions of disability and rehabilitation. It presents PRM as a primary medical specialty, its development and its organization in Europe. Knowledge and skills of PRM physicians, its field of competence and its position and role in health-care systems are discussed. Furthermore, principles of education and training as well as science and research are also described. Last but not least, the challenges and future perspectives for PRM in Europe are addressed.

### *Definitions and basic concepts of PRM*

PRM is the primary medical specialty responsible for education and training patients and health care providers, health promotion, prevention, medical diagnosis, functional assessment, treatment and rehabilitation management of persons of all ages experiencing disabling health conditions and their co-morbidities. PRM physicians treat health conditions, impairment of physical, mental and cognitive functions, as well as activity limitations. PRM physicians aim at improving participation and quality of life of their patients. This

also includes improving health behavior and promoting the positive influence of personal and environmental factors on functioning.

The profile of PRM includes the following:

- PRM is a person- and functioning-oriented medical specialty (contrary to the organ- and disease-oriented specialties or specialties that focus on specific age groups).

- PRM physicians have medical responsibilities and additional competences in setting-up a functional assessment.

- PRM physicians can directly provide treatments, and/or lead the multi-professional rehabilitation team that works in a collaborative way with other disciplines.

- PRM has a multimodal approach including a wide range of treatment tools (including medicines, exercises, physical modalities and other rehabilitation interventions, some of which provided by other rehabilitation professionals).

- PRM treats the individual's health conditions focusing on reducing impairments and activity limitations in order to empower patients to achieve full participation.

- PRM has a transversal role and collaborates with all other specialties.

PRM is focused on the person and not on a specific disease or setting, thus PRM physicians collaborate with many other medical specialists and health professionals and have a role in different health care settings (e.g. acute and/or post-acute rehabilitation hospitals, rehabilitation centres, out-patient services, community services). PRM physicians take care of persons experiencing disabilities and patients with long-term health conditions but also acute dysfunction to prevent secondary impairments.

As recently underlined by the WHO with "Rehabilitation 2030 — A call for action", the relevance of PRM for society has increased as a result of the ageing population and growing number of people experiencing disability. Thus, any planning of services has to take into account the burden of disability within the society and should include PRM services at all levels of care.

### *Organization and history of PRM in Europe*

Historically, PRM developed from some main streams throughout Europe. One is the use of physical agents (water, heat, cold, massage, joint manipulations,

physical exercise, etc.) (Physical Medicine). Another one the practice of rehabilitation that gained importance due to the survivals of wounded in the 2<sup>nd</sup> World War, as well as to various epidemics (*e.g.* poliomyelitis) (Rehabilitation Medicine). In some countries, it developed in relation with other medical specialties like neurology, rheumatology, orthopedic medicine, radiology, but also cardiology, pneumology, or paediatrics, with the specificity of primarily looking at functioning of patients with these health conditions. In other countries, it started in specific settings like balneology or sports medicine. Nowadays, due to the commonalities among all these streams, they converged in the single PRM multidimensional specialty.

For a uniform definition and positioning in Europe, different organizations of PRM have been created: the EARM, the ECPRM, the ESPRM; and the PRM Section of the UEMS. Nowadays such a uniform definition of the specialty exists in Europe, which is concordant with the internationally accepted description of PRM (based on the ICF-model).

Additionally, regional fora, such as the Mediterranean Forum of PRM and the Baltic and North Sea Forum of PRM, have been established and national PRM societies exist in most European countries. They take an important role to develop PRM at the interface of Europe with neighbouring regions as well as at national levels. The European PRM associations also take a strong role in related activities across the world.

Moreover, research in PRM has been significantly improved and the number of PRM journals increased (many of them indexed in international data bases and with impact factor), and scientific congresses and courses developed. Last but not least, the recent creation of the Cochrane Rehabilitation field will also give a great boost to this primary medical specialty.

### *Practice of physical and rehabilitation medicine in Europe*

From a physiological perspective, the fundamental principles of PRM include physical and behavioral mechanisms including:

- repairing processes and functional adaptation (incl. tissue regeneration, improvement of functional capacity, training processes etc.) as well as supporting recovery processes;

- learning processes and behavioural change (incl. patient education and teaching new motor and behavioural strategies);

- compensatory processes both at the physical mental and intellectual levels as well assistive technologies and environmental adaptations.

Additionally, PRM physicians have management skills and play a role in supporting people to manage their resources to achieve optimal participation (including giving advice to their families and caregivers). Furthermore, PRM physicians have a high level of communication skills in order to teach, inform and educate patients and their relatives.

The clinical work of PRM physicians can be characterized as the “medicine of functioning”. Its core health strategy is rehabilitation aiming at optimizing functioning in light of health conditions. However, PRM physicians also use curative (to cure the disease), preventive (to prevent disease and/or complications and progression) and supportive strategies (aiming at maintaining optimal functioning). Clinical PRM processes are following the so-called rehabilitation cycle (all patients require an assessment with definition of their individual goals before providing the intervention; finally, an evaluation will be performed to check if the patient has achieved all what is needed, or if it is necessary to start again the rehabilitation cycle).

The spectrum of diseases treated by PRM physicians is extremely wide as many health conditions are associated with some form of disability. This includes diseases in musculoskeletal, nervous, circulatory, respiratory, urogenital system as well as to the skin and the digestive tract. PRM clinical activities also relate to some most common problems across diseases such as immobilization, spasticity, pain, communication disorders and others.

The diagnosis in PRM is a combination between the medical diagnosis (diagnosis of the disease) and the PRM specific functional assessment (assessment of functioning). The latter is based on the ICF conceptual framework, and obtained through functional evaluations and scales.

PRM physicians may apply a wide range of interventions, ranging from medications, exercises, manual therapies, physical modalities, technical aids, educational programs and environmental adaptations. Standardized PRM programs have been developed

for many health conditions and functioning problems based on scientific evidence and providing best practice models.

PRM interventions and programs are always patient-centered, and outcomes include functioning and personal dimensions (reducing impairments, activity limitations, and participation restrictions). They also aim at reducing costs as well as decrease in mortality for certain groups of patients. PRM programs in most cases are delivered by the multi-professional rehabilitation teams in a collaborative way with other disciplines, under the leadership of PRM physicians.

As numerous documents and reports from WHO and the UN call for the strengthening of rehabilitation as a key health strategy of the 21<sup>st</sup> century worldwide, further implementation of PRM in healthcare systems is crucial. Within this context, PRM should be provided along the whole continuum of care and at all levels of health care aiming at appropriate services functioning needs of the individual as well as on temporal aspects of a health condition (congenital or acquired, and acute, progressive or degenerative). This includes aspects of habilitation, rehabilitation as well as PRM in acute settings, in post-acute and in long-term settings.

#### *Education and training in PRM*

To achieve a good rehabilitation approach as needed by the European societies, all physicians and health professionals should receive an adequate undergraduate education. To acquire the wide field of competence needed, PRM physicians have to undergo a well organized and appropriately structured postgraduate training of adequate duration. Besides achieving medical knowledge, competencies in patient care, specific procedural skills, and attitudes towards interpersonal relationship and communication, profound understanding of the main principles of medical ethics and public health, ability to apply policies of care and prevention for people with disabilities, capacity to master strategies for reintegration of disabled people into society, apply principles of quality assurance and promote a practice-based continuous professional development. At the European level, recommendations and standards required are provided by the UEMS-PRM Board. Last but not least, continuing professional development and medical education programs are provided by the European PRM

bodies (in collaboration with the European Accreditation Council of Continuous Medical Education).

#### *Science and research in the field of PRM*

Related to the wide spectrum of tasks of PRM, science and research in PRM also has a wide scope of topics. It ranges from basic research in mechanisms of disease and disability, mechanisms of action of interventions, studies on clinical outcomes, epidemiological studies as well as scientific approaches of the implementation of PRM services in health systems and developing the theoretical background on disability and rehabilitation. This is reflected in the topics of European and international congresses and PRM journals. However, the current situation of science and research activities in PRM in Europe is facing new possibilities and challenges.

The importance of rehabilitation research is defined, and its peculiar methodology due to the problem to bridge the gap between biology and behavior and facing topics like the relationship between biomedicine and PRM and PRM outcome research. PRM also has to face the challenges of Evidence Based Medicine that are also dealt with in the new Cochrane Rehabilitation Field. Finally, the transfer of scientific knowledge into clinical practice is of major importance.

#### *The way forward*

Challenges and future perspectives of PRM in Europe are emerging from the dramatic changes in demography, life expectancy, survival rates, disability burden, increasing prevalence of long-term health conditions, progress in technology, but also health costs and society changes in terms of requirements of wellness and quality of life together with health. All these challenges combine with the specificities of PRM, that is the medical specialty focusing on the whole person and his or her functioning in the various health conditions, with the aim to guarantee the best possible participation through improvement of activities and reduction of impairments. The possible consequences of these changes in the future evolution of PRM clinical practice, services, education, research are presented; moreover, the vision on the progress to harmonization of the development of PRM across Europe, and the possible contribution of PRM to policy planning are presented.

## Introduction

The White Book (WB) sets out the nature, area of work and parameters of Physical and Rehabilitation Medicine (PRM) in Europe. It describes the specialty and the competencies expected of fully trained specialists (PRM physician) in the field, as well as the clinical context of the work and the nature of education and specialist training. The book builds on the two previous editions of WB, which appeared in 1989<sup>1</sup> and in 2006/2007.<sup>4, 5</sup>

The WB primarily targets five groups:

- PRM physicians and other rehabilitation professionals;
- health care professionals in other medical specialties and professions allied to medicine
- PRM residents, medical and other rehabilitation professional students
- policy makers and planners in healthcare, rehabilitation and disability issues
- the general public and, in particular, persons with disabilities and representatives of their organizations.

The European medical community is continuously enlarging and this offers further opportunities and challenges, particularly from the East of the continent to learn what the PRM European community is doing by developing specific projects with the PRM Section of the European Union of Medical Specialists (UEMS) and the European Society of PRM (ESPRM). This publication seeks to assist the process of harmonization of specialist PRM activity to help ensure that persons experiencing disabilities are well served by the specialty irrespective of where they live in this enlarged community. The WB is offered to the PRM community across the world as a reference, even in the face of different situations and challenges.

Healthcare is undergoing great changes both at European and at national levels. The general public has increasing expectations of medical care, which mirror the philosophical debate about human rights and responsibilities across society, particularly in relation to the full participation of persons with disabilities. Medical practice is continually evolving, with the improvement in clinical standards and the need for excellence through continuing professional development, revalidation and enhancement of specialist training. As the need for greater competency increases, it is important for PRM to re-define what it is, what it can offer, how it can best

deliver its services and expertise, and what standards of training should be demanded of entrants into the specialty. This book aims to respond to these requirements.

The text is presented in four parts (the background of PRM, its organization and practice in Europe and the conclusions) with appendices (including the methods section). The contents start with basic definitions (the concepts and the specialty) before looking at the relevance of rehabilitation to people with disabling conditions and to society (*i.e.* why it is needed). The text then moves from general rehabilitation, that is not specifically medical, to PRM, which is the medical specialty devoted to rehabilitating patients and persons with disabilities. The definition of PRM as a primary medical specialty (the core concepts) is presented along with its development (where PRM comes from) and organization (PRM activities and their representation) in Europe. Moving to practice, the fundamentals of PRM (knowledge, skills and abilities of PRM physicians), the field of competence (PRM in practice) and the place in healthcare systems and society are discussed. Education of PRM in Europe (shaping the future) and science and research in PRM (challenges and specificities) are also reported before reaching the conclusions: the way forward for PRM in Europe (challenges and perspectives for the future).

## Methodology of the third edition of the WB of PRM in Europe

The 3<sup>rd</sup> edition of the White Book (WB) of Physical and Rehabilitation Medicine (PRM) in Europe has been developed according to a specific methodology in order to achieve the most consistent and true representation of the text. It has been produced and approved by all delegates and academicians of the European PRM Bodies Alliance. All delegates are officially nominated by their national competent authorities or national societies and consulted the members of their relevant authorities during the process. Consequently, the WB represents the views of the whole PRM European community. Its production has been a truly collective effort involving the 4 European PRM Bodies, 11 editors, 38 first authors, 63 co-authors, 38 internal and 39 external reviewers, 241 delegates and academicians, representing 36 PRM societies in the continent.

During 2014 the idea of a new edition of the WB was

proposed inside the European Academy of Rehabilitation Medicine (EARM) and a discussion was started inside the other European PRM Bodies: the European Society of PRM (ESPRM) and the European Union of Medical Specialists (UEMS) PRM Section and Board. According to the methods of work of the Bodies, motions were proposed and were all unanimously approved throughout the process.

Among the first decisions was the creation of a Steering Committee, including 2 members per European Body. The Steering Committee included:

- Stefano Negrini (UEMS PRM Section) – Coordinator;
- Saša Moslavac (UEMS PRM Board) – Secretary;
- Pedro Cantista (ESPRM),
- Gordana Devečerski (ESPRM),
- Alvydas Juocevicius (UEMS-PRM Board),
- Christoph Gutenbrunner (EARM),
- Enrique Varela-Donoso (UEMS-PRM Section),
- Anthony B. Ward (EARM).

The Steering Committee met regularly and proposed the main motions to be approved. At all stages the Presidents and Secretaries of the Societies have been involved. They have been:

- EARM: Guy Vanderstraeten and Xanthi Michail (Presidents), and Angela McNamara (Secretary)
- ESPRM: Xanthi Michail and Alain Delarque (Presidents), Elena Ilieva and Carlotte Kiekens (Secretaries)
- UEMS PRM Section: Nicolas Christodoulou (President), Mauro Zampolini (Secretary)
- UEMS PRM Board (for the College): Alvydas Juocevicius and Maria Gabriella Ceravolo (Presidents), Nikolaos Barotsis (Secretary)

In the first semester of 2015 the need of a new edition (3<sup>rd</sup>) of the WB, due to the many changes in the European Societies, and consequently in PRM practice, reflected by European and World documents was finally defined. The WB is authored by the 4 European PRM Bodies, that are also the copyright holders:

- European Academy of Rehabilitation Medicine (EARM);
- European Society of PRM (ESPRM);
- PRM Section of the European Union of Medical Specialists (UEMS PRM Section);
- European College of PRM (served by the UEMS-PRM Board).

The stakeholders are the National PRM Societies.

The WB follows the outline of the previous editions:

- First Edition (1989): Book published by Universidad Complutense de Madrid in four languages: English, French, Italian, Spanish. Author: EARM with UEMS Physical Medicine and Rehabilitation Section and European Federation of Physical Medicine and Rehabilitation;
- Second Edition (2006-7): published in Special issues of 2 journals (in PubMed), *Europa Medicophysica* (now *European Journal of Physical and Rehabilitation Medicine*); *Journal of Rehabilitation Medicine*. Language: English, then translated in various other European languages by the National Societies. Authors: EARM and UEMS PRM Section and Board with collaboration of ESPRM.

The aim of the WB is to describe, from a European perspective, the work of the specialty of PRM and of PRM physicians in:

- A changing world of health care systems and shrinking funding;
- Reacting and contributing to medical progress and technological innovation;
- Developing strategies to meet the challenge of scientific and technological advances;
- Dealing with changing perspectives of disability;
- Promoting and facilitating the autonomy and participation of persons with disabilities in everyday life;
- Being a didactic reference for PRM practice and academic life to young health professionals (especially medical doctors in training).

It was decided to start from the contents of the second edition and accept all what was already written if still applicable, modifying the text as required. This has been true for:

- the chapters (some new chapters have been included – specifically chapters 3 and 6) sometimes expanding previous paragraphs;
- the single paragraphs inside the chapters.

In the second semester of 2015 a Provisional Summary was approved including:

- 11 chapters with an editor for each chapter– it was decided to publish each chapter as an independent paper in PubMed so to better expose the contents to the scientific world audience; each chapter consequently has its own abstract and includes the collective names of authors. In the final version, the chapters are:



- Definitions and concepts of PRM
- Why rehabilitation is needed by individuals and society
- A primary medical specialty: the fundamentals of PRM
- History of the specialty: where PRM comes from
- The PRM organizations in Europe: structure and activities
- Knowledge and skills of PRM physicians
- The clinical field of competence: PRM in practice
- The PRM specialty in the healthcare system and society
- Education and continuous professional development: shaping the future of PRM
- Science and research in PRM: specificities and challenges
- Challenges and perspectives for the future of PRM
- 62 paragraphs – each paragraph has some key persons with specific roles:
  - First Author: paragraphs writing: draft (starting from the text of the previous second edition of the WB) and final version; coordination with co-authors; deadlines respect
  - Co-authors: correcting and improving the first draft; they come from the authors' call and/or are nominated by the first authors; in each paragraph, they come from different European areas (North, South, West and East)
  - Internal reviewers: from the European PRM Bodies – first review of paragraphs
  - External reviewers: PRM experts out of the European PRM Bodies – first review of paragraphs.

The first authors of each single paragraph have been decided by the Steering Committee according to specific criteria after a call to all delegates and academicians. The criteria included: specific expertise, number of publications in PubMed listed journals, other specific publications, acceptance to fulfil the task and deadlines.

The editors of the WB have been chosen by the Steering Committee primarily among their members but also in the European Bodies according to their specific expertise in editing and on their chapter. Stefano Negrini served as Coordinator and Saša Moslavac as Secretary

of the editors. The editors of the single chapters are:

- Chapter 1: Pedro Cantista, Nicolas Christodoulou
- Chapter 2: Anthony B. Ward
- Chapter 3: Stefano Negrini
- Chapter 4: Enrique Varela-Donoso
- Chapter 5: Mauro Zampolini
- Chapter 6: Stefano Negrini
- Chapter 7: Christoph Gutenbrunner
- Chapter 8: Carlotte Kiekens
- Chapter 9: Maria Gabriella Ceravolo
- Chapter 10: Alain Delarque
- Chapter 11: Stefano Negrini

The writing process has been organized with the following steps:

- December 31<sup>st</sup> 2015 - Deadline of first call for authors to all Delegates and Academicians
- February 28<sup>th</sup> 2016 - Deadline of second call for authors to all Delegates and Academicians
- July 15<sup>th</sup> 2016 - Deadline for writing of “sensitive” paragraphs:
  - 3.2 Ethical aspects;
  - 4.5 PRM team;
  - 5.1 The streams of developing the field of competence in PRM;
  - 8.9 Relationship with other specialties;
  - 8.10 Relationship with other rehabilitation professionals
- August 15<sup>th</sup> 2016 - Deadline for all other paragraphs

The process of reviews and revisions has been quite elaborated and is fully described in Tables I and II. It included:

- four Consensus Conferences
- four review/revision cycles involving either all delegates/academicians (1<sup>st</sup> and 3<sup>rd</sup>) or all editors and Presidents (2<sup>nd</sup> and 4<sup>th</sup>).

Overall each review and revision round was aimed at improving and refining the text, making it coherent among chapters and paragraphs. Revisions have always been performed by the editors individually and/or collectively to guarantee uniformity to the text.

The first stage of review (Table I) has concluded with the most important Consensus Conference (the 3<sup>rd</sup>) held in Munich on 9<sup>th</sup> of March 2017. Participants have been all delegates of ESPRM and UEMS-PRM Section and Board, and all academicians of EARM. Each editor for his chapter has presented: contents of chapter, com-

TABLE I.—*Review and revision process until the Consensus Conference in Munich (9 March 2017).*

	Review	Revision
First Consensus Conference (UEMS PRM Section Professional Practice Committee)	25-8-2016 Prague (Czech Republic) On “Sensitive” paragraphs	
First Review/revision	30-9-2016 Internal and external reviewers on single paragraphs Delegates, academicians and editors on single paragraphs	30-11-2016 Editors on their chapter
Second Review/revision	15-12-2016 Editors on the whole WB	7-1-2017 Editors on their chapter
Second Consensus Conference (editors)	16/17-12-2016 Don Gnocchi Foundation Rovato (Brescia) - Italy On each single chapter	
Third Review/revision	21-1-2017 Editors on the whole WB	31-1-2017 Editors on their chapter
Third Consensus Conference (European PRM Bodies)	9-3-2017 Munich (Germany) Delegates and academicians on the whole WB	

ments received, answer to the comments, changes to the text according to the comments. Since a general discussion was not possible due to time constraints, some comments have been allowed, and then all participants had to send their last comments as reported in Table II.

Publication of the WB has been planned in January 2018. In spring 2017, it has been decided to ask first to the journals that published the previous Second Edition (the European Journal of PRM and the Journal of Rehabilitation Medicine). Only the European Journal of PRM accepted the rules, and is now the only publishing journal. The rules included:

- Copyright remains on the European PRM Bodies Alliance
- On-line Open Access
- Printed version for free, including only the White Book
- Publication in January 2018
- A PubMed entry for the whole WB including preface, introduction, executive summary and methodology
- Each chapter is published as a single PubMed entry with a common title as follows: White Book of PRM in Europe. “Title”. “Sub-title”

TABLE II.—*Review and revision process after the Consensus Conference in Munich.*

	Review	Revision
Fourth Review/revision	15-3-2017 Comments of the Consensus Conference 15-4-2017 Collection of references from all delegates and academicians	20-6-2017 editors on their chapter
Fourth Consensus Conference (editors)	30-6/1-7-2017 University Hospital Leuven (Belgium) Collective by editors on each single chapter	
August 2017	Distribution of final paragraphs to all delegates and academicians	
Fifth Consensus Conference (UEMS PRM Section Professional Practice Committee)	8-9-2017 Bratislava (Slovakia) On preface, executive summary, dictionary and methodology	
Autumn 2017	ESPRM, UEMS-PRM Section and Board voting in Bratislava	
November 2017	EARM voting in Hannover	
August-November 2017	Linguistic correction	

— Recognition that the papers will be immediately linked on the website to the Journals, and that there will be a 2 years embargo before publishing the pdf on the European PRM Bodies Alliance website

The official launch will be during the ESPRM (with EARM and UEMS-PRM S&B) Meeting in Vilnius from 1 to 6 May 2018. The WB will be presented during the Opening Ceremony, and the various chapters will be presented as Lectures throughout the Meeting in the appropriate thematic sessions, so to constitute a “fil rouge” of the whole Conference. Also a world presentation is programmed and has been agreed with the International Society of PRM (ISPRM) from 8 to 12 July 2018 during the ISPRM Meeting in Paris.

### References

1. European Academy of Rehabilitation Medicine, European Union of Medical Specialists, Physical Medicine and Rehabilitation Section, European Federation of Physical Medicine and Rehabilitation. White Book of Physical and Rehabilitation Medicine in Europe. 1st Edition. Madrid: Universidad Complutense de Madrid; 1989.
2. World Health Organization. International Classification of Impairments, Disabilities, and Handicaps. 1980. 207 p.
3. World Health Organization. WHO | International Classification of Functioning, Disability and Health (ICF) [Internet]. WHO. [cited 2014 Aug 19]. Available from: <http://www.who.int/classifications/icf/en/>
4. Section of Physical and Rehabilitation Medicine Union Européenne des Médecins Spécialistes (UEMS), European Board of Physical and Rehabilitation Medicine, Académie Européenne de Médecine de Réadaptation, European Society for Physical and Rehabilitation Medicine. White book on physical and rehabilitation medicine in Europe. Eur Medicophysica. 2006 Dec;42(4):292–332.
5. White book on Physical and Rehabilitation Medicine in Europe. J Rehabil Med. 2007 Jan;(45 Suppl):6–47.
6. Convention on the rights of persons with disabilities [Internet]. [cited 2014 Nov 8]. Available from: <http://www.un.org/disabilities/convention/conventionfull.shtml>
7. Article 26 - Habilitation and rehabilitation | United Nations Enable [Internet]. [cited 2017 Jul 15]. Available from: <https://www.un.org/development/desa/disabilities/convention-on-the-rights-of-persons-with-disabilities/article-26-habilitation-and-rehabilitation.html>
8. WHO | World report on disability [Internet]. WHO. [cited 2014 Nov 8]. Available from: [http://www.who.int/disabilities/world\\_report/2011/en/](http://www.who.int/disabilities/world_report/2011/en/)
9. WHO | WHO global disability action plan 2014-2021 [Internet]. WHO. [cited 2014 Oct 21]. Available from: <http://www.who.int/disabilities/actionplan/en/>
10. World Health Organization. Rehabilitation 2030: a call for action: Meeting report [Internet]. WHO; 2017. Available from: <http://www.who.int/disabilities/care/rehab-2030/en/>

For this paper, the collective authorship name of European PRM Bodies Alliance includes:

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## Glossary

Activity	According to ICF is the execution of a task or action by an individual
Activity limitations	According to ICF are difficulties an individual may have in executing activities.
Acute phase	Refers to the period during an acute hospital admission following injury or illness, or after complex medical treatment or its complications. It can also apply to an acute event in a person with an established disability.
Adapted physical activity	Is defined as a cross disciplinary body of knowledge directed towards the identification and solution of individual differences in physical activity. It is a service delivery profession and an academic field of study which supports an attitude of acceptance of individual differences, advocates enhancing access to active lifestyles and sport, and promotes innovation and cooperative service delivery and empowerment systems. Adapted Physical Activity includes, but is not limited to, physical education, sport, recreation, and rehabilitation.
Applied research	Using existing knowledge, is directed towards specific goals such as the development of a new medication, a new medical device, or a new rehabilitation procedure
Aquatic therapy	Generic term that refers to all therapies that can be performed through water, regardless of the composition of this
Balneology	The branch of medical science concerned with the study of the therapeutic use of natural mineral waters, steam, gases and peloids. This use is called Balneotherapy and includes not only the application of baths but also other modalities such as drinking cures, inhalation and other complementary techniques (physical agents, environmental factors / Climatotherapy) giving it a character of a holistic and complex therapy approach.
Barriers	Environmental factors that reduce functioning / increase disability
Basic research (fundamental or pure research)	Is knowledge for knowledge, the study of a biomedical phenomena to have a full understanding of it.
Bed-blocker	Patient who has been approved for discharge from inpatient care, but has no alternative facility to which he or she can go, thus blocking use of that bed by other patients, especially by those with more acute disease or higher needs
Bibliomed	it is a Spanish Virtual Medical Library
Biomedical research	Involves the investigation of the biological process, the causes of diseases, their medical diagnosis, the evaluation of their consequences on functioning, disability and health at an individual and a societal level. Biomedical research evaluates also the effects of the PRM interventions at all these levels.
Biopsychosocial model	It is a health model developed in contrast to the widely applied biomedical one. It states that health and illness are determined by a dynamic interaction between biological (genetic, biochemical, etc.), psychological (mood, personality, behaviour, etc.) and social factors (cultural, familial, socioeconomic, medical, etc.). This also expresses the view that disease outcome is attributable to this complex interaction.
Body functions	According to ICF are physiological functions of body systems (including psychological functions).
Body structures	According to ICF are anatomical parts of the body such as organs, limbs and their components.
Capacity	According to ICF it is a qualifier that describes an individual's ability to execute a task or an action. This construct indicates the highest probable level of functioning of a person in a given domain at a given moment.
Chiropractic	School and current of manual therapy described by Palmer in the 19 <sup>th</sup> century by which small joint adjustments are performed in the body. It etymologically means „practice by hands“.
Clinical impact research	Is a new concept defined as a research field aiming to assess what are the impacts of healthcare and public health interventions targeted to persons with disabilities.
Committee on Publication Ethics (COPE)	Is a non-profit organization. The mission is to define best practice in the ethics of publishing.
Compensatory processes	Processes to adapt to the new (acquired) health condition using mechanisms based on other body structures/ functions, behavioural changes and/or assistive devices (prosthesis, orthosis or technical aids)
Contextual factors	Circumstances that may influence our life and health. Among contextual factors are external environmental factors and internal personal factors
Continuing Professional Development	The process of tracking and documenting the skills, knowledge and experience gained (by the PRM physician), both formally and informally during work experience, beyond any initial training.
Continuous Medical Education	Educational activities aimed at maintaining, developing or increasing the knowledge, skills and professional performance that the PRM physician uses when providing health services.
Cumulative Index to Nursing and Allied Health Literature (CINAHL)	Is an index of English-language and selected other-language journal articles about nursing, allied health, biomedicine and healthcare.

*(To be continued)*

Glossary (*continues*)

Current Contents	Is a rapid alerting service database from the Institute for Scientific Information, now part of Thomson Reuters that is published online and in several different printed subject sections.
Disability	Is a umbrella term, covering impairments, activity limitations and participation restrictions that may be defined as the problem a person has performing the actions that he or she needs and wants to do, because of how an underlying health condition – a disease, injury or even ageing – affects his or her performance in his or her actual environment.
Disease	A disorder of structure or function that produces specific symptoms or that affects a specific location and is not simply a direct result of physical injury
Environmental factors	Among contextual factors are the external factors (for example, social attitudes, architectural characteristics, legal and social structures, as well as climate, terrain and so forth)
European Disability Strategy 2010-2020	Strategy to increase the participation of people with disabilities in society and the economy, and enable them to fully exercise their rights
European Physical and Rehabilitation Medicine Bodies	The four European Physical and Rehabilitation Medicine Organizations: European Academy of Rehabilitation Medicine (EARM), European Society of Physical and Rehabilitation Medicine (ESPRM), European Union of Medical Specialists PRM Section (UEMS-PRM Section) and European PRM College (served by UEMS-PRM Board)
Extracorporeal shock waves therapy (ESWT)	Non-invasive surgical procedure that use abrupt, high amplitude pulses of mechanical energy, similar to soundwaves, generated by an electromagnetic coil or a spark in water to encourage the healing of some physical disorders (“Extracorporeal” means that the shockwaves are generated externally to the body and transmitted from a pad through the skin).
Facilitators	Environmental factors that improve functioning / increase disability
Functional assessment	Is the determination of a person’s level of function and ability to perform everyday tasks and requirements of living.
Function-centred Functioning	Any health care intervention aimed at improving/recovering body functions All that human bodies do and the actions that people perform. In the ICF, functioning is operationalised in terms of functioning domains, and these domains are partitioned into the dimensions of Body Functions and Structures, Activities and Participation. Functioning is a umbrella term describing the interaction between a person with a health condition and his or her environment (defined in the International Classification of Functioning, Disability and Health, WHO 2001)
Goal-directed (or goal-oriented or task-oriented)	It is said for exercises based on the practice of purposeful motor acts
Habilitation	Within PRM this term refers to the part of Rehabilitation dealing with growing age, when not all functions have been developed and when consequently diseases and impairments can negatively impact on the correct development of some otherwise normal functions
Health condition	The situation that interferes with health (diseases, disorders and injuries). In ICF disability and functioning are viewed as outcomes of interactions between health conditions (diseases, disorders and injuries) and contextual factors.
Holism	The treating of the whole person, taking into account mental and social factors, rather than just the symptoms of a disease. In PRM it is not used to justify scientifically unproven treatments, since: PRM is a primary medical specialty totally based on evidence
Impairments	According to ICF are problems in body function or structure such as a significant deviation or loss.
Implementation research	Evaluate health interventions at home, in “real world” settings
Inter disciplinary research	Is performed within teams including different disciplines or bodies of specialized knowledge
Learning processes	In PRM, new motor and behavioural strategies to be learned to counter-act disability and improve functioning in a specific health condition.
Lived health	Is a person’s level of functioning in his or her current environment and depends both on the person’s environment and biological health.
Long-term phase	Refers to the long-term period following the post-acute phase for people who are experiencing chronic disease and long-term disabilities or difficulties in functioning, when the situation is stabilized; emphasis lays on maintenance and secondary prevention.
Manual medicine	Discipline that incorporates all the valid methods of diagnosis, assessment and treatment that a duly qualified physician can carry out using preferably his expert hands. It includes both soft tissue and structural techniques.
Mechanotherapy	Modality of physical treatment devised by Zander in the 19 <sup>th</sup> century and consisting of the performance of therapeutic exercise through the use of mechanical devices.
Medical diagnosis	The classical process of diagnosis by Medical Doctors.

*(To be continued)*

Glossary (*continues*)

MEDLINE	(Medical Literature Analysis and Retrieval System Online, or MEDLARS Online) is a bibliographic database of life sciences and biomedical information.
Collaborative team action	See below Physical and Rehabilitation Medicine team
Multimodal approach	Due to the focus on impairment, activity limitations and participation restrictions, the attention to personal factors and environmental factors, and the multi-professional team, the approach in PRM is rarely based on a single treatment. In PRM patients are usually treated with a broad range of therapies, provided by a broad range of health professionals. These can include, among others, exercise therapy, occupational therapy, speech therapy, neuropsychological treatments, behavioural therapies, physical therapies, manual therapies. Each patient is treated with a unique approach, according to his disease, impairments, activity limitations, participation restrictions, environmental and personal factors, in a totally multimodal and individualised approach.
Multi-professional	It is said of the rehabilitation team, whose members typically belong to different professional profiles (e.g. physiotherapists, speech therapists, occupational therapists, etc.).
Multi-professional team	See below Physical and Rehabilitation Medicine team
Neuroplasticity (or brain plasticity)	It is used to describe the life-long experience-driven remodelling of brain networks, especially occurring during childhood and immediately after a brain lesion.
Osteopathy	School and current of manual therapy created by Still in the 19 <sup>th</sup> century that evaluates and treats different physical disorders through joint adjustments. It etymologically means „the way of the bones“.
Participation	According to ICF is involvement in a life situation.
Participation restrictions	According to ICF are problems an individual may experience in involvement in life situations.
Patient classification system	Is a system to classify patients in homogeneous groups according to their needs of care and related financing.
Patient-centred	Any health care intervention aimed at improving the overall functioning /well-being of an individual
Peer counsellor	Is a person, with a health or disability status equal to that of the patient, who provides counselling including emotional and informational assistance and encouragement.
Performance	According to ICF it is a qualifier that describes what an individual does in his or her current environment. Since the current environment always includes the overall societal context, performance can also be understood as “involvement in a life situation” or “the lived experience” of people in their actual context.
Performance	What an individual does in his or her current environment. (Since the current environment always includes the overall societal context, performance can also be understood as “involvement in a life situation” or “the lived experience” of people in their actual context).
Personal factors	Among contextual factors are the internal factors which include gender, age, coping styles, social background, education, profession, past and current experience, overall behaviour pattern, character and other factors that influence how disability is experienced by the individual.
Physical agent	A form or a mean of physical energy application to living tissues in a systematic manner to alter physiologic processes, in conjunction with or for therapeutic purposes. Physical agents include different modalities such of thermal, acoustic, aqueous, mechanical, electrical, magnetic or light techniques. Etymologically it means “agents of nature” and in fact some of the physical agents are still applied without any modifications from their nature origin.
Physical and Rehabilitation Medicine	The actual definition of the specialty according to the White Book is: PRM is the primary medical specialty responsible for the prevention, medical diagnosis, treatment and rehabilitation management of persons of all ages with disabling health conditions and their co-morbidities, specifically addressing their impairments and activity limitations in order to facilitate their physical and cognitive functioning (including behaviour), participation (including quality of life) and modifying personal and environmental factors.
Physical and Rehabilitation Medicine physician	Medical Doctor with the specialty in Physical and Rehabilitation Medicine. Physical and Rehabilitation Medicine specialist; the same as Physiatrist.
Physical Medicine	The part of Physical and Rehabilitation Medicine dealing with the application of Physical Modalities, including Diagnostic or Therapeutic techniques; it includes Therapeutic Exercises, since they are based on physical forces.
Physical Medicine and Rehabilitation	Old definition of the Specialty, still maintained in some countries out of Europe (notably US, but not only). It has now been substituted by Physical and Rehabilitation Medicine
Physical Modalities	Instruments used to apply physical external therapeutic forces. Sometimes also called Physical Therapy and/or Physiotherapy
Physical Therapy	The part of Physical and Rehabilitation Medicine dealing with the application of Physical Modalities. Sometimes also called Physiotherapy.

*(To be continued)*

Glossary (*continues*)

Physiotherapist	Rehabilitation health professional practicing Physiotherapy. It is not a Medical Doctor. Not to be confused with Physical and Rehabilitation Medicine physician
Physiotherapy	One of the Physical and Rehabilitation Medicine areas or modalities of intervention, usually practiced by Physiotherapists. Sometimes also called Physical Therapy. In some cases some of these interventions are applied by PRM physicians.
Post-acute phase	Refers to the period following the acute phase after a sudden onset condition, when the patient is medically sufficiently stable; also patients with intermittent, progressive or stable conditions can benefit in phases of changing needs; in this phase the patient is still evolving.
Postgraduate	Usually, any academic course dedicated to individuals with a first-level degree. For medical doctors, it also includes learning and studying for achieving knowledge and skills in a specialized medical domain.
Potential of recovery	Due to the repairing processes, they are also linked to the individual and environmental factors; PRM physicians propose and plan rehabilitation if there is a potential of recovery (functional prognosis).
Pre-clinical trials	Involve experiment in cells and in non-human animal models.
Prehabilitation	An educational programme and pre-operative physical and/or psychological conditioning enhancing functional and mental capacity aimed at improving postoperative functional out-comes.
Primary research	Is an original first hand research; the publication of its results will be written by the person(s) who participated in the research.
Physical and Rehabilitation Medicine intervention	Is any diagnostic or therapeutic act or procedure related to the Field of competence of PRM.
PsycINFO	Is a database of abstracts of literature in the field of Psychology.
Rehab-cycle	Is the re-iterating process of assessment, assignment, intervention and evaluation of the rehabilitation needs and goals of a person.
Rehabilitation	A set of measures that assist individuals, who experience or are likely to experience disability, to achieve and maintain optimum functioning in interaction with their environments.
Rehabilitation Medicine	Name given to the specialty in some European countries, but not accepted internationally. Considered by some as the part of Physical and Rehabilitation Medicine dealing with rehabilitation excluding Physical Modalities and/or Physical Therapy: since rehabilitation is holistic and includes all evidence based treatments allowing to rehabilitate people experiencing disability, also Physical Modalities with evidence cannot be excluded.
Rehabilitation programme	A rehabilitation programme is the chronological list of diagnostic and therapeutic actions and interventions needed to respond to a patient's rehabilitation needs and goals; this can be for a specific phase or over the continuum of care.
Rehabilitation service	Rehabilitation services are personal and non-personal intangible products, offered to persons with a health condition experiencing or likely to experience disability, or to their informal care-givers within an organisational setting, in interaction between provider and person, addressing individual functioning needs that aim at enabling persons to achieve and maintain optimal functioning, considering the integration of other services addressing the individual's needs including health, social, labour and educational services, and delivered by rehabilitation professionals, other health professionals, or appropriately trained community-based workers.
Repairing processes	Ability of the body to recover from a disease, disorder or injury. They are mainly related to the quantity and natural history of diseases and impairments.
Robotic	Medical discipline whereby, using intelligent technological devices that interact with subjects and / or their environment, individuals are helped to train and recover a lost physical function.
Science Citation Index (SCI)	Is a citation index originally produced by the Institute for Scientific Information (ISI), covers more than 8,500 notable and significant journals, across 150 disciplines, from 1900 to the present.
SCImago	Is a Journal Rank (SJR indicator) that measure of scientific influence of scholarly journals that accounts for both the number of citations received by a journal and the importance or prestige of the journals where such citations come from.
Scopus	Is a bibliographic database containing abstracts and citations for academic journal articles covering nearly 22,000 titles from over 5,000 publishers, of which 20,000 are peer-reviewed journals in the scientific, technical, medical, and social sciences (including arts and humanities);
Secondary research	Is the analysis and interpretation of primary research publications in a field with a specific methodology. Cochrane Rehabilitation is an example of secondary research.
Sedbase	It is a drugs side effects database.
SPA-physician	Expert physician in natural mineral water, its effects in the body and management usually working in Thermal establishments or Balneotherapy units; when qualified (by acquiring in some European countries a specific specialty or competence), SPA- physicians are called Medical Hydrology Doctors (Hydrologists) or Balneology Doctors (Balneologists).

*(To be continued)*

Glossary (*continues*)

Team-based	Any healthcare intervention delivered as the result of a shared decision making within the multi-professional team.
Thermal establishment	Place where medical treatments are carried out by means of natural mineral water.
Translational medical research	Research and development represent the transfer from basic research to commercially viable applications (from “bench to bedside”)
Triage	The selection and allocation of treatment to patients according to a system of priorities, based on the patients’ need of care designed to maximize the outcome.
UN Convention of Human Rights 2005	Implementation of Universal Declaration.
UN Universal Declaration of Human Rights	Governments’ commitment to progressive measures to secure the universal and effective recognition and observance of the human rights.
Undergraduate	The entry level of university students. It includes all the academic programs up to the level of a bachelor’s degree or, in case of medical students, of master’s degree.
Virtual reality	Discipline based on the use of computers and other devices, whose purpose is to produce an appearance of reality that allows the user to have the sensation of being present in it.
Vocational rehabilitation	Process which enables persons with functional, psychological, developmental, cognitive and emotional impairments or health disabilities to overcome barriers to accessing, maintaining or returning to employment or other useful occupation.
Walking laboratory	Measurement system that allows the monitoring as the ambulation develops, collecting information of all the aspects and characteristics of this
WHO Global Disability Action Plan	2014-2021 initiative for “Better health for all people with disability”

*Physical and Rehabilitation Medicine team*

In the literature dealing with team work and collaboration in rehabilitation, terms sometimes are used differently from their definition in scientific literature on team models and interaction between team members. Therefore, a clarification of terms is needed here.

In PRM literature the terms are mostly used to describe collaboration partners working together in the team:

— Multi-professional team: team consisting of multiple rehabilitation professionals (*e.g.* PRM, PT, OT, SLT and/or others)

— Inter-disciplinary collaboration: collaboration

among different medical specialties (*e.g.* PRM, trauma surgeon, neurologist, cardiologist and/or others)

The term “multi-professional team” will be used for a rehabilitation team consisting of different rehabilitation professionals, the term “interdisciplinary counselling” for collaboration of PRM physicians with other medical specialists and the term “collaborative team work” for a team working in an interdisciplinary, multidisciplinary or transdisciplinary way according to the setting and needs.

The Physical and Rehabilitation Medicine team is a multi-professional team working in collaborative way with other disciplines, under the leadership of a PRM physician.



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## Abbreviations

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ABI	Acquired Brain Injury
ABMS	American Board of Medical Specialties
ABPMR	American Board of Physical Medicine and Rehabilitation
ADL	Activities of Daily Living
APRM	Annals of Physical and Rehabilitation Medicine
ART	Acute Rehabilitation Team
ARU	Acute Rehabilitation Unit
ARUR	All Russian Union Rehabilitators
ASSIA	Applied Social Science Index & Abstracts
BNF-PRM	Baltic and North Sea Forum on Physical and Medical Rehabilitation
CAC	Clinical Affairs Committee of European Union of Medical Specialists - Physical and Rehabilitation Medicine Section
CARF	Commission on Accreditation of Rehabilitation Facilities
CBR	Community Based Rehabilitation
CCU	Critical Care Unit
CDP	Community Development Policy
CINHAL	Cumulative Index to Nursing and Allied Health Literature
CME	Continuing Medical Education
CNS	Central Nervous System
COPE	Committee on Publication Ethics
CPD	Continuing Professional Development
Cr	Clinical Rehabilitation (Journal)
CRPD	Convention on The Rights of Persons With Disabilities
CST	Classification. Terminology and Standards
Dalys	Disability-Adjusted Life-Years
DAR	Disability and Rehabilitation
EACCME	European Accreditation Council of Continuing Medical Education
EARM	European Academy of Rehabilitation Medicine
EBM	Evidence Based Medicine
EBPRM	European Board of Physical and Rehabilitation Medicine
ECMEC	European Continuing Medical Education Credit
ECPRM	European College of Physical and Rehabilitation Medicine
EEA	European Economic Area
EFPRM	European Federation of Physical Medicine and Rehabilitation
EJPRM	European Journal of Physical and Rehabilitation Medicine
EMRSS	Euromediterranean Rehabilitation Summer School Haim Ring in Syracuse
EPR	Early Physical Rehabilitation
ESM	European School Marseille
ESPRM	European Society of PRM
EU	European Union
FES	Functional Electrical Stimulation
Fin	Finland
FREDA	Freedom, Respect, Equality, Dignity, Autonomy
GDP	Gross Domestic Product
Ger	Germany
GMC(UK)	UK General Medical Council
HALE	Healthy Life Expectancy
IBECS	Indice Bibliográfico Español en Ciencias de la Salud (Spanish Bibliographic Index in Health Sciences)
ICD	International Classification of Diseases, Produced By The World Health Organization
ICF	International Classification of Functioning, Disability and Health
ICHI	International Classification of Health Interventions
ICIDH	International Classification of Impairments, Disabilities and Handicaps Produced By The World Health Organization
ICSO-R	International Classification of Service Organisations For Rehabilitation
ICT	Information and Communication Technologies
ICU	Intensive Care Unit
IJRR	International Journal of Rehabilitation Research
Insci	International Survey on Spinal Cord Injury
INSERM	French National Institute For Health and Medical Research

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*(To be continued)*

Abbreviations (*continues*)

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ISPRM	International Society of PRM
JPRM	Journal of Physical and Rehabilitation Medicine
JRM	Journal of Rehabilitation Medicine
LOS	Length of Stay
Madr	Madrid
MCQ	Multiple Choice Questions
MFPRM	Mediterranean Forum of Physical and Rehabilitation Medicine
NGO	Non-Governmental Organization
NMES	Neuro-Muscular Electrical Stimulation
OT	Occupational Therapy/Occupational Therapist
PhD	Doctor of Philosophy (Latin Philosophiae Doctor)
PPC	Professional Practice Committee of European Union of Medical Specialists - Physical and Rehabilitation Medicine Section
PR	Pulmonary Rehabilitation
PRM	Physical and Rehabilitation Medicine
PT	Physical Therapy
QoL	Quality of Life
RAT	Rehabilitation Advisory Team
RCT	Randomized Controlled Trial
RFO	European Research Funding Organizations
RM	Rehabilitación (Madr.)
RPO	Research Performing Organizations
SALT	Speech and Language Therapy
SCI	Spinal Cord Injury
Sco	Scotland
SERMEF	Sociedad Española de Rehabilitación y Medicina Física (Spanish Society of Rehabilitation and Physical Medicine)
SIMFER	Società Italiana di Medicina Fisica e Riabilitazione
Slo	Slovenia
SLT	Speech and Language Therapy/ Speech and Language Therapist
SPA	“Salus Per Aquam”. Health Through The Water
Swisci	Swiss Spinal Cord Injury Cohort Study
TBI	Traumatic Brain Injury
TENS	Transcutaneous Electrical Nerve Stimulation
TMS	Transcranial Magnetic Stimulation
UEMS	Union Européenne Des Médecins Spécialistes - European Union of Medical Specialists
UN	United Nations
UNCRPD	United Nations Convention on Rights of Persons With Disabilities
UV	Ultra Violet (Radiation)
VR	Vocational Rehabilitation
WB	White Book of Physical and Rehabilitation Medicine in Europe
WHO	World Health Organization
WRD	World Report on Disability

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## BACKGROUND OF PHYSICAL AND REHABILITATION MEDICINE

# White Book on Physical and Rehabilitation Medicine (PRM) in Europe. Chapter 1. Definitions and concepts of PRM

European Physical and Rehabilitation Medicine Bodies Alliance

### ABSTRACT

In the context of the White Book of Physical and Rehabilitation Medicine (PRM) in Europe, this paper deals with the definitions and concepts relevant for PRM. Physical and Rehabilitation Medicine is the primary medical specialty responsible for the prevention, medical diagnosis, treatment and rehabilitation management of persons of all ages with disabling health conditions and their co-morbidities, specifically addressing their impairments and activity limitations in order to facilitate their physical and cognitive functioning (including behavior), participation (including quality of life) and modifying personal and environmental factors.

To arrive to this PRM definition we need to consider a conceptual description of it. Several fundamental aspects must be observed namely functioning, disability and rehabilitation.

These definitions include and are presented in this chapter:

– Functioning: all that human bodies do and the actions that people perform. In the International Classification of Functioning, Disability and Health (ICF), functioning is operationalized in terms of functioning domains, and these domains are partitioned into the dimensions of Body Functions and Structures, Activities and Participation;

– Disability: the problem a person has performing the actions that he or she needs and wants to do, because of how an underlying health condition – a disease, injury or even ageing – affects his or her performance in his or her actual environment;

– Rehabilitation: a set of measures that assist individuals, who experience or are likely to experience disability, to achieve and maintain optimum functioning in interaction with their environments

The ICF definition of disability clearly distinguishes between problems that result entirely from the underlying health condition (capacity) from problems arising from the interaction between capacity and the environment and personal factors (performance).

This paper approaches all these concepts that are essential to the understanding of the PRM strategy to evaluate disability and implement interventions that may lead to the improvement of functioning and health.

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**Key words:** Physical and Rehabilitation Medicine - Europe - Disability - Functioning - Rehabilitation.

### Introduction

The White Book (WB) of Physical and Rehabilitation Medicine (PRM) in Europe is produced by the 4 European PRM Bodies and constitutes the reference book for PRM physicians in Europe. It has multiple values, including to provide a unifying framework for the European Countries, to inform decision-makers at the European and national level, to offer educational material for PRM trainees and physicians and information about PRM to the medical community, other rehabilitation professionals and the public. The WB states the importance of PRM as a primary medical specialty. The contents include definitions and concepts of PRM, why rehabilitation is needed by individuals and soci-

ety, the fundamentals of PRM, history of PRM specialty, structure and activities of PRM organizations in Europe, knowledge and skills of PRM physicians, the clinical field of competence of PRM, the place of PRM specialty in the healthcare system and society, education and continuous professional development of PRM physicians, specificities and challenges of science and research in PRM and challenges and perspectives for the future of PRM.

Physical and Rehabilitation Medicine is the primary medical specialty responsible for the prevention, medical diagnosis, treatment and rehabilitation management of persons of all ages with disabling health conditions and their co-morbidities, specifically addressing their impairments and activity limitations in order to facili-

tate their physical and cognitive functioning (including behavior), participation (including quality of life) and modifying personal and environmental factors.

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— **Rehabilitation:** a set of measures that assist individuals, who experience or are likely to experience disability, to achieve and maintain optimum functioning in interaction with their environments.

## Functioning

### *Functioning, WHO's health information reference*

Since its foundation in 1948, WHO's mandate has been to achieve "the enjoyment of the highest attainable standard of health as a fundamental right of every human being" in which health is defined as the "...state of complete physical, mental and social well-being and not merely the absence of disease or infirmity."<sup>1</sup>

To monitor this aspiration, WHO has regularly updated the International Classification of Diseases (ICD) as a universal reference system for recording mortality and morbidity.<sup>2</sup> Its latest version, the ICD 11, will also allow for the description of both the biomedical character and the impact of health conditions.<sup>3</sup>

In 2001, the World Health Assembly endorsed the International Classification of Functioning, Disability and Health (ICF)<sup>4</sup> in order to operationalize both the biomedical nature of health conditions — body functions and structures and their impairments — and the overall impact on the lived experience of health in

interaction with the person's environment. The ICF provides a classification and a standard international common language in terms of which the lived experience of health can be operationalized at the individual and population levels. In the ICF, the biomedical nature and the overall impact of health conditions, in the context of people's lives, taking into account the environment in which they live and their personal factors, is called functioning.

The ICF is an international classification of health and functioning; it is also an information reference system for the standardized description of health, functioning and disability at all levels of health and related systems, including the social, education and labor ones. The ICF is meaningful and useful to practitioners who aim to optimize functioning of individual patients, policy makers who aim to shape the health system in response to people's functioning needs and requirements, and researchers who aim to explain and influence functioning as well as the sciences and professions of functioning.<sup>5</sup>

### *Functioning, WHO's operationalization of health*

'Functioning' is the central concept of the ICF and denotes the complete set of human body functions and structures, as well as all human actions, simple and complex (Figure 1).

In brief, functioning is all that human bodies do and

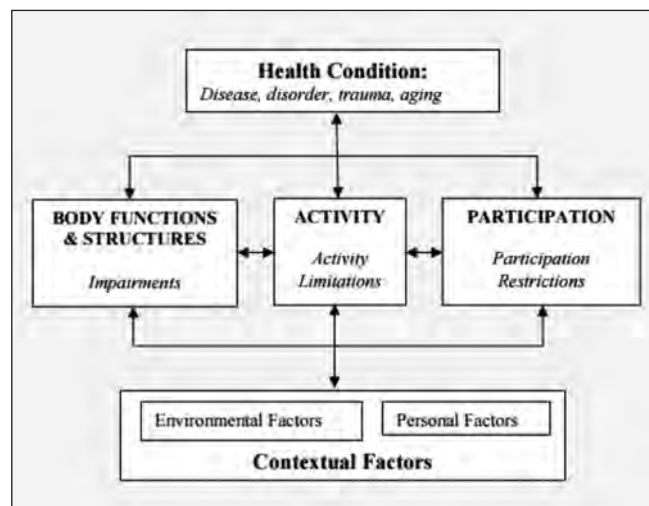


Figure 1.—The framework of functioning and disability in the International Classification of Functioning, Disability and Health.



the actions that people perform. In the ICF, functioning is operationalized in terms of functioning domains, and these domains are partitioned into the dimensions of Body Functions and Structures, Activities and Participation. These are further organized in terms of a spectrum from simple to complex, from a basic body function such as seeing to highly complex and socially-determined areas of participation such as working or participating in community life. As a classification, the ICF is designed to be comprehensive, yet flexible, providing the clinician or researcher with a complete language of functioning while allowing for expansion through the specification of additional domains if needed.

Each of the ICF functioning domains is conceived as a continuum, from total absence of functioning to full functioning. At a point in time, everyone’s level of functioning in every domain can, in principle, be described and, depending on the intended research or clinical purpose of doing so, a slice-in-time comprehensive portrait of a person’s overall functioning can be also described. Moreover, as a person’s overall functioning will vary on a continuum over a lifetime, the ICF provides a reference language for longitudinal description as well. While functioning increases during a person’s early years, it will decrease in consequence of injuries and diseases and ultimately with ageing. With sufficient population data, it is therefore possible to construct representative trajectories of ageing, in light of the occurrence of specific health conditions and comorbidities, in terms of which the potential impact on functioning of clinical and population interventions can be described or predicted.

*Practical tools to Implement the ICF in clinical practice, service provision and payment, policy and research*

Practical tools facilitate the ICF application – a clinical data collection tool and an ICF-based reporting tool<sup>5, 6</sup> — for a wide range of purposes. ICF is a classification, so in order to use it we need a variety of tools that move the classification into practice. These tools allow us to specify which domains of functioning we wish to document; make it possible to collect data on functioning consistently, at the clinical or population level; and make it possible to report the data collected using a common metric, which allows for the valid comparison

of functioning data collected from various sources (Figure 2). Accordingly, in clinical data collection planning, for a research study or for reporting already collected data, ICF users need to ask themselves the following four questions about functioning:<sup>7, 8</sup>

- What ICF domains do we want to document? (e.g. by using the ICF Generic Set, the ICF Rehabilitation Set or an ICF Core Set for a specific health condition, along the continuum of care, or a context such as vocational rehabilitation).<sup>9-12</sup>
- What perspective do we wish to take (i.e. either capacity or performance)?
- What data collection tools will apply to our purpose?
- What metric approach do we wish to use for reporting?

*The ICF and functioning in Rehabilitation*

The ICF is fundamental to rehabilitation, the fifth health strategy along with curative, supportive preventive and palliative ones.<sup>13-15</sup> The ICF is also fundamental to the field of PRM, which indeed might be called the medicine of functioning.<sup>5, 14, 15</sup> This is because the

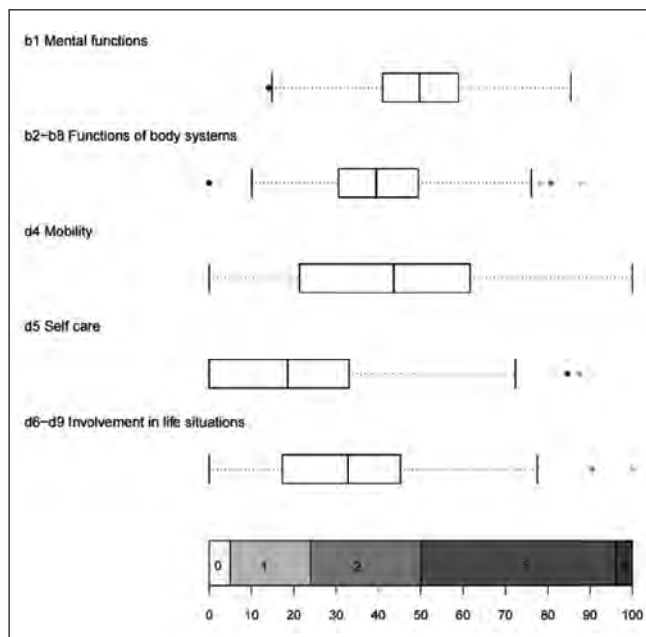


Figure 2.—Demonstration of functioning profile for Swiss Spinal Cord Injury Cohort Study (SwiSCI) population.

overall objective of both rehabilitation and PRM is to optimize a person’s functioning and thereby increase his or her quality of life.<sup>16</sup> PRM achieves this by optimizing through treatment the intrinsic health aspects of functioning, or ‘capacity’ in ICF terms, or by means of enabling changes to his or her environment to optimize the person’s actual performance of functioning. These interventions are only successful when they are directed to the interaction between health condition and environmental factors, as only then interventions can optimize the overall outcome of functioning. Ultimately, PRM’s goal is to translate a person’s intrinsic capacity or bio-

logical health into actual performance in interaction with the environment and personal factors, that is, the person’s lived health. In brief for rehabilitation in general and PRM in particular, functioning is the starting point of clinical assessment, the anticipated outcome of intervention, and the basis for quality management of interventions.

To describe, understand and influence functioning, PRM must rely on the ICF, both in terms of its underlying conceptual model of functioning and, more practically, on its classifications that can be used to ensure comparability of collected and reported data. The ICF can be applied in the description of individual patients<sup>17</sup> (Table I) as well as populations (Figure 2). With the ICF, intervention targets and goals can be specified in terms of the person’s functioning level (across relevant domains), the underlying health condition and comorbidities, and the relevant personal and environmental factors that shape the person’s lived experience of health. Interventions themselves can be specified using the International Classification of Health Interventions (ICHI) that classifies functioning, surgical and pharmacological interventions. The joint use of the ICF, the ICD and ICHI thereby allows for a comprehensive standardized coding of the full rehabilitation cycle, including assessment, assignment, intervention and evaluation.<sup>18</sup>

In order to foster the implementation of the ICF in day-to-day rehabilitation practice, the UEMS-PRM Section and Board is leading a European effort towards a system-wide implementation of the ICF in PRM, rehabilitation and health care at large in interaction with governments, non-governmental actors and the private sector. The effort is aligned with the International Society of Physical and Rehabilitation Medicine (ISPRM)’s work-plan with WHO.<sup>19, 20</sup>

### Disability

#### Disability and WHO’s ICF

The International Classification of Functioning, Disability and Health (ICF)<sup>4</sup> captures our intuitive notion of a disability as a problem a person has performing the actions he or she needs and wants to do because of how an underlying health condition — a disease, injury or even ageing — affects his or her performance in the person’s actual environment. In the ICF, this experience is conceptualized in terms of the basic ICF notion of func-

TABLE IA.—*Functioning profiles. ICF Categorical Profile; ICF Qualifier: rate the extent of problems (0 = no problem to 4 = complete problem) in the components of body functions (b), body structures (s), activities and participation (d); Goal Relation: 1 and 2 refer to Cycle goal 1 and 2; SP refers to Service-Program Goal; Goal value refers to the ICF qualifier to achieve after an intervention.*

ICF categories of the ICF Rehabilitation Set		Problem				
(G) = ICF Generic Set category		0	1	2	3	4
b130	Energy and drive functions (G)					
b134	Sleep function					
b152	Emotional function (G)					
b280	Sensation of pain (G)					
b455	Exercise tolerance functions					
b620	Urination functions					
b640	Sexual functions					
b710	Mobility of joint functions					
b230	Muscle power functions					
d230	Carrying out daily routine (G)					
d240	Handling stress and other psychological demands					
d410	Changing basic body positions					
d415	Maintaining a body position					
d420	Transferring oneself					
d450	Walking (G)					
d455	Moving around (G)					
d465	Moving around using equipment					
d470	Using transportation					
d510	Washing oneself					
d520	Caring for body parts					
d530	Toileting					
d540	Dressing					
d550	Eating					
d570	Looking after one’s health					
d640	Doing housework					
d660	Assisting others					
d710	Basic interpersonal interactions					
d770	Intimate relationships					
d850	Remunerative employment (G)					
d920	Recreation and leisure					

TABLE IB.—Functioning profiles. ICF Categorical Profile; ICF Qualifier: rate the extent of problems (0 = no problem to 4 = complete problem) and the extent of positive (+) or negative impact of environmental (e) and personal factors (pf).

	Facilitator					Barrier							
	4+	3+	2+	1+	0	1	2	3	4				
e110	Products or substances for personal consumption											-	-
e115	Assistive products... for personal use in daily living											2	+4
e120	Assistive products---for personal...mobility ...											1	+4
e155	Design, construction...of buildings for private use											-	-
e310	Immediate family											-	-
e320	Friends											-	-
e355	Health professionals											-	-
e460	Social attitudes											-	-
e580	Health services, systems and policies											-	-
pf	Self-assurance											SP	0
pf	Motivation											-	-
pf	Assertiveness											SP	0
pf	Motives											-	-

tioning across domains of body functions and structure, activities and participation — *i.e.* everything the body does and the actions, simple and complex that people perform — in interaction with environmental factors that can act either as barriers (limiting performance) or facilitators (enhancing performance). Thanks to the ICF this potentially complex experience is operationalized by a classification, so that the experience can be accurately and fully described, in an internationally standard language.

The ICF definition of disability is somewhat broader than our everyday notion since it includes impairments (problems in body functions and structures) and clearly distinguishes between problems that result entirely from the underlying health condition (capacity) from problems arising from the interaction between capacity and the environment and personal factors (performance). Since rehabilitation in general and PRM in particular seek to optimize functioning in all domains, it can be said that these health strategies address, and attempt to eliminate or ameliorate the experience of disability.

*Disability epidemiology*

For decades the challenge has been to reach a consensus about the definition of disability as a first step toward a true epidemiology of disability. Although the

ICF has now established a consensus conceptualization, the current state of the epidemiology of disability tends to confuse two experiences: problems people experience performing actions entirely because of their state of health — the capacity perspective — and problems people experience resulting from the interaction between their state of health and environmental and personal factors – the performance perspective. Although they differ, both perspectives are important to estimate the prevalence of disability as well as to understand rehabilitation practice.<sup>7</sup> In line with its Disability Action Plan,<sup>21</sup> WHO has taken the step to refine disability epidemiology by developing a Model Disability Survey that clearly distinguishes the capacity from the performance perspectives, in order to disentangle the health from the environmental determinants of the experience of disability.<sup>22</sup>

*Disability interventions*

From the performance perspective — *i.e.* the actual lived experience of disability — limitations in the capacity to perform in some domain such as in mobility or major life activities may be considerably reduced by appropriate assistive devices and other environmental facilitators that enhance performance and so reduce disability. Yet these rehabilitation interventions require us

to be able to translate the potential gains from capacity improvement and environmental changes on the actual performance of actions. As a matter of rehabilitation practice, the ICF makes it clear that these interventions must focus on the interaction between person and environment. The effectiveness and quality of rehabilitation interventions must be assessed, not merely in the extent of capacity improvement or environmental facilitation, but in the actual outcome of this interaction. That is what it means to optimize functioning.

### *Disability evaluation*

Since domains of functioning lie on a continuum from no problem to complete problem, disability is not the opposite of functioning, but rather a range of functioning within the overall continuum that, intuitively, lies toward the complete problem end of that continuum. There is therefore no single point on the continuum where, for every domain, functioning ends and disability begins. These threshold points will be determined in different ways for different purposes. This is important epidemiologically since, for example, legal definitions of disability will establish the threshold for purposes of eligibility to support and services, differently across countries, and even between different ministries within countries. These definitions cannot provide the basis for internationally comparable disability epidemiology, which instead requires a standardized metric of functioning derived psychometrically. In terms of clinical practice, although there may be general agreement about when, for any domain, functioning is sub-optimal, good clinical practice recognizes that the level of functioning that a person experiences as disability will be shaped by personal and cultural expectations. Person-centered care requires that these expectations be respected, even if in the end they do not determine good clinical practice.

### *Disability – two societal perspectives*

The ICF conceptualization of functioning and disability explains a persistent disagreement about the disability experience, reflected in two societal perspectives.<sup>7, 23</sup> On the one hand, disability is clearly a universal feature of the human condition, in the sense that everyone will experience or is at risk of experiencing limitations of

capacity and problems of performance in one or several domains of functioning. Although not everyone will experience a severe disability over the course of their lifespan, ageing itself is a process of accumulating impairments across many domains, often individually of low or moderate severity, but collectively quite limiting. That disability is a universal feature therefore is simply a descriptive fact of the epidemiology of functioning. At the same time, however, primarily for socio-political reasons, we socially identify a group of individuals as ‘persons with disabilities’ as, effectively, a minority group who, as a group, have been marginalized from the mainstream and denied, to one extent or another, full inclusion and effective participation in society. This social problem is not universal, but is restricted to a separate minority.

The focus of rehabilitation is on the universal sense of disability. Because of population ageing – caused in part by the success of modern medicine and increased survival from disease and trauma – increasingly rehabilitation interventions are focused not only on severe assaults on functioning, such as stroke and Spinal Cord Injury (SCI), but also on situations of multiple, but relatively mild or moderate disabilities associated with the ageing process and linked to several health conditions, rather than a single severe disability directly associated with a single severe chronic health condition.<sup>24, 25</sup> The future challenge of rehabilitation as a health strategy, and PRM in particular, in the context of increased burden of care, increased costs of health and social care and greater social expectations of good health, will therefore be to create complex interventions strategies that respond to the entire experience of disability, involving several, diverse, domains of functioning. Equally important will be the evaluation of the outcomes of these interventions, in order to ensure quality and contain costs. But as a society – including rehabilitation professionals and professional organizations – we almost must address the concerns of those individuals living with disability who are excluded from fully participating in society. Here the focus is primarily on the social goal of full inclusion in line with basic human rights. These rights have been expressly reaffirmed for this social group by the 2006 United Nations’ Convention on the Rights of Persons with Disabilities.<sup>26</sup>

## Rehabilitation

*Rehabilitation, a main health strategy of the health system*

From a health system perspective, rehabilitation is one of the five health strategies,<sup>13, 14</sup> the goals and outcome indicators of which are shown in Table II.<sup>27</sup> Since the Declaration of Alma Ata in 1978 rehabilitation is considered an essential health strategy in primary care which aims to address “the main health problems in the community” by “providing promotive, preventive, curative and rehabilitative services”.<sup>28</sup>

TABLE II.—*The main health strategies of the health system, their goals and indicators adapted from: Stucki G, Bickenbach J. Functioning: the third health indicator in the health system and the key indicator for rehabilitation. Eur J Phys Rehabil Med. 2017;53:134-8.*

Strategy	Health Goal	Indicator	
Preventive	Health condition prevention (disease prevention)	Morbidity	ICD
Promotive	Optimal biological health	ICF-Capacity	ICF
Curative	Health condition control (disease control)	Mortality	ICD
Rehabilitative	Optimal functioning	ICF-Capacity and performance	ICF
Supportive	Optimal lived health	ICF-Performance	ICF
Palliative	Quality of life and wellbeing	Satisfaction	

TABLE III.—*International Classification of Functioning, Disability and Health (ICF)-based conceptual description of rehabilitation strategy, modified version (ICF terms are marked in bold).*

Rehabilitation is the health strategy which, based on WHO’s **integrative model of functioning, disability and health** applies and integrates  
 → approaches to assess **functioning** in light of **health conditions**  
 → approaches to optimize a **person’s capacity**  
 → approaches that build on and strengthen the resources of the **person**  
 → approaches that provide a **facilitating environment**  
 → approaches that develop a **person’s performance**  
 → approaches that enhance a person’s health-related quality of life in partnership between person and provider and in appreciation of the person’s perception of his or her position in life over the course of a **health condition** and in all age groups; along and across the continuum of care, including hospitals, rehabilitation facilities and the community, and across sectors, including health, education, labor and social affairs; with the goal  
 to enable persons with **health conditions** experiencing or likely to experience **disability** to achieve and maintain optimal **functioning**

From: Meyer T, Gutenbrunner C, Bickenbach J, Cieza A, Melvin J, Stucki G. Towards a conceptual description of rehabilitation as a health strategy. Journal of rehabilitation medicine. 2011;43(9):765-9. Table II p. 768.

*The emergence of rehabilitation as the key health strategy of the 21<sup>st</sup> century*

The curative, preventive and promotive health strategies were responsible for the growth in influence of medicine and public health for most of the 19<sup>th</sup> and 20<sup>th</sup> centuries. But towards the end of the last century epidemiological challenges emerged, principally because of the successes of previous decades. Specifically, the population was ageing because of better health care and increased survival for conditions previously considered lethal, and the non-communicable chronic diseases became, at least in the high resource world, the primary source of mortality.<sup>28</sup> In this century, as a consequence, besides maintaining the public health goal of prevention, the primary health strategy is not so much to cure as to optimize the functioning of people who are living longer, but with considerably more disability.<sup>30, 31</sup> But this is the natural domain of rehabilitation, whose

### Box 4.1. What is rehabilitation?

This Report defines **rehabilitation** as “a set of measures that assist individuals who experience, or are likely to experience, disability to achieve and maintain optimal functioning in interaction with their environments”.

A distinction is sometimes made between habilitation, which aims to help those who acquire disabilities congenitally or early in life to develop maximal functioning; and rehabilitation, where those who have experienced a loss in function are assisted to regain maximal functioning (2). In this chapter the term “rehabilitation” covers both types of intervention. Although the concept of rehabilitation is broad, not everything to do with disability can be included in the term. Rehabilitation targets improvements in individual functioning – say, by improving a person’s ability to eat and drink independently. Rehabilitation also includes making changes to the individual’s environment – for example, by installing a toilet handrail. But barrier removal initiatives at societal level, such as fitting a ramp to a public building, are not considered rehabilitation in this Report.

Rehabilitation reduces the impact of a broad range of health conditions. Typically rehabilitation occurs for a specific period of time, but can involve single or multiple interventions delivered by an individual or a team of rehabilitation workers, and can be needed from the acute or initial phase immediately following recognition of a health condition through to post-acute and maintenance phases.

Rehabilitation involves identification of a person’s problems and needs, relating the problems to relevant factors of the person and the environment, defining rehabilitation goals, planning and implementing the measures, and assessing the effects (see figure below). Educating people with disabilities is essential for developing knowledge and skills for self-help, care, management, and decision-making. People with disabilities and their families experience better health and functioning when they are partners in rehabilitation (3-9).

Figure 3.—Definition of rehabilitation in the World Report on Disability [WRD].

objective is to optimize intrinsic health capacity and enhance facilitating environments so that, in interaction, the outcome is more functioning and less disability. In effect, demographic and epidemiological realities have socially transformed rehabilitation into the key health strategy of the 21<sup>st</sup> century.<sup>32</sup>

### *Defining rehabilitation based on the ICF*

The adoption of the International Classification of Functioning, Disability and Health (ICF)<sup>4</sup> has provided the framework for rethinking rehabilitation as a health strategy and putting rehabilitation on a firmer conceptual footing. A slightly modified part of an ICF-based conceptual description of rehabilitation published in 2007 by the professional practice committee of the UEMS-PRM Section<sup>14</sup> was used as the definition of rehabilitation in the World Health Organiza-

VR is a multi-professional evidence-based approach that is provided in different settings, services, and activities to working age individuals with health-related impairments, limitations, or restrictions with work functioning, and whose primary aim is to optimize *work participation*.

Figure 4.—Proposed conceptual definition of vocational rehabilitation (VR) based on the ICF.

tion's World Report on Disability (WRD) launched in 2011 (Figure 3).<sup>33</sup> In the same year, after an international discussion, ISPRM developed and endorsed an up-dated version of this conceptual description (Table III).<sup>15</sup>

This conceptual description has also served as the basis for derived conceptualizations for specific applications. In particular, a derived version was developed for the medical specialty PRM, first in a version for inter-

TABLE IV.—*International Classification of Functioning, conceptual description of Physical and Rehabilitation Medicine (PRM).*

1. Physical and Rehabilitation Medicine is the medical specialty that, based on WHO's integrative model of **functioning, disability and health** and rehabilitation as its core health strategy,
2. diagnoses health conditions
3. assesses functioning in relation to **health conditions, personal and environmental factors**
4. performs, applies and/or prescribes biomedical and technological interventions to treat health conditions in order to
  - stabilize, improve or restore **impaired body functions and structures**
  - prevent **impairments** and medical complications, and manage risks
  - compensate for the absence or loss of **body functions and structures**
5. leads and coordinates intervention programs to optimize **activity and participation**
  - in a patient-centered problem-solving process
  - in partnership between person and provider and/or carer and in appreciation of the person's perception of his or her position in life
  - performing, applying and integrating biomedical and technological interventions, psychological and behavioral; educational and counseling, occupational and vocational, social and supportive, and physical environmental interventions
6. provides advice to patients and their immediate social **environment**, service providers and payers
  - over the course of a **health condition**,
  - for all age groups
  - along and across the continuum of care,
  - including hospitals, rehabilitation facilities and the community
  - and across sectors
  - including health, education, employment and social affairs
7. provides education to patients, relatives and other important persons to promote functioning and health
8. manages rehabilitation and health across all areas of health services
9. informs and advises the public and decision makers about suitable policies and programs in the health sector and across other sectors that
  - provide a **facilitative** larger physical and social environment;
  - ensure access to rehabilitation services as a human right;
  - and empower PRM specialists to provide timely and effective care
10. with the goal
  - to enable persons with health conditions experiencing or likely to experience disability to achieve and maintain optimal functioning in interaction with their environment.

ICF terms are marked in bold, rows are numbered in italic.

WHO: World Health Organization.

From: Gutenbrunner C, Meyer T, Melvin J, Stucki G. Towards a conceptual description of Physical and Rehabilitation Medicine. Journal of rehabilitation medicine. 2011;43(9):760-4. Table I p. 762.

national discussion,<sup>34</sup> followed by a revised version endorsed by ISPRM in 2011 (Table IV).<sup>16</sup> This conceptual description lends itself to the development of derived conceptualizations for specific areas of PRM, such as in relation to rehabilitation focusing on organ systems or health conditions. Finally, a second derived conceptual description has been developed for vocational rehabilitation (VR) (Figure 4).<sup>35</sup>

## References

- WHO. Constitution of the World Health Organisation. [Internet]. 2006. Available from: [http://www.who.int/governance/eb/who\\_constitution\\_en.pdf](http://www.who.int/governance/eb/who_constitution_en.pdf)
- WHO. World Health Organisation International Classification of Diseases. Version 10. 1992.
- Selb M, Kohler F, Robinson Nicol MM, Riberto M, Stucki G, Kennedy C, *et al*. ICD-11: a comprehensive picture of health, an update on the ICD-ICF joint use initiative. *J Rehabil Med*. 2015 Jan;47(1):2–8.
- WHO. International Classification of Functioning, Disability and Health (ICF) 2001. 2001.
- Stucki G, Zampolini M, Juocevicius A, Negrini S, Christodoulou N. Practice, science and governance in interaction: European effort for the system-wide implementation of the International Classification of Functioning, Disability and Health (ICF) in Physical and Rehabilitation Medicine. *Eur J Phys Rehabil Med*. 2017;53(2):299–307.
- Prodinger B, Ballert CS, Brach M, Brinkhof MWG, Cieza A, Hug K, *et al*. Toward standardized reporting for a cohort study on functioning: The Swiss Spinal Cord Injury Cohort Study. *J Rehabil Med*. 2016 Feb;48(2):189–96.
- Stucki G, Prodinger B, Bickenbach J. Four steps to follow when documenting functioning with the International Classification of Functioning, Disability and Health (ICF). *Eur J Phys Rehabil Med*. 2017;53(1):144–9.
- Prodinger B, Tennant A, Stucki G. Standardized reporting of functioning information on ICF--based common metrics. *Eur J Phys Rehabil Med*. 2017 May 23;
- WHO | International Classification of Functioning, Disability and Health (ICF) [Internet]. WHO. [cited 2017 Jun 14]. Available from: <http://www.who.int/classifications/icf/en/>
- ICF Based Documentation Form. World Health Organisation and ICF Research Branch [Internet]. [cited 2016 Aug 23]. Available from: <http://www.icf-core-sets.org/>
- Bickenbach J, Cieza A, Rauch A, Stucki G. ICF Core Sets Manual for Clinical Practice. Hogrefe: Verlagsguppe. 2012.
- ICF Research Branch. ICF Research Branch [Internet]. 2016. Available from: <https://www.icfresearch-branch.org/>
- Stucki G, Bickenbach J, Gutenbrunner C, Melvin J. Rehabilitation: the health strategy of the 21st century. *J Rehabil Med*. 2017. [Epub ahead of print]
- Stucki G, Cieza A, Melvin J. The International Classification of Functioning, Disability and Health (ICF): a unifying model for the conceptual description of the rehabilitation strategy. *J Rehabil Med*. 2007 May;39(4):279–85.
- Meyer T, Gutenbrunner C, Bickenbach J, Cieza A, Melvin J, Stucki G. Towards a conceptual description of rehabilitation as a health strategy. *J Rehabil Med*. 2011 Sep;43(9):765–9.
- Gutenbrunner C, Meyer T, Melvin J, Stucki G. Towards a conceptual description of Physical and Rehabilitation Medicine. *J Rehabil Med*. 2011 Sep;43(9):760–4.
- ICF Case Studies. Translating Interventions into Real-life Gains – a Rehab-Cycle Approach. [Internet]. 2016. Available from: <https://www.icf-casestudies.org/index.php?lang=en>
- Dorjbal D, Cieza A, Gmünder HP, Scheel-Sailer A, Stucki G, Üstün TB, *et al*. Strengthening quality of care through standardized reporting based on the World Health Organization's reference classifications. *Int J Qual Health Care*. 2016;28(5):626–33.;
- Li J, Prodinger B, Reinhardt JD, Stucki G. Towards the system-wide implementation of the International Classification of Functioning, Disability and Health in routine practice: Lessons from a pilot study in China. *J Rehabil Med*. 2016 Jun 13;48(6):502–7.
- Gutenbrunner C, Bickenbach J, Kiekens C, Meyer T, Skempes D, Nugraha B, *et al*. ISPRM discussion paper: proposing dimensions for an International Classification System for Service Organization in Health-related Rehabilitation. *J Rehabil Med*. 2015 Oct 5;47(9):809–15.
- WHO. WHO Global Disability Action Plan 2014–2021: Better health for all people with disability. Sixty-seventh World Health Assembly 4 April 2014 [Internet]. 2014. Available from: <http://www.who.int/disabilities/actionplan/en/>
- WHO. Model Disability Survey [Internet]. Available from: [www.who.int/disabilities/data/mds/en/](http://www.who.int/disabilities/data/mds/en/).
- Bickenbach J, Rubinelli S, Stucki G. Being a person with disabilities or experiencing disability: Two perspectives on the social response to disability. *J Rehabil Med*. 2017;49(7):543–9.
- He W, Muenchrath M H, Kowal Paul. Shades of Gray: A Cross-Country Study of Health and Well-Being of the Older Populations in SAGE Countries, 2007–2010 International Population Reports. 2012.
- WHO. World Report on Ageing and Health. 2015.
- United Nations. Convention on the Rights of Persons with Disabilities, G.A. Res. 61/106 (2007). [Internet]. Available from: [www.un.org/esa/socdev/enable/rights/convtexte.htm](http://www.un.org/esa/socdev/enable/rights/convtexte.htm)
- Stucki G, Bickenbach J. Functioning: the third health indicator in the health system and the key indicator for rehabilitation. *Eur J Phys Rehabil Med*. 2017;53(1):134–8.
- WHO. Declaration of Alma-Ata. International Conference on Primary Health Care [Internet]. 1978. Available from: [http://www.who.int/publications/almaata\\_declaration\\_en.pdf](http://www.who.int/publications/almaata_declaration_en.pdf)
- WHO. Global Status Report on Noncommunicable Diseases 2014. 2014.
- United Nations DESA. World Population Prospects. The 2015 Revision. [Internet]. Available from: [https://esa.un.org/unpd/wpp/publications/files/key\\_findings\\_wpp\\_2015.pdf](https://esa.un.org/unpd/wpp/publications/files/key_findings_wpp_2015.pdf)
- Wan H, Muenchrath M, Kowal Paul. Shades of Gray: A Cross-Country Study of Health and Well-Being of the Older Populations in SAGE Countries 2007–2010: International Population Report [Internet]. New York: United States Census Bureau.; 2012. Available from: <https://www.census.gov/prod/2012pubs/p95-12-01.pdf><https://www.census.gov/prod/2012pubs/p95-12-01.pdf><https://www.census.gov/prod/2012pubs/p95-12-01.pdf>
- Stucki G. Olle Höök Lectureship 2015: The World Health Organization's paradigm shift and implementation of the International Classification of Functioning, Disability and Health in rehabilitation. *J Rehabil Med*. 2016 Jun 13;48(6):486–93.
- WHO, World Bank. World Report on Disability. 2011.
- Stucki G, Melvin J. The International Classification of Functioning, Disability and Health: a unifying model for the conceptual description of physical and rehabilitation medicine. *J Rehabil Med*. 2007 May;39(4):286–92.
- Escorpizo R, Reneman MF, Ekholm J, Fritz J, Krupa T, Marnetoff S-U, *et al*. A conceptual definition of vocational rehabilitation based on the ICF: building a shared global model. *J Occup Rehabil*. 2011 Jun;21(2):126–33.

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- European College of Physical and Rehabilitation Medicine (ECPRM) – served by the UEMS-PRM Board
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## BACKGROUND OF PHYSICAL AND REHABILITATION MEDICINE

# White Book on Physical and Rehabilitation Medicine in Europe. Chapter 2. Why rehabilitation is needed by individual and society

European Physical and Rehabilitation Medicine Bodies Alliance

### ABSTRACT

In the context of the White Book of Physical and Rehabilitation Medicine (PRM) in Europe, this paper describes the background to the context of PRM services and comprises the following:

- Epidemiological Aspects of Functioning and Disability
- Ethical Aspects and Human Rights
- Rehabilitation and Health Systems
- Economic Burden of Disability
- Effects of Lack of Rehabilitation

Health care service planning accounts for the burden of disability among society and the chapter describes the justification for specialist rehabilitation, the background of PRM and why making a functional diagnosis and a management plan based on function is its core competence.

The chapter describes the increasing burden of disability due to conditions seen in PRM practice rather than on all those diseases contributing to physical disablement and does not include mental illness, learning disabilities, etc. Ten percent of Western Europe's population have a disability and are surviving longer, resulting in higher costs for health and social care and a greater impact of co-morbidities. The chapter also describes the impact and increased costs in the absence of rehabilitation. Not only is money spent on rehabilitation recovered with five to nine-fold savings (*e.g.* in return to work), but rehabilitation is effective in all phases of health conditions. Specialized rehabilitation (as delivered by PRM services) is highly cost-efficient for all neurological conditions, producing substantial savings in ongoing care costs, especially in high-dependency patients. Disability discrimination has been outlawed and the text describes the legal context and status of a person living in Europe with a disability. The second part highlights the United Nations Conventions on human rights, confirmed in the World Report on Disability, but also on the principles of ethical practice among PRM physicians.

The third part addresses the variability of access to and funding of rehabilitation services across countries. The chapter also distinguishes highly specialist interventions (such as those provided by a PRM physician) from specialized therapies, (such as pressure ulcer management) and generic therapies (*e.g.* after an uncomplicated limb fracture). It will be important for healthcare authorities, public health organizations, payers, providers, healthcare professionals, consumers and the community.

The economic and social burden of disability on society is considerable and will get worse, although this is difficult to quantify. Direct costs are variable and include disabled persons' additional costs for daily living and state disability benefits. Rehabilitation has a pivotal role in reducing these costs through promoting personal recovery and increasing function through altering environmental factors. This part describes cost savings studies through rehabilitation for persons with severe disabilities.

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**Key words:** Physical and rehabilitation medicine - Europe - Burden of disability - Economics - Human rights - Rehabilitation costs and impact.

### Introduction

The White Book (WB) of Physical and Rehabilitation Medicine (PRM) in Europe is produced by the 4 European PRM Bodies and constitutes the reference book for PRM physicians in Europe. It has multiple values, including to provide a unifying framework for the European Countries, to inform decision-makers at the

European and national level, to offer educational material for PRM trainees and physicians and information about PRM to the medical community, other rehabilitation professionals and the public. The WB states the importance of PRM, which is a primary medical specialty. The contents include definitions and concepts of PRM, why rehabilitation is needed by individuals and society, the fundamentals of PRM, history of PRM spe-

cialty, structure and activities of PRM organizations in Europe, knowledge and skills of PRM physicians, the clinical field of competence of PRM, the place of PRM specialty in the healthcare system and society, education and continuous professional development of PRM physicians, specificities and challenges of science and research in PRM and challenges and perspectives for the future of PRM.

This chapter describes the background to the context of PRM services. Any planning of the latter has to take into account the burden of disability among society and the chapter provides an overview of the situation not only in Europe, but also generally across the world. Specialists in PRM need to relate to this context and know how to apply it to permit them to practice within the accepted standards for the specialty. Other doctors, healthcare professionals and service planners also need to know the background of PRM and why making a functional diagnosis and a management plan based on function is the core element of competence in PRM.

### Epidemiological aspects

#### *Demographic change in Europe*

Europe's population is not only growing and, has recently had a further expansion from large numbers of migrants. The figures in 2013 pointed to a total of 742.5 million inhabitants, of whom 510 million live in the 28 member states of European Union. The Union of European Medical Specialists (UEMS) includes the Greater European Space with 31 countries — EU member states plus Switzerland, Norway, Iceland). Turkey, Israel and Serbia are associate members, but the UEMS PRM Section also contains observer countries (Bosnia and Herzegovina, Montenegro, FYROM, Georgia, Armenia, Russia and Ukraine). The UEMS is seeking to include other countries from Eastern Europe and those bordering Asia, such as Belarus, Kazakhstan and Azerbaijan.

The total population thus rises to 851.6 million according to the more recent statistics (2016). Life expectancy is also increasing among Europeans. For instance, it rose in Germany by almost 3 years between 1990 and 2000 and, by 2030, it is estimated that one person in four will be aged 65 years or over.<sup>1, 2</sup> In addition to an ageing population, an increased level of disability is seen, which is reflected by a growth in the burden of care, higher costs for health and social care and a great-

er impact of co-morbidities. About 10% of Western Europe's population experience a disability, as described in a British survey.<sup>3, 4</sup>

Two important factors have also to be considered:

— Survival from serious disease and trauma leaves an increasing number of people with complex problems functional deficits.

— Many of these people are young at the time of their event/injury and will survive for many decades.<sup>5, 6</sup>

Examples are numerous, *e.g.* stroke, traumatic brain injury, polytrauma and childhood cancer, where better-organized acute care and rehabilitation have led to greater survival and better outcomes.<sup>7-16</sup>

There is also an expectation of good health in today's society. This places further demands on all health care, including PRM physicians. Dealing with the consequence of disease and trauma, such as spasticity following an insult to the brain or spinal cord, means that not only do patients' lives improve, but there is also a benefit to the health economy by reducing the expenditure of treating these complications. This will have a direct effect on care provision, working lives and pensions.<sup>12, 13, 17</sup> In particular, problems, such as immobility, pain, nutrition, incontinence, communication disorders, mood and behavioral disturbance become important in addition to systemic illness and the complications of the predisposing disabling conditions. Rehabilitation is effective in reducing the burden of disability and in enhancing opportunities for people with disabilities. There is evidence that it may be less expensive than providing no such service (17). There is strong evidence that preventing complications of immobility (*e.g.* pressure ulcers and contractures), of brain injury (*e.g.* behavioral problems) and of pain (*e.g.* mood changes) can lead to many benefits.<sup>17</sup>

#### *Epidemiology of functioning and disability*

Epidemiological studies have traditionally based their methodology on pathologies. They have now started to address chronic disease as an entity, but have not yet properly tackled the concepts of functioning, participation and quality of life among persons with disabilities as a population. A modern approach is to deal with these problems by focusing on healthy life expectancy (HALE) and disability-adjusted life-years (DALYs). These are summary measures of population health that

combine information on mortality and non-fatal health outcomes to represent population health in a single number. In addition to the incidence and prevalence of the most frequent pathologies in the field (strokes, spinal cord lesions, traumatic brain injuries, amputations, rheumatic diseases, other neurological or musculoskeletal conditions, pain, etc.), epidemiology in PRM should consider the:

- resultant loss of functioning in terms of the ICF categories;
- natural history of functions, activity and participation;
- need for and access to resources for use in rehabilitation (human resources, facilities, equipment, materials);
- access to the available PRM resources.

Such information aids the planning and prioritisation of regional, national and European services, in the funding of research and in the development of training by giving information on the effectiveness and cost-effectiveness of PRM interventions. There are many reports giving the incidence and prevalence of the major disabling conditions seen in PRM practice. Some examples are given in Appendix 3. PRM is particularly concerned with their impact. As an example we may look for the results of a recent survey in Portugal which reported that at least 0.7% of the entire population was restricted to bed; 0.4% were restricted to sitting (require wheelchairs); 1.9% did not live in their own homes; 9.0% did not walk or had a significant limitation in walking; 8.5% were limited in transferring to and from bed; 6.2% could not use the toilet without help; 8.6% needed help dressing or undressing; 3.6% of men and 5.3% of women had urinary incontinence; around 2.3% had speech difficulties. The overall prevalence of all disabilities in the community was 10%.<sup>18</sup>

In summary, the epidemiological data support the burden of long term conditions among populations in Europe and highlights the need for rehabilitation in Europe. Specific epidemiologic data focused on functioning and reduced activities are essential to give us the correct idea how we are progressing in global rehabilitation care. It is thus possible to surmise the importance of the need for rehabilitation and the potentially significant contribution of PRM in reducing this burden as well as to empowering people with disabilities.

### Ethical aspects and human rights

The aim of this chapter is to highlight the progress to date in supporting human rights for people with disabilities, particularly, when they need the advice of and treatment from PRM services. This chapter deals with two aspects: human rights as a societal approach (macro level) and an ethical approach of practicing medicine (micro level). In reality, there is an interaction of both.

The conclusion was that human rights are playing an increasing role in the struggle to improve health and healthcare globally. They also have important implications for rehabilitation practitioners and researchers and should form the core of any ethical framework for rehabilitation. It might even be argued that rights and dignity are themselves valued outcomes for rehabilitation.

This chapter deals mainly with human rights, but has been included to show where they sit into PRM practice. Specialists in the field must address the ethical issues concerning the principles & norms of proper professional conduct. They should also concern themselves with knowing the rights and the duties of health care professionals themselves & their conduct toward patients and fellow practitioners, including the actions taken in the care of patients and family members. They assume responsibility to adhere to the standards of ethical practice and conduct set by profession and these are set out in all or most European states, e.g. the UK's General Medical Council's "Good Medical Practice". This includes ethical issues in patient care, professional teamwork and coping with healthcare rationing. Clinicians should take note of lifestyle issues for persons with disabilities and should follow general professional conduct in ethical issues in rehabilitation research.

#### *Human rights approach:*

There has been a considerable change in human rights opportunities for, and in the legal framework surrounding discrimination against people with disabilities. There are now over one billion persons with disabilities across the world<sup>19</sup> and they form a significant proportion of society. This equates to about 106 million people living in Europe. Their rights are thus mainstream and they are not a faction to be catered for. In the past, they were simply regarded as a group, for whom care should be provided, but it is the norm now in Europe (or should be) that they live as citizens with full autonomy, inclu-

sion, dignity and human rights.<sup>20</sup> This is fundamental in the text of the UNCRPD. This is also supported in the UN Standard for Human Rights, which forms the basis of legislation to prevent discrimination against people on the grounds of disability. The UN Declaration of Human Rights<sup>21</sup> states that a person with a disability should not be an object of care (a “patient”) throughout life. Instead, he or she is a citizen with special needs related to a specific disability. These needs should be catered in the society, but in a “normal” context. Participation is fundamental and a central aspect of this is access to society. This includes physical access, *e.g.* into public and private areas and buildings, as well as to public transport, information etc. Regulations on accessibility have been established in several European countries for the construction of public buildings. The UN General Assembly approved the development of UN Standards in December 1993 and, through its development into a convention to provide persons with disabilities full participation and equality, it is important in laying down fundamental principles. The WHO defines disability as an interaction of a person with a health condition and the environment solving the “either-or” discussion between the medical or social approach to an as well as approach.<sup>19</sup>

The Council of Europe has also published a series of reports and documents on human rights for people with disabilities. These have not been produced in detail here, as they were published in the 2<sup>nd</sup> Edition of the White Book.<sup>22, 23</sup> Its aims are to:

- improve the quality of life of persons with disabilities and their families over the next decade;
- adopt measures aimed at improving quality of life of people with disabilities, which should be based on a sound assessment of their situation, potential and needs;
- develop an action plan in order to achieve these goals;
- allow equity of access to employment as a key element for social participation;
- adopt innovative approaches, as persons with physical, psychological and intellectual impairments live longer;
- create activities to enable a good state of physical and mental health in the later stages of life;
- strengthen supportive structures around persons with disabilities in need of extensive support;
- promote the provision of quality of services;

— develop programs and resources to meet the needs of persons with disabilities.

Disability Rights legislation has also been created in several European countries.<sup>24</sup> Some have had long-standing legislation with a general policy on the rehabilitation of persons with disabilities (*e.g.* France has had a Disabled Persons Act since 1975), but the majority of countries have passed anti-discrimination legislation only during the last fifteen to twenty years, *e.g.* Act of Equal Opportunities for Disabled Persons (Germany), Framework Law (Italy), Constitution Act (Finland), Act on Provision of Rights of Persons with Disabilities (Hungary 1998), Health for All 2004 (Slovenia), Disability Discrimination Act 1996 (UK), Toward Inclusion 2001 (UK) etc.

These are as follows:<sup>7</sup>

— Rehabilitation & the right to health is described in the World Report on Disability 2011 and the UN Convention on Human Rights 2005 (19,25,26). Human rights are based on the FREDA values (Freedom, Respect, Equality, Dignity, Autonomy), which gives freedom from discrimination, particularly where minority rights are considered. All members of society have a right to health in terms of health determinants, sanitation, food, water, nutrition and a right to rehabilitation. The conceptual description of rehabilitation has previously been described in the context of its provision through the health sector

— Rehabilitation is also supported through international law and there has been much written in many declarations and conventions — *e.g.* 2006 UN Convention on Rights of Persons with Disabilities.<sup>27</sup> Equally, rehabilitation is supported under regional EU law and the European Convention on Human Rights describes this. Finally, PRM and health services support a human rights approach to the practice of rehabilitation and PRM services. These should be available, acceptable to users, be of high quality and be accessible to all (*i.e.* non-discriminatory, physical, affordable, within the field of ethics, but this is not enshrined in law or conventions.

— They should also enshrine professional values and standards, medical education and training on ethics and human rights and advocacy

The recommendations were to:<sup>27</sup>

- promote professional standards;
- highlight education and training on ethics and hu-

man rights for medical undergraduates and doctors in training;

- encourage education among people with disabilities, influencing policymakers and set advocacy assistance.

From a human rights perspective, rehabilitation practice imposes essential standards of healthcare services, which should be:

- accessible from a physical and information perspective;
- non-discriminatory;
- affordable;
- acceptable from an ethical and cultural aspect;
- scientifically and medically appropriate and of the highest quality.

Turning to health care, the primary goal of health care policy is to maximize the health of the population within the limits of the available resources, and within an ethical framework built on equity and solidarity principles. Innovative technologies that offer a therapeutic benefit should be made available at an acceptable cost.<sup>28</sup> The implied choices, at the macro-, meso- and micro- level will be described below. In 2005 the World Health Assembly adopted a Resolution on “Disability, including Prevention, Management and Rehabilitation” and made a number of recommendations, charging the Director-General with a number of tasks.<sup>29</sup> The WHO regards disability as a human rights issue, a public health issue and a development issue.<sup>30, 31</sup>

### *Applying the principles of (medical) ethics*

From a medical ethics perspective, what does this mean for medical practice? Shared decision making is important for clinicians in all medical specialties, but particularly so for those in PRM. The adoption of human rights as the driving force for an inclusive policy and medical ethics is the underlying principle of patient-centered rehabilitation care and PRM practice. Advocates in decision making at government and planning level. This chapter will address only ethical principles at a macro level, *i.e.* in relation to healthcare policy.

Conceptual choices made by society and health authorities may influence decisions with regard to persons with disabilities. These include the concepts of disability and responses described above. The World Report on Disability (2011) and the United Nations Convention

on the Rights of Persons with Disabilities (UNCRPD, 2006) have highlighted the importance of advocacy for person with disabilities through the WHO Global Disability Action Plan 2014-2021: “Better health for all people with disabilities.”<sup>18, 27, 30</sup> Article 1 of the UNCRPD describes the purpose of the convention: to promote, protect and ensure the full and equal enjoyment of all human rights and fundamental freedoms by all people with PWD, and to promote respect for their inherent dignity. The UNCRPD is legally binding in the countries that ratified it and Article 26 “Habilitation and rehabilitation” engages states to organise, strengthen and extend comprehensive habilitation and rehabilitation services and programs, particularly in the areas of health, employment, education and social services.

All of these are enshrined in PRM practice and are supported by PRM physicians and rehabilitation has thus become the key health strategy of the 21<sup>st</sup> century.<sup>32</sup> This has to address the growing need for rehabilitation because of advances in healthcare and medical technology, ageing populations, increased survival rates and life expectancy and the greater burden of chronic and long-term conditions, which put pressure on extra costs amid shrinking budgets.

Ethical and cultural issues aspects are also discussed in other chapters in the book and demonstrate that PRM physicians also act as advocates in advising governments and health care planners on decision making. These chapters will show that they are also addressed in rehabilitation curricula and postgraduate training. Professionals delivering PRM services should take time (and do) to reflect on these issues.

### **Rehabilitation and health systems**

Access to and funding of rehabilitation services vary from country to country and many of these variations depend on the relevant health care and social systems.<sup>33, 34</sup> Differences are also apparent from the differences in the way that data is collected and calculated. In some countries, there may even be regional differences. Stakeholders include healthcare authorities (politicians as well as administration), public health organizations, payers (health and social insurance or other organizations which fund health and social care), providers, healthcare professionals, consumers and the community.

Access to rehabilitation interventions is governed by prescription through a PRM physician. The discussion of rehabilitation across Europe has to separate highly specialist interventions, such as those provided by a PRM physician from specialized therapies, such as pressure ulcer management and generic therapies, such as mobilizing treatments after, say, an uncomplicated limb fracture. This chapter will not be able to address all of these, as they are paid for differently, but they are all provided in one way or another. Payers and commissioners of healthcare need to be aware of the value of specialist treatments, which require a multi-professional team as opposed to a single practitioner. They may appear expensive, but there is good evidence of their cost-efficiency in acute, post-acute and long-term settings.<sup>35, 36</sup> PRM is present in all but one of the 34 members of the UEMS and each country needs to define what will be and will not be funded through normal resource streams.

This book deals primarily with PRM in most European countries. PRM interventions are covered by a public insurance package, especially for specialist rehabilitation in acute settings and Chapter 8 describes the different phases of the PRM process. However, almost everywhere there is an out of pocket supplement for the patient, usually largest in more chronic and long-term care. Often, private insurance systems and private hospitals exist for patients, who want to complete their treatment with extra care above the provided public package. Post-acute PRM programs and physical therapy can be limited in duration or the number of sessions, but most of the variability exists in long-term rehabilitation. This seems to originate from historical differences, mainly between previous Eastern and Western Europe, but also between northern versus Mediterranean areas. In some countries, there is no public funding for long-term care, even more so since the recent financial crisis. In most Central and Eastern European countries, long-term rehabilitation is usually relatively well organized and may be combined with “Spa centers.”

Acute PRM services (inpatient and outpatient) are generally embedded in acute/general hospitals or in private practice (outpatient). Post-acute services are provided in general as well as in specific hospitals/centers, while long-term services are mainly organized in specific facilities, sometimes depending on social service rather than healthcare.

In some countries, patients have access to PRM programs through referral to a PRM physician, but there is a trend of referrals of patients from acute services to start early rehabilitation under the care of PRM physicians.

Although PRM is recognized in nearly every country of Europe, the distribution of specialists is still relatively low. There are large differences in the number of specialists by country, in their role in the health system and in their conditions of work. Appendix 2 shows the variation in numbers of specialists by country and, while an optimal number of PRM physicians per unit of population has yet to be set across Europe, there clearly remains a disparity between states.

### **Economic burden of disability**

#### *The cost of disability*

The economic burden of disability assumes a greater importance to address the increase in the number of people with disabilities and the impact of greater and longer survival. In addition, the economic crisis in Europe raises the question of how these people will be sustained through economic support. The growth in the numbers already places an economic and social burden on society and it is likely to get worse, as post-World War Two baby boomers pass the age of 70 years. The true extent of the numbers of people with severe and moderately severe disability is difficult to determine, but they are certainly placing demands on health care. One reason is that the definitions of disability often change across disciplines. There are also different assessment tools and different public programmes for disability, leading to difficulties in comparing data from various sources (33). In addition, the limited data on the cost components of disability makes it difficult to quantify the loss of the productivity and there are no commonly agreed methods for cost estimation.<sup>1</sup>

In order to understand better, we must use the ICF definition of disability<sup>37</sup> as a functional limitation that results not only from impairment or personal limitation on the daily activity, but also from the relation of a person with the environment, which involves dysfunction at one or more of three levels: impairments, activity limitations and participation restrictions. The resulting loss of capacity, at physical or mental level, reduces the performance of some of the activities of daily living, increasing the cost of reaching a given level of well-

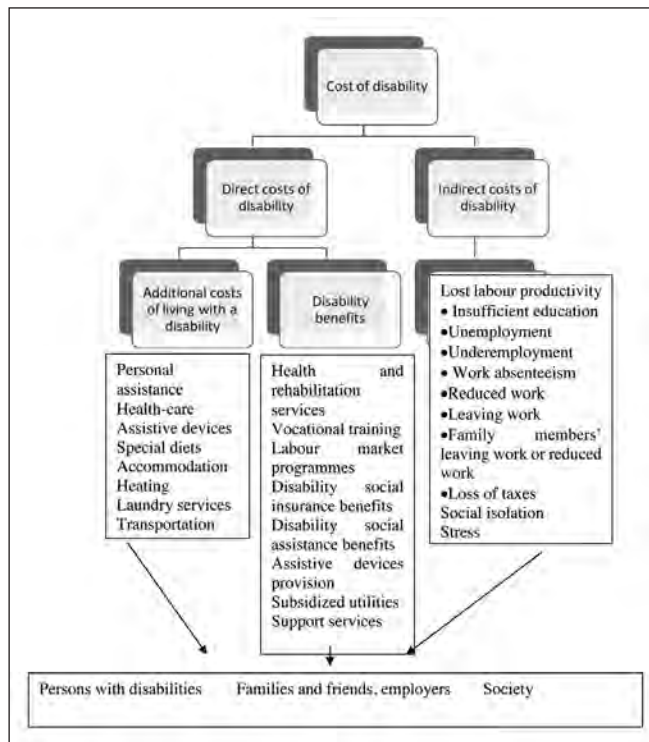


Figure 1.—The cost of disability.

being. According to the World Report on Disability, the cost of disability could be classified in direct and indirect<sup>19</sup> (Figure 1).

Direct costs can be classified into two categories: (i) the additional costs encountered by that disabled persons and their families for daily living standards and (ii) the disability benefits provided from governments.<sup>1</sup> In the United Kingdom, estimates range from 11% to 69% of standard income.<sup>38</sup> In Ireland, the estimated cost of disability varied from 20.3% to 37.3% of average weekly income, depending on the duration and degree of limitations of these people. It is higher in those with severe limitations.<sup>39</sup> 14% for households in Bosnia and Herzegovina<sup>40</sup> are classified as containing a disabled person.

Public spending on disability programs includes benefits for full and partial disability benefits, as well as disability-specific early retirement plans or reduced work capacity. Expenditure is at about 2% of gross domestic product (GDP) with the inclusion of sickness benefits. This equates to almost 2.5 times the spending on unemployment benefits and reaches about 5% of

GDP in the Netherlands and Norway.<sup>40</sup> Estimating loss in productivity due to disability and relevant taxes is thus complex and needs statistical information.

A recent study has proposed that the cost of the disability is related to two problems.<sup>41</sup> The first is financial. People with a disability may have more difficulty in getting a job, retaining the job, or may get a lower income; however, they may have to use their own finances/savings to achieve satisfaction or may need a greater income just for routine activities. The second problem relates to social protection systems, which provide services through direct taxation or facilitate the environment, such as preferred parking or employment subsidies aimed to compensate for the higher costs relevant to disability in many countries.<sup>41</sup>

In Europe, some policies address the reintegration of disabled people into the work, while others aim to compensate persons with disabilities. According to Eurostat, public social spending for disability reached a 2% of GDP in the EU-28 in 2012, ranging from 0.7% in Cyprus to 4.4% in Denmark.<sup>41</sup>

The European Commission highlighted in the European Disability Strategy 2010-2020<sup>42</sup> the eight areas for joint action between the EU and EU member states. These are:

- accessibility;
- participation;
- equality;
- employment;
- education and training;
- social protection;
- health, and External Action.

*The role of rehabilitation in reducing the cost of disability*

Rehabilitation has thus, in principle, a pivotal role in reducing the cost of disability via promoting functional recovery and increasing the function with a management of environmental factors. To reduce the cost of the disability, such a hypothesis needs to have a good cost-efficiency ratio. Recently, two studies of cost-efficiency of inpatient rehabilitation — one for complex neurological disabilities in the UK (43) and the other for brain injury in Ireland<sup>44</sup> — clearly demonstrated substantial ongoing care cost savings produced by rehabilitation with mean weekly cost reductions of £ 760<sup>43</sup> or £ 639<sup>44</sup>

for each highly dependent patient. The cost-recovery of rehabilitation was achieved in 14.2 or 15.6 months.<sup>43, 44</sup> It is important to note that the expected annual savings per patient in this markedly dependent group of patients at admission to inpatient rehabilitation can amount to € 50,000.<sup>44</sup> A residential neurobehavioral rehabilitation program during the post-acute phase of brain injury led to cost-benefits of £ 1.13 million for those receiving rehabilitation in the first year following brain injury and reaching to £ 0.86 million for those receiving rehabilitation later after injury (> one year).<sup>45</sup> These findings extend the benefit of rehabilitation services (including PRM programs) over and above just functional improvement, but also to important cost-savings to both families and third-party payers as well as to society in general. Cost-efficiency outcomes extend to rehabilitation in a variety of settings for diverse disabling conditions. For instance, two studies revealed the benefits of multidisciplinary pain rehabilitation on cost savings. There were considerable cost savings with 42.98 fewer days of sickness absence at one year when compared with patients receiving standard care.<sup>46</sup> The other study calculated savings of US\$ 27,119 per family in the year following admission to a three-week interdisciplinary pediatric chronic pain rehabilitation program of physical therapy, occupational therapy, land and water-based group exercise, recreational therapies, and psychological therapies. There were also significant reductions in the duration of hospitalization, visits to physicians' offices, physical and occupational therapy services, psychotherapy visits and missed parents' work days.<sup>47</sup> The long-term cost-efficiency of cardio-pulmonary rehabilitation has also been demonstrated.<sup>48, 49</sup> There are also benefits in terms of perceived disability, significantly lower hours of sickness absence, when a coordinated and tailored vocational rehabilitation (VR) program is delivered by a multi-professional team working in a collaborative way under the lead of a PRM physician when compared to the controls in those with musculoskeletal disorders. The total indirect cost-savings were of the order of US\$ 1366 per person at six months and US\$ 10,666 per person after one year in the intervention group.<sup>50</sup> Community rehabilitation programs for long-term care in frail elderly people was additionally found to be cost-efficient with high patient satisfaction. However, when compared with traditional in-patient rehabilitation, it did not reduce the length of hospital stays or hospital readmission rates.<sup>51</sup>

A study on occupational musculoskeletal disorders demonstrated that early rehabilitation may result in medical cost-savings of up to 64% and disability benefits cost savings of up to 80%. The cost of rehabilitation was also up to 56% lower with early delivery and with expected cost savings of approximately US\$ 170,000 per claim.<sup>52</sup> Another study calculated the long-term net cost savings at US\$ 817,836.<sup>53</sup>

A recent study on multiple sclerosis highlighted significant differences between patients with a low disability score against those with a high disability score — the latter making a significantly greater number healthcare visits and having more hospitalizations, worse health-related quality of life, more significant problems in work, more unemployment and a need to change or stop work, which all increased the direct and indirect costs of disability.<sup>54</sup> Added to this calculation should be further indirect costs of disability of € 910 million (accounting for ~0.5% of GDP) in a Portuguese population with rheumatic diseases in 2013 resulting from early retirement. These figures included the high annual cost due to lost years of working life.<sup>55</sup>

It is known that in some situations rehabilitation interventions produce further additional costs. However, they may be associated with more improvements in clinical outcomes. In some other situations, rehabilitation interventions may produce similar clinical outcomes at lower costs. Rehabilitation interventions may result in savings other health care or social services costs through maintaining productivity, which had been lost due to the underlying health condition or disability.

### Effects of lack of rehabilitation

What happens if rehabilitation and, in particular, physical and rehabilitation medicine (PRM) services are not provided? Withholding them may appear less costly, but is that cost-saving cancelled by greater expenditure on health and social care elsewhere as a consequence? <sup>43</sup> Good rehabilitation provision is, therefore, an important issue in the planning and justification of PRM services, both for the individual and his or her family/caregiver, but also for other services and society in general. It is known that money spent on rehabilitation is recovered with five to nine-fold savings and that rehabilitation is effective in all phases of health conditions.<sup>22, 23</sup> It is also known that specialized rehabilitation



(as delivered by PRM services) is highly cost-efficient for all neurological conditions, producing substantial savings in ongoing care costs, especially in high-dependency patients.<sup>43</sup> PRM services deal with the rehabilitative needs of people with complex needs and they thus consume considerable resources in health care. For instance, stroke patients with spasticity directly cost up to four times as much as those without spasticity.<sup>56</sup>

Examples of the benefits of PRM services are that:

- early spasticity management can prevent contractures and reduce the time spent in further inpatient rehabilitation;<sup>57</sup>

- early supported discharge after stroke will reduce the overall costs of health care;<sup>58</sup>

- PRM services are associated with not only a higher return to work, but also sustain people at work by appreciating that vocational rehabilitation needs to consider all the factors required to maximize the likelihood of a sustainable return to work.<sup>59</sup>

A person's rehabilitation potential cannot be considered in isolation from what would have been the outcome without rehabilitation. The question that specialist rehabilitation attempts to address is, "*will the patient benefit from the rehabilitation program in a way that would not have occurred, had the recovery been left to chance?*" The natural history of the impairment and the consequent disabilities and disadvantages play a major role in the eventual outcome following rehabilitation. Some conditions recover spontaneously and early intervention may give the false impression that therapy has been efficacious.<sup>60, 61</sup> On the other hand, early intervention may be associated with an improved outcome even where full recovery does not occur.<sup>62</sup>

The lives of people with persisting disabilities and their families can be enhanced by rehabilitation, but, more importantly, the consequence of them not having rehabilitation may be to reduce independent functioning and quality of life.<sup>63</sup> In the acute hospital, many correctable problems, such as nutrition, swallowing, mobility and equipment issues may not be addressed as the focus is inevitably on treating the primary impairment. This is where PRM physicians can assist in preventing complications and in ensuring an optimal level of functioning.<sup>64</sup> In the absence of rehabilitation complications and loss of function may occur and discharge may be delayed. Yet health services have a statutory duty to provide rehabilitation services to meet health needs of all patients.<sup>65, 66</sup>

The following may be found in the absence of rehabilitation for a variety of conditions.

- immobility including weakness, cardio-respiratory impairment, muscle wasting, pressure sores, spasticity, contractures and osteoporosis;

- pain;

- nutritional problems;

- swallowing problems;

- bladder and bowel problems (constipation and incontinence);

- communication problems;

- cognitive problems and an inability to benefit from learning;

- mood and behavioral problems;

- ill-health and systemic illness from a variety of causes, e.g. urinary tract and cardio respiratory problems, diabetes mellitus;

- complications of underlying conditions.

Knowing this, PRM services need to be involved in longer-term follow-up of patients, as they move into living in the community, in order to prevent:

- secondary health problems and social isolation;

- carers becoming exhausted by the burden of care and thus break down of the domestic situation;

- general practitioners or social workers being called on unnecessarily;

- emergency admissions back to hospital;

- unnecessary placements in residential or nursing home care;

- inappropriate and untimely prescription of disability equipment;

- inability to update disability equipment in the light of advancing technology, e.g. neuro-prostheses.

This short text cannot go into great detail with the effects of a lack of rehabilitation, but its overall result may be that the person is frequently left with a poorer functional capacity and quality of life. This has been demonstrated in community settings through wastage of resources expended in acute and post-acute settings. Several initiatives have recognized this reversal in abilities after patients are discharged home and an international expert group produced a simple easy-to-use checklist using stroke survivors as a model.<sup>67</sup> The checklist has now been validated and found to be useful, so that it can be used as a means identifying issues for persons with disabilities living at home or in institutional settings.<sup>68</sup> The experience is that many people

suffer preventable complications through a lack of rehabilitation and health services end up spending more expensive resources (e.g. surgery) to retrieve the situation or simply repeating treatments, from which the patients should have “moved on.”

Describing the effects of a lack of rehabilitation is an important issue in promoting and justifying high-caliber PRM services.

## References

- Beyer H, Beyer L, Ewert Th, Gadomski M, Gutenbrunner Chr, Kröling P, *et al*. Weißbuch Physikalische Medizin und Rehabilitation. Physikalische Medizin: Rehabilitationsmedizin Kurortmedizin. 2002 M 1-M 30;
- Deutscher Bundestag. Unterrichtung durch die Bundesregierung: Bericht der Bundesregierung über die Lage behinderter Menschen und die Entwicklung ihrer Teilhabe. 4575 Drucksache / : Bundesdruckerei, Berlin; 2005;146.
- Ward AB, Chamberlain MA. Disabled Young Adults. In Rehabilitation of the Physically Disabled Adult. 2nd Ed. Evans CD, Goodwill J, Chamberlain MA, Eds. London: Chapman & Hall; 1996.
- Dennis M, Langhorne P. So stroke units save lives: where do we go from here? *BMJ*. 1994;1273-1277.
- Brooks JC, Shavelle RM, Strauss DJ, Hammond FM, Harrison-Felix CL. Long-Term Survival After Traumatic Brain Injury Part II: Life Expectancy. *Arch Phys Med Rehabil*. 2015 Jun;96(6):1000-5.
- Shavelle RM, Strauss DJ, Day SM, Ojdana KA. Life expectancy: In: *Brain Injury Medicine: Principles and Practice*. Zasler ND, Katz DI & Zafonte RD. Demos, New York; 2007. 247-261 p.
- Rice-Oxley M, Turner-Stokes L. Effectiveness of brain injury rehabilitation. *Clin Rehabil*. 1999;13 Suppl 1:7-24.
- Redmond AD, Johnstone S, Maryosh J, Templeton J. A trauma centre in the UK. *Ann R Coll Surg Engl*. 1993 Sep;75(5):317-20.
- Templeton J. Organising the management of life-threatening injuries. *J Bone Joint Surg Br*. 1994 Jan;76(1):3-5.
- Kaste M, Skyhoj Olsen T, Orgogozo J, Bogousslavsky J, Hacke W. Organization of stroke care: education, stroke units and rehabilitation. *European Stroke Initiative (EUSI). Cerebrovasc Dis*. 2000;1-11.
- Anonymous. Organised inpatient (stroke unit) care for stroke. *Stroke Unit Trialists' Collaboration*. *Cochrane Database of Systematic Reviews*. 2002;
- National Clinical Guidelines for Stroke. Clinical Effectiveness and Evaluation Unit. 2nd Edition. Royal College of Physicians of London; 2004.
- Turner-Stokes L, Nyein K, Halliwell D. The Northwick Park Care Needs Assessment (NPCNA): a directly costable outcome measure in rehabilitation. *Clin Rehabil*. 1999 Jun;13(3):253-67.
- Livingston MG, Brooks DN, Bond MR. Patient outcome in the year following severe head injury and relatives' psychiatric and social functioning. *J Neurol Neurosurg Psychiatry*. 1985 Sep;48(9):876-81.
- British Society of Rehabilitation Medicine. Working Party Report on Traumatic Brain Injury. 1998 London;
- McLellan DL. Rehabilitation. *British Medical Journal*. 1991;355-357.
- Bent N, Tennant A, Swift T, Posnett J, Scuffham P, Chamberlain MA. Team approach versus ad hoc health services for young people with physical disabilities: a retrospective cohort study. *Lancet Lond Engl*. 2002 Oct 26;360(9342):1280-6.
- Martin J, Meltzer H, Eliot D. Report 1 The Prevalence of Disability among Adults. Office of Population, Census and Surveys, Social Survey Division. London: OPCS Surveys of Disability in Great Britain; 1988.
- WHO, World Bank. *World Report on Disability*. 2011.
- United Nations. *Standard Rules to provide persons with disability full participation and equality*. New York; 1994.
- United Nations. *Convention on the Rights of Persons with Disabilities (CRPD)*. New York; 2006.
- Gutenbrunner C, Ward A, Chamberlain M. The White Book on Physical and Rehabilitation Medicine in Europe. *J Rehabil Med*. 2007 Jan;(45 Suppl).
- Gutenbrunner C, Ward AB, Chamberlain MA. The White Book on Physical & Rehabilitation Medicine in Europe. *Journal of Rehabilitation Medicine*. 2006;287-333.
- Report of the Council of Europe. Recommendation R (92) A coherent policy for people with disabilities. Council of Europe. Strasbourg; 1992.
- Skempes D, Stucki G, Bickenbach J. Health-related rehabilitation and human rights: analyzing states' obligations under the United Nations Convention on the Rights of Persons with Disabilities. *Arch Phys Med Rehabil*. 2015 Jan;96(1):163-73.
- United Nations. *Convention on Human Rights*. United Nations, New York; 2005.
- United Nations. *Convention on the rights of persons with disabilities 2005 & 2009*. United Nations, New York.
- Belgian EU Presidency. Report of the Belgian EU Presidency, adopted by the EU Council of Ministers of Health. 2010.
- World Health Assembly Resolution. Innovative care for chronic conditions: building blocks for action: global report. WHO 2002. 2002.
- Global Disability Action Plan 2014-2021: Better health for all people with disabilities.
- Gutenbrunner C, Negrini S, Kiekens C, Zampolini M, Nugraha B. The Global Disability Action Plan 2014-2021 of the World Health Organisation (WHO): a major step towards better health for all people with disabilities. Chance and challenge for Physical and Rehabilitation Medicine (PRM). *Eur J Phys Rehabil Med*. 2015 Feb;51(1):1-4.
- Stucki G. Olle Höök Lectureship 2015: The World Health Organization's paradigm shift and implementation of the International Classification of Functioning, Disability and Health in rehabilitation. *J Rehabil Med*. 2016 Jun 13;48(6):486-93.
- Turner-Stokes L, McCrone P, Jackson DM, Siegert RJ. The Needs and Provision Complexity Scale: a multicentre prospective cohort analysis of met and unmet needs and their cost implications for patients with complex neurological disability. *BMJ Open*. 2013;3(2).
- Siegert RJ, Jackson DM, Playford ED, Fleminger S, Turner-Stokes L. A longitudinal, multicentre, cohort study of community rehabilitation service delivery in long-term neurological conditions. *BMJ Open*. 2014 Feb 28;4(2):e004231.
- Ward AB, Gutenbrunner C, Damjan H, Giustini A, Delarque A. European Union of Medical Specialists (UEMS) section of Physical & Rehabilitation Medicine: a position paper on physical and rehabilitation medicine in acute settings. *J Rehabil Med*. 2010 May;42(5):417-24.
- Ward AB, Gutenbrunner C, Giustini A, Delarque A, Fialka-Moser V, Kiekens C, *et al*. A position paper on Physical & Rehabilitation Medicine programmes in post-acute settings. Union of European Medical Specialists section of Physical & Rehabilitation Medicine (in conjunction with the European Society of Physical & Rehabilitation Medicine). *J Rehabil Med*. 2012 Apr;44(4):289-98.
- WHO. *International Classification of Functioning, Disability and Health WHO Geneva 2001*. 2001.
- Zaidi A, Burchardt T. Comparing incomes when needs differ: equalization for the extra costs of disability in the UK. *Review of Income and Wealth*; 2015.
- Cullinan J, Gannon B, Lyons S. Estimating the extra cost of living for people with disabilities. *Health Econ*. 2011 May;20(5):582-99.
- Braithwaite J, Mont D. Disability and poverty: a survey of World Bank poverty assessments and implications. *European Journal of Disability Research*. 2009;219-232.
- Antón JA, Braña FJ, Muñoz de Bustillo R. An analysis of the cost of disability across Europe using the standard of living approach. 2016;281-306.
- European Disability Strategy 2010-2020, A Renewed Commitment to a Barrier-Free Europe, (2010).

43. Turner-Stokes L, Williams H, Bill A, Bassett P, Sephton K. Cost-effectiveness of specialist inpatient rehabilitation for working-aged adults with complex neurological disabilities: a multicentre cohort analysis of a national clinical data set. *BMJ Open*. 2016 Feb 24;6(2):e010238.
44. Cooney MT, Carroll A. Cost effectiveness of inpatient rehabilitation in patients with brain injury. *Clin Med Lond Engl*. 2016 Apr;16(2):109-13.
45. Oddy M, da Silva Ramos S. The clinical and cost-benefits of investing in neurobehavioural rehabilitation: a multi-centre study. *Brain Inj*. 2013;27(13-14):1500-7.
46. Busch H, Bodin L, Bergström G, Jensen IB. Patterns of sickness absence a decade after pain-related multidisciplinary rehabilitation. *Pain*. 2011 Aug;152(8):1727-33.
47. Evans JR, Benore E, Banez GA. The Cost-Effectiveness of Intensive Interdisciplinary Pediatric Chronic Pain Rehabilitation. *J Pediatr Psychol*. 2016 Sep;41(8):849-56.
48. Dendale P, Hansen D, Berger J, Lamotte M. Long-term cost-benefit ratio of cardiac rehabilitation after percutaneous coronary intervention. *Acta Cardiol*. 2008 Aug;63(4):451-6.
49. Ehlken N, Verduyn C, Tiede H, Staehler G, Karger G, Nechwatal R, *et al*. Economic evaluation of exercise training in patients with pulmonary hypertension. *Lung*. 2014 Jun;192(3):359-66.
50. Bültmann U, Sherson D, Olsen J, Hansen CL, Lund T, Kilsgaard J. Coordinated and tailored work rehabilitation: a randomized controlled trial with economic evaluation undertaken with workers on sick leave due to musculoskeletal disorders. *J Occup Rehabil*. 2009 Mar;19(1):81-93.
51. Sahota O, Pulikottil-Jacob R, Marshall F, Montgomery A, Tan W, Sach T. Comparing the cost-effectiveness and clinical effectiveness of a new community in-reach rehabilitation service with the cost-effectiveness and clinical effectiveness of an established hospital-based rehabilitation service for older people: a pragmatic randomised controlled trial with microcost and qualitative analysis - the Community In-reach Rehabilitation And Care Transition (CIRACT) study. *Health Services and Delivery Research*; 2016.
52. Theodore BR, Mayer TG, Gatchel RJ. Cost-effectiveness of early versus delayed functional restoration for chronic disabling occupational musculoskeletal disorders. *J Occup Rehabil*. 2015 Jun;25(2):303-15.
53. Lord RK, Mayhew CR, Korupolu R, Manthey EC, Friedman MA, Palmer JB, *et al*. ICU early physical rehabilitation programs: financial modeling of cost savings. *Crit Care Med*. 2013 Mar;41(3):717-24.
54. Jones E, Pike J, Marshall T, Ye X. Quantifying the relationship between increased disability and health care resource utilization, quality of life, work productivity, health care costs in patients with multiple sclerosis in the US. *BMC Health Serv Res*; 2016.
55. Laires PA, Gouveia M, Canhão H, Branco JC. The economic impact of early retirement attributed to rheumatic diseases: results from a nationwide population-based epidemiologic study. *Public Health*. 2016 Nov;140:151-62.
56. Lundström E, Smits A, Borg J, Terént A. Four-fold increase in direct costs of stroke survivors with spasticity compared with stroke survivors without spasticity: the first year after the event. *Stroke*. 2010 Feb;41(2):319-24.
57. Verplancke D, Snape S, Salisbury CF, Jones PW, Ward AB. A randomized controlled trial of botulinum toxin on lower limb spasticity following acute acquired severe brain injury. *Clin Rehabil*. 2005 Mar;19(2):117-25.
58. Fjaertoft H, Indredavik B, Magnussen J, Johnsen R. Early supported discharge for stroke patients improves clinical outcome. Does it also reduce use of health services and costs? One-year follow-up of a randomized controlled trial. *Cerebrovasc Dis Basel Switz*. 2005;19(6):376-83.
59. Fadyl JK, McPherson KM, Schlüter PJ, Turner-Stokes L. Factors contributing to work-ability for injured workers: literature review and comparison with available measures. *Disability & Rehabilitation*. 2010;
60. Warner R. Stroke rehabilitation: benefits of educational initiatives. *Br J Nurs Mark Allen Publ*. 2000 Nov 9;9(20):2155-62.
61. Grahn BEM, Borgquist LA, Ekdahl CS. Rehabilitation benefits highly motivated patients: a six-year prospective cost-effectiveness study. *Int J Technol Assess Health Care*. 2004;20(2):214-21.
62. Wade D. Investigating the effectiveness of rehabilitation professions - a misguided enterprise? *Clin Rehabil*. 2005 Jan;19(1):1-3.
63. Quintard B, Croze P, Mazaux JM, Rouxel L, Joseph PA, Richer E, *et al*. Life satisfaction and psychosocial outcome in severe traumatic brain injuries in Aquitaine. *Ann Readaptation Med Phys Rev Sci Soc Francaise Reeducation Fonct Readaptation Med Phys*. 2002 Nov;45(8):456-65.
64. McLellan DL. Targets for Rehabilitation. *British Medical Journal*. 1985;1514.
65. Nybo T, Sainio M, Muller K. Stability of vocational outcome in adulthood after moderate to severe pre-school brain injury. *Journal of International Psychological Society*. 2004;719-23.
66. Association of British Neurologists, NeuroConcern Group of Medical Charities, British Society of Rehabilitation Medicine. *Neurological Rehabilitation in the United Kingdom*. 1992.
67. Philp I, Brainin M, Walker MF, Ward AB, Gillard P, Shields AL, *et al*. Development of a Post-stroke Checklist to Standardize Follow-up Care for Stroke Survivors. *Journal of Stroke & Cardiovascular Diseases*. 2013;e173-80.
68. Ward AB, Chen C, Norrving B, Gillard P, Walker MF, Blackburn S, *et al*. Evaluation of the Post Stroke Checklist: a pilot study in the United Kingdom and Singapore. *Int J Stroke Off J Int Stroke Soc*. 2014 Oct;9 Suppl A100:76-84.

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## BACKGROUND OF PHYSICAL AND REHABILITATION MEDICINE

# White Book on Physical and Rehabilitation Medicine (PRM) in Europe. Chapter 3. A primary medical specialty: the fundamentals of PRM

European Physical and Rehabilitation Medicine Bodies Alliance

### ABSTRACT

In the context of the White Book of Physical and Rehabilitation Medicine (PRM) in Europe, this paper deals with the core concepts at the base of the PRM specialty. These are the essential constituents that make PRM a primary medical specialty, different from all the other medical specialties, and PRM physician the primary medical specialist among the rehabilitation professionals. The core concepts that will be discussed in this Section include:

- PRM is a person/functioning oriented specialty, and this makes the specialty different from the organ/disease oriented, or treatment/age specific medical specialties
- PRM physicians have medical responsibilities, like all the other medical specialists, but with an additional specificity of making a functional assessment
- Like the other specialists, PRM physicians provide direct treatments, but they also work leading the multi-professional rehabilitation team, that works in a collaborative way with other professionals and medical specialists
- Due to its function oriented approach, PRM has a multimodal approach including a wide variety of treatment tools (frequently provided by other rehabilitation professionals) and manages all persons' morbidities (health conditions), since it focuses on decreasing impairments and activity limitations to allow the best possible participation of patients
- As PRM bases its work on functioning, it has a transversal role to other specialties: it overlaps with several of them, sharing part of their knowledge, but it is also totally independent from all of them, since it is based on a different and transversal body of knowledge
- PRM is focused on the person and neither on the disease nor on the setting; in fact, PRM is not only transversal to specialties, but also to the settings of care, and PRM physicians should know these different realities: persons with disabilities and those with long-term health conditions in fact move inside the national health systems between various facilities to obtain the best possible functioning and participation through an appropriate rehabilitation process.

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**Key words:** Physical and Rehabilitation Medicine - Europe - Diagnosis - Person - Patient care team.

### Introduction

The White Book (WB) of Physical and Rehabilitation Medicine (PRM) in Europe is produced by the 4 European PRM Bodies and constitutes the reference book for PRM physicians in Europe. It has multiple values, including to provide a unifying framework for the European Countries, to inform decision-makers at the European and national level, to offer educational material for PRM trainees and physicians and information about PRM to the medical community, other rehabilitation professionals and the public. The WB states the importance of PRM, that is a primary medical spe-

cialty. The contents include definitions and concepts of PRM, why rehabilitation is needed by individuals and society, the fundamentals of PRM, history of PRM specialty, structure and activities of PRM organizations in Europe, knowledge and skills of PRM physicians, the clinical field of competence of PRM, the place of PRM specialty in the healthcare system and society, education and continuous professional development of PRM physicians, specificities and challenges of science and research in PRM and challenges and perspectives for the future of PRM.

This chapter is new in the context of the White Books produced until now, and it has been introduced to bet-

ter focus on the core concepts at the base of the PRM specialty. These are in fact the essential constituents that makes:

- PRM a primary medical specialty, different from all the other medical specialties
- PRM physician the primary medical specialist among the rehabilitation professionals.

The core concepts that will be discussed in this Section include:

- PRM is a person/functioning oriented specialty, and this makes the specialty different from the organ/disease oriented, or treatment/age specific medical specialties

- PRM physicians have medical responsibilities, like all the other medical specialists, but with an additional specificity of making a functional assessment

- Like the other specialists, PRM physicians provide direct treatments, but they also work leading the multi-professional rehabilitation team, that works in a collaborative way with other professionals and medical specialists

- Due to its function oriented approach, PRM has a multimodal approach including a wide variety of treatment tools (frequently provided by other rehabilitation professionals) and manages all persons' morbidities (health conditions), since it focuses on decreasing impairments and activity limitations to allow the best possible participation of patients

- As PRM bases its work on functioning, it has a transversal role to other specialties: it overlaps with several of them, sharing part of their knowledge, but it is also totally independent from all of them, since it is based on a different and transversal body of knowledge

- PRM is focused on the person and neither on the disease nor on the setting; in fact, PRM is not only transversal to specialties, but also to the settings of care, and PRM physicians should know these different realities: persons with disabilities and those with long-term health conditions in fact move inside the national health systems between various facilities to obtain the best possible functioning and participation through an appropriate rehabilitation process.

The aim of this chapter is to discuss, in detail, all the core concepts of the medical specialty of PRM, that makes it unique, specific and essential in the current trend of health care, which includes acute and long-term

health conditions, characterized by increasing disability from better survival and progressive ageing in populations.

### **The person/functioning oriented versus disease oriented approach in PRM**

After the first dissections, and the understanding of anatomy and physiology, science in modern medicine has progressed deeply rooted in the knowledge of body structures and functions: this strict relationship with the physical human being allowed to overcome the almost magic traditions orally handed down from masters to disciples that had ruled official medicine since the dawn of history. Consequently, medicine organized mainly around topics centered on body structures/functions — like heart (cardiology), lungs (pneumology), joints, bones, and muscles (orthopedics), brain and neuromuscular functions (neurology), eyes (ophthalmology) and so on. There are a few exceptions to this general rule, with fields that could be considered “transversal” to the previous “vertical” ones, like general medicine, pediatrics and geriatrics. This organ-based approach led to the classical “biomedical model” of treatment, where the search for etiology and pathoanatomy/physiology of a disease is considered the way to develop a good therapy, to eradicate the cause of illness and cure the patient (Figure 1). Physicians grow with this model in mind: in fact, after the basic topics of their first years of studies, “anatomical pathology” is one of the first subjects introducing medical students to the clinical world.

PRM was born in a different way, and not around a specific body structure/function: in fact, the progress of Medicine and Surgery allowed more and more the survival of acute patients, (*e.g.* after important impairments due to accidents, war injuries and/or infectious diseases — like poliomyelitis) and this required a specific attention to their sequelae. Therefore, the focus of PRM from the start has been the achievement of the

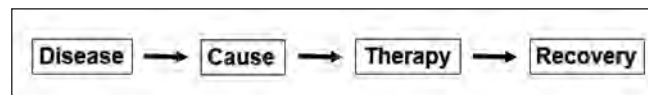


Figure 1.—The organ-based approach of the classical “biomedical model” of medicine.

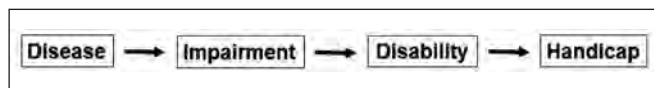


Figure 2.—The International Classification of Impairments, Disabilities and Handicaps (ICIDH) <sup>1</sup> model.

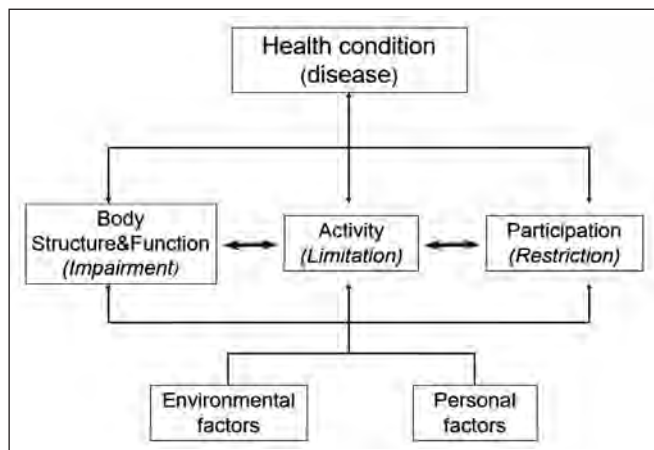


Figure 3.—The International Classification of Functioning, Disability and Health (ICF) <sup>2</sup> model.

best possible “functioning” in a long-term health condition. It was quite immediately clear that the classical biomedical model was not applicable to PRM, but decades had to pass before this concept of functioning was totally understood. A breakthrough came through the International Classification of Impairments, Disabilities and Handicaps (ICIDH)<sup>1</sup> (Figure 2) and, following this, with the International Classification of Functioning, Disability and Health (ICF)<sup>2</sup> (Figure 3). At the same time, the “bio-psycho-social model” of treatment <sup>3, 4</sup> was developed, where therapy focuses on the care of the whole person. In fact, it was clear since the beginning that the core of PRM was not a single body structure/function, but the total person and human being, including his psychology and motivation (called today “personal factors”) and social environment (called today “participation” and “environmental factors”).

The actual reference framework of the specialty, the ICF, includes all these aspects (Figure 3). It is interesting to look at this graph thinking where our “functioning-based” specialty, with its broad approach to the person, is in comparison with the classical “organ-based” ones, with their disease-oriented approach. According

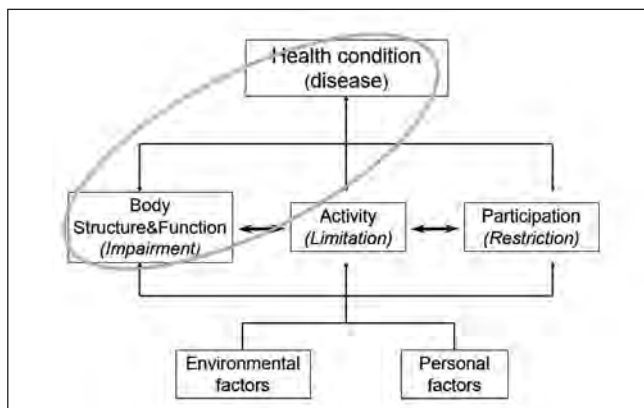


Figure 4.—According to the “biomedical model”, the classical “organ-based” medical specialties are mainly focused on the disease, as well as on the body structures and functions.

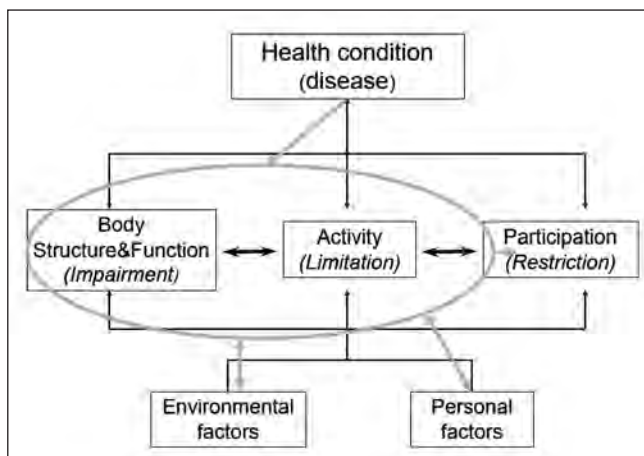


Figure 5.—The “functioning-based” PRM specialty is focused in general on functioning and disability (that in fact is all the person); PRM clinical work has a specific focus on reducing “activity limitations”, and improving “impairments”, while addressing also “participation restrictions” at a micro-level (personal), while the meso- and macro-levels can be addressed, with the expert help of PRM physicians, by those who work on society at large, including educators and politicians or other decision makers. In doing so, it is mandatory for PRM physician to perfectly know the medical diagnosis (“health condition” and “disease”), and to strongly interfere with the “contextual factors” (“personal” and “environmental”). The best possible “participation” for the individual is the final goal.

to the “biomedical model”, the latter are mainly focused on the disease, as well as on the body structures and functions (Figure 4). Instead, PRM is focused in general on functioning and disability (that in fact is all the person); PRM clinical work (Figure 5) has a specific focus on reducing “activity limitations”, and improving “im-

pairments”, while addressing also “participation restrictions” at a micro-level (personal), while the meso- and macro-levels can be addressed, with the expert help of PRM physicians, by those who work on society at large, including educators and politicians or other decision makers. In doing so, it is mandatory for PRM physician to perfectly know the medical diagnosis (“health condition” and “disease”), and to strongly interfere with the “contextual factors” (“personal” and “environmental”). The best possible “participation” for the individual is the final goal.

The following points generally distinguish the person-centered approach of PRM from the disease-oriented of the organ based specialties:

- a comprehensive bio-psycho-social approach to health conditions to account for all aspects of functioning;

- the practical medical approach to impairments and activities limitations, with the main and final aim to positively influence and finally improve participation;

- taking patients’ contextual factors into account, when planning rehabilitation programs; in ICF terminology they serve as “facilitators” and/or “barriers” to achieve best functioning: psychological, cognitive, motivational, and economical individual factors, but also the environmental factors (including care-givers, geographical location, legislation, overall economical country level...) are crucial for the outcome;

- ensuring a focus on the patient’s optimal participation, is high on patients’ aims for rehabilitation and this is a final outcome;

- the underlying health condition is the context of a PRM program. Setting up services for someone with a rapidly progressive illness may be quite different from that for someone with a chronic slowly evolving condition. Knowledge of the diagnosis allows the PRM physician to provide an optimal treatment, anticipate potential complications and associations, slow deterioration (where relevant) and give a prognosis, which may include end-of-life considerations;

- PRM interventions are different around the world, coherently with the existing contextual factors and the participation required and allowed by that specific society.<sup>5,6</sup>

Another word widely used with respect to PRM is “holism”, to state that PRM is focused on the whole person. This word perfectly paints the specialty focused

on “functioning” and “disability” (that are “holistic” by definition). In this context, the meaning of the term “holism” is totally different from that in alternative/complimentary practices, and it is not used to justify scientifically unproven treatments: PRM in fact is a primary medical specialty totally based on evidence.

In front of the characteristics of PRM today, as a specialty with a transversal knowledge (person oriented), but an application that is vertical inside the other specialties (disease oriented), there are many possible approaches in clinics. We could consider them looking at the two possible extremes:

- the “general PRM physician” (in analogy with the “general practitioner”), that must have a very good knowledge of all health conditions requiring a PRM approach; he/she should be able to manage all patients with all pathologies. This model is mostly diffused in acute wards and post-acute inpatients practice in general PRM wards (primary rehabilitation care). The advantage in this case is the possibility to manage as a single medical specialist with a multi-professional team working in a collaborative way with other disciplines, almost all patients, and the possibility to perform a triage to orient most complex patients to secondary/tertiary care; the disadvantage is the possible loss of specificity (a lot of time to manage the disease and not enough time to focus on rehabilitation) and of deep knowledge of specific fields;

- and the “specialized PRM physician”: in this case a clinician becomes highly expert also in the basic “organ” specialty, losing some general competence and focusing mainly on the medical diagnosis, evaluation, treatment and rehabilitation of patients with specific diseases. This is most diffused in tertiary PRM wards, research and university PRM post-acute wards, but also in some outpatient settings. The advantage in this case is the high specificity of work, the easiness of contacts with “organ” specialists (sometimes even the possibility to reduce their specific contribution in the most common cases), the deep specific knowledge; disadvantage, the focused knowledge closely resembling that of “organ” specialists.

Among these two extremes, all possibilities exist in PRM practice today, and PRM physicians are trained for both extremes and all the intermediate clinical situations.

### Diagnostic responsibilities of PRM physicians

As stated above, in the context of the ICF, rehabilitation is a medical strategy aimed at enabling people experiencing disabilities to achieve optimal functioning in interaction with the environment.<sup>7</sup> This primary function is achieved through the rehabilitation process itself, but firstly, is based on a specific medical diagnosis. This gives the “boundaries” of PRM interventions, defining the medical prognosis, and consequently a lot of the patient’s expectations from a medical perspective. This perspective provides a stable basis, around which all the other components of the PRM program can be developed. In fact, the medical diagnosis forecasts a range of possible residual impairments, activity limitations and also (to a lesser extent) participation restrictions. What the medical diagnosis does not define is the level of these impairments, limitations and restrictions: in fact, they will be the results of the rehabilitation process together with the personal and environmental factors.

Without a precise medical diagnosis, it is not possible to start and adequately plan the PRM program either the very short-, short- or long-term one. The medical diagnosis determines also the style of the communication with the patient and the agreement to be reached on achievable goal setting. At the start of the rehabilitation process, it is necessary for the patient and his/her family/caregivers to accept the patient’s new “status”. This will then interact with his or her personal and environmental factors to set and determine the outcomes of the rehabilitation process.

Consequently, PRM physicians have a major medical diagnostic responsibility. In some clinical situations, typically when the patient’s impairment is mild (*e.g.* following “conservative” treatment in orthopedic and/or sports medicine), the PRM physician is the first health professional to see the patient and arrive at the diagnosis. In these cases, the PRM physician has a primary role in assessing patients for possible alternative treatments and/or referring for more specific diagnostics by other specialists. In other clinical situations, typically in post-acute wards, PRM physicians are called in after the intervention of other specialists. In these situations, the PRM physician’s role is to check and confirm the patient’s primary medical diagnosis and to identify any comorbidities and already known impairments and activity limitation. Other medical specialists sometimes

feel uncomfortable in evaluating these as they are “out of their specialty-specific competence”. Patient follow-up in the medium and long term sometimes allows a refining of the medical diagnosis, when the course of the condition does not follow its usual expected pattern. An exception to this general rule is that it is sometimes impossible to make a definitive diagnosis immediately and treatment can be proposed to elucidate this further (diagnosis “*ex adjuvantibus*”).

Apart from the general medical diagnosis, the PRM physician is specifically responsible for the functional assessment of patients before starting the PRM process. This aims primarily at identifying the impairments and activity limitations, measuring their level and consequently setting the goals of the PRM program to achieve the best individual participation. Moreover, PRM physicians have competences in eliciting the meaning of an illness or a disability to an individual patient, the impact on their sense of personal identity and the resulting emotional reaction. Parts of the functional assessment can also be done by the other rehabilitation professionals, but PRM physicians importantly perform it for all the domains of body structures/functions and activities, while other focus only on their specific competences. PRM physicians maintain in this way a wider perspective, that allows to define, in collaboration with the other rehabilitation professionals, priorities and temporal timing of the different interventions. Moreover, the functional assessment is the overlap of competence between the different rehabilitation professionals that constitute the common background for dialogue, interaction, and team building. Nevertheless, also in a team perspective, the functional assessment responsibility finally rests on the shoulders of PRM physicians.

In this functional perspective, there are some diagnostic tools that are specific to PRM and have been widely developed inside the specialty, such as disability and quality of life questionnaires, but also motion analysis systems, electrodiagnostic and ultrasound instruments, etc.

Moreover, PRM physicians have been among the first to recognize the importance of ICF for further development of rehabilitation, better information about healthcare and stimulation of research with the common goal of achieving optimal functioning and minimizing disability of both individuals and general health aspects.<sup>8-10</sup>



### **The PRM multimodal approach and multiple morbidities management**

PRM covers a broad range of disorders and includes the consequences of trauma, surgery, diseases and congenital conditions. This is in sharp distinction with/to other medical specialties that treat organs or organ-systems (*e.g.* cardiology, nephrology, dermatology), specific age groups (*e.g.* pediatrics, geriatrics) or that apply a certain skill or technical instrumentation (*e.g.* surgery, radiology, radiotherapy).

Therefore, PRM usually is considered as a “transversal specialty”. Moreover, PRM is not primarily focused on prevention or treatment of the disorder itself, but focuses on the consequences in terms of activity limitations and restrictions in participation. The prevention and reduction of activity limitations and optimization of participation are the core of PRM.

As a result, PRM has adopted a patient-centered approach that also includes the personal characteristics of the patient. The consequence of this “holistic” approach is that PRM physicians do not work alone, but need to involve a large number of other healthcare professionals. The healthcare professionals operate in a collaborative way in a multi-professional team lead by the PRM physician, which also includes the patient and/or his/her caregivers.

Diagnosing, assessing, treating, training, exercising, coaching and supporting this broad range of patients with a large multi-professional team in the acute, sub-acute and chronic phases requires expensive and well-equipped facilities. Usually a PRM department provides facilities (and its personnel) including: electromyography, diagnostic ultrasounds, strength measurement, gait analysis, neuropsychological testing, gymnasium, occupational therapy rooms, swimming pool, physical modalities etc.

The broad range of patients, the focus on impairment, activity limitations and participation restrictions, the attention to personal factors and environmental factors, the multi-professional team and the necessity of equipment and other facilities make PRM a complex, multimodal and comprehensive specialty.

Each patient is usually treated with a broad range of therapies, provided by a broad range of health professionals. These can include, among others, exercise therapies, occupational therapies, speech therapies, neuropsychological treatments, behavioral therapies,

physical therapies, manual therapies. Each patient is treated with a unique approach, according to his disease, impairments, activity limitations, participation restrictions, environmental and personal factors, in a totally multimodal and individualized approach.

The ageing of the population has a huge impact in service providing, as well as on people with disabilities: this conversely impacts on PRM specialty and treatments. Rarely patients after a certain age have only one disease; rarely the main disease for the PRM intervention is not influenced by other important morbidities. The recently developed “syndemic” conceptual framework<sup>11</sup> fit quite well into the approach of PRM to comorbidity. In fact, it emphasizes the synergistic role of diseases and (social) context in affecting the clinical course, and strongly relies upon a biosocial conception of health.

Therefore, treatments must be continuously adapted, making approaches even more individualized. PRM’s holistic approach focuses on the entire person with the aim of improving his/her activities and increasing his/her participation and inevitably takes into account all the comorbidities, that influence treatments and outcomes.

Moreover, comorbidities are usually scarcely evaluated by the referring specialists in case of patients coming from acute wards and they frequently require a diagnostic workout by PRM physicians at the admission to the post-acute wards. Comorbidities heavily impact on the burden of care and on final outcomes: specific scales are under development to better understand, study and clinically manage their impact in the PRM process.

### **The multi-professional PRM team lead by the PRM physician**

PRM physicians provide treatments in two different ways: as in many other specialties, they do it personally, using specific techniques (*e.g.* interventional PRM, injections, manipulations “*manu medica*”, etc.); instead, quite specific to PRM is the delivery of treatments through team work. The latter is particularly true, when a rehabilitation process is concerned and other non-physician rehabilitation professionals are included.

The achievement of successful rehabilitation requires multiple health care professionals with a wide range of clinical skills and expertise. They must work together

harmoniously, but also effectively as a team, in order to achieve rehabilitation goals for patients and their families. It is this style of multi-professional teamwork that differentiates PRM from many other specialties. The combined group activity of an effective team should provide synergy and result in better outcomes than the sum of each individual working alone.<sup>12-14</sup>

Even if being multi-professional in nature, the terms used in medical and management literature can be confusing as different team approaches or models exist and are defined according to the interaction among team members. Consequently, the means, in which the multi-professional team works, has been defined by different models: multi-, inter- and trans-disciplinary, with different meanings. A multidisciplinary team model utilizes the skills of individuals from different disciplines but each discipline still approaches the patient from his own perspective and usually the physician communicates with other professionals of the team. An interdisciplinary team model integrates the approach of different disciplines with a high level of collaboration and communication among the team professionals using an agreed and shared strategy; the leadership of the team remains in the hands of one PRM physician. In a transdisciplinary team model the boundaries of professionals' practice are blurred and any professional is capable of working in any particular team role.<sup>15, 16</sup>

An interdisciplinary approach in the multi-professional team is the preferred pattern of team working. However, even if it is not the most appropriate to answer to the needs of the patient and provide a good rehabilitation program, other models can also be found in various rehabilitation settings, such as a multidisciplinary approach in an acute-care unit or a transdisciplinary approach in long-term community care for a patient with educational needs. In most settings, an interdisciplinary model is most effective because it allows a collaborative, holistic and patient-centered approach to rehabilitation.<sup>17</sup> For all these reasons in this book we prefer the term "collaborative" referred to team work, since various models can be applied effectively in different settings. The PRM team, under the responsibility of the PRM physician, should agree and set realistic goals along with patients and their families and then work together to achieve these goals using a shared strategy. This is often best done in joint sessions

which may serve to avoid over-stimulation, fatigue or repetition.

Evidence shows that improved functional outcomes and even better survival can be achieved with multi-professional collaborative teamwork in several conditions particularly stroke, traumatic brain injury, hip fracture, pulmonary rehabilitation and back pain.<sup>17-19</sup>

The interpretation and the means to obtain a good collaborative approach for the multi-professional team are different according to the settings. In a PRM ward (in acute and post-acute hospitals) all professionals work together in the same facility under the responsibility of the PRM physician. The turn-over of patients is relatively low, the rehabilitation time long enough, and the answer of patients to treatments quite rapid. All these factors play a major role in determining the approach to team management that is considered "classical" in PRM, since it is the most studied.

In the acute hospital with a central PRM department the multi-professional team of the PRM department is responsible for all rehabilitation issues in the acute hospital. The multi-professional PRM team acts on a consultant basis for all wards. The multi-professional team consists of PRM physicians and rehabilitation professionals under the responsibility of the PRM physician. The multi-professional team works collaboratively with other disciplines at the different wards wherever they are needed.

Also, outpatients' settings must provide multi-professional teams working in a collaborative way with other disciplines, under the responsibility of the PRM physician. Nevertheless, teams may be incomplete or sometimes do not seem to exist, particularly when the PRM physician and the rehabilitation professionals providing treatment are not even working in the same place teamwork. Teams may operate without the physical presence of one or several rehabilitation professionals, but always under the PRM physician's responsibility (liability). Other specific characteristics of this setting include huge number of patients, rapid turn-over, short time for evaluation and treatments (a few sessions) and rapid answers to treatments. Obviously, the difficulties of a team approach increase in these cases, and management is based on protocols and/or simple prescriptions: in case of exceptions to protocols, disagreement and/or particular clinical cases, direct written and/or speaking contacts between the professionals are needed. Possibly, team meetings should also be planned, even if with

reduced frequency. Very close to this setting, is the situation of the so-called “post-rehabilitation” and/or maintenance activities in chronic patients. Sometimes, it is argued that these settings are not clinical and outside the rehabilitation team, but the management of these complex patients is usually difficult and they intermittently require classical rehabilitation interventions: consequently, also in these cases a team management of maintenance is more appropriate, even if light strategies should be adopted.

Another different situation for team work management is in long term PRM facilities, where turn-over and clinical changes are very slow, and rehabilitation treatment reduced. In these cases, team meetings are still possible, but on a very low pace.

Successful rehabilitation team work requires some specificities, even if not all are possible in the different settings proposed:

— management and leadership: PRM physicians are clinical managers and should be good leaders of the rehabilitation team: in addition, they should be able to manage groups, solve problems, facilitate discussion, make decisions and listen;

— hierarchy: even if there is no direct hierarchical relationship (not possible when in different facilities), there must be in all health systems someone, who is ultimately responsible for the patients, and for making clinical decisions: this is the physician, usually the PRM physicians, in a functional hierarchical relationship;

— time: appropriate time must be devoted to team building, which may vary according to the setting. Since rehabilitation is not possible without the team, this is proper working time and not only improves the standards of clinical work, but really allows it to function;

— respect of roles and professions: all the team members have different competences that must be recognized by all the others; the roles are different, and a hierarchy exists with the leadership of the PRM physician and needs to be respected;

— personal factors: teams function, if people make it function. There are clearly personal factors, such as the availability to change, the ability to collaborate, team work education, a balance of personal strength to accept to have one’s own work discussed and sometimes challenged, and the ability to listen and permission to speak. These factors can only partially be learned, but are necessary to practise rehabilitation for all professionals

— environmental factors: general attitudes in the working place (in and out the rehabilitation ward, including the administrative management) plays a major role in facilitating or inhibiting team work; PRM physicians have a major role in facilitating the environmental attitude. Moreover, specific instruments and communication tools should be developed according to the setting.

## References

1. World Health Organization. International Classification of Impairments, Disabilities, and Handicaps. 1980. 207 p.
2. World Health Organization. WHO | International Classification of Functioning, Disability and Health (ICF) [Internet]. WHO. [cited 2014 Aug 19]. Available from: <http://www.who.int/classifications/icf/en/>
3. Engel GL. The need for a new medical model: a challenge for biomedicine. *Science*. 1977 Apr 8;196(4286):129–36.
4. Engel GL. The biopsychosocial model and the education of health professionals. *Ann N Y Acad Sci*. 1978 Jun 21;310:169–87.
5. Negrini S, Frontera WR. The Euro-American rehabilitation focus: a cultural bridge across the ocean. *Am J Phys Med Rehabil*. 2008 Jul;87(7):590–1.
6. Negrini S, Frontera W. The Euro-American Rehabilitation Focus: a cultural bridge across the ocean. *Eur J Phys Rehabil Med*. 2008 Jun;44(2):109–10.
7. Stucki G, Cieza A, Melvin J. The International Classification of Functioning, Disability and Health (ICF): a unifying model for the conceptual description of the rehabilitation strategy. *J Rehabil Med*. 2007 May;39(4):279–85.
8. Stucki G. International Classification of Functioning, Disability, and Health (ICF): a promising framework and classification for rehabilitation medicine. *Am J Phys Med Rehabil*. 2005 Oct;84(10):733–40.
9. Stucki G, Grimby G. Applying the ICF in medicine. *J Rehabil Med*. 2004 Jul;(44 Suppl):5–6.
10. Stucki G, Ustün TB, Melvin J. Applying the ICF for the acute hospital and early post-acute rehabilitation facilities. *Disabil Rehabil*. 2005 Apr 8;27(7–8):349–52.
11. The Lancet null. Syndemics: health in context. *Lancet Lond Engl*. 2017 Mar 4;389(10072):881.
12. Joel A. Delisa and contributors. *Physical Medicine & Rehabilitation: Principles and Practice*. section 3. 4th Edition. Lippincott Williams & Wilkins; Volume 1; 2005.
13. Bokhour BG. Communication in interdisciplinary team meetings: what are we talking about? *J Interprof Care*. 2006 Aug;20(4):349–63.
14. Behm J, Gray N. Chapter 5: Interdisciplinary Rehabilitation Teams. In *Rehabilitation nursing: a contemporary approach to practice*. Jones & Bartlett Learning 2012. USA; 2012.
15. Körner M. Interprofessional teamwork in medical rehabilitation: a comparison of multidisciplinary and interdisciplinary team approach. *Clin Rehabil*. 2010 Aug;24(8):745–55.
16. Norrefalk J-R. How do we define multidisciplinary rehabilitation? *J Rehabil Med*. 2003 Mar;35(2):100–1.
17. Neumann V, Gutenbrunner C, Fialka-Moser V, Christodoulou N, Varela E, Giustini A, *et al*. Interdisciplinary team working in physical and rehabilitation medicine. *J Rehabil Med*. 2010 Jan;42(1):4–8.
18. Mømsen A-M, Rasmussen JO, Nielsen CV, Iversen MD, Lund H. Multidisciplinary team care in rehabilitation: an overview of reviews. *J Rehabil Med*. 2012 Nov;44(11):901–12.
19. Semlyen JK, Summers SJ, Barnes MP. Traumatic brain injury: efficacy of multidisciplinary rehabilitation. *Arch Phys Med Rehabil*. 1998 Jun;79(6):678–83.

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For this paper, the collective authorship name of European PRM Bodies Alliance includes:

- European Academy of Rehabilitation Medicine (EARM)
- European Society of Physical and Rehabilitation Medicine (ESPRM)
- European Union of Medical Specialists PRM section (UEMS-PRM section)
- European College of Physical and Rehabilitation Medicine (ECPRM) – served by the UEMS-PRM Board
- the Editors of the 3<sup>rd</sup> edition of the White Book of Physical and Rehabilitation Medicine in Europe: Stefano Negrini, Pedro Cantista, Maria Gabriella Ceravolo, Nicolas Christodoulou, Alain Delarque, Christoph Gutenbrunner, Carlotte Kiekens, Saša Moslavac, Enrique Varela-Donoso, Anthony B. Ward, Mauro Zampolini
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## ORGANIZATION OF PHYSICAL AND REHABILITATION MEDICINE IN EUROPE

# White Book on Physical and Rehabilitation Medicine (PRM) in Europe. Chapter 4. History of the specialty: where PRM comes from

European Physical and Rehabilitation Medicine Bodies Alliance

### ABSTRACT

In the context of the White Book of Physical and Rehabilitation Medicine (PRM) in Europe, this paper deals with the history of the PRM medical specialty. The specialty evolved in different European countries, and sometimes also into the single countries, from different medical streams that finally joined. These included among others: balneology, gymnastic, use of physical agents (water, heat, cold, massage, joint manipulations, physical exercise, etc.). Another important role has been played by the increasing number of people experiencing or likely to experience disability due to improvement of medicine and consequent survivals from wars, accidents and/or big infective epidemics (like polio); these evolutions happened in strict relationship with other specialties like cardiology, neurology, orthopaedics, pneumology, rheumatology, traumatology, creating a knowledge transversal to all of them. Consequently, the PRM specialty has been gradually introduced in the different European countries, however with no uniformity. Subsequently, European Organizations were created for its diffusion and coordination at the level of medical competences and patient care as well as medical teaching and research: The European Federation of Physical Medicine and Rehabilitation - later European Society (ESPRM), The Académie Médicale Européenne de Médecine de Réadaptation (EARME), The PRM Section of the European Union of Medical Specialists and the European College of PRM (served by the UEMS-PRM Board), were created and work today regarding these general aims. Nowadays a uniform definition of the specialty exists in Europe, which is concordant with the internationally accepted description of PRM (*based on the ICF-model*). Moreover, research in PRM has been mainly improved during recent decades in Europe due to some external as well as internal scientific influences, thus increasing its scientific importance, together with a parallel increase in rehabilitation journals, many of them indexed and some with impact factor (Cr, EJPRM, JRM, among others), as well as a parallel increase in scientific congresses and courses. Last but not least, the recent creation of the Cochrane Rehabilitation field will also give a great boost to this primary medical specialty, as well as the discovery on new physical agents and technologies that diminish activity limitation and participation restriction of disable persons.

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### Introduction

The White Book (WB) of Physical and Rehabilitation Medicine (PRM) in Europe is produced by the 4 European PRM Bodies and constitutes the reference book for PRM physicians in Europe. It has multiple values, including to provide a unifying framework for the European Countries, to inform decision-makers at the European and national level, to offer educational material for PRM trainees and physicians and information about PRM to the medical community, other rehabilitation professionals and the public. The WB states the importance of PRM, that is a primary medical specialty. The contents include definitions and concepts of

PRM, why rehabilitation is needed by individuals and society, the fundamentals of PRM, history of PRM specialty, structure and activities of PRM organizations in Europe, knowledge and skills of PRM physicians, the clinical field of competence of PRM, the place of PRM specialty in the healthcare system and society, education and continuous professional development of PRM physicians, specificities and challenges of science and research in PRM and challenges and perspectives for the future of PRM.

This Chapter deals with the history of PRM in Europe. It has been introduced for the first time in the WB because the present of the specialty is heavily conditioned in many respect by its historical growth. Moreover, an overall

understanding of what happened all over Europe is still missing, and its understanding opens new perspectives to the national histories that are sometimes highly different from what happened in other European Countries. In fact, the specialty includes today all these streams, and it is part of the unification of European practices understanding the history and where national practices are to be collocated in comparison with other countries.

In this Chapter also the evolution of the European Organizations is presented, including the European Bodies, other Scientific Societies, and the journals that are in the field of PRM.

### **Historical notes on the evolution of the specialty**

The PRM medical specialty has gone through different phases until its consolidation in the last century. In different periods of history, both concepts of, physical medicine and rehabilitation have undergone changes in the interpretation of its meaning overall the second one. There have also been changes in the praxis of its clinical activity.<sup>1</sup>

The use of physical agents by physicians and above all centered in the European region, began in the remote antiquity. Approximately 100,000 years BC in Gánovce in Slovakia Neanderthal woman sinks her body to thermal mineral springs.<sup>2</sup> Greeks and later the Romans, advocating in such practice: aquatic therapy, massage and other manual medicine modalities, heat and cold procedures as well as physical exercise. All these medical interventions were performed by physicians during the Old Age (Hippocrates, Galen, etc) and Middle Age (Avicenna, Averroes, etc), with the objectives to achieve pain relief, disability diminishing and well-being in general. In many cases these modalities were also used to prepare people for battles.<sup>3, 4</sup>

With the advent of Renaissance and along with advances in the knowledge of modern anatomy and physics, a great effort was made to use the physical modalities as a treatment. Thus, renowned doctors like Paracelsus (15<sup>th</sup> century) recommended massage as an indispensable means for maintaining health. Ambroise Paré in the 16<sup>th</sup> century applied massage on amputated stumps and on war scars and also Hieronymus Mercurialis was the link between Greek and modern medical gymnastics since he recommended, among other things, the realization of physical exercise along with diet and

hygiene for treatment of different processes.

During the following centuries, physical agents continued to be used as a therapeutic modality and this included aquatic therapy, creating in the 17<sup>th</sup> and 18<sup>th</sup> century multitude of thermal establishments for rest and medical cures (Richard Russell, Vicente Pérez, Siegmund Hahn, etc.).<sup>3, 4</sup>

In the 19<sup>th</sup> century, electricity began to be used also as diagnosis and treatment modality thanks to Dr. Duchenne de Boulogne, considered the father of the electrotherapy and electrodiagnosis;<sup>5</sup> although previously, during the 17<sup>th</sup> century, the Royal Academy of Sciences of France had begun to publish annual reports on medical electrotherapy. In the same century, a great push was given to physical exercise as a therapeutic modality for musculoskeletal disorders thanks to dr. Pier Henrich Ling, creator with his disciples, of Swedish Medical Gymnastics.<sup>3</sup> Later, other medical gymnastic modalities were also described in Europe. In that same century, another doctor, Sebastian Busqué y Torró (Spain),<sup>6</sup> follower of Ling, was the first to use the word “rehabilitation” in the medical literature. Somewhat later, Dr. Zander (Sweden) created what we now know as mechanotherapy. In this last way, at the end of that century there were already in some European hospitals and clinics, mechanotherapy institutes that functioned as really rehabilitation cabinets as well as in some factories where physical treatments were provided to their own workers.

Also in 19<sup>th</sup> century, the concept of locomotive re-education was developed by the French school of Neurology, being used the physical exercise since then for the treatment of nervous system processes; and Jaques Delpech created in Montpellier the scoliosis school for spinal deformities treatment.<sup>7</sup>

In the same century underwent a great push aquatic therapy thanks to Sebastian Kneipp (Germany), Vinzenz Priessnitz (Austria) among others, who despite not being doctors, their methods were accepted and further developed by SPA-physicians.<sup>8</sup> On the other hand, Andrew Taylor Still (USA-physician), father of Osteopathy as well as Daniel David Palmer, (USA-non physician), father of Chiropractic, created the basis for the development of manual medicine discipline in the later century.<sup>9</sup>

As mentioned before, PRM was created as primary speciality during the 20<sup>th</sup> century. The procedure of its development across European Countries has not been uniform with its origins in some cases being from the

combined specialties of Rheumatology and Rehabilitation (previously Physical Medicine) in others from Balneology and yet others arising *de novo*.<sup>1</sup> The push for such creation came mostly after The Second World War and polio epidemics, due to this, the large number of disabled people in need of physical and non-physical medical cares, including today the attention to refugees and to ill-treated persons have to be taken into account as motors of this specialty. Also the increase and improvement of medico-surgical treatments and techniques during the last and current centuries as well as orthopaedic treatment developments, longevity of the population, sports injuries etc, push and continue today in such direction.<sup>1</sup>

On the other hand and based somehow on Still and Palmer's works as mentioned before, renowned doctors created different European schools of orthopedic and manual medicine such as James Cyriax and Leon Chaitow (United Kingdom),<sup>9-11</sup> Robert Maigne (France),<sup>12</sup> Vladimir Janda and Karel Lewitt (in the former Czechoslovakia),<sup>13-15</sup> among others; Thus promoting the use of the manual means of assessment, diagnosis and treatment as work tools highly appreciated and practiced today by physicians of this speciality, especially used in musculoskeletal disorders.<sup>16</sup>

Also the discovery of the existence of neuroplasticity allowed many subjects suffering from central nervous system processes (stroke, cerebral palsy, acquired brain injury, etc.) who were previously not considered for rehabilitation, to be treated using therapeutic exercise.<sup>17</sup>

Moreover, the discovery of new physical treatment, diagnostic and research modalities such as: extracorporeal shock waves,<sup>18, 19</sup> walking laboratories, robotic, virtual reality,<sup>20</sup> diagnostic ultrasounds and advanced neuroimaging techniques, among others, is leading this specialty to its current and modern conception.

All this combined with the impending reform of the PRM curricula at European and National levels.

PRM specialty has had a large development of clinical practice, publications, meetings and education based on hospitals and rehabilitation centers sharing experiences and perspectives practically in all European Countries. All its procedures are done in patients of all ages and also combining socio-cultural and ethical matters focused on global recovery towards full autonomy. The term that demonstrates this broad development is "in-

dividual recovery potential" reflecting the main sources and final goals for rehabilitation.

Taking into account this history of common steams but also diversity, it is remarkable that now in Europe a uniform definition of the specialty exists, which is concordant with the internationally accepted description of PRM (*based on the ICF-model*).<sup>21</sup> The current general aim of the specialty is to focus on the many different interventions necessary to reach the highest possible level of functional efficiency and participation in relation to the person's will and context.

### History and development of PRM Organizations in Europe

As mentioned before, following the Second World War, the idea of a specific policy in the field of Rehabilitation Medicine began to come into mind worldwide and especially in Europe. The idea of a new medical specialty therefore began to materialize by founding national scientific societies.<sup>1</sup>

Under an initiative on May 10, 1950, a project to found an international federation of physical medicine was born in London. This organization was to federate the national scientific societies in Physical Medicine worldwide. The 1st Congress of the International Federation of Physical Medicine (later renamed for International Federation of Physical Medicine and Rehabilitation), was held in London in 1952. The first three congresses held in Europe (1956 Copenhagen, 1964 Paris, 1972 Barcelona) have promoted the crystallization of a knot of European doctors actuated by the same bound to create the specialty in Europe.

It is of interest to observe that Physical and Rehabilitation Medicine (PRM) in Europe, began to be organized during the years of laborious birth of the great political European organizations, Council of Europe in 1949, and then European Community (Belgium, France, Germany, Italy, Luxemburg, Netherlands) by the Treaty of Rome in 1957. The specialty of PRM, in Europe, has therefore found its strength and spirit in the foundations of the European mind.<sup>22</sup>

From the 1950s to the 1970s, some doctors, from different European countries, linked by the same mind and spirit and the same will to go ahead, got to work in order to individualize, to make autonomous, and to develop

the new specialty which was neither known nor named at that time.

Their work resulted in the foundation of four European organizations which, growing and enhancing their own activities, resulted in the setting up of a new autonomous specialty in all the European countries. These four organizations were, chronologically: in 1963, the European Federation of Physical Medicine and Rehabilitation; in 1969, the Académie Médicale Européenne de Médecine de Réadaptation; and in 1971 the PRM Section of the European Union of Medical Specialists (UEMS), whilst in 1991 The European College of PRM has been developed.

The organization founders, and those who, over the years, have dedicated themselves to working within the organizations (and people working for the same goal, later on), were considered convinced “Europeans” and also saw their mission as integrated in European community growth.

#### *The European Society of Physical and Rehabilitation Medicine (ESPRM)*

European Federation of Physical Medicine and Rehabilitation (EFPMR) has evolved towards the European Society of Physical and Rehabilitation Medicine (ESPRM):

The official birth of The European Federation of Physical Medicine and Rehabilitation (EFPMR), (Fédération Européenne de Médecine Physique et Réadaptation as written in French in Belgium) was on April 25, 1963 as published in the Official Journal of the Belgian Kingdom. The Federation was an organization with a scientific goal, gathering the national Scientific Societies. The aims of this federation were essentially scientific. It established the following purposes:

1. the organization of scientific collaboration with the view to develop PRM;
2. the harmonization across European countries of both specialist training and qualification criteria in rehabilitation medicine;
3. the promotion in each European country of a national PRM scientific society and of a theoretical organization to defend the general interests of the PRM physician; and
4. the harmonization on international level of the actions taken by different organizations and the represen-

tation of the PRM specialization in various European authorities.

Since the beginning, the EFPMR’s mission had been to promote specialist training in PRM by instituting an “études commission” (studies commission).

This commission, after an inquiry on the situation of teaching in different European countries, produced a draft paper, “Training specialists in Europe.” It was presented at the 5<sup>th</sup> Congress of the International Federation in Montreal. In 1970, this report was considered by the European Regional Bureau of the World Health Organization as a useful reference document for drafting the conference program entitled “Teaching Medical Rehabilitation” held in Poland, November 10-16, 1971. In this conference, it was established that the responsibility of rehabilitation medicine practitioners was to leave the expertise to an “ad hoc” instructed specialist and not to other discipline specialists.

This choice was decisive because, at the beginning, the national society members came from relevant disciplines (orthopedics, neurology, rheumatology, radiology, etc.), the discipline was referred to by various names, and practice seemed to be different throughout European regions. So, in this time in which the specialty did not exist in any European country, the Federation created the conditions for the emergence and concretization of a new specialty and for its practitioners’ defense.<sup>23</sup>

The EFPMR was represented as a non-governmental organization at the European Council through the elaboration, by some of its expert members, of an important paper, published in 1984, entitled “A coherent policy for the rehabilitation of people with disabilities — training of healthcare personnel involved in the field of rehabilitation: the current situation in member states and proposals to improve this type of training.”

The EFPMR began to promote scientific meetings that took the shape of European congresses, which, for many years, were held every 2 years. Moreover, the scientific journal *Europa Medicophysica* (Italy), had been circulating since 1964. This indexed review, now known as the *European Journal of Physical and Rehabilitation Medicine*, is an important tool for the development of PRM research in Europe.

In 2003, the European Federation of PRM, which had so greatly contributed to the foundation and the homogeneous development of our discipline, was dissolved



to make way for the creation of a European scientific society, the European Society of Physical and Rehabilitation Medicine (ESPRM), whose membership is open also to individual members specialized in PRM, although the participation of National Societies remains its central element. This society set the goal of developing a greater homogeneity from a scientific and professional point of view. The National societies (which in 1963 were only 5) in 2003 had reached the number of 20 (Austria, Belgium, Bulgaria, Croatia, Cyprus, France, Germany, Greece, Italy, Latvia, Lithuania, Netherlands, Portugal, Romania, Serbia, Slovenia, Spain, Switzerland, Turkey and The United Kingdom). In this period PRM strongly enriched its role all over Europe gaining responsibilities in Health Services in many Countries (unfortunately having several differences in educational and professional fields) and receiving some acknowledgments by the European bodies too.

The mission of ESPRM is a) to be the leading scientific European Society for physicians in the field of physical and rehabilitation medicine, b) to improve the knowledge of fundamentals and the management of activities, participation and contextual factors of people experiencing or likely to experience disability and c) to improve and maintain a strong connection between research and clinical practice in PRM.

*Académie Médicale Européenne de Médecine de Réadaptation/European Academy of Rehabilitation Medicine (EARM)*

In 1968, during the preparation of the 5<sup>th</sup> Congress of the International Federation, it was observed that colleagues from various countries working for the specialty were changing too often. It was also observed that none of the goals of the Federation was aimed at the philosophy of Rehabilitation Medicine. So, it was decided to establish an Academy that would be made up of persons, well known in the area of Rehabilitation Medicine, in order to set up an organization in which the members would stay for a long time and especially work on the philosophic and ethical aspects of Rehabilitation Medicine and encourage the scientific development of the specialty. The Academy was founded in Geneva in 1969 by eight founding members, under the name of Académie Médicale Européenne de Médecine de Réadaptation. This name was changed into Académie

Européenne de Médecine de Réadaptation /European Academy of Rehabilitation Medicine in 1996.

The registered seat of the Academy is in Brussels. Its logo is “Societatis vir origo ac finis” (Man is both the source and the goal of society). Its official language was French, but recently both French and English have been declared to be the official languages, with English more commonly used.

The aim of the Academy is to improve all areas of rehabilitation for the benefit of those who need it. It thus promotes education and research across Europe, acting as a reference point in scientific, educational and research matters, exchanging ideas and information, facilitating the exchange of PRM doctors between different countries and engaging in moral and ethical debate. EARM is made up of people who are prominent in the European world of Rehabilitation Medicine. They have to be medical doctors specialized in Rehabilitation Medicine, who are particularly distinguished in the field, not only from a technical or scientific point of view, but also for their humanistic aspects. They come from most of the European countries and recently membership continues to extend eastwards. The maximum number of members is 50, but it has never exceeded 40 whilst the current number is 35. They are chosen by invitation, elected only by secret ballot, after a complex procedure that entails presentation by three Academy members. EARM, although it has had an autonomous program of activities, has collaborated closely with the ESPRM and with the PRM Section and Board of UEMS. From this collaboration, the first edition of the White Book of Physical and Rehabilitation Medicine was published in 1989. This book was written in 4 languages (Spanish, English, French, Italian) and then re-edited in different countries. A second edition of the European White Book of Physical and Rehabilitation Medicine was published in 2006.

During the past years a number of documents have been published including:

— Inaugural Lectures of Academicians published in *Europa Medicophysica*, (Minerva Medica, Torino, Roma, Milano). *Médecine de Rééducation et Réadaptation*, 235 p, Documenta Geigy, Paris, 1982

— Many ethical documents have been produced under Academy's patronage, with “The Accessibility in Rehabilitation of Disabled People” ranking as the most important.

*The PRM Section of the European Union of Medical Specialists (UEMS)*

The free inter-country circulation of doctors in the six different countries of the European Community (1957) made necessary to organize the harmonization of education and qualification of specialists, in order to obtain the quality of care at the same optimal level in every European country. This was the goal of the UEMS, which was founded in July 1958 in Brussels. The UEMS has maintained close contact with the European Union authorities and the Council of Europe from the beginning. In the following years, the specialist sections were gradually founded.<sup>24</sup>

A Section called Physiotherapie/Physiotherapy was founded in 1963, but the first autonomous meeting was held in 1971 (Mondorf les Bains, Luxemburg). At this meeting, some historical protagonists and legitimate lawful delegates, with the help of jurists of the UEMS, asserted the autonomy and requested changing the specialty name to Physical Medicine and Rehabilitation (this name later was changed to Physical and Rehabilitation Medicine).<sup>25</sup>

Since the creation of the Section and until near the end of the 20<sup>th</sup> Century, the specialty was not yet the same in the different countries. The main problems to be solved were:

- to establish a definition of the specialty, exact and official;
- to give the same name to this specialty in all of the countries of the European Community and Europe;
- to define the role of the physician specialized in the discipline;
- to give guidelines for optimal and harmonized education to all European countries;
- to examine how and what Continuous Medical Education (CME) was in the specialty in each country;
- to establish a convenient and reasonable relation between the specialty and the remedial professions in rehabilitation;
- to define the Field of Competence of the PRM physicians and defend the interests of those practicing PRM in Europe;
- to accredit the quality of clinical care programmes and define minimum required European guidelines for clinical practice.

These different goals have been reached, more or less, during 40 years. Even now, it is necessary the work

to be continued for some of these goals. As an example it can be mentioned the elaboration of the e-book on the field of competences of European PRM physicians (Part I and Part II) by the Professional Practice Committee (PPC) of the Section, as well as the procedure for PRM specialty development or implementation in European continent countries where it is not established yet as a primary one (*e.g.* Russia, Ukraine etc).

*The European College of Physical and Rehabilitation Medicine (ECPRM)(served by the UEMS-PRM Board)*

Since 1990, the members of the Section have dedicated themselves to prepare the setting up of the European College of PRM, the fourth organization of the European specialists. The Collège Europeene de Medecine Physique et de Readaptation statutes were registered on July 19, 1991 in The Hague (Holland), the seat of the European Court of Justice. The founder signees of the statutes were from five different countries: Belgium, France, Portugal, Spain, and Holland. Through the years the name of this Body was adapted (but not registered) as European Board of PRM. The relationship between the Board and the Section was very close. Actually, the Board took all the responsibilities of the Section's educational affairs. The main goal of the Board was the harmonization of education and training in the different countries, at the highest possible level. An executive committee of six members was established and assisted by a commission of teachers made up of university professors.

There was a workshop 3 or 4 times a year, in Paris most frequently, gathering the Executive Committee with the Educational Committee. In less than 2 years, the PRM training curriculum, a kind of theoretical program made up of sections, the methods of practical training, the rules for obtaining the title of Board certified by equivalence, the conditions of the examination, the criteria for accreditation of trainers and training sites and the bilingual English–France logbook, were established. At the same time, the commission worked on the creation of a databank of examination questions (multiple clinical questions {MCQ} and case histories). An archive of more than 500 questions was created for the first session of the European examination held in Ghent (Belgium) in 1993. Anonymity and objectivity were the key elements maintained during correction of the ex-

ams. Since this date, the MCQ Bank has become considerably richer and the examination is held every year in every country with permanently increasing number of candidates. Since 2001, a reorganization of the Section and Board was made. This reorganization was necessary, owing to the workload of the management of a medical specialty under full development. Due to recent reorganization of the UEMS, this fourth organization of the European PRM Bodies was decided to continue operating under the title of European College of PRM and served by the UEMS PRM Board.

### **History and development of science in PRM in Europe. European PRM Scientific Journals**

The development of science in PRM may have followed several pathways, PRM being an independent medical specialty in nearly all European countries that has often stemmed, after the 2<sup>nd</sup> World War, from other both biomedical and clinical. Thus, besides PRM physicians trained from the beginning in PRM, physicians were also recruited from both biological areas (such as anatomy and physiology) and established clinical fields (such as neurology, orthopaedics, sports medicine and rheumatology). There has also been an influence from non-physicians, especially from psychologists and other behavioural science and technical areas. Scientific activities ought to be closely related to the clinical development of a speciality and this has also been the case for PRM. In the scientific development, research mainly related to biomedicine and technology (mostly, mechanical and electronic bioengineering), as well as to clinical practice with observational follow-up studies, appeared early, and later increased the number of randomized controlled trials (RCT) and methodological studies, especially on outcome measurements.

#### *Importance of “external” influence and the development of research fields*

PRM research has been influenced by external factors (such the International Classification of Impairments, Disabilities and Handicaps, ICIDH, and the International Classification of Functioning, Disability and Health, ICF), by new knowledge from modern psychometric techniques, from biomedical fields (as on neural plasticity and stem cell research), and by the development of

new technology. ICF, published by the World Health Organization (WHO) in 1980, never reached a large use, but had a conceptual impact on PRM, as well as an influence on the development of outcome measures. It was criticized for different reasons, *e.g.* for being too closely related to the traditional biomedical model and also for its terminology. When in 2001 it was further developed into ICF, a larger impact was noted, already at an early stage. It has also a more relevant terminology and could be expressed in positive and not only in negative terms. Thanks to this classification, PRM research demonstrated an increasing interest and also ability to approach the Bio-Psycho-Social model of disability. Methodology suitable for research within the activity and participation areas had to be developed and used, which to a large extent means use of instruments with categorical data (ordinal scales), requiring modern psychometric methodology. Of great help in that development has been the introduction of Rasch analysis in PRM research. The Danish mathematician Georg Rasch originally developed Rasch methodology. It is based on the relationship between the ability of the subjects and the difficulty of the items and the results are expressed in logit units. If data fit the model, raw scores can be transformed into interval-level ability estimates, a key requisite for measuring change. Early initiatives for the use of Rasch methodology in PRM were taken in the '90s in USA and the interest further spread to Europe. At the same time, the understanding and practical possibility to use randomized controlled trials (RCT) increased, especially during the last 20 years. In PRM, such studies are important in objectively evaluating intervention programs, but can have some practical limitations. Moreover, the technology with relationship to PRM research has also developed, *e.g.* in orthotics and robotics, in technology for movement analysis and in neurophysiology, and in following real-life physical activity (*e.g.* through wearable sensors). All these developments have broadened the possibility for clinical research in PRM.

The increasing number of non-medical rehabilitation professions, such as occupational therapists, physiotherapists and neuropsychologists doing research in the PRM field has broadened the competence of the PRM multi-professional team. Good models not only for multi-professional research, but also for transitional research, taking the advantage of collaboration between basic research and clinical research have developed.

### *Scientific meetings and congresses of the European PRM organizations. The Cochrane-PRM field creation*

Meetings and congresses arranged by different scientific organizations have contributed to communication and development of science in PRM, especially during the last twenty years, when the scientific quality of such meetings has increased. A number of PRM symposia, courses and international schools have also been arranged on special topics, such as biomechanical and movement analysis, neurophysiological background to rehabilitation, methodological aspects on outcome measurements, etc. In several congresses, informative and educational sessions on scientific publication—including “Meet the editor” and “How to write a manuscript” sessions — have been included. The international organizations “International Rehabilitation Medicine Association” and “International Federation of Physical and Rehabilitation Medicine,” merged 1999 into “International Society of Physical and Rehabilitation Medicine (ISPRM),” a worldwide PRM organisation with strong participation from European scientists. From a European perspective, the “European Federation of Physical Medicine and Rehabilitation” was founded in 1963, and among its aims there was the promotion of the national PRM societies and related congresses. The Federation changed in 2003 its name to “European Society of Physical and Rehabilitation Medicine (ESPRM),” as already mentioned, maintaining its aim of being the leading scientific society for European PRM physicians, including a European biennial scientific congress. In addition, two more regionally-based PRM organizations are working in Europe: the “Mediterranean Forum of Physical and Rehabilitation Medicine” (MFPRM) with its first congress in 1996, and the “Baltic North Sea Forum for Physical and Rehabilitation Medicine” (BNFPRM) with its first congress in 2010. Both these organizations have also attracted participants from their relevant parts of Europe and they organize a biennial PRM congress in their region.

### *Cochrane Rehabilitation field*

Under the initiative of the Evidence Based Medicine Special Interest Scientific Committee of the European Society of Physical and Rehabilitation Medicine with the approval of the other European PRM bodies, the

Cochrane Rehabilitation field has been created and it was launched in December 16<sup>th</sup>, 2016. Thanks to this, as well as to the cooperation in this new field of a large number of PRM physicians and other rehabilitation professionals, it will be possible in the future to give a special boost to the scientific evidence in our speciality, allowing among other things to improve rehabilitation research methodology, creation of new clinical practice guidelines as well as other benefits for rehabilitation.<sup>26</sup> ([www.rehabilitation.cochrane.org](http://www.rehabilitation.cochrane.org)).

### *Development of scientific journals within Europe*

Scientific Journals are among the most important contributors to the growth of science in PRM speciality. A great number of national PRM journals in Europe and also journals more spread internationally has been developed. Ten national journals belonging to the European Physical and Rehabilitation Medicine Journal Network (<http://www.esprm.net/journal-network>) from Bulgaria, Croatia, France, Germany and Austria, Portugal, Slovenia, Spain, Turkey have been presented in a paper,<sup>27</sup> but the field is in constant evolution. The three top Europe-based journals with an actual link with PRM scientific societies and an international perspective are<sup>28</sup> (in alphabetic order): Clinical Rehabilitation, European Journal of Physical and Rehabilitation Medicine and Journal of Rehabilitation Medicine.

### **European-international PRM Journals**

In order to give some indication on changes in scientific activity in PRM in Europe, we have examined specifically the content of the three above PRM journals at three time points 1975, 1995 and 2015 (as for Clinical Rehabilitation just at the two last time points) with respect to type and topics of the articles over the last 40 years.

### *Clinical Rehabilitation (Cr) 1987*

It is the official journal of the British Society of Rehabilitation Medicine, in association with the Society for Research in Rehabilitation. In 1997, it joined the Journal of Rehabilitation Sciences and became the official journal of the Netherlands Society of Rehabilitation and Physical Medicine. Always published in English it is indexed by Medline since 1995, and has an Impact Fac-

tor since 1995. The journal started in 1987. The number of evaluative studies has progressively increased, especially RCT studies five to seven times from 1987-1995 to 2002.<sup>29</sup> In 1995, the journal strongly advocated for more RCT studies in rehabilitation research.<sup>30</sup> Indeed, that was successfully done over the years, with an increase in the percentage of RCT from 18% of the published papers in 1995 to 50% in 2015. At the same time, the observational studies including qualitative studies decreased from 48% to 2%. The methodological articles decreased from 20% in 1995 to 12% in 2015, and unfortunately very few studies using Rasch analysis have been published. Reviews did not appear in 1995, but were 24% of the articles in 2015. The topics for the articles were rather constant with neurological conditions being around half of the articles with some increase between the two times points. It has developed a specific interest in goal setting and in describing interventions. It is now trying to increase also the very important and very underdeveloped theoretical base for rehabilitation

*European Journal of Physical and Rehabilitation Medicine (EJPRM) (1964), formerly "Europa Medicophysica" – Official Journal of ESPRM and UEMS-PRM Section and Board*

The journal started to be published in 1965 as Europa Medicophysica. Since the beginning it was the official journal of the European Federation of Physical Medicine and Rehabilitation, later become ESPRM, with 19 countries in the Editorial Board. It is published in association with the International Society of PRM (ISPRM), and is the official journal of the Mediterranean Forum of PRM (MFPRM). It was published in three languages (Italian, French and English) until 1994, when English became the only language. It is indexed by Medline since 2004, and has an Impact Factor since 2010. It changed to the current name in 2008. It was originally dominated by manuscripts from Southern Europe, but in 2007 became internationally oriented. A few RCTs were published in 1975 and 1995, but they had a marked increase (23% of the published manuscripts) in 2015. The percentage of observational studies has been rather high: 19% (1975), 29% (1995), and 41% (2015), respectively. Methodological studies started to appear in 1995, including occasionally some articles using Rasch analysis. In 1975 review paper and special reports were

common (56%), whereas in the later years they have not been as dominating. Manuscripts concerning neurological conditions have been around half or little less of the published manuscripts, with musculoskeletal and pain conditions increasing markedly from 1975 and 1995, and being 29% in 2015. Its main scope is publishing clinically meaningful papers, helping to improve PRM clinical practice.<sup>31</sup>

*Journal of Rehabilitation Medicine (JRM) (1969), formerly "Scandinavian Journal of Rehabilitation Medicine" – Official Journal of ISPRM, UEMS-PRM Board and EARM*

It started to be published in 1968 as Scandinavian Journal of Rehabilitation Medicine, and changed its name in 2001. Manuscripts were initially almost exclusively from the Nordic countries, but rather soon the proportion of manuscripts from other parts of the world increased (around 50% in 1996 and 80% in 2015), first due to an increase of European papers, and after 2005 also of non-European manuscripts. RCTs were not published in 1975, but appeared in 1995 as 21% and in 2015 as 27%; in contrast, non-controlled evaluative studies decreased (from 25% in 1975 to 8% in 2015). There has been an interest to publish different types of methodological studies, being around a quarter of the published articles during the period. The number of articles using Rasch analysis has increased, but still being relatively few in relation to the number of articles using ordinal scale data. Reviews and Special Reports started to appear from around 2000 and in 2015 were 11% of the published articles. The topics for the articles were fairly constant from 2004 to 2011 and over the whole period around 50% on neurological conditions, around a quarter from musculoskeletal and pain conditions, and the rest of the articles either from other conditions, as cardiac and respiratory conditions, or from studies involving several groups of patients or healthy individuals, including the elderly.

#### **Other European PRM scientific journals with international projection**

We present here short historical notes about other multinational journals, we will follow an order according to the year of foundation.

*Annals of Physical and Rehabilitation Medicine (APRM) (1974), formerly “Annales de Réadaptation et de Médecine Physique” – Official Journal of ES-PRM and UEMS-PRM Section*

Official journal of the French Society of Physical and Rehabilitation Medicine (SOFMER, Société Française de Médecine Physique et de Réadaptation), it is published in association with the International Society of Physical and Rehabilitation Medicine (ISPRM) since 2012. The Publisher is Elsevier, which diffuses the Annals via Science Direct. It was exclusively edited in French until 2005, became bilingual from 2009 and is exclusively published in English since 2015. APRM is indexed in Medline since 2001 and will have the first impact factor in 2018, and is now a scientific journal which meets international standards, and covers all fields and aspects of rehabilitation sciences, from fundamental, to medical and social sciences. The Journal publishes original peer-reviewed clinical and research articles, epidemiological studies, new methodological clinical approaches, review articles, editorials and the guidelines. Are mainly concerned: methods of evaluation of motor, sensory, cognitive and visceral impairments; functional disabilities; handicaps in adult and children; processes of rehabilitation in orthopedic, rheumatological, neurological, cardiovascular, pulmonary and urological diseases.

*Rehabilitación (Madr) (1966)*

Official journal of the Sociedad Española de Rehabilitación y Medicina Física (SERMEF). It was founded in 1966 by the board of directors of the Society. Its publisher is Elsevier-España, S.L.U. and draws four issues per year and a monograph on a subject of the greatest interest and topicality appointed by the editorial board. It is published in Spanish (except abstracts that are always both Spanish and English). It is not indexed by Medline yet, but included in: IME, Eventline, Bibliomed, Sedbase, CINAHL, Scopus, Pascal and IBECs. Its history goes back to a previous journal: Acta Fisioterápica Ibérica (1956) which was the official journal of the “Sociedad Española de Fisioterapia Reeducativa y Recuperación Funcional”. In 1966, Acta Fisioterápica Ibérica and Revista Española de Rehabilitación del Aparato Locomotor (supplement of the orthopaedic surgery journal) were unified in the new journal. Reha-

ilitación (Madr) is the main scientific diffusion tool for PRM physicians in Spain as well as for those in Spanish-speaking Latin-America countries. Its main scope is continuous medical education in PRM specialty.

*International Journal of Rehabilitation Research (IJRR) (1977)*

Official journal of Rehabilitation International from 1977 to 1985, and then, since the establishment, of the European Federation of Research in Rehabilitation that in 2009 was renamed European Forum for Research in Rehabilitation. Publishers: Schindele (1977-1990), Chapman and Hall (1990-1998), and now Lippincott Williams & Wilkins/Wolters Kluwer (since 1998). It was always written in English. It is indexed by Medline since 1978, and has an Impact Factor since 1997. It is a forum for the publication of research into functioning and disability, and the contextual factors which influence the life experiences of people of all ages in both developed and developing societies. Currently it has an impact factor.

*Physikalische Medizin – Rehabilitationsmedizin – Kurortmedizin - Journal of Physical and Rehabilitation Medicine (JPRM) (1991)*

It is the official journal of the German Society of Physical Medicine, the Austrian Society of Physical and Rehabilitation Medicine, the German Professional Association of Rehabilitation Medicine and the Austrian Professional Association of Physical and Rehabilitation Medicine. Published by Georg Thieme. In 2009 the journal's subtitle Journal of Physical and Rehabilitation was added. It has an Impact Factor since 2015. It publishes articles in English and German. Its history goes back to 1898, with Zeitschrift für diätetische und physikalische Therapie (Journal of Dietary and Physical Therapy), continued in the German Democratic Republic since 1971 as Zeitschrift für Physiotherapie; in West Germany, the Zeitschrift für Physikalische Medizin was founded in 1970. In 1991 the two societies and journal of East and West Germany merged. Its main scope is original articles, case reports and educational articles in Physical Medicine and Rehabilitation Medicine. Congress abstracts, news from the societies and associations.

### *Journal of the Portuguese Society of Physical Medicine and Rehabilitation*

The SPMFR Journal is published since 1992, and a reference for all Portuguese specialists in MFR and for Portuguese medical societies. Its printed copies are sent to all members of SPMFR, Sociedades Médicas de Portugal and various medical libraries. It is also spread to other Portuguese speaking countries, through cooperation with colleagues from Brazil, Angola, Mozambique, Cape Verde, Guinea Bissau, S. Tome and Príncipe, East Timor.

Articles from the area of Rehabilitation Medicine, original and review, are published, and all manuscripts submitted must be in accordance with the International Committee of Medical Journal Editors. The SPMFR Review has a complete peer review process, clear definition of its objectives and scope, and conflict of interest statement, in accordance with the Recommendations for the Conduct, Reporting, Editing and Publication of Scholarly Work in Medical Journals (ICMJE Recommendations). Articles can be submitted in English, French and / or Portuguese. Abstracts must be in English and in another language (French or Portuguese).

### **Conclusions for PRM journals**

Scientific research in this medical specialty has been increasing over the past century and continues during the present. Research mainly related to biomedicine and technology (mostly, mechanical and electronic bioengineering), as well as to clinical practice with observational follow-up studies, appeared early, and later increased the number of randomized controlled trials (RCT) and methodological studies, especially on outcome measurements. European PRM authors are publishing an increasing number of research reports in both clinical and experimental field, not just in PRM journals (some of them indexed by Medline and with a currently impact factor) but also in other leading journals belonging to different biomedical categories. There has been a clear development in the type of articles being published with randomized control trials (RCT), being much more common now than 40 years ago. Similarly, the number of clinical trials published in medical journals indexed by PubMed, including the keyword “Physical Medicine and Rehabilitation,” has increased from 65 in 2006 to 200 in 2015. In addition, at present the

number of clinical trials registered on ClinicalTrial.gov, and located in Europe, is about one third of the world output when searched by keyword either “Rehabilitation Medicine” (583/1764), or “Physical Medicine and Rehabilitation”/“Physical and Rehabilitation Medicine” (84/264). All that will hopefully strengthen the possibility for the scientific input on clinical practice in PRM, and Europe has a leading position in that. The patient groups in the surveyed journals are mainly neurological conditions, and then musculoskeletal and pain conditions: this reflects the clinical situation in PRM settings. In addition, methodological studies have been performed on both construct and psychometric characteristics of different outcome instruments. Last but not least, there has been a large interest in research connected to ICF, starting already in the beginning of the present century: several papers have been published on conceptual aspects of ICF and on the development of ICF with core sets, and as a basis for outcome measures as well as for structuring PRM research and clinical work. Scientific Journals are among the most important contributors to the growth of science in PRM specialty. There are some commonalities in their history in Europe. They have generally born locally to serve a specific PRM Society and Country and had to face an evolution to become international. The data-bases (mainly PubMed, and ISI with its Impact Factor), born in USA and initially including mainly US journals, created a first main challenge. Another has been the transformation in English language (for journals based in non-English speaking countries), particularly difficult for editors, authors and readers. Finally, the international evolution included for the oldest journals a change of name to make it more modern and/or corresponding to the actual contents.

### **References**

1. Ward AB. Physical and rehabilitation medicine in Europe. *J Rehabil Med.* 2006;38:81-6.
2. Vlček, E. The Fossil Man of Gánovce Czechoslovakia. *J R Anthropol Inst.* 1955;163-71.
3. Conti AA. Western medical rehabilitation through time: a historical and epistemological review. *ScientificWorldJournal.* 2014;2014:432506.
4. Conti AA. Reconstructing medical history: historiographical features, approaches and challenges. *Clin Ter.* 2011;162:133-6.
5. Schmitt C, Mehlman CT, Meiss AL. Hyphenated history: Erb-Duchenne brachial plexus palsy. *Am J Orth* 2008;37(7):356-58.
6. Climent Barberá JM. Formation of the concept of rehabilitation in the gymnastic work of Sebastián Busqué Torró (1865). *Med E Hist.* 1991;40:1-16.

7. Peltier LF. The “back school” of Delpech in Montpellier. *Clin Orthop Relat Res* 1983;179:4-9.
8. De Vierville JP. Aquatic Rehabilitation: A Historical Perspective. In: Becker BE, Cole AJ, editors. *Comprehensive aquatic therapy*. Pullman: Washington State University Publishing; 2010. 1-21 p.
9. Pettman E. A history of manipulative therapy. *J Man Manip Ther*. 2007;15(3):165-74.
10. Cyriax J. *Textbook of orthopaedic medicine. Vol.2 Treatment by Manipulation, Massage and Injection*. London: Baillière Tindall.1984.
11. Chaitow L. *Palpation skills. Assessment and diagnostic through touch*. 3<sup>rd</sup> edition. Harcourt Publisher Limited. Churchill Livingstone 2000.
12. Meloche J P, Bergeron Y, Bellavance A, Morand M, Hout J, Belzile G. Painful intervertebral dysfunction: Robert Maigne’s original contribution to headache of cervical origin. *Headache*. 1993;328-34.
13. Janda V. *Muscle fuction testing..* London: Butterworths; 1983.
14. Lewit K. *Manipulative Therapy in the Rehabilitation of the Motor System*. 3<sup>rd</sup> edition. London: Butterworths; 1985.
15. Lewit K. Disturbed balance due to lesions of the cranio-cervical junction. *J Orthop Med*. 1998;58-61.
16. Valero R, Varela E, Küçükdeveci AA, Oral A, Ilieva E, Berteanu M, et al. Spinal pain management. The role of physical and rehabilitation medicine physicians. The European perspective based on the best evidence. A paper by the UEMS-PRM Section Professional Practice Committee. *Eur J Phys Rehabil Med*. 2013;49:715-25.
17. Draganski B, Gaser C, Busch V, Schuierer G, Bogdahn U, May A. Neuroplasticity: changes in grey matter induced by training. *Nature*. 2004;427(6972):311-2.
18. Ogden JA, Alvarez RG, Levitt R, Marlow M. Shock wave therapy (Orthotripsy) in musculoskeletal disorders. *Clin Orthop. Relat Res*. 2001;387:22-40.
19. Del Castillo-González F, Ramos-Alvarez JJ, Rodríguez-Fabián G, González-Pérez J, Jiménez-Herranz E, Varela E. Extracorporeal shockwaves versus ultrasound-guided percutaneous lavage for the treatment of rotator cuff calcific tendinopathy: a randomized controlled trial. *Eur J Phys Rehabil Med*. 2016;52:145-51.
20. Giustini A, Varela E, Franceschini M, Votava J, Zampolini M, Berteanu M, et al. UEMS--Position Paper. New technologies designed to improve functioning: the role of the physical and rehabilitation medicine physician. *Eur J Phys Rehabil Med*. 2014 ;50:579-83.
21. Reinhardt JD, Zhang X, Prodinge B, Ehrmann-Bostan C, Selb M, Stucki G, et al. Towards the system-wide implementation of the International Classification of Functioning, Disability, and Health in routine clinical practice: Empirical findings of a pilot study from Mainland China. *J Rehabil Med*. 2016;48:515-21.
22. Bardot A, Tonazzi A. European physical and rehabilitation medicine organisms--origins and developments. *Eura Medicophys*. 2007;43:185-94.
23. Bertolini C, Delarque A. A brief history of European organizations of physical and rehabilitation medicine. *Am J Phys Med Rehabil*. 2008;87:592-5.
24. De Korvin G, Delarque A. Physical and rehabilitation medicine section and board of the European Union of Medical Specialists. Community context; history of European medical organizations; actions under way. *Ann Phys Rehabil Med*. 2009;52:594-607.
25. Gutenbrunner C, Ward A, Chamberlain M. The White Book on Physical and Rehabilitation Medicine in Europe. *J Rehabil Med*. 2007 Jan;(45 Suppl):6-47-.
26. Negrini S, Kiekens C, Levack W, Grubisic F, Gimigliano F, Ilieva E, et al. Cochrane physical and rehabilitation medicine: a new field to bridge between best evidence and the specific needs of our field of competence. *Eur J Phys Rehabil Med*. 2016 ;52:417-8.
27. Negrini S, Ilieva E, Moslavac S, Zampolini M, Giustini A. The European physical and rehabilitation medicine journal network: historical notes on national journals. *Eur J Phys Rehabil Med*. 2010;46:291-6.
28. Franchignoni F, Stucki G, Muñoz Lasa S, Fialka-Moser V, Vanderstraeten G, Quittan M, et al. Publishing in physical and rehabilitation medicine: a European point of view. *J Rehabil Med*. 2008;40:492-494.
29. Wade D, Tennant A. An audit of the editorial process and peer review in the journal *Clinical rehabilitation*. *Clin Rehabil*. 2004;18:117-24.
30. Wade D. Randomized and controlled clinical trials in *Clinical Rehabilitation*. *Clin Rehabil*. 1995;9:275-82.
31. Grimby G. *Journal of Rehabilitation Medicine: Looking back at 13 years as Editor-in-Chief*. *J Rehabil Med*. 2012;44:517-20.

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- European Academy of Rehabilitation Medicine (EARM)
- European Society of Physical and Rehabilitation Medicine (ESPRM)
- European Union of Medical Specialists PRM section (UEMS-PRM section)
- European College of Physical and Rehabilitation Medicine (ECPRM) – served by the UEMS-PRM Board
- the Editors of the 3<sup>rd</sup> edition of the White Book of Physical and Rehabilitation Medicine in Europe: Enrique Varela-Donoso, Pedro Cantista, Maria Gabriella Ceravolo, Nicolas Christodoulou, Alain Delarque, Christoph Gutenbrunner, Carlotta Kiekens, Saša Moslavac, Anthony B. Ward, Mauro Zampolini, Stefano Negrini
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## ORGANIZATION OF PHYSICAL AND REHABILITATION MEDICINE IN EUROPE

# White Book on Physical and Rehabilitation Medicine (PRM) in Europe. Chapter 5. The PRM organizations in Europe: structure and activities

European Physical and Rehabilitation Medicine Bodies Alliance

### ABSTRACT

In the context of the White Book of Physical and Rehabilitation Medicine (PRM) in Europe, this paper addresses the structure, organization and activities of PRM bodies in Europe.

There are four main bodies, the Section of Physical and Rehabilitation Medicine of the European Union of Medical Specialists (UEMS) very close to the European Union and is committed to define the professional competencies of PRM, the quality management and accreditation and with the Board the educational matters. The European College of PRM is served by the UEMS PRM Board and its main activities are analyzed below in the description of the Board of the UEMS PRM Section. The European Society of Physical and Rehabilitation Medicine (ESPRM) mainly dedicated to promoting research in rehabilitation and create a network of knowledge of PRM across the Europe. The European Academy of Rehabilitation Medicine mainly dedicated to defining the ethical issues in rehabilitation and finding strategies for better educational approaches in rehabilitation.

There are 2 further bodies (the regional Fora) aimed to create bridges across the Mediterranean area (Mediterranean Forum of PRM) and across the northern Europe including the eastern countries such as Russia, Belarus and Ukraine (Baltic and North Sea Forum of PRM). To support the knowledge, we have in Europe 7 main journals dedicated to Rehabilitation with a growing impact factor.

Last but not least the PRM bodies have an important role across the world with a connection with the International Society of PRM and WHO. The UEMS Section approved motion of international collaboration.

In conclusion, PRM activity in Europe is not limited to the official border but in the network included eastern countries and Mediterranean area. The European extended network is strongly connected with the international PRM bodies, first of all the International Society of PRM.

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**Key words:** Physical and Rehabilitation Medicine - Europe - Scientific Societies - Publications.

### Introduction

The White Book (WB) of Physical and Rehabilitation Medicine (PRM) in Europe is produced by the 4 European PRM Bodies and constitutes the reference book for PRM physicians in Europe. It has multiple values, including to provide a unifying framework for the European Countries, to inform decision-makers at the European and national level, to offer educational material for PRM trainees and physicians and information about PRM to the medical community, other rehabilitation professionals and the public. The WB states the importance of PRM, that is a primary medical specialty. The contents include definitions and concepts of PRM, why rehabilitation is needed by individuals and society, the fundamentals of PRM, history of PRM spe-

cialty, structure and activities of PRM organizations in Europe, knowledge and skills of PRM physicians, the clinical field of competence of PRM, the place of PRM specialty in the healthcare system and society, education and continuous professional development of PRM physicians, specificities and challenges of science and research in PRM and challenges and perspectives for the future of PRM.

The organization of Physical and Rehabilitation Medicine specialty in Europe has been developed in the years to allow on one side to improve the actual practices and on the other to make them uniform in the various European countries. In this chapter, the activities and programs of all the European relevant organization are presented. These includes:

— The European PRM Bodies joined for this third edition of the White Book to form the European PRM Bodies Alliance: they include the European Academy of Rehabilitation Medicine, the European Society of PRM, the PRM Section of the European Union of Medical Specialists (UEMS) and the European College of PRM (served by the UEMS PRM Board).

— The Regional Fora: the Mediterranean Forum of Physical and Rehabilitation Medicine and the Baltic and North Sea Forum of Physical and Rehabilitation Medicine

- The National PRM Societies in Europe
- The European multinational PRM Journals

Finally, the role of Europe in PRM activities across the world is presented.

### European PRM Bodies

#### *The Section of Physical and Rehabilitation Medicine of the European Union of Medical Specialists (UEMS)*

Specialty was officially recognized in 1968 when, in Geneva (Switzerland), the World Health Organisation's Expert Committee on Medical Rehabilitation announced the existence of a new medical discipline: Physical Medicine and Rehabilitation.<sup>1, 2</sup> Three years later, in 1971, the UEMS approved the creation of a Section under this name. More historical details for the development of PRM and the creation of PRM Section of the UEMS are described in chapter 4 above. Since

2001 the Section was reorganized to serve the multiple needs of the specialty within the European Union<sup>3</sup> ([www.euro-prm.org](http://www.euro-prm.org)). It was divided in three committees (Figure 1).

— The Board (PRM Training and Education Committee)

— The Clinical Affairs Committee (for defining and accrediting the quality of clinical care in PRM)

— The Professional Practice Committee (for defining and protecting the Field of Competence of the PRM physicians)

#### THE BOARD AND THE TRAINING IN PRM

Since 1991, the educational affairs of the Section were given to the newly established Européenne College de Médecine Physique et de Réadaptation Fonctionnelle to act as the European Board, according to the provisions of the UEMS Specialist training. The route to start training is slightly different in each country but, despite different entry points to the specialist training program, the curriculum has much similarity across the continent. The European Board of PRM has the task of harmonizing specialist training across Europe, supported by the Basel Declaration and subsequent texts from UEMS<sup>4</sup> and has taken on the following roles:

- European examination for recognition of specialist training leading to a fellowship;
- Continuing medical education & professional development used for ten-yearly revalidation of fellowship;
- Recognition of European trainers & training units through site visits.

The eventual aim of this harmonization is to produce specialists who can work across European health care systems and allow national medical authorities/employers to recognize the knowledge and expertise of the specialists who have been trained in another part of Europe. All aspects of the Section and Board, including the specialty's curriculum can be obtained through the Section's website at [www.euro-prm.org](http://www.euro-prm.org).

#### THE CLINICAL AFFAIRS COMMITTEE (CAC) DEALS WITH THE QUALITY OF CARE IN PRM

— In accordance with the declarations of UEMS<sup>5-7</sup> this committee sets up the procedure for European Accreditation of PRM Programs of Care (voted in 2004).<sup>8</sup>

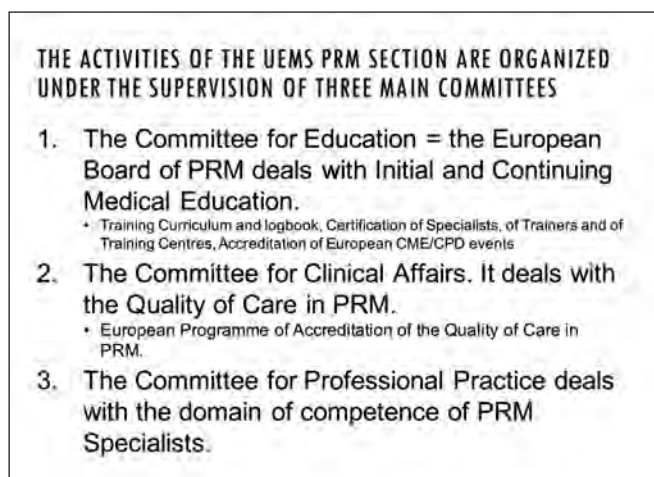


Figure 1.—The activities of the UEMS PRM Section.

Not based on legal obligations or financial advantages the only goal of this accreditation is to make people throughout Europe aware of the quality of PRM care proposed in Europe and to develop a European PRM culture of quality. The accreditation procedure was first conceived as a simple measure for selecting the programs of care that met a certain number of requirements, particularly organizational requirements. The procedure was based on a questionnaire posted online on the UEMS PRM website, which was then submitted to a five-members international jury. The questions concerned the program's target population, objectives and scientific bases, the role of the PRM physician, the means of implementation, the team organization and the evaluation of the results. Over the 2-years pilot phase 13 programs were thus accredited. Following several conclusions from the pilot phase, corrections were done to the questionnaire system which had the advantage of simplicity and the actual description of the program, which rapidly became more important than anything else in forming the opinions of the jury. The "Programme of care in PRM" is the structuring unit for describing the activities of our discipline, the evaluation of its results, and the negotiations for its financing. The programs that have already been accredited, and all the information about the new accreditation procedure can be found online at [www.euro-prm.org](http://www.euro-prm.org). Also, an ongoing process in the CAC is to define minimum required European guidelines for clinical practice.

#### THE PROFESSIONAL PRACTICE COMMITTEE (PPC) DEALS WITH THE FIELDS OF COMPETENCE RELATED TO PRM

The primary objective of the PPC was to insure a single officially-recognized appellation for the PRM specialty in Europe. The expression, "physical and rehabilitation medicine", or a very close equivalent, is officially used in all European countries. Unfortunately, the Directive 2005/36/EC of the European Parliament and of the Council of 7 September 2005 on the recognition of professional qualifications<sup>9</sup> uses the term "physiotherapy". At the request of the PPC, UEMS has monitored this issue to make sure that the European Commission adopts the term "physical and rehabilitation medicine", following the amendment of the old Directive with a new one in 2013 concerning the recognition of the professional qualifications and the names of

medical specialties. A new definition of PRM was voted by the UEMS General Assembly in Antalya (Turkey) in October 2003. In addition, thanks to the joint action of the national delegates to the UEMS Council, our Section was able to obtain a vote on an amendment to the European definition of the Medical Act, adding the words "functioning", "rehabilitative" and "ethical".<sup>10</sup> Under the impetus of the German, Swiss and Austrian delegates, the PRM Section of the UEMS decided to encourage the use of the International classification of functioning, disability and health (ICF) in clinical practice (Rennes, France; 30 March 2007). A working group on this subject was constituted in association with European Society of PRM (ESPRM).<sup>11</sup>

As soon as the PPC was created in 2001, its members began writing a second White Book, revising the first White Book about PRM in Europe, which was published in 1989 by three European organizations (the European PRM Federation, the European Academy and the UEMS Section). The new White Book intended to describe the state of the PRM specialty in all its aspects: title, definition, content and organization of initial education programs, demographics, continuing education, scientific research and publications. It was co-edited by the UEMS PRM Section and European College (Board) and the European Academy of Rehabilitation Medicine in association with the European Society of Physical and Rehabilitation Medicine (ESPRM) and was published jointly by the Journal of Rehabilitation Medicine<sup>12</sup> and Europa Medicophysica.<sup>13</sup> This third edition is designed to present the development of PRM in Europe.

#### MEMBERS

Full membership have the 28 European Union members along with Switzerland, Norway and Iceland. Israel, Serbia and Turkey are associate members. Several other European countries are observers (Montenegro, Former Yugoslav Republic of Macedonia (FYROM), Bosnia & Herzegovina, Georgia, Armenia, Russia, Ukraine). Within all these countries there are over 23.000 trained specialists and trainees. The UEMS therefore has a major task to make a relevant link between all these countries at a European level. The number of PRM physicians across the countries of Europe varies considerably. The general structure of PRM services across Europe is similar despite the differences

between healthcare systems. Proposals for clinical standards are being put together during this process in the form of practice based around health-related groups. Example of this last action are the creation of European Standards of Practice for patients in post-acute setting, the European card for patients with autonomic dysreflexia as well as the e-book on the field of competences part I and part II, the latter is now in progress.

*European Society of Physical and Rehabilitation Medicine [ESPRM] (www.esprm.net)*

Historical details are presented in chapter 4.

The mission of ESPRM is:

- To be the leading scientific European Society for physicians in the field of physical and rehabilitation medicine

- To improve the knowledge of fundamentals and the management of activities, participation and contextual factors of people experiencing or likely to experience disability.

- To improve and maintain a strong connection between research and clinical practice in PRM.

The ESPRM has membership from both individual members who are PRM physicians or from national PRM societies. Nowadays (2017), the latter are 35 in number (Austria, Belgium, Bulgaria, Croatia, Cyprus, Denmark, Estonia, Finland, France, Former Yugoslav Republic of Macedonia (FYROM), Georgia, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Montenegro, Norway, Portugal, Poland, Bosnia & Herzegovina, Romania, Serbia, Slovenia, Spain, Sweden, Switzerland, The Netherlands, Turkey, Russia, Ukraine). It also has cooperating societies coming from countries out of Europe (Israel, Jordan) or whose structure does not respond to the Statutes and bylaws of ESPRM (Malta).

The following Special Interest Scientific Committees (SISC) have been established: (1) Public Health, (2) Orthotics and Prosthetics, (3) Guidelines, (4) Persons with Pain and Disability, (5) Persons with Parkinson / Movement disorders, (6) Persons with Traumatic Brain Injury, (7) Persons with Musculoskeletal Disorders, (8) Sports Affairs, (9) Robotics in Rehabilitation, (10) PRM in Ageing Persons, (11) Evidence Based Medicine, (12) Persons with Spinal Cord Injury, (13) Persons with Stroke, (14) Ultrasounds in PRM and (15) Persons with

Peripheral Nerve Disorders. The following Congresses held by the European Society of Physical and Rehabilitation Medicine, have been the main events at which the activities of the society in the fields of research were promoted: Vienna 2004, Madrid 2006, Brugges 2008, Venice 2010, Thessaloniki 2012, Marseille 2014 and Estoril 2016. Furthermore, the role of the Society is strengthened with regards to its cooperation with other European PRM Bodies, which work at European level in the Physical and Rehabilitation Medicine field, as well as at worldwide level with the ISPRM (International Society of PRM).

*Académie Médicale Européenne de Médecine de Réadaptation / European Academy of Rehabilitation Medicine (EARM) (www.aemr.eu)*

The historical details for the Academy are presented in chapter 4.

The mission is:

- improve all aspects of the rehabilitation of disabled people;

- be a reference point in the scientific educational and humanitarian aspects of PRM;

- engage in moral and ethical debate;

- exchange information defining the field of rehabilitation and its terminology;

- ensure that education in rehabilitations part of the CV;

- support and help improve research in rehabilitation;

- introduce and defend the concept of rehabilitation.

- and facilitate exchange of PRM trainees and doctors between different countries.

This is made up of a maximum of 50 senior academic physicians from all over Europe and academicians focus on humanities and ethical issues in rehabilitation medicine and in disability. Some works on ethics are:

1. The ethical problems posed by the longer survival of a greater number of people who are entirely dependent and conscious.

2. Revealing the prognosis to a paralysed adult.

3. Ethical problems posed by sexuality for persons with disabilities living in institutional establishments.

4. Violence and handicap, published as a brief communication. Journal of Rehabilitation Medicine, 2006.

5. La réadaptation médicale des personnes âgées: défis et challenges humains, éthiques et médico – économiques Commission de Prospectives.

The EARM believes that Rehabilitation is better understood and practised if there is access to the best information and has launched a series of monographs. These books should be particularly useful for young physicians preparing for the European Board certification in PMR, for senior physicians specialised in PMR and allied disciplines looking for information and continuing medical education as well as for all the members of the rehabilitation team.

Books published in Academy's Collection by Springer France are:

— La Plasticité de la Fonction Motrice / The Plasticity of Motricity Function; by J.P. Didier. Springer. 2004;

— Sphincter Functioning / Les fonctions sphinctériennes. by Amarenco G., Chantraine A. (Eds.) (2006);

— Vocational Rehabilitation by Gobelet Charles. Franchignoni Franco (2006);

— Rehabilitation and palliation of cancer patients (Patient care) by Hermann Delbruck (2007);

— Rethinking physical and rehabilitation Medicine - New technologies induce new learning strategies by Didier Jean-Pierre Bigand Emmanuel (2010);

Moreover, the specially published book under the sponsorship of the Academy "Assessment in Physical Medicine and Rehabilitation: Views and Perspectives" by M. Barat and F. Franchignoni has been edited by Mageri Foundation Books in 2005.

For many years EARM, aiming at encouraging new researchers, has created an annual Academy prize to a publication in the PRM field (supported in the past by the Swiss Paraplegic Foundation and the last years by the non-profit Foundation for Rehabilitation Information with the Journal of Rehabilitation Medicine). The prize is officially awarded at each European Congress of Physical and Rehabilitation Medicine.

### Regional Fora

*The Regional Physical and Rehabilitation Medicine (PRM) Fora:*

The Mediterranean Forum of PRM (MFPRM) and the Baltic and North Sea Forum of PRM (BNF-PRM)

In May 1996 was organised the first PRM Mediterranean Congress in Herzliya of Israel under the slogan

"Rehabilitation without frontiers" aiming to promote PRM worldwide and the quality of life of the disabled in the area of the Mediterranean basin. During this congress, a meeting took place under the title: "A Mediterranean PM&R Society, is it viable?"<sup>14, 15</sup> It was decided to organize a biennial Mediterranean Congress and the 2<sup>nd</sup> congress was organized in Valencia in 1998. The Mediterranean Forum of Physical and Rehabilitation Medicine – MFPRM - was created at the 3<sup>rd</sup> Congress in Athens in 2000 and its members are individual PRM physicians coming from Mediterranean countries or countries with close vicinity with them. Since then the Mediterranean congress was organized in Syracuse 2002, Antalya 2004, Vilamoura 2006, Portorose 2008, Limassol 2010, Sorrento 2012, Budva 2013, Alexandria 2015 and Malta 2017. Based on the good experience from the MFPRM a discussion of a Baltic Forum started in 2003.<sup>16</sup> A founder assembly was held in Riga in September 2007 and it was decided to include also the North Sea area into the Forum. It was decided that the Forum would be based on individual memberships. Since March 2010 the Baltic and North Sea Forum on Physical and Medical Rehabilitation – BNF-PRM is registered legally in Latvia. A policy declaration has been adopted by the board in Vilnius in September 2009<sup>16</sup> and the present organization has an executive board an advisory board and four committees. There are two main reasons for the existence of BNF-PRM. The first one is that the Baltic and North Sea is a region with 16 countries having different languages and traditions as well as different health systems leading to differences in approach and strategy for rehabilitation. A second reason for BNF-PRM is the political history of the region. It was divided by the so-called "Iron Curtain" and almost no personal contacts between colleagues living in different sides of the border were possible and consequently there was no scientific communication and exchange.

Obviously, there are basic principles that are common for the MFPRM and BNF-PRM. The main goals of BNF-PRM and MFPRM are:<sup>16, 17</sup>

1. to communicate and exchange knowledge in the field of Physical and Rehabilitation Medicine;

2. to create and evaluate concepts for PRM activities and discussing best practice

3. to stimulate creation of networks for scientific projects regarding different aspects of Rehabilitation research, multicenter trials and projects;

4. to support education and training in the field of PRM and facilitate exchange of young doctors and scientists *e.g.* organizing periodically congresses;

5. to influence national governments and incorporation of issues of rehabilitation into national health strategies;

6. to give opportunity for personal contacts;

7. to have a collaboration and a good cooperation with National and International scientific PRM bodies.

These two Regional Fora extend the PRM culture over the borders of European Community. In the South towards North Africa and West Asia (MFPRM) and in the North over the former “Iron Curtain” including Russia and other countries (BNF-PRM). Both Fora organise scientific congresses<sup>18-21</sup> and summer schools for PRM residents and young specialists. The Euro-Mediterranean PRM Haim Ring School (EMPRMS)<sup>22</sup> takes place every year in Syracuse with the sponsorship of SIMFER, UEMS, ESPRM and the MFPRM. In August 2014, the first Riga Summer School was organised. The “European Journal of PRM”, with the sub-title of “Mediterranean Journal of PRM”, is the MFPRM official journal and the Journal of Rehabilitation Medicine is the official journal of the BNF-PRM. The MFPRM website is [www.mfprm.org](http://www.mfprm.org); the BNF-PRM website is [www.bnfprm.org](http://www.bnfprm.org).<sup>2</sup> The MFPRM and the BNF-PRM are unique and ever growing PRM Societies acting on a volunteer basis to achieve a scientific, cultural and humanitarian mission: to develop and harmonize “Rehabilitation across borders”. These Fora aim to create bridges of understanding and cooperation among Europe and the other countries contributing for better and peaceful regions “without frontiers”.

### National PRM Societies in Europe

In Europe the national societies play a pivotal role in the development of Physical and Rehabilitation Medicine. The European Bodies exist to support National Societies in their task of developing PRM within their own country’s health economies, professional organizations and academic structures.

Every European country has a national society of Physical and Rehabilitation Medicine with different names and different historical origin. The role of the European Bodies is to harmonize the PRM practice and education across Europe and the national societies,

implement the European standards according to their specific and local experience.

A problem arises when in a single country there are more than one PRM societies and sometimes it is difficult to find the delegates to represent all of them.

Furthermore, the national societies are organized differently in the different countries: in some there is one society covering all aspects (*e.g.* The Netherlands). In others, there are different societies (*e.g.* Italy, Belgium, France) covering respectively the scientific, professional and synodical matters.

The role of the European Bodies is to harmonize the PRM practice and education across Europe and the national societies for carrying out the implementation of the European standards according with their specific local experience.

All the national societies of the member countries have their delegates to the PRM Section and Board of UEMS and participate in the regular general assemblies that are organized twice per year.

Usually in the same week there is the meeting of the delegates of ESPRM, where there are representatives of all the member societies for the assembly and individual members.

The ‘European Academy of Rehabilitation Medicine’ members are not directly connected to national societies but are involved directly after an individual application evaluated from the Academy.

PRM is recognized as a core service in each of the member states of the Greater European space and the newer associate and observing countries also adopt the same principles.

Most of the national societies (NS) of the specialists in Physical and Rehabilitation Medicine in Europe are members of the European Society of PRM. In fact, one of the goals of the European Federation of Physical Medicine and Rehabilitation, that was founded in 1963, was the promotion in each European country of a national PRM scientific society and an organization to defend the general interests of the PRM physicians. In 2003, when ESPRM was founded as a successor of the European Federation of PRM, there were 21 National societies—members. Some of the countries like Latvia and Turkey have more than one National Society of PRM physicians. It is very encouraging and informative about the growing influence of ESPRM, that the interest among the NS of joining ESPRM is increasing. In 2015,

the Russian and the Ukrainian Societies joined that encompass a large number of “Physiotherapy Physicians” or other related medical specialization courses with a curriculum different from European Specialisation of PRM. In order to harmonize the specialization curriculum, they are undergoing transition to the European model of the specialty with the support of the UEMS PRM Section and Board.

ESPRM includes not only NS of member states of the European Union but as it is evident by the list of the members it includes almost all the European countries.

The ESPRM had 17,238 active members from the NS in 2016. The percentage of PRM physicians that are members of their national society varies between the countries. For example, in Germany only 21% of the PRM physicians are members of the German PRM Society, while in Italy this percentage reaches 80% and 95% in the UK. Some of the national societies have also other medical specialists and other professionals as full or associate members (*e.g.* Austria, Czech Republic, Hungary, Ireland, Poland, Russia, Slovakia, Switzerland, UK and Malta).

Within the European countries there are 20,655 PRM physicians. The number of PRM physicians across Europe varies considerably and Table I shows the demographic details. The number of PRM physicians per 100 000 inhabitants also varies in the different countries — from 10.4 (in Estonia) to 0.2 (in Ireland, Malta and UK).

Interest in the specialty is growing at a European level — the percentage of trainees of the number of PRM physicians varies from 36% in UK to 2% in Russia. This usually depends on the prestige and position of the specialty among the other medical specialties and the rehabilitation needs of the population. Other countries with a higher number of trainees in comparison with the practicing PRM physicians are Slovenia 32%, Norway 19%, Netherlands 22%, Turkey 22% (Table I).

There are national societies in Europe with very old traditions, founded in the 1920s, like the Romanian Society of Rehabilitation Medicine. Other societies with longer history are the Turkish League against Rheumatism (since 1947), Croatian Society of Physical and Rehabilitation Medicine (since 1947), Austrian Society of Physical Medicine and Rehabilitation (since 1950), Spanish Society of PRM (since 1954). There are also younger societies, like that of Ukraine and Malta, founded in 2014. As an old specialty in all the European Countries Physical and Rehabilitation Medicine physi-

cians have created their professional and scientific organizations (Table II).

The main goal of the National PRM societies is to promote the development of Physical and Rehabilitation Medicine and ensure good rehabilitation care to persons experiencing or are likely to experience disability, to promote the specialty of PRM and the profession of PRM and to develop the Rehabilitation services. The mission and activities of the Societies include propagation of the development of a scientific knowledge regarding rehabilitation, endorsement of scientific research, promotion of education in rehabilitation and popularization of the idea of comprehensive rehabilitation for the benefit of those who need it, increasing the expertise of members.

Some of the societies have mainly scientific and educational goals, related to the professional development of the specialists, while others are engaged in defending the professional interests of PRM physicians, defining the competences of PRM physicians, their relations with the other members of the team, with the other medical physicians and other health professionals. They focus on creating clinical guidelines, clinical standards of good practice and facilitate the specialty to undertake the required research to develop it further. There are societies that cover all these fields. The national PRM societies organize regular scientific events in PRM — conferences and congresses and are responsible about the continuing medical education.

The strength of the societies is that they involve growing number of PRM physicians devoted to the development of PRM, for increased scientific level and activities, very well organized congresses and continuing medical education, good cooperation with other national and international societies, institutions, and organizations involved in rehabilitation.

The weakness usually includes low or difficult communication with the government and with financing providers, not enough activities and strength in defending the professional interests of the PRM physicians and in some countries — low communication with other specialists and not a regular number of the active members.

Most NSs issue their own scientific journal. Others, like the Hellenic Society, use the European Journal of PRM as a National journal. Some of the national journals participate in the European PRM Journals Network that was founded in 2010 with main goals to create the

TABLE I.—Epidemiology of the Physical and Rehabilitation Medicine specialty in Europe. PRM: Physical and Rehabilitation Medicine. For number of physicians and specialists data comes from Eurostat (online data codes: hlth\_rs\_prs1 and hlth\_rs\_spec). \* Total and total percentages have been calculated only for the available data.

	Population	Physicians		Specialists		Practising PRM physicians			PRM trainees		% of PRM physicians
	1000 inhabitants	N.	N.	% of physicians	N.	% of specialists	% of physicians	N.	% of PRM physicians	per 100.000 inhabitants	
Austria	8474	44002	22204	50%	343	1,5%	0,8%			4,05	
Belgium	11200	34020	19399	57%	550	2,8%	1,6%	68	12%	4,91	
Bulgaria	7090	29038	23191	80%	450	1,9%	1,5%	29	6%	6,35	
Croatia	4253	13430	9355	70%	397	4,2%	3,0%	53	13%	9,33	
Cyprus	1141	3032	2056	68%	9	0,4%	0,3%			0,79	
Czech Republic	10520	38776	38499	99%	816	2,1%	2,1%	100	12%	7,76	
Denmark	5614	20639	9092	44%							
Estonia	1325	4052	3297	81%	137	4,2%	3,4%			10,34	
Finland	5439	17511	9953	57%	240	2,4%	1,4%			4,41	
France	66030	207789	112100	54%	1927	1,7%	0,9%	340	18%	2,92	
FYROM	2107	5975	3612	60%	130	3,6%	2,2%	16	12%	6,17	
Georgia	10100	20000	10000	50%	400	4,0%	2,0%	15	4%	3,96	
Germany	80620	338129	188476	56%	1800	1,0%	0,5%	150	8%	2,23	
Greece	11030	68401	47531	69%	210	0,4%	0,3%	35	17%	1,90	
Hungary	9897	30486	25000	82%	350	1,4%	1,1%	30	9%	3,54	
Ireland	4595	13446	5590	42%	11	0,2%	0,1%	2	18%	0,24	
Israel	7940	27000			150		0,6%	40	27%	1,89	
Italy	59801	233102	162281	70%	3500	2,2%	1,5%	490	14%	5,85	
Latvia	2013	6324	4699	74%	130	2,8%	2,1%	20	15%	6,46	
Lithuania	2956	12605	9026	72%	398	4,4%	3,2%	38	10%	13,46	
Luxembourg	536	1656	1067	64%	16	1,5%	1,0%	1	6%	2,99	
Malta	432	1636	817	50%	1	0,1%	0,1%			0,23	
Montenegro	631	1466	1045	71%	55	5,3%	3,8%	2	4%	8,72	
Netherlands	16800	58858	30918	53%	550	1,8%	0,9%	120	22%	3,27	
Norway	5282	22848	8683	38%	261	3,0%	1,1%	50	19%	4,94	
Poland	38530	88437	68609	78%	2047	3,0%	2,3%	160	8%	5,31	
Portugal	10296	47792	22323	47%	550	2,5%	1,2%	100	18%	5,34	
Romania	19322	54807	36971	67%	800	2,2%	1,5%			4,14	
Russia	143436				1730			380	22%	1,21	
Serbia	8806	21840	13658	63%	693	5,1%	3,2%	34	5%	7,87	
Slovakia Rep.	5431	18719	22100	118%	537	2,4%	2,9%	90	17%	9,89	
Slovenia	2072	5830	3685	63%	78	2,1%	1,3%	25	32%	3,76	
Spain	46054	178600	103325	58%	2000	1,9%	1,1%	350	18%	4,34	
Sweden	9876	40637	20573	51%	260	1,3%	0,6%	40	15%	2,63	
Switzerland	8420	34762	18621	54%	227	1,2%	0,7%	35	15%	2,70	
Turkey	79791	141259	6956	5%	2300	33,1%	1,6%	505	22%	2,88	
Ukraine	44500	160912	89560	56%	0	0,0%	0,0%	0	0%	0,00	
United Kingdom	65180	181673	121211	67%	159	0,1%	0,1%	58	36%	0,24	
TOTAL*	817540	2229489	1275483	58%	24212	1,8%	1,0%	3376	15%	2,96	

widest possible readership of the papers published in the European Journals (Table II).

### PRM scientific Activities and their representation in Europe – European PRM Multinational

Scientific journals are key actors of PRM in Europe, since they serve for the development of science and re-

search in our field. Obviously, journals have an international role in what they publish, but in PRM there are at least two main factors that make the location of a journal crucial. In fact, PRM is “scientifically” young,<sup>23</sup> and tradition continues to play a role for treatments, whose evidence is not high, but are nevertheless offered in specific geographical areas (e.g. some modalities, balneology, spa therapy etc.). Moreover, in PRM con-



TABLE II.—Names of National Scientific and Professional Physical and Rehabilitation Medicine Societies in Europe and their Official Journals.

Country	National Society	Name of the Scientific Society In local language	Year of foundation	Name of Professional Society	Journal
Austria	Austrian Society of Physical Medicine and Rehabilitation	Österreichische Gesellschaft für Physikalische Medizin und Rehabilitation	1950	NA	
Belgium	Belgian Society of Physical Medicine and Rehabilitation	Société Royale Belge de Médecine physique et Réadaptation Koninklijke Belgische Vereniging Voor Fysische Geneeskunde & Revalidatie	1910	VBS FGR/GBS MPR	
Bosnia & Erzegovina	Association of Psychiatrists of Republic of Srpska	Udruženje Fizijatara Republike Srpske	2000	NA	
Bulgaria	Association of Physical Medicine and Rehabilitation	Асоциация по Физикална медицина и рехабилитация	1964	NA	Fisikalna Medisina. Rehabilitasia. Sdrave
Croatia	Croatian Society of Physical and Rehabilitation Medicine	Hrvatsko društvo za fizikalnu i rehabilitacijsku medicinu, Hrvatski liječnički zbor	1947		Fizikalna i rehabilitacijska medicina
Cyprus	Cyprus Society of Physical Medicine and Rehabilitation	Κυπριακή Εταιρεία Φυσικής Ιατρικής και Αποκατάστασης	1987	NA	
Czech Republic	Society of Rehabilitation and Physical Medicine of Czech Medical Association of J.E. Purkyne	Společnost Rehabilitační A Fyzikální Medicíny (SRFM)	1967		Rehabilitace a Fyzikalni Lekarstvi
Denmark					
Estonia	Estonian Society of Physical and Rehabilitation Medicine Doctors	Eesti Taastusarstide Selts	1992		
Finland	Finnish Society of Physical and Rehabilitation Medicine	Societas Medicinae Physicalis et Rehabilitationis Fenniae ry	1956		
France	French society of Physical and Rehabilitation Medicine	Société Française de Médecine Physique et de Réadaptation SOFMER	1974	French Union of Physical and Rehabilitation Medicine - Syndicat français de MPR (SYFMER)	Annals of Physical and Rehabilitation Medicine
FYROM	Association of doctors for physical medicine and rehabilitation	Sdrusenie na doktori po fizikalna medicina I rehabilitacija	1955		
Georgia	Georgian Physical Therapy association		2003	Georgian Physical Medicine Association	
Germany	German Society for Physical Medicine and Rehabilitation - Scientific Society for Physical Medicine and Rehabilitation, Balneology and Medical Climatology (DGPMR)	Deutsche Gesellschaft für Physikalische Medizin und Rehabilitation		Professional Association of Physical and Rehabilitation Medicine (BVPhysical and Rehabilitation Medicine) - Berufsverband der Rehabilitationsartse	Physikalische Medizin Rehabilitationmedisin Kurortmedizin Journal of Physical and Rehabilitation Medicine
Greece	Hellenic Society of Physical and Rehabilitation Medicine (HSPPhysical and Rehabilitation Medicine)	Ελληνική Εταιρεία Φυσικής Ιατρικής και Αποκατάστασης (ΕΕΦΙΑΠ)	1974	NA	European Journal of Physical and Rehabilitation Medicine
Hungary	Hungarian Rehabilitation Society	Magyar Rehabilitációs Társaság	1966		Rehabilitáció
Ireland	Irish Association of Rehabilitation Medicine	Irish Association of Rehabilitation Medicine	1989		
Israel	Physical Medicine and Rehabilitation	מוקישו תל קיוריפ האופר	1948		
Italy	Italian Society of Physical and Rehabilitation Medicine	SIMFER Società Italiana di Medicina Fisica e Riabilitazione	1958	Italian Union of Physical and Rehabilitation Medicine physicians - Sindacato italiano Medici Medicina Fisica e Riabilitativa - SIMMFIR	European Journal of Physical and Rehabilitation Medicine
Latvia	Latvian Society of The Physical and Rehabilitation Medicine Doctors	Latvijas Fizikālās Un Rehabilitācijas Medicīnas Ārstu Biedrība	1998	the Association of Latvian Rehabilitation physicians - Latvijas ārstu Rehabilitologu asociācija	

(To be continued)

TABLE II.—Names of National Scientific and Professional Physical and Rehabilitation Medicine Societies in Europe and their Official Journals (continues).

Country	National Society	Name of the Scientific Society In local language	Year of foundation	Name of Professional Society	Journal
Lithuania					
Luxemburg	Luxemburgish Society of Physical and Rehabilitation Medicine	Société luxembourgeoise de médecine physique et de réadaptation	1993		
Malta	Malta Physical & Rehabilitation Medicine Association	Malta Physical & Rehabilitation Medicine Association	2013		
Montenegro					
Netherlands	Netherlands Society of Rehabilitation Medicine	Vereniging van Revalidatieartsen	1955		Nederlands Tijdschrift Revalidatiegeneeskunde (NTR).
Norway	The Norwegian Society of Physical Medicine and Rehabilitation	Norsk Forening for Fysikalsk medisin og Rehabilitering. NFFR.	1977	The Norwegian Association of Physical and Rehabilitation medicine - Norsk Forening for Fysikalsk medisin og Rehabilitering (NFFR)	
Poland	Polish Rehabilitation Society	Polskie Towarzystwo Rehabilitacji	1989		Postępy Rehabilitacji (eng. Advances in Rehabilitation)
Portugal	Portuguese Society of Physical and Rehabilitation Medicine	Sociedade Portuguesa de Medicina Física e de Reabilitação	1953		Revista da Sociedade Portuguesa MFR
Romania	Romanian Society of Rehabilitation Medicine	Societatea Romana de Reabilitare Medicala	1922		Romanian Journal of Rehabilitation Medicine
Russia	All-Russian Union Rehabilitators (ARUR )	Союз реабилитологов России (СРР)	2013		Herald of Regenerative medicine
Serbia	Serbian Association of Physical and Rehabilitation Medicine	Udruženja za fizikalnu i rehabilitacionu medicinu Srbije	1952		Balneoclimatology
Slovakia	Slovak Society of Physical and Rehabilitation Medicine	Slovenská spoločnosť fysiatrie, balneológie a liečebnej rehabilitácie	1975		Rehabilitácia
Slovenia	Slovenian Society for Physical and Rehabilitation Medicine	Slovensko Sdrúženje sa fizikalno in rehabilitacijsko medicino	1998		Rehabilitacija
Spain	Spanish Society of Physical and Rehabilitation Medicine	Sociedad Española de Rehabilitación y Medicina Física	1954		Rehabilitación
Sweden	Swedish Society of Rehabilitation Medicine	Svenst Forening for Rehabilitering medicin	1969		Journal of Rehabilitation Medicine
Switzerland	Swiss Society of Physical and Rehabilitation Medicine	German: Schweizerische Gesellschaft für Physikalische Medizin und Rehabilitation French: Société Suisse de Médecine physique et de Réadaptation Italien : Società Svizzera di Medicina fisica e Riabilitazione	1930		
Turkey	Turkish League Against Rheumatism	Türkiye Romatizma Araştırma ve Savaş Derneği	1947		Archives of Rheumatology
	Turkish Society of Physical Medicine and Rehabilitation	Türkiye Fiziksel Tıp ve Rehabilitasyon Derneği	1958		Turkish Journal of Physical Medicine and Rehabilitation
	Turkish Society of Rehabilitation Medicine	Türk Tıbbi Rehabilitasyon Kurumu Derneği	1978		
	Turkish Society of Physical Medicine and Rehabilitation Specialists	Türkiye Fiziksel Tıp ve Rehabilitasyon Uzman Hekimleri Derneği	1996		Journal of Physical Medicine and Rehabilitation Sciences
Ukraine	Ukrainian Society of Physical and Rehabilitation Medicine	Громадська організація “Українське товариство фізичної та реабілітаційної медицини”	2014		Physical rehabilitation and sports medicine
United Kingdom	British Society of Rehabilitation Medicine	British Society of Rehabilitation Medicine	1984		Clinical Rehabilitation

TABLE IIIA.—Two main bibliometric indices of the Journals of Physical and Rehabilitation Medicine with a multinational distribution in the Journal citation Report (category rehabilitation, 2012-2016).

	Impact Factor at 2 years (position out of 65)					Impact Factor without self-citation (position out of 65)				
	2012	2013	2014	2015	2016	2012	2013	2014	2015	2016
Ann Phys Rehabil Med	-	-	-	-	-	-	-	-	-	-
Eur J Phys Rehabil Med	2.06 (15)	1.95 (14)	1.90 (17)	2.06 (12)	1.83 (20)	1.69 (14)	1.50 (21)	1.47 (23)	1.77 (13)	1.76 (17)
J Rehabil Med	2.13 (14)	1.89 (16)	1.68 (23)	1.59 (25)	1.68 (27)	1.88 (11)	1.72 (14)	1.52 (20)	1.46 (26)	1.53 (28)
Clin Rehabil	2.19 (13)	2.18 (11)	2.249 (10)	2.40 (10)	2.82 (9)	2.09 (9)	2.02 (11)	2.06 (10)	2.25 (8)	2.61 (8)
Int J Rehabil Research	1.05 (43)	1.14 (39)	1.28 (37)	1.25 (40)	1.26 (38)	0.98 (37)	0.94 (41)	1.14 (35)	1.11 (36)	1.1 (41)
Phys Med Rehab Kuror	0.26 (59)	0.45 (59)	0.33 (62)	0.25 (64)	0.26 (63)	0.11 (61)	0.28 (59)	0.27 (61)	0.14 (64)	0.19 (63)
Rehabilitación (Madr.)	-	-	-	-	-	-	-	-	-	-

TABLE IIIB.—Two main bibliometric indices of the Journals of Physical and Rehabilitation Medicine with a multinational distribution in the Scimago data Base (category rehabilitation, 2012-2016).

	Cites per doc - 2 years (position out of 119)					Scopus SCImago Journal Rank (position out of 119)				
	2012	2013	2014	2015	2016	2012	2013	2014	2015	2016
Ann Phys Rehabil Med	1.41 (34)	1.40 (35)	1.50 (34)	1.80 (22)	1.69 (22)	0.59 (31)	0.54 (39)	0.47 (44)	0.51 (45)	0.58 (38)
Eur J Phys Rehabil Med	2.23 (15)	2.24 (15)	2.20 (15)	2.23 (11)	1.70 (21)	0.72 (23)	0.73 (23)	0.82 (18)	0.78 (22)	0.81 (17)
J Rehabil Med	2.73 (7)	2.32 (13)	1.99 (20)	1.84 (19)	1.81 (16)	1.20 (8)	1.03 (12)	1.07 (10)	0.91 (14)	0.90 (14)
Clin Rehabil	2.48 (9)	2.64 (9)	2.99 (8)	2.72 (9)	2.42 (9)	1.17 (10)	0.99 (15)	1.12 (7)	1.14 (9)	1.19 (8)
Int J Rehabil Research	1.23 (36)	1.37 (37)	1.42 (36)	1.44 (34)	1.37 (33)	0.513 (35)	0.50 (44)	0.61 (34)	0.57 (39)	0.62 (33)
Phys Med Rehab Kuror	0.27 (78)	0.32 (72)	0.26 (87)	0.22 (88)	0.27 (83)	0.164 (83)	0.19 (79)	0.17 (85)	0.18 (84)	0.19 (81)
Rehabilitación (Madr.)	0.18 (88)	0.06 (104)	0.15 (96)	0.11 (99)	0.13 (95)	0.14 (91)	0.10 (113)	0.13 (98)	0.11 (102)	0.12 (99)

textual factors play a major role in determining the local therapeutic offer:<sup>24, 25</sup> while Europe as a whole is different from other continents, still there are differences between north and south, but also west and east Europe. All these may have an impact on European journals.

ESPRM decided some years ago to define the “Core PRM Journals” according to specific and strict criteria:<sup>26, 27</sup> in the first 2008 set 3 European journals (Journal of Rehabilitation Medicine, Clinical Rehabilitation, Disability and Rehabilitation) and 2 American journals have been included. Some years later, in 2013, the list expanded to include 2 more European journals (European Journal of Physical and Rehabilitation Medicine and International Journal of Rehabilitation Research). In these years also a European Network of National Journals have been created but not fully developed.<sup>28, 29</sup>

All European Bodies have their official Journals and we will first review them: we will then present the other multinational journals, i.e. those with interest spread in more than one country. The last years, standings of the European Journals in the most important Indexes are listed in Table III. Their fundamentals are listed in Table

TABLE IV.—Fundamentals of the Journals of Physical and Rehabilitation Medicine with a multinational distribution.

	Language	Issues per year	Rejection rate	First answer time (days)	Publication time (months)
Ann Phys Rehabil Med	English	6	75%	30	4
Eur J Phys Rehabil Med	English	6	73%	30	7
J Rehabil Med	English	10	65%	30	2
Clin Rehabil	English	12	86%	14	2
Int J Rehabil Research	English	4	70%	7	6
Phys Med Rehab Kuror	German and English	6			
Rehabilitación (Madr.)	Spanish (English accepted)	4	56%	60	E-pub: 10 Print: 11

IV and the main contents in Tables V. Country representation in Table VI.

*Annals of Physical and Rehabilitation Medicine (APRM) – Official Journal of UEMS-PRM Section*

The Journal is indexed in MEDLINE, Web of Science, and SCImago.

TABLE V.—Thematic contents of European journals in 2015.

	Neuro-logical	Musculo-skeletal	Cardio-pneumo-logical	General rehabilitation	Others
Ann Phys Rehabil Med	40%	25%	20%	10%	5%
Eur J Phys Rehabil Med	37%	35%	8%	11%	9%
J Rehabil Med	55%	23%	4%	20%	3%
Clin Rehabil	48%	28%	4%	6%	14%
Int J Rehabil Research	37%	25%	1%	25%	12%
Phys Med Rehab Kuror Rehabilitación (Madr.)	34%	24%	12%	15%	15%

Categories of papers include: original clinical, epidemiological and research articles, review articles, editorials and guidelines. At the discretion of the editor in chief, 20-30% of published papers are immediately put in free access. All papers are in free access at one year. Publications in the Annals of PRM are free of charge.

*European Journal of Physical and Rehabilitation Medicine (EJPRM) – Official Journal of ESPRM and UEMS-PRM Section and Board*

The Journal is indexed in CINAHL, Current Contents/Clinical Medicine, EMBASE, PubMed/MEDLINE, Science Citation Index Expanded (SciSearch), Scopus.

Categories of papers include: original articles, systematic reviews and meta-analysis, guidelines, special articles, case reports and letters. It regularly co-publishes Cochrane reviews and a Cochrane Corner since 2007. EJPRM requires authors to follow publishing guidelines ([www.equator-network.org](http://www.equator-network.org)).

Areas of interest: clinical papers in all PRM subspecialties (neurological, musculoskeletal, cardiopulmo-

nary, pediatric, general rehabilitation, others). Since 2006 (first among PRM journals worldwide) it gives readers’ open access with free-full text accessible online.

*Journal of Rehabilitation Medicine (JRM) – Official Journal of UEMS PRM Board and EARM*

The Journal is indexed in MEDLINE. PubMed Categories of papers include: original articles, reviews, case reports, short communications, short reports and letters. Areas of interest: functional assessment and intervention studies, clinical studies in various patient groups, methodology in PRM, epidemiological studies on disabling studies and reports on vocational and socio-medical aspects of rehabilitation. From 2017 JRM will be a completely online journal with immediate open access from the actual open access after 6 months.

*Clinical Rehabilitation (CR)*

The Journal is indexed (among the others) by ASSIA, CINAHL, Current Contents / Clinical Medicine, EMCare, MEDLINE, PsycINFO, Science Citation Index, Scopus.

Categories of papers include: original papers, systematic reviews, Rehabilitation in Practice articles correspondence relating to published papers and short reports. Areas of interest include: goal setting, describing interventions evidence based for rehabilitation, theoretical base for rehabilitation. The editor always considers whether a paper is relevant to a practicing clinician of any profession. It covers functional disorders, all ages, every intervention and all methods. Open access is available on payment of a fee.

TABLE VI.—Geographic representation of European journals.

	Europe	Countries (%)				
		1st	2nd	3rd	4th	5th
Ann Phys Rehabil Med	65%	France	USA	Canada	Belgium	Germany
Eur J Phys Rehabil Med	58%	Italy (35%)	Turkey (6%)	Germany (6%)	Brasil (5%)	France (5%)
J Rehabil Md	60%	Netherlands (16%)	Sweden (11%)	Australia (7%)	Denmark (5%)	USA (5%)
Clin Rehabil	49%	UK (18%)	China (9%)	Netherlands (8%)	Australia (7%)	Canada (6%)
Int J Rehabil Research	64%	Italy (15%)	USA (7%)	Netherlands (6%)	Sweden (6%)	Australia (5%)
Phys Med Rehab Kuror Rehabilitación (Madr.)	81%	Spain (78%)	Colombia (11%)	Chile (4%)	Switzerland (4%)	-

*International Journal of Rehabilitation Research*

The Journal is indexed in PubMed/MEDLINE, Science Citation Index Expanded, Social Sciences Citation Index, Current Contents (Social & Behavioural Sciences and Clinical Medicine), Scopus, SCImago, Engineering information and PsycINFO. It is a member of the Committee on Publication Ethics (COPE) which aims to define best practice in the ethics of scientific publishing ([www.publicationethics.org](http://www.publicationethics.org)). Categories of papers include: original articles, review articles, brief reports, case reports and letters. Areas of interest: functioning and disablement throughout the life cycle; rehabilitation programs for persons with physical, sensory, mental, and developmental disabilities, measurement of functioning and disability, special education and vocational rehabilitation, equipment, access and transportation, information technology, independent living, consumer, legal, economic and socio-political aspects of functioning, disability and contextual factors. The Journal is available through individual and institutional subscription, and accessible online through Ovid at institutions worldwide.

*Physikalische Medizin – Rehabilitationsmedizin – Kurortmedizin - Journal of Physical and Rehabilitation Medicine (JPRM)*

The journal is indexed in Scopus and Science Citation Index Expanded, Categories of papers include: original research, clinical case reports and reviews, guidelines and educational articles, CME material, congress abstracts, society news, editorial material and summaries of the latest research. Areas of interest: scientific and educational articles both in physical medicine and rehabilitation Reviewed and accepted articles are published online ahead of print to ensure rapid dissemination of knowledge.

*Rehabilitación (Madr.) (RM)*

The Journal is indexed in Eventline, Bibliomed, Sedbase, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Scopus, Pascal and Indice Bibliográfico Español en Ciencias de la Salud (IBECS). Categories of papers include: original articles, reviews, case reports, letters to the editor, special articles and editorials. Its main goal is to provide evidence basis to

improve interdisciplinary rehabilitation care. Thus, the scope of the journal includes clinical and basic research papers on rehabilitation field that may improve knowledge and skills of the readership (physiatrists, physical therapists, occupational therapists and other allied health professionals). The journal is mailed to all SERMEF members (which are more than 1700 professionals). At this moment, it has not Open access but only for some specific articles.

*Disability and Rehabilitation*

‘Disability and Rehabilitation’ and ‘Disability along with Rehabilitation’: Assistive Technology are international multidisciplinary journals which seek to encourage a better understanding of all aspects of disability and to promote rehabilitation science, practice and policy aspects of the rehabilitation process. Disability and Rehabilitation publishes Reviews, Research Papers, along with sections on Rehabilitation in Practice, Perspectives in Rehabilitation and Case Studies along with occasional Letters, Papers focused on assistive technology are especially appropriate for Disability and Rehabilitation. Assistive Technology, submissions covering a wide range of topics on disability and rehabilitation from researchers and practitioners across all disciplines working in the field are encouraged. The journals welcome both quantitative and qualitative research along with multidisciplinary perspectives to embrace a wide range of professionals. Both journals also publish peer-reviewed special issues as appropriate.

**The role of Europe in PRM activities across the world**

The umbrella organization of PRM physicians worldwide is the International Society of Physical and Rehabilitation Medicine (ISPRM).<sup>30</sup>

ISPRM has three mandates: a humanitarian or civil societal, a professional one and a scientific one.<sup>31, 32</sup> To achieve its goals ISPRM relies first on its memberships which includes members of national societies, including all European PRM societies as well as individual members, In addition, ISPRM collaborates with regional bodies, including in Europe the European Academy of Rehabilitation Medicine (EARM), the European Society of Physical and Rehabilitation Medicine (ESPRM)

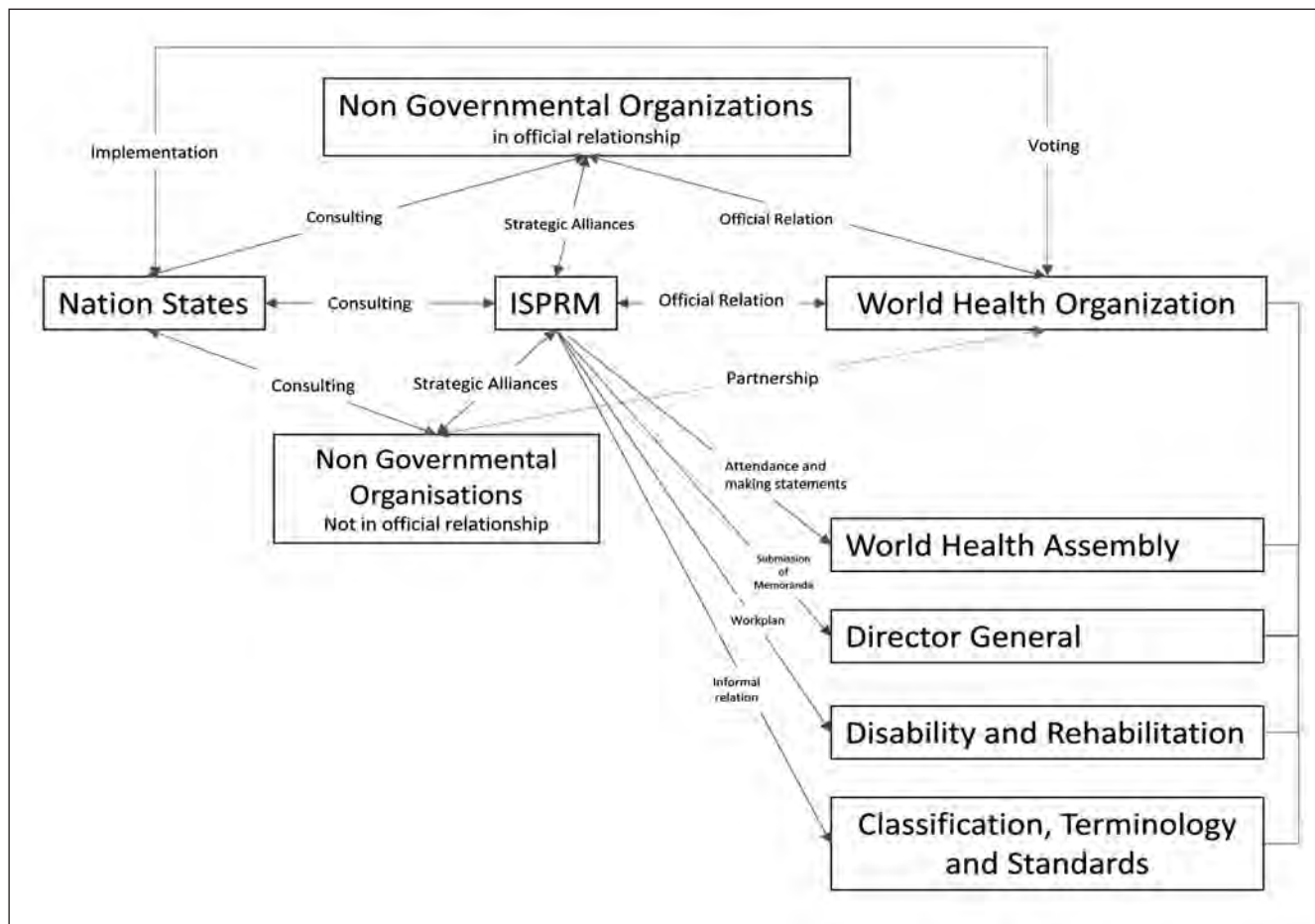


Figure 2.—Pathways of political influence on the World Health Organization (WHO) by a non-governmental organization (NGO) in official relation. CTS: Classification, Terminology and Standards; DAR: Disability and Rehabilitation; ISPRM: International Society of Physical and Rehabilitation Medicine; WHA: World Health Assembly. Adapted from: Reinhardt JD, von Groote PM, Delisa JA, John L, Bickenbach JE, Li LSW. Chapter 3: International non-governmental organizations in the emerging world society: the example of ISPRM. *J Rehabil Med Preview*, 2009;(6), 810-22. <http://doi.org/10.2340/16501977-0430>

and the Physical and Rehabilitation Medicine Section of the European Union of Medical Specialists (UEMS PRM Section), through mutual recognition agreement and a joint work plan. Outside the field of PRM, ISPRM is collaborating with other NGOs and most importantly with World Health Organisation (WHO) (Figure 2).<sup>32</sup>

An important role is played from the regional fora: The North and Baltic Forum of PRM that includes the nearby regions in north Europe Such as Russia, Ukraine and The Mediterranean Forum of PRM that includes all the Mediterranean basin region.

The basis of the official relationship with WHO is a mutually agreed three-year plan for collaboration,

for which once every three years the WHO Executive Board reviews the results. The most important current topics of the collaboration work plan include the system-wide implementation of the International Classification of Functioning, Disabilities and Health (ICF) in PRM, rehabilitation and health care systems at large, the establishing of learning health system across countries worldwide exemplified for the situation of persons living with Spinal Cord Injury<sup>33</sup> and the strengthening of rehabilitation services worldwide.<sup>34</sup> Significant contributions of Europe in the context of the current work plan is the development of National Rehabilitation Quality Management Systems<sup>35</sup> including the specification

of rehabilitation services applying ICSO-R,<sup>36</sup> Clinical Assessment Schedules,<sup>37</sup> the European-wide implementation of culturally adopted versions of the clinical assessment schedules tool<sup>35, 38, 39</sup> and the development of metrics for the standardized reporting of data collected with a range of data collection tools.<sup>35, 40-42</sup> Most importantly, the UEMS PRM Section and Board are developing reference rehabilitation services, committing themselves to provide onsite advise and demonstration to PRM physicians and health care organizations worldwide. Within the context of our specialty, which is in the context of the internal policy agenda of PRM, the European bodies and national societies are involved in the further development of the scientific congress topics list as core element of building the identity and core competencies of PRM. In addition, 8 journals are active members of 'ISPRM web of Journal'.

A most important initiative by the PRM bodies in Europe is the development of a Cochrane field in Rehabilitation (refer to chapter 11 for the details).<sup>43</sup>

## References

- Bardot A, Tonazzi A. European physical and rehabilitation medicine organisms--origins and developments. *Eur Medicophysica*. 2007 Jun;43(2):185-94.
- Bertolini C, Delarque A. A brief history of European organizations of physical and rehabilitation medicine. *Am J Phys Med Rehabil*. 2008 Jul;87(7):592-5.
- De Korvin G, Delarque A. Physical and rehabilitation medicine section and board of the European Union of Medical Specialists. Community context; history of European medical organizations; actions under way. *Ann Phys Rehabil Med*. 2009 Oct;52(7-8):594-607.
- UEMS. Basel Declaration: UEMS Policy on Continuing Professional Development: D0120 [Internet]. 2001 [cited 2009 Jan 6]. Available from: <http://admin.uems.net/uploadedfiles/35.pdf>
- UEMS. Charter on Quality Assurance in Medical Specialist Practice in the European Union: Adopted by the Management Council of the UEMS. [Internet]. 1996 [cited 2009 Jan 6]. Available from: <http://admin.uems.net/uploadedfiles/772.pdf>
- UEMS. Budapest Declaration on Ensuring the Quality of Medical Care. UEMS 2006/18 final. 2006.
- UEMS. Promoting Good Medical Care: D0349 final [Internet]. [cited 2009 Jan 6]. Available from: <http://admin.uems.net/uploadedfiles/772.pdf>
- UEMS - PRM Section. European Accreditation of the Quality of Care [Internet]. [cited 2009 Jan 6]. Available from: [www.euro-prm.org/ClinicalAffairs](http://www.euro-prm.org/ClinicalAffairs)
- European-Union. Directive 2005/36/CE du Parlement européen et du Conseil du 7 septembre 2005 relative à la reconnaissance des qualifications professionnelles. [Internet]. Journal officiel de l'Union européenne L255/22; 2005 [cited 2009 Jan 6]. Available from: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2005:255:0022:0142:FR:PDF>
- UEMS. European definitions of the Medical Act - Definition européen de l'Acte médical (UEMS 2008/03 final).
- WHO. International Classification of Functioning. Disability and Health. [Internet]. [cited 2009 Jan 6]. Available from: <http://www.who.int/classifications/icf/site/index.cfm>
- Gutenbrunner C, Ward A, Chamberlain M. The White Book on Physical and Rehabilitation Medicine in Europe. *J Rehabil Med*. 2007 Jan;(45 Suppl).
- Gutenbrunner C, Ward AB, Chamberlain A. White book on physical and rehabilitation medicine in Europe. *Eura Medicophys*. 2006;292-332.
- MFPRM. About the MFPRM [Internet]. Available from: <http://www.mfprm.org/en/about-the-mfprm/about-the-mfprm>
- MFPRM. The MFPRM [Internet]. Available from: <http://www.mfprm.org/en/home/home>
- Gutenbrunner C, Borg K, Joucevicius A, Tuulik-Leisi V-R, Vetra A, Ward AB. The Idea of the Baltic & North Sea Forum on Physical and Rehabilitation Medicine (BNF-PRM). 2016;
- MFPRM. MFPRM Statute [Internet]. Available from: <http://www.mfprm.org/en/statute/statute>
- Abstracts from the 1st Baltic and North Sea Conference on Physical and Rehabilitation Medicine "Reclaim Function. *J Rehabil Med*. 2010;385-416.
- 2nd Baltic and North Sea Conference on Physical and Rehabilitation Medicine "From Biomechanisms to Outcomes!" *J Rehabil Med*. 2011;817-868.
- Abstracts of the 3rd Baltic and North Sea Conference on Physical and Rehabilitation Medicine. *J Rehabil Med*. 2013;933-986.
- Abstracts of the 4th Baltic and North Sea Conference on Physical and Rehabilitation Medicine. *J Rehabil Med*. 2015;759-800.
- EMRSS. The Euro Mediterranean Rehabilitation Summer School [Internet]. Available from: <http://www.emrss.it/ENG/index.html>
- Negrini S. Steady growth seen for research in physical and rehabilitation medicine: where our specialty is now and where we are going. *Eur J Phys Rehabil Med*. 2012 Dec;48(4):543-8.
- Negrini S, Frontera WR. The Euro-American rehabilitation focus: a cultural bridge across the ocean. *Am J Phys Med Rehabil*. 2008 Jul;87(7):590-1.
- Negrini S, Frontera W. The Euro-American Rehabilitation Focus: a cultural bridge across the ocean. *Eur J Phys Rehabil Med*. 2008 Jun;44(2):109-10.
- Franchignoni F, Stucki G, Muñoz Lasa S, Fialka-Moser V, Vanderstraeten G, Quittan M, *et al*. Publishing in physical and rehabilitation medicine: a European point of view. *J Rehabil Med*. 2008 Jun;40(6):492-494; author reply 494.
- Franchignoni F, Özçakar L, Michail X, Vanderstraeten G, Christodoulou N, Frischknecht R. Publishing in Physical and rehabilitation medicine. An update on the European point of view. *Eur J Phys Rehabil Med*. 2013 Oct;49(5):711-4.
- Negrini S, Stucki G, Giustini A. Developing the European Physical and Rehabilitation Medicine Journal's Network. *Eur J Phys Rehabil Med*. 2009 Mar;45(1):1-5.
- Negrini S, Ilieva E, Moslavac S, Zampolini M, Giustini A. The European physical and rehabilitation medicine journal network: historical notes on national journals. *Eur J Phys Rehabil Med*. 2010 Jun;46(2):291-6.
- Stucki G, Reinhardt JD, von Groote PM, DeLisa JA, Imamura M, Melvin JL. Section 2: ISPRM's way forward. *J Rehabil Med*. 2009 Sep;41(10):798-809.
- DeLisa JA, Melvin JL, Stucki G. Developing the International Society of Physical and Rehabilitation Medicine (ISPM). Foreword. *J Rehabil Med*. 2009 Sep;41(10):789-90.
- Reinhardt JD, von Groote PM, DeLisa JA, Melvin JL, Bickenbach JE, Li LSW, *et al*. Section 3: International non-governmental organizations in the emerging world society: the example of ISPRM. *J Rehabil Med*. 2009 Sep;41(10):810-22.
- Bickebach J, Tennant A, Stucki G. Describing the lived experience of Swiss persons with spinal cord injury. *J Rehab Med*. 2016;113-244.
- Stucki G, Reinhardt JD, Imamura M, Li J, De Lisa JA. International Society of Physical and Rehabilitation Medicine (ISPRM): strengthening Physical and Rehabilitation Medicine (PRM) worldwide. *Chin J Phys and Rehab Med*. 2011;501-03.

35. Stucki G, Zampolini M, Jucevicius A, Negrini S, Christodoulou N. Practice, science and governance in interaction: European effort for the system-wide implementation of the International Classification of Functioning, Disability and Health (ICF) in Physical and Rehabilitation Medicine. *Eur J Phys Rehabil Med.* 2017 Apr;53(2):299–307.
36. Kiekens C, Meyer T, Gimigliano F, Baffone C, Gutenbrunner CM, UEMS PRM ICF Workshop moderators and rapporteurs. European initiative for the application of the International Classification of Service Organization in Health-related Rehabilitation (ICSO-R). *Eur J Phys Rehabil Med.* 2017 Apr;53(2):308–18.
37. Proding B, Scheel-Sailer A, Escorpizo R, Stucki G, UEMS PRM ICF Workshop moderators and rapporteurs. European initiative for the application of the International Classification of Functioning, Disability and Health: development of Clinical Assessment Schedules for specified rehabilitation services. *Eur J Phys Rehabil Med.* 2017 Apr;53(2):319–32.
38. Selb M, Gimigliano F, Proding B, Stucki G, Pestelli G, Iocco M, et al. Toward an International Classification of Functioning, Disability and Health clinical data collection tool: the Italian experience of developing simple, intuitive descriptions of the Rehabilitation Set categories. *Eur J Phys Rehabil Med.* 2017 Apr;53(2):290–8.
39. Li J, Proding B, Reinhardt JD, Stucki G. Towards the system-wide implementation of the International Classification of Functioning, Disability and Health in routine practice: Lessons from a pilot study in China. *J Rehabil Med.* 2016 Jun 13;48(6):502–7.
40. Stucki G, Proding B, Bickenbach J. Four steps to follow when documenting functioning with the International Classification of Functioning, Disability and Health. *Eur J Phys Rehabil Med.* 2017 Feb;53(1):144–9.
41. Proding B, Ballert CS, Brach M, Brinkhof MWG, Cieza A, Hug K, et al. Toward standardized reporting for a cohort study on functioning: The Swiss Spinal Cord Injury Cohort Study. *J Rehabil Med.* 2016 Feb;48(2):189–96.
42. Proding B, Ballert CS, Brinkhof MWG, Tennant A, Post MWM. Metric properties of the Spinal Cord Independence Measure - Self Report in a community survey. *J Rehabil Med.* 2016 Feb;48(2):149–64.
43. Negrini S, Kiekens C, Levack W, Grubisic F, Gimigliano F, Ilieva E, et al. Cochrane physical and rehabilitation medicine: a new field to bridge between best evidence and the specific needs of our field of competence. *Eur J Phys Rehabil Med.* 2016 Jun;52(3):417–8.

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- European Academy of Rehabilitation Medicine (EARM)
- European Society of Physical and Rehabilitation Medicine (ESPRM)
- European Union of Medical Specialists PRM section (UEMS-PRM section)
- European College of Physical and Rehabilitation Medicine (ECPRM) – served by the UEMS-PRM Board
- the Editors of the 3<sup>rd</sup> edition of the White Book of Physical and Rehabilitation Medicine in Europe: Mauro Zampolini, Pedro Cantista, Maria Gabriella Ceravolo, Nicolas Christodoulou, Alain Delarque, Christoph Gutenbrunner, Carlotta Kiekens, Saša Moslavac, Enrique Varela-Donoso, Anthony B. Ward, Stefano Negrini
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# White Book on Physical and Rehabilitation Medicine (PRM) in Europe. Chapter 6. Knowledge and skills of PRM physicians

European Physical and Rehabilitation Medicine Bodies Alliance

## ABSTRACT

In the context of the White Book of Physical and Rehabilitation Medicine (PRM) in Europe, this paper deals with the fundamentals of PRM from a physiological perspective, looking at the human mechanisms both physical and behavioral which are at the base of PRM physicians' work. After a discussion on the development and evolution of PRM that leads to its unique and specific approach, the mechanisms considered include:

- repairing processes (and potential of recovery evaluation): repairing processes are mainly related to the quantity and natural history of diseases and impairments, while potential of recovery is also linked to the individual and environmental factors; PRM physicians work on impairments to favor healing or recovery, and propose rehabilitation if there is a potential of recovery: this is related to the prognostic role of PRM physicians;
- learning processes: PRM is the specialty of teaching new physical ways and behavioral approaches to make patients participate at best through improvement of impairments and modification of activities; in this perspective, during repair and rehabilitation processes, PRM physicians and the rehabilitation team are teachers of new motor and behavioral strategies;
- compensatory processes (adaptation/habilitation/rehabilitation): PRM physicians teach patients how to adapt to the new (acquired) health condition using compensatory mechanisms based on other body structures/functions, behavioral changes and/or assistive devices (or technical aids) (prosthesis and orthosis); during growth PRM physicians aim at allowing a complete (and compensatory) development of the intact function, not to be impaired by the original disease; compensatory processes are related to activities;
- management skills: PRM physicians are managers of people and resources; they manage patients and their caregivers, to teach and allow them to reach the best possible participation, also focusing on maintenance; they lead the team, with the aim to make it function at best for the sake of the patient; finally, they manage resource allocation for the functioning of patients and team;
- communication skills: PRM physicians need to develop very good communication skills, so to teach, inform and educate patients and their caregivers: this will allow the proper behavioural changes and also the correct physical compensations.

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**Key words:** Physical and rehabilitation medicine - Europe - Learning - Recovery of function - Case management - Communication.

## Introduction

The White Book (WB) of Physical and Rehabilitation Medicine (PRM) in Europe is produced by the 4 European PRM Bodies and constitutes the reference book for PRM physicians in Europe. It has multiple values, including to provide a unifying framework for the European Countries, to inform decision-makers at the European and national level, to offer educational material for PRM trainees and physicians and information about PRM to the medical community, other rehabilitation professionals and the public. The WB states the importance of PRM, that is a primary medical specialty. The contents include definitions and concepts of PRM, why rehabilitation is needed by individuals and society, the fundamentals of PRM, history of PRM spe-

cialty, structure and activities of PRM organizations in Europe, knowledge and skills of PRM physicians, the clinical field of competence of PRM, the place of PRM specialty in the healthcare system and society, education and continuous professional development of PRM physicians, specificities and challenges of science and research in PRM and challenges and perspectives for the future of PRM.

This chapter deals with the fundamentals of PRM from a physiological perspective, looking at the human mechanisms both physical and behavioral which are at the base of PRM physicians' work. After a discussion on the development and evolution of PRM that leads to its unique and specific approach, the mechanisms considered include:

— learning processes: PRM is the specialty of teach-

ing new physical ways and behavioral approaches to make patients participate at best through improvement of impairments and modification of activities; in this perspective, during repair and rehabilitation processes, PRM physicians and the rehabilitation team are teachers of new motor and behavioral strategies;

- repair processes (and potential of recovery evaluation): repair processes are mainly related to the quantity and natural history of diseases and impairments, while potential of recovery is also linked to the individual and environmental factors; PRM physicians work on impairments to favor healing or recovery, and propose rehabilitation if there is a potential of recovery: this is related to the prognostic role of PRM physicians;

- compensatory processes (adaptation/habilitation/rehabilitation): PRM physicians teach patients how to adapt to the new (acquired) health condition using compensatory mechanisms based on other body structures/functions, behavioral changes and/or assistive devices (or technical aids) (prosthesis and orthosis); during growth PRM physicians aim at allowing a complete (and compensatory) development of the intact function, not to be impaired by the original disease; compensatory processes are related to activities;

- management skills: PRM physicians are managers of people and resources; they manage patients and their caregivers, to teach and allow them to reach the best possible participation, also focusing on maintenance; they lead the team, with the aim to make it function at best for the sake of the patient; finally, they manage resource allocation for the functioning of patients and team;

- communication skills: PRM physicians need to develop very good communication skills, so to teach, inform and educate patients and their caregivers: this will allow the proper behavioral changes and also the correct physical compensations.

The aim of this Chapter is to discuss in detail all these mechanisms of the PRM medical specialty, that makes PRM physicians the rehabilitation physicians.

### **Evolution driving to the actual fundamentals of PRM**

Traditionally, medicine has based its treatments of making etiological diagnosis, setting pharmacological or surgical treatments, and ultimately analyzing the out-

come based on measures such as blood tests or radiological improvements. This “anatomy-clinical” model created the foundations of medical knowledge and has long been the dominant and sometimes even exclusive model in medical practice and teaching. This model is based on the following logical sequence: an etiology or cause results in a disease that is manifested by clinical symptoms and laboratory findings. Doctors sought an anatomically constrained origin for conditions (in the form of tissue damage, hence the place of pathology) and retained the notion of a nosology (classification of diseases). This classification of diseases is now operating as the ICD-10 (and ICD-11, pending publication).<sup>1</sup> This anatomy-clinical model focuses on the disease and it has shown to be very effective for medical diagnosis and in the context of acute diseases for which there is a causal treatment (etiology or cause) or symptomatic treatment (symptoms or manifestations). Nevertheless, this approach is insufficient when there is no cure and the disease results in disability and handicap (ICIDH model 1980) or activity limitation and participation restriction (ICF 2001 model),<sup>2</sup> especially (but not only) in severe acute conditions with long-term sequelae and irreversible pathologies.

The model known as “functional” is focusing, not on the disease, but on the patient, describing the functioning limitations and environmental factors (personal and environmental). And this is precisely the paradigm of interest to the PRM physicians, since the focus of the intervention is not merely the etiological reason of the disease but its consequences in the functioning of the individual. This model is more relevant to the description and analysis of chronic conditions and their treatment because it considers the situation of disability as a mismatch between an individual, the environment and its personal desires (projects).<sup>3</sup> Therapeutic interventions do not aim to cure the patient only by treating the disease and impairments: they aim also at activity limitations and participation restrictions. Therefore, the actions of PRM focus on three targets: first, the individual, by promoting not only the repair process (disease and impairments) but also the compensatory processes (intrinsic — compensation developed by the individual — or extrinsic — with external devices); second, the environment (physical, personal, professional, etc.), and finally, on individual projects (education, work, personal and social life), that will be modified and adapted.

### *The ICF: a key concept for PRM*

The medical specialty of PRM has adopted the International Classification of Functioning, Disability, and Health (ICF) developed by the World Health Organization.<sup>2</sup> This classification includes a new approach to persons with disabilities relying on a multi-dimensional approach.<sup>4</sup> An example of the application of this approach is the identification of a lesion (etiology) using modern imaging techniques that allow us to see details of the injured tissue and the identification of undamaged structures that could be used in the process of rehabilitation. For the PRM physician, the challenge is to consider these findings to propose rehabilitation methods that could favor plasticity and regeneration. The second aspect is the assessment of different body structures and functions using the clinical examination and selective assessments scales. For the PRM physician, one objective is to measure the severity of the impairment and also to make precise correlations between impairments and underlying lesions. This anatomic-clinical approach is particularly important in musculo-skeletal and neurological disorders, as well as cognitive losses due to focal lesions. The third aspect is the assessment of limitations in activity. This is at the core of PRM, which considers the remaining abilities of the persons with disabilities to be more important than impairments in body structures and functions. This is a more positive vision relying on the activity itself. The fourth level corresponds to the assessment of social consequences of the injury or disease.<sup>5</sup> In this context, the previously used terms “disadvantage” and “handicap” have been replaced with the more positive term of participation, placing the patient in the context of his/her personal, professional, and social life. The ICF also constitutes a good model for rehabilitation strategies.<sup>6</sup> The dimensions of the ICF can also refer to distinct targets or outcome measures for rehabilitation. The ‘body structure/impairment’ can correspond to the possibility to stimulate the undamaged structures with a technique or a treatment stimulating plasticity capabilities.<sup>7,8</sup> The “body function/impairment” can refer to the recovery of a function such as strength, coordination, or dexterity in the case of motor function; discrimination or identification in the case of sensory function; and planning, verbal comprehension, memorization for cognitive functions. The “activity/limitation” can refer to the reduction of the disability and the possible gener-

alization of functional recovery to others activities and the enhancement of activity limitation by compensation. The “participation/restriction” corresponds to the reduction of the disadvantage by social interventions based on recognition and inclusion considering personal and environmental factors. The “contextual factors” and their possible role of facilitators and/or barriers, have to be taken into account. In the context of ICF, it must also be considered that the development of the capacity does not correspond necessarily to the final performance of the patient, that should in any case be the final end of PRM action.

This multi-dimensional approach of the disease and its consequences for diagnosis, treatment, and rehabilitation reinforce the acceptance that PRM may be considered as a medicine of the human person in complementarity with the medicine or specialties of organs.

### **Learning processes in physical and rehabilitation medicine**

Learning is a part of the rehabilitation process and, recently, has had a higher profile and recognition of its importance in PRM practice. The PRM physician is a teacher, especially when new concepts of adaptation (*e.g.* plasticity) and motor learning must support rehabilitation programmes. The principles of adaptation and plasticity are covered in the PRM training programme and PRM physicians thus know and understand the theoretical background of the principles of teaching and learning.<sup>10</sup>

During training, PRM physicians learn how individuals learn motor skills (motor learning) and this requires an appreciation of the following factors:<sup>11</sup>

- motor development: how to gain a capacity to develop motor skills to increase the final performance;
- motor control: how the neurological system controls movement;
- motivation: how to motivate individuals to want to learn motor skills and participate in their programme;
- teaching practice for physical training: how the treatment environment can optimise the acquisition of motor skills.

This knowledge equips PRM physicians to design strategies to enhance outcomes and avoid mal-adaptation. Effective modern concepts of motor learning and recovery are developed with the aim of inducing skill-

acquisition relevant to the patient's daily life. Such an approach is beneficial in preventing the learned non-use phenomenon and to restore function. However, a too intensive programme can be counter-productive and does not allow for natural adaptation.<sup>12</sup> Commonly, learning involves instructions about "how to do something"/"how to perform a task." Even without any explicit instruction, a person often has the capacity to understand how to do a task, simply using implicit learning.

Explicit and implicit learning are thought to tap into different neural pathways. The implicit learning process is more robust in neurological injuries, especially when memory has been severely impaired. Even though the first approach is currently more often used, explicit and implicit learning procedures have potential in all aspects of Physical and Rehabilitation Medicine.<sup>13, 14</sup> Recovery of function, whether spontaneous or enhanced by therapy, is a dual process of plasticity. This is largely interdependent, and it is driven by changes in both the nervous and the musculo-skeletal systems. The neuroplastic process depends on the muscle effector activity, while its expression depends on the neurological command and regulation.

More generally, in all conditions affecting physical activity, where there is a disorder of muscle recruitment or control, or where there is a loss of performance, strengthening muscles and physical reconditioning are essential, but cannot be considered as stand-alone. They must not be split from all the other aspects of conventional neuromotor rehabilitation, as far as the activity is both due to plasticity.<sup>15</sup>

PRM physicians thus embrace this new functional concept, to work with therapists, to advance the concepts of both neurological and orthopedic rehabilitation.<sup>16</sup> This is seen, for instance in action and observation treatments and in the interest of virtual reality increasingly used in rehabilitation programmes.

The cerebellum and basal ganglia are critical for motor learning, which allows people to gain skilled behaviors. If these are intact after brain injuries, regaining this skill is possible through repetitive training to overcome difficulties in learning new motor skills as well as limited postural control and deficits in sensory-motor coordination.<sup>17</sup> PRM clinicians see that repetitive practice is a feature of any intervention as part of motor learning, but clinical practice principles are not entirely based on the findings from research studies of motor control

and motor learning research and rehabilitation practice. An example of motor learning includes robot arm paradigms, where the resistance of patients is measured while using a hand-held device throughout specific arm movements. Another principle is the important concept of the actual amount of practice undertaken in the intervention under study. There is a relationship between the impact of the retention of memory gained from repeating task practice over time and the amount of training given.<sup>18</sup> Excessive efforts at learning thus may result in considerable improvements in long term retention, but have little effect on the individual's performance. Thus, PRM physicians prescribe and propose different practice treatment schedules to get around the inadequacies of simple repetition of movement. Skill relearning acquisition is variable, as it thought that true brain recovery is elicited through repetition alone.<sup>14</sup> Compensation methods develop through pure repetition and to elicit cortical changes (true recovery), individuals should be exposed to more challenging tasks. Rehabilitation techniques should be geared towards patients' specific motor deficits and possibly combined, for example, with constraint induced movement therapy with virtual reality. Two critical questions posed of a rehabilitation technique are whether the gains persist for a significant period after training and whether they generalize to untrained tasks. Motor learning and repetitive practice is thus used in the stroke and brain injury population and includes:<sup>14</sup>

- arm ability training: impairment-oriented training for mild hemiparesis;
- constraint induced movement therapy;
- electromyography-triggered neuromuscular stimulation;
- interactive robot therapy;
- virtual reality-based rehabilitation.

#### **Understanding the repair processes and using the compensatory processes in PRM for adaptation, habilitation and rehabilitation**

Recovery of function, improvement of activities and reduction of participation restrictions constitute major goals in PRM. These objectives primarily concern patients with motor deficits which are the first cause of disability into the world. Motor recovery corresponds to the spontaneous or rehabilitation induced improve-

ment of motor function after a musculo-skeletal and/or nervous system damage. Longitudinal studies about natural motor recovery after stroke showed that recovery curves do not follow a linear process, but mainly proceed through a first phase (within 3 months) with fast recovery and a second phase with slower improvement of motor function<sup>19</sup> or more rarely by steps and plateaus.<sup>20</sup>

Motor recovery includes two components: the true recovery ‘per se’ and the compensation. In the musculo-skeletal system recovery can imply a “*restitutio ad integrum*”, sometimes even anatomical, normally mostly functional (with some residual scars requiring prevention of future impairments). Neurologically, the true motor recovery refers to the vicariant capacity of the human motor system to restore totally or partially motor function after lesion. It results from brain plasticity mechanisms as regression of a diaschisis,<sup>21</sup> reorganization of the contralateral sensorimotor cortex and involvement of undamaged hemisphere,<sup>22</sup> restoration of conduction in the corticospinal tract or in alternate motor fibres,<sup>23</sup> recruitment of pre-existing parieto-frontal connections<sup>24</sup> and modifications of the inter-hemispheric connectivity.<sup>25</sup>

Compensatory mechanisms are adopted to achieve the best possible functioning (activity and participation) when a complete anatomical recovery is not possible. The compensation can rely on the involvement of alternative muscles to perform the movement (e.g. the shoulder and elbow muscles for grasp after stroke<sup>26</sup> or wrist muscles extensors for tenodesis grasp in C6 tetraplegia,<sup>27</sup> the use of the contralateral unimpaired upper limb or the environmental changes. Another possible compensation is the use of another body structure/function to compensate for the damaged one (e.g. proprioception and vision for a damage of the internal ear in equilibrium and balance disorders). Prosthesis and orthosis are compensatory devices widely used in PRM, even if they require adequate training and the activation of compensatory and/or new motor functions to be effective.

Motor learning refers to the capability of the human motor system to learn through practice and experience. Motor learning includes motor adaptation, skill acquisition and decision-making.<sup>28</sup> These capabilities may be mobilized in normal subject for acquiring new motor abilities and in patients for improving motor recovery.

### *Motor adaptation*

For a PRM physician, motor adaptation must be understood in a broad sense. In biological terms, adaptation is the process of change by which an organism or species becomes better suited to its environment. Motor adaptation appears as the process able to produce the better plan to minimize the energetic cost and optimize the efficiency of the movement, whatever is the environment and the state of the effector. A lot of environmental perturbations or biological changes, such as growth or ageing, needs such adaptation. Moreover, in PRM practice, motor adaptation is needed because pathological process is responsible for skeletal, neurological, muscular lesions or bioenergetics impairment. In that view, motor adaptation is not only a form of motor learning in which the nervous system learns to predict and cancel effects of a novel environment, but rather a process developed to maximize performance in that environment.<sup>29</sup> This view is in accordance with the ICF considering all the contextual factors, associating environmental and personal factors in the limitation of the patients functioning. Bearing that in mind, it would be useful to widen the sense of the term “motor adaptation,” which must involve both nervous system and musculoskeletal system strongly linked by cooperative interaction.<sup>30</sup>

The mechanisms involved are complex, eliciting a lot of behavioral or computational models of motor control and motor adaptation.<sup>31</sup> These models implicate a wide range of disciplines notably neurosciences, psychology, robotics, mathematics, or computer sciences. Such models are useful for understanding motor behavior in computational terms, but they are less successful when the link between computational and neurobiological models is considered, or when they are applied to functional and pathological issues.<sup>32</sup> However, we can emphasize the role of the plasticity of the motor function. If neuroplasticity is involved, notably in the synaptic function,<sup>33</sup> we must remember that the plasticity is a general biological property concerning also the effector, with its different constitutive tissues, bones, joints, and skeletal muscles.

The skeletal muscle plasticity is well understood, it is responsible for the conditioning resulting from physical training and for deconditioning appearing during chronic immobility or starvation. These conditions are frequent in patients with neurological, cardiovascular,

respiratory, or renal diseases. Sometimes their independence is severely compromised. However, using some endurance activity programs, it is possible to “maximize” their motor performances, avoiding a severe dependency.<sup>34</sup>

### *Motor strategies*

To achieve a particular goal, we can use more than one motor plan. Theoretically there is an abundance of solutions more or less energetically economic and mechanically efficient, but among all these motor strategies practically we choose the best one. Such skill depends from motor development and from motor learning, leading progressively to the construction of internal models that predict sensory consequences of motor commands. Because of individual morphological and biological different characteristics, these models are specific for one person and sometimes they can be very unusual. Taylor based a review upon the role of strategies in motor learning on the Fosbury Flop, which led to an innovative paradigm shift in high jump.<sup>35</sup> This example emphasizes the relativity of the concept of “normality”. Moreover, in PRM field the patients develop a learning characterized by a re-optimization process considering the new conditions imposed by their impairments. At that point it is necessary to put forward the idea that rehabilitation has not to be “a particular ideal of health or performance, determined externally” by the medical team.<sup>36</sup>

The main processes leading to neural functional representations, so called internal models, have supported a new approach in rehabilitation of hemiplegic patients: the bilateral transfer.<sup>37</sup> In patients with subacute stroke, a functional improvement in the affected hand by means of a training performed with the unaffected hand can be observed. The processes involved in this sensorimotor learning are not definitively known, but it allows for important prospects for the PRM specialty.

### *Sensorimotor adaptation*

Motor adaptation may be induced in response to an external perturbation as a sensory conflict induced by prismatic lenses creating a shift of visual environment (Figure 1A). This sensorimotor adaptation is produced after repeated rapid pointing movements in the direction of visual targets. Their initial shift to the side of the opti-

cal deviation and towards the virtual target progressively decreased, reflecting the capability of the motor system to consider the spatial error consecutive to prism deviation. The proprioceptive realignment corresponds to the displacement of the perceived position of the arm in the direction of the optical deviation. It is responsible for proprioceptive straight-ahead estimation (i.e. pointing in the sagittal axis) in the direction opposite to the optical deviation after prism removal. The visual realignment corresponding to the displacement of the perceived direction of the gaze in the direction opposite to the optical deviation. It is responsible for visual straight-ahead estimation in the direction of the optical deviation after prism removal.<sup>38</sup> The algebraic sum of proprioceptive and visual realignment was equal to the total realignment in the eye-hand coordination, as measured by pointing to a visual target without visual feedback or knowledge of results.<sup>39</sup>

The awareness of error pointing detection/correction during prism exposure is not necessary for sensorimotor realignment. Experimental procedures, using growing optical displacements, allow significant realignment free of contamination by deliberate correction.<sup>40, 41</sup> Likewise, neglect patients do not detect the visual disturbance during prism exposure show substantial and long-lasting after-effects.<sup>38, 42</sup> Adaptation can even develop during imagined visuo-manual pointing movements (without any overt execution) during prism exposure. Therefore, when intersensory spatial discrepancy of the hand location (visual shifted location vs proprioceptive non-shifted location) is available, motor preparation is sufficient to drive realignment.<sup>43</sup>

### *Sensorimotor adaptation and cognitive expansion*

Interestingly this visomotor adaptation induced by prismatic exposure can interact with higher brain functions related to multisensory integration, as proved by surprising effects reported on left unilateral neglect after a rightward optical deviation of the visual field in right brain damaged patients (Figure 1B).<sup>44</sup> This improvement affects some symptoms, which are free from manual responses (auditory neglect, representational neglect) and others no neglect deficits such as constructional deficits, navigation, and even reduction of complex regional pain syndrome suggesting thus an expansion of sensorimotor after-effects to spatial cognition through a bottom-up track.<sup>38, 45</sup>

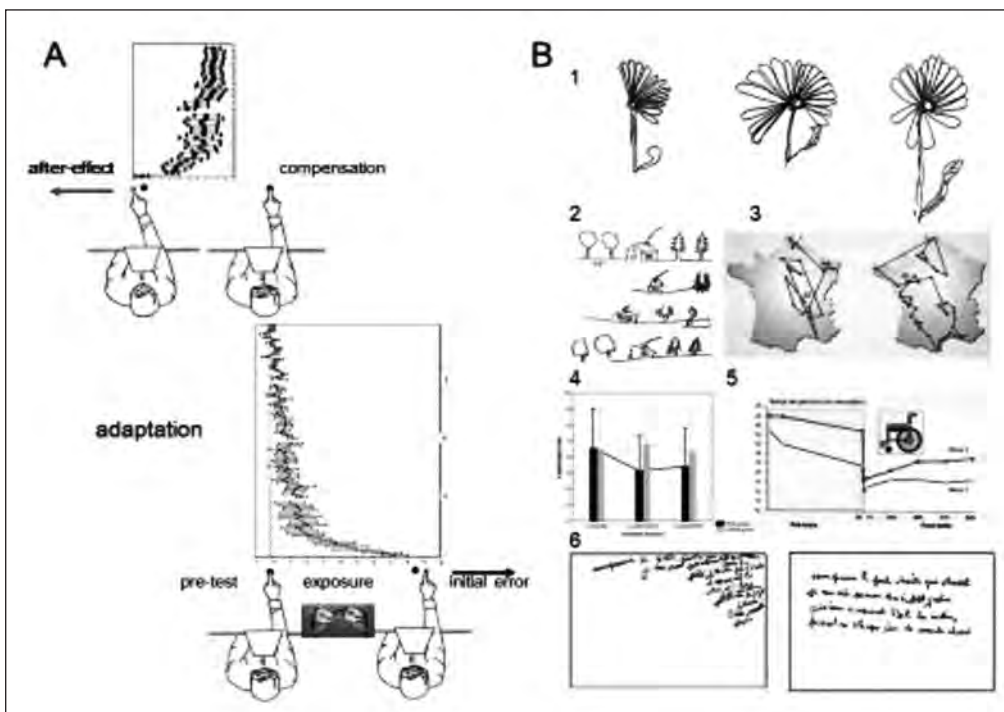


Figure 1.—Prism adaptation. Prism adaptation phases (A): The subject wears a pair of goggles fitted with prismatic lenses creating a rightward optical shift of 10° (Pre-test). A shelf was placed under the patient’s chin to prevent viewing of the hand at its starting position, but allowing an unobstructed view of the targets and terminal pointing errors (suppression of visual feedforward of the movement). At the start of the process, the subject is asked to make rapid pointing movements (suppression of visual feedback of the movement) in the direction of a visual target (Exposure). Pointings movements are shifted to the side of the optical deviation (black arrow) and towards the virtual target (Initial errors). The motor system can then take into account the spatial error consecutive to prism deviation (adaptation), regardless of whether the subject shows phenomenological awareness of the error, and finally compensate for the optical deviation (Compensation). Following removal of the prismatic glasses, when the subject is asked to once again rapidly point towards a target, the movement is shifted in the direction opposed to the optical deviation (leftward: red arrow) (After-effects). The relevant point for neglect rehabilitation is that after a rightward optical deviation of the visual field, subjects thus show a systematic leftward deviation of visuo-motor responses with the adapted limb without implication of voluntary attention of the patient *i.e.* according to a bottom-up track.

Improvement of spatial cognition deficits after prismatic adaptation in right-brain-damaged patients (B): visual neglect in drawing tasks from memory of daisy (1) and by copy (2); representational neglect assessed by mental evocation of map of France (3); auditory neglect assessed by a listening task (4); wheelchair navigation (5) and spatial dysgraphia (6).

Mirror effects, *i.e.* simulation of neglect was also observed in numerous cognitive functions in healthy individuals following prism adaptation. Neglect simulation was not only described in peripersonal, extrapersonal and bodily space representation but also in the mental numbers and letters scales. The influence of prism adaptation extends also to spatial attention, hierarchical processing and spatial remapping.<sup>46</sup> The term “cognitive” used to depict after-effects, refers to the fact that effects take place beyond the usual framework of compensatory sensorimotor after-effects and involves mental abilities as judgement, comparison or mental representation of space. The occurrence of cognitive after-effects is even more inter-

esting when considering that they cannot be explained in terms of sensorimotor after-effects but that they strictly depend on spatial realignment. Furthermore, spatial realignment must be strong enough (by using at least 10° optical deviation in both neglect patients and healthy individuals) to produce cognitive after-effects.<sup>45, 46</sup>

*Other mechanisms of adaptation*

Apart from the direct neurophysiological adaptations considered till now, there are adaptations that can be considered “external” to the anatomical site of the original lesion, and/or even external to the considered

person. The former includes the use of other body structures and functions to vicariate the damaged one; the latter, the use of prosthesis/orthosis to compensate the loss of function. In both cases a good PRM approach and teaching process, including information, education and exercises, is necessary to optimize the adaptation and achieve the best possible functional results.

#### *Adaptation, habilitation and rehabilitation*

Adaptation processes, and firstly motor adaptation are important in PRM. Motor adaptation involves sensorimotor interactions solicited in response to an external perturbation or changes in the body, and relied on practice of repeated exercises during a short duration. Adaptation is learned implicitly without subject awareness, making it an easy applicable method in patients with brain damage and attentional deficits. It involves long-lasting sensorimotor after-effects, but also cognitive after-effects, showing thus that sensorimotor interactions may influence cognitive processes via a bottom-up track. The characteristics of adaptation and its beneficial effects should lead to promote more rehabilitation methods based on adaptation in PRM.

Even if they are used in the same way, these neurophysiological processes play a different role in rehabilitation (mainly related to the adults) and in habilitation (during growth). In the first the aim is to recover the best possible participation in front of what has been partially or totally lost, in the latter the aim is to avoid a negative impact on the development of the intact body structures/functions due to the originally damaged ones, so avoiding secondary impairments, preserving the best possible activity achievements, and finally participation. During habilitation, growth can be considered a driving force leading to “natural” sometimes ineffective or even damaging compensations; but growth can also be a strong force that, if well guided through correct adaptation processes, can lead in time to good compensations producing better functioning than what expected according to the natural history of the original disease.

#### **Potential of recovery evaluation and prognosis in PRM**

Functional recovery is the aim of a person after facing a disease, an injury or other health condition (*e.g.* aging)

and the search of a rehabilitation treatment is the mean to gain back the best possible functioning. A PRM physician is trained to see the patient not as a group of organs and systems with a certain preserved function or structure but as a whole with a certain level of functioning.

The rehabilitation plan needs to start determining the premorbid functioning level but also needs to start with the image in mind of the final functioning. Longitudinal studies about natural history of diseases showed that recovery curves do not follow a linear process, but mainly proceed through a first phase with fast recovery and a second phase with slower improvement of motor function or more rarely by steps and plateaus. The length of the first phase is different in the various pathologies, and it is considered the most important for rehabilitation: most of PRM efforts should focus on this phase (post-acute rehabilitation), so to increase the quality and quantity of recovery.

In a PRM perspective focused on the person beyond the disease, though, the prognosis is only partly based on this natural history of the original disease. On one side comorbidities must also be considered, and on the other the personal and environmental factor as barriers and/or facilitators of recovery. Moreover, the individual participation aims required high attention and contribute to determine the final prognosis and the entire rehabilitation treatment project.

Nevertheless, in times of shrinking resources, it is mandatory to set appropriate goals for each patient according to the disease related prognosis, and to the other concept of “rehabilitation potential”: will the patient be able to improve his condition to a better functional state? Will the rehabilitation intervention be able to really change the participation of the patient? In a purely “compassionate” model, rehabilitation is not denied to anybody; in an exclusively “disease-centered” model, rehabilitation is not given, since the patient is believed able to recover spontaneously without any intervention as soon as the disease has been treated. In a modern approach, though, rehabilitation should be given to patients really able to improve, in a specific period of time of the health condition, with a start and an end of treatment (to be followed by maintenance, also called post-rehabilitation).

Highly specific to PRM is the problem of communicating to patients the expectations (prognosis) due to medical factors, which is not done in many disabling



diseases by the medical specialist treating in the acute phase. This is itself one of the highest challenges in rehabilitation, especially nowadays, when medical and scientific developments have impact on a society, which believes that “anything is possible:” thus, reaching a consensus of the aims of rehabilitation agreed by patient/proxy and medical team can be stressing.<sup>47</sup> The PRM physician must be informed about the diseases that cause disability in order to have more information regarding the prognosis, but despite all the available medical information there are still some conditions (for example minimally conscious patients after TBI) whose prognosis is uncertain and proxies and patients will normally have an optimistic bias<sup>48</sup> towards their prognosis which means that they will demand for unrealistic objectives and treatments. In this sense the training in communicating skills of the PRM physician as well as leadership skills will help in pursuing a better understanding of the rehabilitation planning.<sup>49</sup>

PRM physicians play an important role in the rehabilitation process, since they have been trained into the development of skills to lead multi-professional teams, closely collaborating with other disciplines and have the capacity to give a throughout assessment of the complex functional status of the patient and the possibilities of acquiring a certain outcome in the future.<sup>50</sup> It also faces with the responsibility of providing an image of the potential value of functional status to plan needs for the future, determine provision of services and allocation of resources of treatment. In the current times in which health resources are limited, it is very important to give the accurate scientific evidence of the rehabilitation methods and its impact in the patient, their families, and the society.

### Management skills

PRM physicians are responsible for facilitating the patients' efforts to achieve as optimal as possible a life after illness or injury or in the development of someone with a health condition. Being good PRM physicians, requires excellent technical, scientific but also management skills.

Developing management skills has been a part of medical training over the last two decades and several studies have pointed out that those better managed health systems produce not only higher quality care of

patients and improved productivity, but also increase satisfaction among patients and staff.<sup>51</sup>

Traditionally, as many sociological studies show, physicians hold a negative attitude towards managerial practices, which probably is the result of a traditional paternalistic approach of practicing medicine. The emphasis on medical education has focused on increasing knowledge and apprenticeship instead of prioritizing efficiency and quality. Over many years in the history of practicing medicine, physicians were used to working in small individualized consults or centers, were used to leading an unquestioning team and practicing without regard for costs and other economic factors.

This has now changed in the 21<sup>st</sup> century, where medicine faces several challenges such as:

- The shift from the paternalistic approach of medicine to a patient-centered approach, in which the professional's role becomes a provider of solutions for the patient's problem and should be adapted according to the patient's moral decisions and expectations.

- The rise of new tests, new treatments, new drugs and, of course, the increase of longevity and the greater impact of several long-term conditions of certain diseases are the responsible for the enormous cost of health services.

- The financial threats to the survival of many health care systems is the result of the situation mentioned above and there is a trend to focus towards improving health care not only in medical results but in measuring quality of care, transparency, and efficiency.<sup>52</sup>

In the field of rehabilitation, the same pattern can be observed with even some paradigmatic considerations. PRM physicians treat patients who often have complicated conditions such as polytrauma, spinal cord injury, traumatic brain injury or chronic pain. They work leading multi-professional teams working in a collaborative way, in which good communication and coordination is essential for success. They also deal with the higher expectations of recovery by patients and their families. With internet access and the ease, with which patients can find information on their condition, it is now quite common for patients to seek multiple opinions on services within the same or different hospitals increasing also the cost of care. But also, many of the above-mentioned diseases with the scientific and technological advances become chronic conditions which increase the demand of constant

care and constant demand of treatment, for example the need for physiotherapy, occupational therapy or speech therapy.

In this context, the need of good leadership adapted to the current societal changes and way of thinking is mandatory, otherwise there would be a management failure. As stated by the Royal College of Physicians of London in 2005, leadership skills should be incorporated in the doctor's training in order to support professionalism and improve productivity.

Physicians need to learn having a macroscopic view on health provision and resource allocation.<sup>53</sup> They need to be able to achieve a common goal, not only from an individual point of view of his or her patient but as the whole society. This implies a need to learn and understand the political, economic, and social environment of the system as well as an ethical based decision making process.

A PRM physician should actively take part in the design of healthcare pathways for the provision of care of people with disabilities and develop clinical guidelines to recommend treatments across the continuum of care, for example the needs in the acute, subacute, and long term phases of the diseases.

Within a rehabilitation service, at the *meso-level*, the PRM physician should develop management skills to build an effective team. It is already known that team care approach is more effective than fragmented care for patients and the PRM physician should coordinate the care of the patient throughout the different members of the team (physiotherapists, occupation therapists, social workers...etc.). Typical leadership qualities<sup>54</sup> should be encouraged to promote a better satisfaction and dynamic of the group. These qualities include good communication skills, the ability to encourage different members of the team to participate and join in, suggest aims and objectives of treatments, avoid personal criticism and reach the final aim through a majority consensus. These team meetings should result in the establishment of a care team individualized plan with specific objectives, with the determination of the clinical interventions, duration of treatment and assignment of duties. The PRM physician should be able to detect and arbitrate over conflicts that can emerge among the different team members and should be able to handle it in a successful way like for example opening a space for debate, trying to avoid personal details or accusations

or promote a team building session for conflict resolution.<sup>55</sup>

At the micro-level, the challenge for PRM physicians is strictly related to patients' long-term management, which may include long term care, including home adaptations, long-term and post-rehabilitation care, adapted physical activity, continuous counselling. Rehabilitation patients have needs of general management that goes beyond the simple management inside the PRM facility, and this should be considered by PRM physicians.

Finally, many patients needing rehabilitation may move through a series of PRM facilities and services usually provided by different teams. In some specific areas, like stroke or spinal cord injury, specific pattern of coordinated care has been developed and proved effective, such as the Stroke Units or the Spinal Centers. Nevertheless, it must be recognized that, beyond spinal cord or stroke, it is highly frequent that a rehabilitation patient moves from the acute hospital to a PRM ward / hospital, then finishing in long term treatment facilities that could be outpatient ambulatory, home-care or long term hospitals. Some of these patients can have new episodes due to the natural history of disease, and start the same circuit again perhaps with a different end. The problem is that usually there are not definite organizational pathways, and the different rehabilitation structures are usually managed as "silos": each time new arrangements must be taken, always for the same patient with the same problem. Management solutions have been proposed, like PRM loco-regional inter-facilities Departments, to facilitate these pathways, and under development in some EU regions.

In conclusion, PRM physicians should be able to develop good management skills within the reference of the needs of the current state of medicine and health care systems. They should be able to lead the multi-professional team working in a collaborative way with other disciplines, to bring primary and secondary goals of rehabilitation together, plan interventions, delegate tasks for the different members of the team and communicate in an effective and empathic way to patients and their families. They should be able to manage patients in the long term, as well as in the short term in their individual pathways of care throughout different rehabilitation facilities, possibly through the creation of PRM loco-regional Departments. Within these cri-

teria, the satisfaction with the treatment as well as an efficient and cost saving allocation of health resources should be warranted.

### **Communication skills (including information and patient education)**

Effective communication with patients and their caregivers, as giving adequate information and providing health education, play a central role in rehabilitation and is a determinant skill for PRM physicians.

Core aims of communication between patient and rehabilitation team include fostering of relationships, exchange of information, enhancement of the patient and caregivers participation in decision making, enabling of self-management, responding to emotions, and managing of uncertainty.<sup>56</sup> The patient knows very well his disability: he chooses his future and for this reason must actively participate in the decision-making process.

Communication may be therapeutic itself when it leads to better management of emotions, social support, empowerment, and appropriate setting of rehabilitation goals. Several randomized controlled and cross-chaptered studies have shown that patient-centered communication (clear explanations, compassion, enhanced patient participation) have correlated with favorable biological effects (lower blood pressure, less anxiety, less organ damage in patients with systemic lupus erythematosus, higher quality of life among breast cancer patients).<sup>57</sup>

Good collaboration within the multiprofessional team helps to avoid redundant and incoherent information. Team collaboration provides the patient with an adequate communication formulated by proper and competent professional. Moreover, a key point is the coherence of messages received, not to create in patients and their families' confusion.

Comprehensive information delivered by a PRM physician regarding the cause, natural history and prognosis of a health condition, proposed therapy, its mechanisms of action, expected functional outcome and possible side effects helps the patient to form a rational attitude towards the treatment, favors compliance and promotes active participation in therapy. In the context of serious, potentially intractable illness (like cancer) with a poor prognosis related to the disease, individuals usually rely on others to help them think and feel their way

through difficult decisions. On the other hand, in front of the poor prognosis of functional recovery (in spinal cord injury), that is much less understood and where hopes (and expectations) of recovery are bigger, the patient and caregivers may be unable to retain information provided when they are not ready.<sup>58</sup> Communication style is very important in this context; PRM physicians should be trained on how to give information that may contradict the patient's initial expectations.

Impaired psychosocial adjustment to disability is more frequent in patients with evidence of a cognitive deficit.<sup>59</sup> A patient who, due to a health condition, is disabled, or may get disabled, should be informed how disability can lead to handicap or social withdrawal, how this process could be prevented, and about the rights of persons with disability.<sup>60</sup> The relation between a health-care provider and patient, his/her significant others and her/his caregivers should not be limited to unidirectional information flow, but rather warrant the process of reciprocal information exchange. Knowledge learned from the patient regarding their lived experience of disability is important for proper goal setting in rehabilitation, selection of adequate assistive technologies and appropriate social intervention. In the decision-making process, the perspective of a person experiencing or likely to experience disability allows integrating a multitude of factors with the aim of opening a constructive discussion about the life plan.

### *Patient education*

An important role of the PRM physician is to respond to the patient's demand for comprehensive information on the actual evidence of some methods and means of treatment (*e.g.* dietary supplements, certain complementary and alternative therapies) that are well advertised, though usually with poor evidence. Much of the information on these methods that users are exposed to is commercial in intent and fraught with misinformation.<sup>61</sup>

Health education as an intervention addressed both to individuals and to society, is recognized by the Council of Europe as a fundamental element in disability prevention.<sup>60</sup> Among many definitions of health-related patient education, a Cochrane collaboration group agreed to launch "teaching or training of patients concerning their own health needs."<sup>62</sup>

Recent changes in healthcare and rehabilitation practice (reduced hospital length of stay, staff shortage, increasing the popularity of advanced technologies) increase the demand of effective patient education directed on self-management and health promotion. Dimensions of patient education include:

- knowledge, perception and beliefs of one's health condition, its consequences, treatment, and preventive options. Cognitive dimensions of health knowledge encompass: identity (name of a condition and self-perceived severity), duration (chronic or acute problem), consequences (physical, social, and economic), cause (personal ideas about causes of the condition) and control (patient's opinion on a capacity to control the illness);<sup>63</sup>

- problem-solving abilities: problem orientation (motivation, attitudes, thinking styles) and solving skills (defining the problem, generating alternatives, decision-making and solution implementation);<sup>64</sup>

- health locus of control and perceived self-efficacy;<sup>65</sup>

- health behaviors;
- coping strategies.

Also families/caregivers play an important role in education of the patients. Their inclusion into a group education for in-patients contributes in more realistic discharge planning and increases participation of the caregivers in further care.<sup>66</sup> Interventions addressing families of patients with severe disability usually consist of individual counselling, education, and group support. Both education and counselling significantly improve caregiver's knowledge and stabilize significant others functioning, though counselling is more effective than education alone.<sup>67</sup>

Timing in delivering educational content is important. This also applies to giving information to the patient and caregivers.<sup>68</sup> In early rehabilitation, when biomedical themes are prevalent, educational goals should mirror the therapeutic process. Psychological and medico-social aspects targeting health-related behaviors, every-day habits, vocational education, learning social skills should be commenced in post-acute rehabilitation considering the psychological processes of disability acceptance. Immediate effects of education depend on the context of care. It may consist of skills (ability to use a wheelchair, communicate a need, caregiver's ability for a performance of passive exercises) attitudes and

knowledge (motivation to self-performed exercising, conviction that cancer-related pain may be effectively controlled). During the chronic phase, education contents should cover socially important issues as well as prevention of secondary conditions.

Long-term goals of patient education usually include social integration, independence, improved health risk profile, maintenance of physical and vocational activity, custom of protective health behaviors (*e.g.* regular exercising, adequate diet, foot protection in a diabetic), retention of adequate knowledge of the health condition, realistic expectations regarding outcome, active attitude towards therapy. A list of exemplary educational contents in selected health conditions is displayed in Table I.<sup>76-101</sup>

The methodology of patient education should complement the overall rehabilitation process, and be the result of multi-professional team collaboration. All team members are responsible for carrying out elements of patient education per their fields of competence. The PRM physician, as team leader, is responsible for coordination of the educative process, including delivering crucial information (regarding diagnosis and prognosis, particularly in a case of permanent functional loss) and assessing factors influencing patient's abilities to set rehabilitation goals.<sup>69</sup> Educative methods should be adapted to the patient's experience and most common psychological profiles typical for a given health condition.<sup>65</sup> The intensity of education, expected immediate effect and range of information provided should be adjusted to treatment phase and patient's demand (for example, education regarding sexuality in acute rehabilitation of a paraplegic should be limited to simple information that the ability to achieve satisfaction has not been lost, whereas in chronic stage the content and form of education should fully comply with patient's and partner's needs).<sup>58</sup> The process of education should consist in the identification of learning barriers, gain of both knowledge and practical skills, evaluation, and positive reinforcement. Application of modern educational methods (biofeedback, tele-education) and materials (interactive platforms, games) should correspond with methods used in biopsychosocial interventions.<sup>58</sup> PRM societies and rehabilitation centers should publish educational evidence-based resources.<sup>65, 70</sup> Peer participation in patient education is increasingly popular in certain health conditions

TABLE I.—*Examples of educational needs in selected health conditions.*<sup>76-101</sup>

Health condition	Educational spectrum
Neurologic disorders in children (Cerebral palsy, ABI)	Patient: forming and maintaining social relations, using assistive devices, participation in leisure activities Caregivers: ability to reduce caregiver's stress and burden, caregivers conflict, improving management of child behavior problem, exercise techniques
Conditions with cognitive deficits (e.g. dementia, ABI, mental retardation)	Patient: Communication (including non-verbal communication), ADL, leisure and vocational (if possible) activities Caregivers: nursing techniques, understanding patient's needs,
Health conditions with depression	Patients: ADL, expression of emotions, leisure and vocational activities Caregivers: understanding the impact of the disease, patient's needs
Spastic disorders	Patient: daily stretching exercises, relaxation techniques Caregivers: nursing and exercise techniques, splint use (if indicated)
Parkinson's disease	Patient and caregivers: understanding the disease process, exercise techniques, maintaining social relations
Multiple sclerosis	Patient: ADL, ergonomics, energy conservation techniques Caregivers: nursing and exercise techniques
Spinal cord injury, myelomeningocele	Patient: wheelchair and other assistive devices use, pain management, ADL, vocational activities, Patient and caregivers: pressure sore prophylaxis, bladder and bowel care, sexuality, fertility, exercise and nursing techniques
Nonspecific back and neck pain disorders	Patient: ergonomics (ADL, workplace, leisure), maintenance of activities, exercising, positioning techniques
Limb loss	Patient and caregivers in pre-amputation stage: prognosis of functional gain expected during rehabilitation Patient in post-amputation stage: ADL, locomotion, prosthesis and assistive devices use, pain control, social life, vocational activities
Osteoarthritis, inflammatory joint diseases	Patient and caregivers: assistive devices use, BMI maintenance, joint protection, stress management, energy conservation techniques, maintenance of activities
Osteoporosis	Patient and caregivers: diet, physical activity, static and dynamic postural exercises, prevention of falls, proper use of medicines (e.g. bisphosphonates)
Myofascial pain	Patient: nature of the symptoms, treatment, and prevention strategies (ergonomics, self-stretching and strengthening techniques, self-massage, cold/heat self-applications), relaxation techniques
Upper limb peripheral neuropathies	Patient: ergonomics (ADL, work, leisure)
Hypertension, coronary artery disease, diabetes, obesity	Patient and caregivers: understanding risk factors of cardiac disease, prognosis of functional gain during rehabilitation, health awareness (to avoid hypervigilance). Patient: ADL, nutritional modification, physical activity, vocational activities, health-related behaviours (smoking cessation), foot care (in diabetes),
Chronic obstructive pulmonary disease	Patient and caregivers: respiratory exercises and airway self-clearance, prevention of exacerbations, patient: health-related behaviours (smoking cessation), maintenance of physical and vocational activities
Cancer	Patient and caregivers: Pain management, activity maintenance, exercising techniques, assistive devices use (if indicated), prevention of falls,
Lymphedema	Patient: prophylaxis of exacerbations, self-manual drainage techniques, injury prevention and skin care. Exercise performance and sport. Correct use of compression garments and/or bandages
End-stage diseases	Patient and caregivers: pain control, assistive device use, nursing and exercising techniques, Caregivers: treatment plans and patient's needs,
Elderly	Patient and caregivers: exercising techniques, diet, pain control, prevention of falls, rationale of pharmacotherapy, use of assistive devices Caregivers: understanding of patient's needs,

TBI: traumatic brain injury; ADL: activities of daily living.

(spinal cord injury, limb loss). This approach raises the role of PRM physician who should look at quality and substance of learning.<sup>71</sup>

Systematic reviews and meta-analyses show that interventions for encouraging patients to understand and manage their chronic conditions, enhancing patient's compliance, contribution of caregiver's in the continuation of treatment, although promising and rational,

appear to be inconsistently evidenced regarding the functioning, participation, quality of life, service use, reduction of direct and indirect costs of treatment. The effect of education appears to be more evident in complex patients.<sup>62, 71, 72</sup>

Health-related and personal factors hindering the efficacy of communication and patient education comprise speech, language, comprehension, perception and

memory deficiencies, poor anger control, depression, history of learning disability, abuse, chronic pain.<sup>73</sup> Intractable health conditions cannot always be addressed per patient's demands: this can decrease trust in health-care professionals.<sup>68</sup> Among environmental factors decreasing the efficacy of patient education the most important are lack of social support,<sup>73</sup> and health provider related factors. These include: availability unmatched with the time when the patient and caregivers fully understand their educational needs;<sup>58, 74</sup> being less cooperative or using controlling behavior; lack of adequate knowledge or noncompliance with guidelines (*e.g.* in assistive devices provision);<sup>74,75</sup> negative attitudes and beliefs concerning a subject of education (*e.g.* sexuality);<sup>58</sup> providing the patient with inadequately good feeling about his health;<sup>62</sup> neglecting broader environmental context of care, patient's knowledge, values, experience and preferences.

## References

1. International statistical Classification of Diseases and Related Health Problems (ICD). World Health Organization. 10th Revision.;
2. International Classification of Functioning, Disability and Health (ICF). World Health Organization. 10th Revision.;
3. André JM. [Handicap: definitions, treatment principles, recuperation process]. *Bull Acad Natl Med*. 1994 Oct;178(7):1301-1316; discussion 1316-1317.
4. Alford VM, Ewen S, Webb GR, McGinley J, Brookes A, Remedios LJ. The use of the International Classification of Functioning, Disability and Health to understand the health and functioning experiences of people with chronic conditions from the person perspective: a systematic review. *Disabil Rehabil*. 2015;37(8):655-66.
5. Magasi S, Wong A, Gray DB, Hammel J, Baum C, Wang C-C, et al. Theoretical foundations for the measurement of environmental factors and their impact on participation among people with disabilities. *Arch Phys Med Rehabil*. 2015 Apr;96(4):569-77.
6. Escorpizo R, Bemis-Dougherty A. Introduction to Special Issue: A Review of the International Classification of Functioning, Disability and Health and Physical Therapy over the Years. *Physiother Res Int J Res Clin Phys Ther*. 2015 Dec;20(4):200-9.
7. Lexell J, Brogårdh C. The use of ICF in the neurorehabilitation process. *NeuroRehabilitation*. 2015;36(1):5-9.
8. Stinear CM, Byblow WD, Ward SH. An update on predicting motor recovery after stroke. *Ann Phys Rehabil Med*. 2014 Nov;57(8):489-98.
9. Robertson JV, Roby-Brami A. Augmented feedback, virtual reality and robotics for designing new rehabilitation methods in Rethinking physical and rehabilitation medicine. Ed Springer 2010. Didier J.P and Bigand E;
10. Boyd LA, Winstein CJ. Impact of explicit information on implicit motor-sequence learning following middle cerebral artery stroke. *Phys Ther*. 2003 Nov;83(11):976-89.
11. Ganguly K, Poo M-M. Activity-dependent neural plasticity from bench to bedside. *Neuron*. 2013 Oct 30;80(3):729-41.
12. European Board of PRM physician. Training Curriculum.
13. André J. Fondements, stratégies et méthodes en médecine physique et de réadaptation. In: *Traité de médecine physique et de réadaptation*. Paris: Flammarion. Held JP, Dizion O; 1999.
14. Krakauer JW. Motor learning: its relevance to stroke recovery and neurorehabilitation. *Curr Opin Neurol*. 2006 Feb;19(1):84-90.
15. Hetherington R, Dennis M. Plasticity for recovery, plasticity for development: cognitive outcome in twins discordant for mid-childhood ischemic stroke. *Child Neuropsychol J Norm Abnorm Dev Child Adolesc*. 2004 Jun;10(2):117-28.
16. Didier J. *La plasticité de la fonction motrice*. 1st Ed. XII. Paris: Springer Medical; 2004.
17. Geuze RH. Postural control in children with developmental coordination disorder. *Neural Plast*. 2005;12(2-3):183-196; discussion 263-272.
18. Joiner WM, Smith MA. Long-term retention explained by a model of short-term learning in the adaptive control of reaching. *J Neurophysiol*. 2008 Nov;100(5):2948-55.
19. Jørgensen HS, Nakayama H, Raaschou HO, Vive-Larsen J, Stoer M, Olsen TS. Outcome and time course of recovery in stroke. Part I: Outcome. The Copenhagen Stroke Study. *Arch Phys Med Rehabil*. 1995 May;76(5):399-405.
20. Rode G, Rossetti Y, Boisson D. Inverse relationship between sensation of effort and muscular force during recovery from pure motor hemiplegia: a single-case study. *Neuropsychologia*. 1996 Feb;34(2):87-95.
21. Feeney DM, Baron JC. Diaschisis. *Stroke*. 1986 Oct;17(5):817-30.
22. Ward NS, Brown MM, Thompson AJ, Frackowiak RSJ. Neural correlates of motor recovery after stroke: a longitudinal fMRI study. *Brain J Neurol*. 2003 Nov;126(Pt 11):2476-96.
23. Lindenberg R, Renga V, Zhu LL, Betzler F, Alsop D, Schlaug G. Structural integrity of corticospinal motor fibers predicts motor impairment in chronic stroke. *Neurology*. 2010 Jan 26;74(4):280-7.
24. Schulz R, Koch P, Zimmerman M, Wessel M, Bönstrup M, Thomalla G, et al. Parietofrontal motor pathways and their association with motor function after stroke. *Brain J Neurol*. 2015 Jul;138(Pt 7):1949-60.
25. Li Y, Wu P, Liang F, Huang W. The microstructural status of the corpus callosum is associated with the degree of motor function and neurological deficit in stroke patients. *PloS One*. 2015;10(4):e0122615.
26. Levin MF, Michaelsen SM, Cirstea CM, Roby-Brami A. Use of the trunk for reaching targets placed within and beyond the reach in adult hemiparesis. *Exp Brain Res*. 2002 Mar;143(2):171-80.
27. Mateo S, Revol P, Fourtassi M, Rossetti Y, Collet C, Rode G. Kinematic characteristics of tenodesis grasp in C6 quadriplegia. *Spinal Cord*. 2013 Feb;51(2):144-9.
28. Kitago T, Krakauer J. Motor learning principles for neurorehabilitation. Elseviers B.V. M.P. Barnes and D.C. Good; 2013.
29. Izawa J, Rane T, Donchin O, Shadmehr R. Motor adaptation as a process of reoptimization. *J Neurosci Off J Soc Neurosci*. 2008 Mar 12;28(11):2883-91.
30. Didier JP. *La plasticité de la fonction motrice: un concept structurant en médecine physique et de réadaptation*. Springer-Verlag. Didier JP; 2004. 15-21 p.
31. Gollhofer A, Taube W, Nielsen JB. *Routledge handbook of motor control and motor learning*. Routledge International Handbooks. 2013.
32. Friston K. What is optimal about motor control? *Neuron*. 2011 Nov 3;72(3):488-98.
33. Hirano T. Long-term depression and other synaptic plasticity in the cerebellum. *Proc Jpn Acad Ser B Phys Biol Sci*. 2013;89(5):183-95.
34. Harber MP, Konopka AR, Udem MK, Hinkley JM, Minchev K, Kaminsky LA, et al. Aerobic exercise training induces skeletal muscle hypertrophy and age-dependent adaptations in myofiber function in young and older men. *J Appl Physiol Bethesda Md* 1985. 2012 Nov;113(9):1495-504.
35. Taylor JA, Ivry RB. The role of strategies in motor learning. *Ann N Y Acad Sci*. 2012 Mar;1251:1-12.
36. Iosa M, Morone G, Ragaglia MR, Fusco A, Paolucci S. Motor strategies and bilateral transfer in sensorimotor learning of patients with subacute stroke and healthy subjects. A randomized controlled trial. *Eur J Phys Rehabil Med*. 2013 Jun;49(3):291-9.
37. JM Mouillie, V Saout, I Richard. *Rehabilitation and norms*. Paris: Springer-Verlag; Didier JP, and E Bigand E; 2010. 53-68 p.

38. Rossetti Y, Jacquin-Courtois S, Calabria M, Michel C, Ghallager S, Luauté J, et al. Testing cognition and rehabilitation in unilateral neglect by wedge prism adaptation: multiple interplays between sensorimotor adaptation and spatial cognition. Japan: Springer. K. Kansaku K, ; Cohen LG, Birbaumer N; 2015.
39. Wilkinson DA. Visual-motor control loop: a linear system? *J Exp Psychol.* 1971 Aug;89(2):250–7.
40. Jakobson LS, Goodale MA. Trajectories of reaches to prismatically-displaced targets: evidence for “automatic” visuomotor recalibration. *Exp Brain Res.* 1989;78(3):575–87.
41. Michel C, Pisella L, Prablanc C, Rode G, Rossetti Y. Enhancing visuomotor adaptation by reducing error signals: single-step (aware) versus multiple-step (unaware) exposure to wedge prisms. *J Cogn Neurosci.* 2007 Feb;19(2):341–50.
42. Rode G, Lacour S, Jacquin-Courtois S, Pisella L, Michel C, Revol P, et al. Long-term sensorimotor and therapeutical effects of a mild regime of prism adaptation in spatial neglect. A double-blind RCT essay. *Ann Phys Rehabil Med.* 2015 Apr;58(2):40–53.
43. Michel C, Gaveau J, Pozzo T, Papaxanthis C. Prism adaptation by mental practice. *Cortex J Devoted Study Nerv Syst Behav.* 2013 Sep;49(8):2249–59.
44. Rossetti Y, Rode G, Pisella L, Farné A, Li L, Boisson D, et al. Prism adaptation to a rightward optical deviation rehabilitates left hemispatial neglect. *Nature.* 1998 Sep 10;395(6698):166–9.
45. Jacquin-Courtois S, O’Shea J, Luauté J, Pisella L, Revol P, Mizuno K, et al. Rehabilitation of spatial neglect by prism adaptation: a peculiar expansion of sensorimotor after-effects to spatial cognition. *Neurosci Biobehav Rev.* 2013 May;37(4):594–609.
46. Michel C. Beyond the Sensorimotor Plasticity: Cognitive Expansion of Prism Adaptation in Healthy Individuals. *Front Psychol.* 2015;6:1979.
47. Plant SE, Tyson SF, Kirk S, Parsons J. What are the barriers and facilitators to goal-setting during rehabilitation for stroke and other acquired brain injuries? A systematic review and meta-synthesis. *Clin Rehabil.* 2016 Sep;30(9):921–30.
48. Lefebvre H, Levert MJ. Breaking the news of traumatic brain injury and incapacities. *Brain Inj.* 2006 Jun;20(7):711–8.
49. DeLisa’s Physical Medicine & Rehabilitation. Principles and Practice. V. Chapter 13.
50. Lexell J. What’s on the horizon: defining psychiatry through rehabilitation methodology. *PM R.* 2012 May;4(5):331–4.
51. Rehabilitation Team Function and Prescriptions, Referrals and Order Writing. Chapter 13. DeLisa’s Physical Medicine and Rehabilitation. ISBN/ISSN: 9781469853413.
52. Building bridges: engagin medical residents in quality improvement and medical leadership. Voogt J, Van Rensen E, Van der Schaaf M, Noordegraaf M, Schneider M. *Int J Qual Health Care.* 2016 Sep 2.
53. Interprofessional collaborative care characteristics and the occurrence of bedside interprofessional rounds: a cross-sectional analysis. Gonzalo J, Hime J, McGillen B, Shifflet, Lehman E. *BMC Health Services Research* 2016; 16:459.
54. The ‘romance of teams’: Toward an understanding of its psychological underpinnings and implications. Allen NJ, Hecht TD. *Journal of Occupational and Organizational Psychology.* 2004, 77, 439-61.
55. Rehabilitation Team Function and Prescriptions, Referrals and Order Writing. Chapter 13. DeLisa’s Physical Medicine and Rehabilitation. ISBN/ISSN: 9781469853413.
56. de Haes H, Bensing J. Endpoints in medical communication research, proposing a framework of functions and outcomes. *Patient Educ Couns.* 2009 Mar;74(3):287–94.
57. Street RL, Makoul G, Arora NK, Epstein RM. How does communication heal? Pathways linking clinician-patient communication to health outcomes. *Patient Educ Couns.* 2009 Mar;74(3):295–301.
58. Herson L, Hart KA, Gordon MJ, Rintala DH. Identifying and overcoming barriers to providing sexuality information in the clinical setting. *Rehabil Nurs Off J Assoc Rehabil Nurses.* 1999 Aug;24(4):148–51.
59. Davidoff GN, Roth EJ, Richards JS. Cognitive deficits in spinal cord injury: epidemiology and outcome. *Arch Phys Med Rehabil.* 1992 Mar;73(3):275–84.
60. Council Of Europe S. Recommendation No. R (92) 6 of the Committee of Ministers to Member States on a coherent policy for people with disabilities. 1992.
61. Gay RE, Bauer BA, Yang RK. Integrative medicine in rehabilitation. 4th Edition; Elsevier, Saunders. Braddom RL; 483-97 p.
62. Coster S, Norman I. Cochrane reviews of educational and self-management interventions to guide nursing practice: a review. *Int J Nurs Stud.* 2009 Apr;46(4):508–28.
63. Meyer D, Leventhal H, Gutmann M. Common-sense models of illness: the example of hypertension. *Health Psychol Off J Div Health Psychol Am Psychol Assoc.* 1985;4(2):115–35.
64. Elliott TR, Hurst M. Social Problem Solving and Health. *Bienn Rev Couns Psychol.* 2008 Jul 1;1:295–309.
65. Gélis A, Stéfan A, Colin D, Albert T, Gault D, Goossens D, et al. Therapeutic education in persons with spinal cord injury: a review of the literature. *Ann Phys Rehabil Med.* 2011 May;54(3):189–210.
66. Brillhart B, Stewart A. Education as the key to rehabilitation. *Nurs Clin North Am.* 1989 Sep;24(3):675–80.
67. Evans RL, Matlock AL, Bishop DS, Stranahan S, Pederson C. Family intervention after stroke: does counseling or education help? *Stroke.* 1988 Oct;19(10):1243–9.
68. Hearn JH, Cotter I, Fine P, A Finlay K. Living with chronic neuropathic pain after spinal cord injury: an interpretative phenomenological analysis of community experience. *Disabil Rehabil.* 2015;37(23):2203–11.
69. Draaistra H, Singh MD, Ireland S, Harper T. Patients’ perceptions of their roles in goal setting in a spinal cord injury regional rehabilitation program. *Can J Neurosci Nurs.* 2012;34(3):22–30.
70. Gremeaux V, Coudeyre E. The Internet and the therapeutic education of patients: A systematic review of the literature. *Ann Phys Rehabil Med.* 2010 Dec;53(10):669–92.
71. Stewart R, Bhagwanjee A. Promoting group empowerment and self-reliance through participatory research: a case study of people with physical disability. *Disabil Rehabil.* 1999 Jul;21(7):338–45.
72. Cooper H, Booth K, Fear S, Gill G. Chronic disease patient education: lessons from meta-analyses. *Patient Educ Couns.* 2001 Aug;44(2):107–17.
73. North NT. The psychological effects of spinal cord injury: a review. *Spinal Cord.* 1999 Oct;37(10):671–9.
74. Cox RJ, Amsters DI, Pershouse KJ. The need for a multidisciplinary outreach service for people with spinal cord injury living in the community. *Clin Rehabil.* 2001 Dec;15(6):600–6.
75. Powell-Cope G, Moore DH, Weaver FM, Thomason S. Perceptions of practice guidelines for people with spinal cord injury. *Rehabil Nurs Off J Assoc Rehabil Nurses.* 2015 Apr;40(2):100–10.
76. Ponsford J, Willmott C, Rothwell A, Cameron P, Ayton G, Nelms R, et al. Impact of early intervention on outcome after mild traumatic brain injury in children. *Pediatrics.* 2001 Dec;108(6):1297–303.
77. Braga LW, Da Paz ACJ, Ylvisaker M. Direct clinician-delivered versus indirect family-supported rehabilitation of children with traumatic brain injury: a randomized controlled trial. *Brain Inj.* 2005 Sep;19(10):819–31.
78. Zientz J, Rackley A, Chapman S, et al, *J Med Speech Lang Pathol.* Evidence-based practice recommendations: educating caregivers on Alzheimer’s disease and training communication strategies. 2007;
79. Desrosiers J, Noreau L, Rochette A, Carbonneau H, Fontaine L, Viscogliosi C, et al. Effect of a home leisure education program after stroke: a randomized controlled trial. *Arch Phys Med Rehabil.* 2007 Sep;88(9):1095–100.
80. Baker NA, Tickle-Degnen L. The effectiveness of physical, psychological, and functional interventions in treating clients with multiple sclerosis: a meta-analysis. *Am J Occup Ther Off Publ Am Occup Ther Assoc.* 2001 Jun;55(3):324–31.
81. Anson K, Ponsford J. Evaluation of a coping skills group following traumatic brain injury. *Brain Inj.* 2006 Feb;20(2):167–78.
82. Mathiowetz VG, Finlayson ML, Matuska KM, Chen HY, Luo P. Randomized controlled trial of an energy conservation course for persons with multiple sclerosis. *Mult Scler Houndmills Basingstoke Engl.* 2005 Oct;11(5):592–601.

83. Mathiowetz V, Matuska KM, Murphy ME. Efficacy of an energy conservation course for persons with multiple sclerosis. *Arch Phys Med Rehabil.* 2001 Apr;82(4):449–56.
84. Vanage SM, Gilbertson KK, Mathiowetz V. Effects of an energy conservation course on fatigue impact for persons with progressive multiple sclerosis. *Am J Occup Ther Off Publ Am Occup Ther Assoc.* 2003 Jun;57(3):315–23.
85. Anderson TP, Newman E, Dryja R, Price M. Urinary tract care: improvement through patient education. *Arch Phys Med Rehabil.* 1983 Jul;64(7):314–6.
86. Cardenas DD, Hoffman JM, Kelly E, Mayo ME. Impact of a urinary tract infection educational program in persons with spinal cord injury. *J Spinal Cord Med.* 2004;27(1):47–54.
87. Hagglund K, Clark M, Schopp L, Sherman A, Acuff M. Consumer assistant education to reduce the occurrence of urinary tract infections among persons with spinal cord injury. *Top Spinal Cord Inj Rehabil.* 2005. 53–62 p.
88. Garber SL, Rintala DH, Holmes SA, Rodriguez GP, Friedman J. A structured educational model to improve pressure ulcer prevention knowledge in veterans with spinal cord dysfunction. *J Rehabil Res Dev.* 2002 Oct;39(5):575–88.
89. Pellerito JM. The effects of traditional and computer-aided instruction on promoting independent skin care in adults with paraplegia. *Occup Ther Int.* 2003;10(1):1–19.
90. Schubart J. An e-learning program to prevent pressure ulcers in adults with spinal cord injury: a pre- and post- pilot test among rehabilitation patients following discharge to home. *Ostomy Wound Manage.* 2012 Oct;58(10):38–49.
91. Viehbeck M, McGlynn J, Harris S. Pressure ulcers and wound healing: educating the spinal cord injured individual on the effects of cigarette smoking. *SCI Nurs Publ Am Assoc Spinal Cord Inj Nurses.* 1995 Aug;12(3):73–6.
92. King RB, Porter SL, Vertiz KB. Preventive skin care beliefs of people with spinal cord injury. *Rehabil Nurs Off J Assoc Rehabil Nurses.* 2008 Aug;33(4):154–62.
93. Sheppard R, Kennedy P, Mackey C. Theory of planned behaviour, skin care and pressure sores following spinal cord injury. *J Clin Psychol Med Settings.* 2006;
94. Morison MJ. Pressure sore management: the patient's role. *Prof Nurse Lond Engl.* 1989 Dec;5(3):134, 136, 138 passim.
95. Rintala DH, Garber SL, Friedman JD, Holmes SA. Preventing recurrent pressure ulcers in veterans with spinal cord injury: impact of a structured education and follow-up intervention. *Arch Phys Med Rehabil.* 2008 Aug;89(8):1429–41.
96. Norrbrink Budh C, Kowalski J, Lundeberg T. A comprehensive pain management programme comprising educational, cognitive and behavioural interventions for neuropathic pain following spinal cord injury. *J Rehabil Med.* 2006 May;38(3):172–80.
97. Little P, Lewith G, Webley F, Evans M, Beattie A, Middleton K, et al. Randomised controlled trial of Alexander technique lessons, exercise, and massage (ATEAM) for chronic and recurrent back pain. *Br J Sports Med.* 2008 Dec;42(12):965–8.
98. Waddell G, Burton K. Information and advice for patients. Edinburgh, UK, Churchill Livingstone. Waddell G; 2004. 323-342 p.
99. van Tulder MW, Koes B, Malmivaara A. Outcome of non-invasive treatment modalities on back pain: an evidence-based review. *Eur Spine J Off Publ Eur Spine Soc Eur Spinal Deform Soc Eur Sect Cerv Spine Res Soc.* 2006 Jan;15 Suppl 1:S64-81.
100. Liddle SD, Gracey JH, Baxter GD. Advice for the management of low back pain: a systematic review of randomised controlled trials. *Man Ther.* 2007 Nov;12(4):310–27.
101. Poquet N, Lin C-WC, Heymans MW, van Tulder MW, Esmail R, Koes BW, et al. Back schools for acute and subacute non-specific low-back pain. *Cochrane Database Syst Rev.* 2016 Apr 26;4:CD008325.

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# White Book on Physical and Rehabilitation Medicine (PRM) in Europe. Chapter 7. The clinical field of competence: PRM in practice

European Physical and Rehabilitation Medicine Bodies Alliance

## ABSTRACT

In the context of the White Book on Physical and Rehabilitation Medicine (PRM) in Europe this paper deals with the scope and competencies of PRM starting from its definition as the “medicine of functioning.” PRM uses the rehabilitative health strategy as its core strategy together with the curative strategy. According to the complexity of disabling health conditions, PRM also refers to prevention and maintenance and provides information to the patients and other caregivers.

The rehabilitation process according to the so-called rehabilitation cycle including an assessment and definition of the (individual) rehabilitation goals, assignment to the rehabilitation program evaluation of individual outcomes.

PRM physicians treat a wide spectrum of diseases and take a transversal across most of the medical specialties. They also focus on many functional problems such as immobilization, spasticity, pain syndromes, communication disorders, and others.

The diagnosis in PRM is the interaction between the medical diagnosis and a PRM-specific functional assessment. The latter is based on the ICF conceptual framework, and obtained through functional evaluations and scales: these are classified according to their main focus on impairments, activity limitations or participation restrictions; environmental and personal factors are included as barriers or facilitators.

Interventions in PRM are either provided directly by PRM physicians or within the PRM team. They include a wide range of treatments, including medicines, physical therapies, exercises, education and many others. Standardized PRM programs are available for many diseases and functional problems. In most cases rehabilitation is performed in multi-professional teams working in a collaborative way, as well as with other disciplines under the leadership of a PRM physician and it is a patient-centered approach.

Outcomes of PRM interventions and programs, showed reduction of impairments in body functions, activity limitations, and impacting on participation restrictions, and also reduction in costs as well as decrease in mortality for certain groups of patients.

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**Key words:** Physical and rehabilitation medicine - Field of competence - PRM diagnosis - PRM assessments - PRM treatments - Rehabilitation process - PRM team.

## Introduction

The White Book (WB) of Physical and Rehabilitation Medicine (PRM) in Europe is produced by the 4 European PRM Bodies and constitutes the reference book for PRM physicians in Europe. It has multiple values, including to provide a unifying framework for the European Countries, to inform decision-makers at the European and national level, to offer educational material for PRM trainees and physicians and information about PRM to the medical community, other rehabilitation professionals and the public. The WB states the importance of PRM specialty, that is a primary medical specialty. The contents include definitions and concepts of PRM, why re-

habilitation is needed by individuals and society, the fundamentals of PRM, history of PRM specialty, structure and activities of PRM organizations in Europe, knowledge and skills of PRM physicians, the clinical field of competence of PRM, the place of PRM specialty in the healthcare system and society, education and continuous professional development of PRM physicians, specificities and challenges of science and research in PRM and challenges and perspectives for the future of PRM.

This paragraph systematically presents the practical work of PRM physicians describing:

— the scope and competencies of PRM starting from its definition as the “medicine of functioning” responsible of the rehabilitative strategy to be applied together

with the curative strategy when the latter is not enough for the best recovery of patients' participation; according to the complexity of the health condition, PRM also refers to prevention and maintenance, as well as to rehabilitation training for other health professionals and to management of patients and caregivers;

- the rehabilitation process according to the so-called rehabilitation cycle: all patients require an assessment with definition of their individual goal(s) before providing the intervention(s); finally, an evaluation will be performed to check if the patient has achieved all what is needed, or if it is necessary to start again the rehabilitation cycle;

- the spectrum of diseases treated by PRM physicians: a comprehensive but not exclusive list of the most important individual health conditions is given. The transversal role of PRM across most of the medical specialties is clear, but the overlap is only apparent, since the focus of PRM is rehabilitation (sometimes also improperly called "conservative treatment"). Also, the most common general problems such as immobilization, spasticity, pain syndromes, communication disorders etc, are presented;

- the diagnosis in PRM is the interaction between the classical medical diagnosis (that uses all the typical tools of the profession) and the PRM specific functional assessment. The latter is based on the ICF conceptual framework, and obtained through functional evaluations and scales: these are classified according to their main focus on impairments, activity limitations or participation restrictions; environmental and personal factors are included as barriers or facilitators;

- the interventions in PRM, provided directly by PRM physicians or indirectly through the PRM team; in this respect, standardized PRM programs have been recognized by the UEMS PRM Section;

- the multi-professional PRM team is one of the way with which PRM physicians provide treatments, particularly in the most complex rehabilitation settings; the team works collaboratively, as well as with other disciplines and is led by the PRM physician;

- the outcomes of PRM interventions and programs, that are patient-centred, and include functional and personal outcomes (reducing impairments in body functions, activity limitations, and impacting on participation restrictions), reduction in costs as well as decrease in mortality for certain groups of patients.

## Scope of competencies of PRM

Physical and Rehabilitation Medicine (PRM) physicians are involved in the management of patients with a multitude of different health conditions. They are concerned with the impact of these conditions on personal functioning and participation.<sup>1,2</sup> The medical specialty of PRM is conceptually described as the "medicine of functioning"<sup>3,4</sup> based on the WHO's Integrative Model of Functioning (Appendix 1). Problems in functioning involve impairments in body functions and/or structures, activity limitations and participation restrictions which are represented by the umbrella term "disability," as specified in the International Classification of Functioning, Disability and Health (ICF).<sup>5</sup>

To better understand the scope of competencies of PRM, the interaction between the curative and the rehabilitation strategy is demonstrated in Figure 1.<sup>6</sup> If a patient with a health condition reports no relevant limitations in functioning, curing the disease is sufficient to solve the problem. If a patient experiences disability related to his or her health condition, a second strategy must be applied in order to reduce disability or supporting functioning respectively. This strategy has been described as rehabilitation strategy.<sup>3,4</sup> In this case the sole application of curative strategies may not solve the problem and some exclusion from society may remain. It is specific for PRM to combine therefore the curative and rehabilitative strategy by applying a multitude of interventions aiming at both, treatment of the pathology and overcoming disability.<sup>7</sup>

However, PRM treatments and programs may also refer to other health strategies, such as prevention (*e.g.* of complications of immobilization or treatments, diseases related to lack of physical activity), as well as maintenance and support (*e.g.* provision of assistive devices for long-term use, palliative care). In many cases these interventions and programs combine these strategies according to the individual needs of the patient.<sup>8</sup>

This chapter predominantly describes the clinical approach of PRM physicians with the disease or impairment as starting point. However, the field of competence includes education and training as well as management, coordination and advice. The complexity of tasks in rehabilitation is demonstrated in Figure 2<sup>9</sup> by a hierarchical structure with increasing complexity (levels 1 to 5). While at levels 1 and 2 the immediate environment and primary health care works have a strong role, PRM phy-

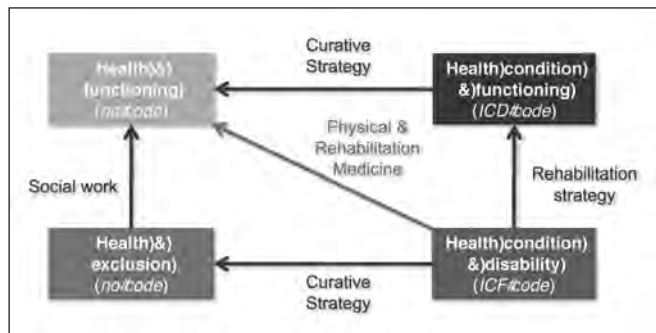


Figure 1.—Interactions of the curative and rehabilitative strategies and the integrative role of PRM (modified from Reinhardt *et al.*).<sup>6</sup>

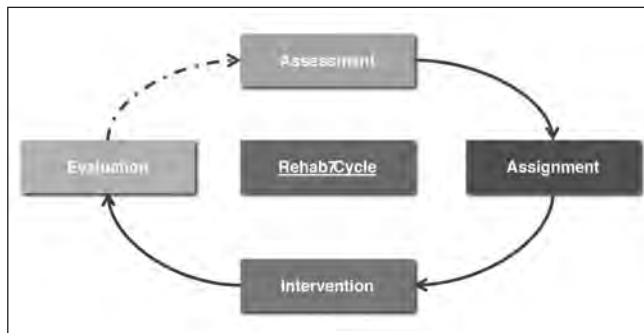


Figure 3.—The rehabilitation cycle (modified from Stucki *et al.*<sup>12</sup> and Rauch *et al.*<sup>14</sup>).

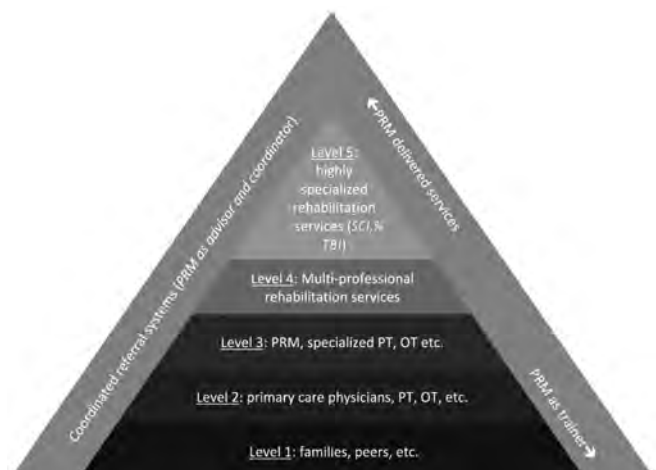


Figure 2.—Pyramid of the levels of specialization in health related rehabilitation as well as the role of PRM in service delivery, coordination of services, and education and training (from Gutenbrunner *et al.*).<sup>9</sup>

sicians should take care, either alone or within a multi-professional team, in more complex situations (levels 3 and 4). The top of the pyramid describes very highly specialized services for patients with complex rehabilitation needs and goals and/or less prevalent health conditions early in specific circumstances, rehabilitation for health conditions (*e.g.* spinal cord injury, traumatic brain injury, chronic pain, growing age).

At levels 3 to 5 PRM physicians are delivering treatments and services by themselves. However, PRM physicians may also contribute to levels 1 and 2, in particular by providing education and training to other health care providers. As in many cases, different levels of rehabilitation care may be needed, and the process must

be coordinated. Such coordination is a main competency of PRM physicians, too, and may also be relevant for health care planners in need of advice from an expert’s perspective.

**The rehabilitation process: assessment, goal-setting, intervention, and evaluation**

As mentioned above, PRM physicians manage, lead and coordinate the rehabilitation process within a problem-oriented, patient-centered and holistic approach. Depending on the characteristics and the requirements of the patient, PRM physicians might carry out the process alone or within a team of rehabilitation professionals. The rehabilitation process starts with the medical diagnosis and continues as long as the person needs rehabilitation interventions.<sup>10</sup> The rehabilitation process regularly comprises 4 stages (Figure 3):

- assessment;
- goal-setting;
- intervention;
- evaluation.<sup>11</sup>

They can be described as follows (Box 1):

— Assessment: In the first stage, the presence and the severity of the patient’s problems are identified. This identification includes the assessment of functioning based on the ICF framework and therefore lists the impairments of body functions and structures, activity limitations, and participation restrictions.<sup>12</sup> In addition, environmental factors (such as support and attitudes of family, friends, employer or community, physical environment, health and other services, etc.), personal factors (such as lifestyle, habits, education, race/ethnicity,

**Box 1.—Patient case: application of the four phases of the rehabilitation cycle**

A patient suffering from traumatic brain injury is admitted to a rehabilitation facility to start the rehabilitation program. The first step of rehab-cycle is the assessment aimed to define the problem correlated to the disability. We can identify a partial loss of the strength of the muscles in the 4 limbs (b730.2), he has impaired attention (b140.2) and severe memory deficit (b144.3). He refers pain in the mobilization of right hip. These impairments lead to a decreased capacity in acquiring information that, with the help of facilitation by person and technologies could give a good performance (d132.23). There are problems in Changing and maintaining body position (d410-d429), Carrying, moving and handling objects (d430-d449), Walking and moving (d450-d469), Washing oneself with good performance with help (d510.12).

The second step is the assignment to manage the problem by the health professionals of the team. The third phase is the type of intervention. The PRM physician coordinates these phases discussing with the team the priority of the intervention and the purpose of the modification.

A summary of the 3 phases can be found below.

ICF item	Severity	Assignment	Intervention
b140 Attention functions	2	Neuropsychologist PRM doctor	Attention training amantadine
b144 Memory functions	3	Neuropsychologist	
b280 Sensation of pain	3	Physical Therapist PRM doctor	Exercises Pain killer drugs
b710 Mobility of joint functions	2	Physical Therapist	Exercises
b730 Muscle power functions	2	Physical Therapist	Exercises
b735 Muscle tone functions	2	Physical Therapist PRM doctor	Exercises antispastic drugs
b740 Muscle endurance functions	3	Physical therapist	Exercises
b750 Motor reflex functions	2	Physical therapist PRM doctor	Exercises, antispastic drugs
b770 Gait pattern functions	3	Physical therapist PRM doctor	Exercises, antispastic drugs

	Capacity	Performance		
d132 Acquiring information	3	2	Physical therapist	Exercises
d410 Changing basic body position	2	1	Physical therapist	Exercises
d415 Maintaining a body position	2	1	Physical therapist	Exercises

	Capacity	Performance		
d420 Transferring oneself	2	1	Physical therapist	Exercises
d440 Fine hand use	3	3	Physical therapist Occupational Therapist	Exercises, training
d445 Hand and arm use	2	2	Physical therapist Occupational therapist	Exercises, training
d450 Walking	3	1	Physical therapist	Exercises
d455 Moving around	4	3	Physical therapist	Exercises
d510 Washing oneself	1	0	Occupational therapist	Exercises
d520 Caring for body parts	1	0	Occupational therapist	Exercises
d530 Toileting	1	0	Occupational therapist	Exercises
d540 Dressing	2	0	Occupational therapist	Exercises
d550 Eating	1	0	Speech and language therapist	Exercises
d560 Drinking	2	0	Speech and language therapist	Exercises

After a period of rehabilitation program, it is possible to evaluate the progress and eventually define another cycle of rehabilitation.

	Basal assessment		Evaluation of the progress after a period	
	Severity		Severity	
b140 Attention functions	2		1	
b144 Memory functions	3		3	
b280 Sensation of pain	3		1	
b710 Mobility of joint functions	2			
b730 Muscle power functions	2		1	
b735 Muscle tone functions	2		1	
b740 Muscle endurance functions	3		2	
b750 Motor reflex functions	2		1	
b770 Gait pattern functions	3		2	

	Capacity	Performance	Capacity	Performance
d132 Acquiring information	3	2	3	1
d410 Changing basic body position	2	1	1	0
d415 Maintaining a body position	2	1	1	0
d420 Transferring oneself	2	1	1	0
d440 Fine hand use	3	3	3	2
d445 Hand and arm use	2	2	2	1
d450 Walking	3	1	2	1
d455 Moving around	4	3	3	2
d510 Washing oneself	1	0	0	0
d520 Caring for body parts	1	0	0	0
d530 Toileting	1	0	1	0
d540 Dressing	2	1	1	0
d550 Eating	1	1	1	0
d560 Drinking	2	2	1	1

life events or social background), prognostic factors, the individual’s rehabilitation potential and needs, as well as his/her wishes and expectations are identified. Different members of the collaborative PRM multi-professional team (under the leadership of the PRM physician) may contribute to this assessment stage with their specific professional knowledge of the person and his/her functioning (Table I).

— Goal setting: Considering the problems and potentials identified at the assessment stage, a rehabilitation plan, specific for the individual rehabilitation plan, is established at the goal-setting stage. This plan comprises short-term and long-term goals for the patient proposing the time-frame in which it should be delivered. Involvement of the patient and the family/carer in the goal-setting stage in order to set realistic and achievable goals is of paramount importance. This stage also includes the assignment of established goals to specific interventions and subsequently to the responsible

member(s) of the multi-professional PRM team (with the leadership of a PRM physician) to carry out the interventions.<sup>13</sup> The selection of interventions is greatly facilitated using the ICF model.<sup>14</sup>

— Intervention: At the intervention stage, all therapeutic, educational and supportive interventions specified in the rehabilitation plan are undertaken according to the goals set (*see below*). Interventions should aim to prevent, stabilize, improve or restore impairments of body functions and structures, and to optimize activities and participation taking into account the individual’s capacity and performance as well as the relevant environment.<sup>4</sup>

— Evaluation: Finally, the effects of intervention programs vs the goals set are evaluated. In other words, outcome assessment is done in order to evaluate goal achievement. At this point, the PRM team needs to determine whether there are still unresolved but resolvable problems and in which case the rehabilitation process

TABLE I.—*Examples of some of the problems addressed in a rehabilitation plan.*

Problem	Goal	Possible interventions
<i>Impairments of body functions and structures</i>		
Pain	Reduce pain	Analgesic drugs; physical therapy modalities; stress management; improvement of coping and other strategies
Muscle weakness	Increase muscle strength	Strengthening exercises; electrical stimulation for muscle strengthening
Aphasia	Assess speech and language functions in detail, promote speech and language functions	Speech and language training
Depression	Manage depression, normalize and monitor for mood disturbance in order to enhance participation to physical and occupational therapy sessions	Antidepressant medication for depression; psychotherapy; cognitive and behavioral therapy; counselling
Urinary and bowel dysfunction, pelvic floor pain syndrome	Diagnostic assessment & tests for bladder and bowel function (e.g. physical assessment, bladder & bowel diary, urine analysis, urine culture, urinary ultrasound, urodynamic tests, neurophysiological tests), promote independency for bladder & bowel management, promote management of chronic pelvic floor pain syndrome	Bladder & bowel retraining; pelvic floor exercises for strengthening & relaxing muscles; EMG or pressure biofeedback; medication; intermittent catheterization; electrical stimulation for strengthening pelvic floor muscles and modulating pain; electrical stimulation for managing detrusor muscle overactivity or underactivity
<i>Activity limitations and participation restrictions</i>		
Difficulty in getting dressed, and toileting	Promote and ensure independency in self-care activities	Balance, transfer and mobility training; task specific training for dressing and toileting; environmental adaptations for toilet
Difficulty in walking	Promote and ensure independency in walking	Balance, transfer and mobility training; prescription, training and supervision for assistive device for walking
Inability to manage household activities	Assess individual’s capacity and performance in household activities; promote and ensure independency in household activities	Training of household activities (prepare and cook meal, washing, cleaning and others); promotion of ability using alternative methods or sources and/or assistive equipment; house and other environmental adaptations
Loss of employment	Return to work	Assessment of vocational capacity of the individual and workplace; restoration of vocational abilities; job adaptation; work retraining; workplace adaptations and equipment; improvement in access to and support at work

should continue. To do so, the existing PRM program is reviewed and re-planned according to the new goal, or if the rehabilitation process will be completed.<sup>11</sup> This process is iterative and if there are still problems/issues requiring intervention, the cycle continues until the goals are achieved (Figure 1). At most stages of this rehabilitation process, the PRM team uses various assessment tools to establish the presence and the severity of problems, to inform intervention planning, to monitor progress, and to predict recovery and discharge planning.<sup>15</sup> Using standard assessment tools (outcome measures) within an ICF-based assessment procedure enhances the communication among the team members. At the end of the rehabilitation process, the patient and

his/her family/carer should be informed about further maintenance of health, follow-up visits if needed and how to re-access services.

PRM management also includes management of referral and transition between services. The use of ICF may enhance a structured approach to rehabilitation process and ease the communication of the PRM team with respect to the problems, goals, and interventions.<sup>6</sup> Goal-setting helps patients achieve a higher quality of life or sense of well-being and a higher self-efficacy.<sup>16</sup> The evaluation of changes in the functioning state and goal achievement are important outcome measures in clinical practice to demonstrate effectiveness of services.<sup>17</sup>

TABLE II.—Conditions PRM physicians treat or can be involved in (a comprehensive list can be found in Appendix 2).

- 
- Traumatic diseases, *e.g.* traumatic brain injury, spinal cord injury, multiple trauma, plexus and peripheral nerve injuries, sports trauma/injuries, work-related trauma, bone fractures traumatic rupture of tendons or ligaments, burn injury, and consequences of surgery and other treatments (*e.g.* limb amputation, radiation associated contractures)
  - Non-traumatic diseases of the nervous system: *e.g.* stroke extrapyramidal and movement disorders including Parkinson disease dystonias, multiple sclerosis, infections (incl. poliomyelitis) and tumors of the CNS, complex consequences of neurosurgery, muscular dystrophy and neuromuscular disorders, systemic atrophies affecting the CNS (*e.g.* ataxias, spinal muscular atrophies, motor neuron disease including amyotrophic lateral sclerosis, post-polio syndrome), other degenerative diseases of the nervous system (*e.g.* Alzheimer disease)
  - Acute or chronic pain from various causes: such as amputation, post-surgical care, critical illness polyneuropathy, and chronic widespread pain (incl. fibromyalgia)
  - Non traumatic diseases of the musculo-skeletal system: spinal column (chronic and acute low back pain, cervical or dorsal pain), infectious, functional, degenerative and inflammatory arthropathies (*e.g.* osteoarthritis, rheumatoid arthritis, ankylosing spondylitis, spinal stenosis, temporomandibular joint disorders), soft tissues disorders (*e.g.* tendinitis, tenosynovitis), fibroblastic disorders (*e.g.* Dupuytren disease, plantar fasciitis), shoulder lesions (*e.g.* adhesive capsulitis, rotator cuff syndrome), enthesopathies of limbs (*e.g.* epicondylitis, tendinitis, iliotibial band syndrome, calcaneal spur, metatarsalgia), other soft tissue disorders (*e.g.* myalgia, fibromyalgia), disorders of bone density and structure (*e.g.* osteoporosis, osteomalacia), and other disorders of bone (*e.g.* Sympathetic reflex dystrophy/Complex regional pain syndrome), other joint disorders including acquired deformities, and deforming dorsopathies (*e.g.* scoliosis).
  - Mental and behavioral disorders with relevance to rehabilitation: *e.g.* dementias, bipolar affective disorder, post-traumatic stress disorder, depression, anxiety disorder, mental disorder in childhood (*e.g.* childhood autism, Rett syndrome, attention deficit hyperactivity disorder)
  - Cardiovascular diseases: *e.g.* ischemic heart diseases, acute myocardial infarction, heart failure, lower limb atherosclerosis, myocarditis, high blood pressure.
  - Diseases of the lymphatic system: *e.g.* breast cancer related lymphoedema and other lymphoedema
  - Diseases of the respiratory system: asthma, chronic obstructive pulmonary disease, pulmonary hypertension, lung transplant
  - Endocrine, nutritional, and metabolic diseases: diabetes mellitus, complications of the metabolic syndrome, obesity, malnutrition
  - Hematological diseases: functional consequences of leukemia, lymphoma, transplant of the bone marrow
  - Diseases of the gastrointestinal system: *e.g.* noninfective inflammatory bowel disease
  - Diseases of the genito-urinary & gastrointestinal system: *e.g.* vesico-sphincter disorders, stress urinary or fecal incontinence, neurogenic bladder and bowel dysfunction, pelvic floor pain syndromes, genito-sexual disorders, chronic renal failure
  - Disorders of vestibular function relevant to rehabilitation: *e.g.* vertigo, tinnitus aurium
  - Disorders of the skin and subcutaneous tissue: *e.g.* decubitus ulcers, psoriasis)
  - Functional consequences of cancer: including head/neck cancer, breast cancer, corpus uteri cancer, ovary cancer, pancreas cancer, prostate cancer, esophagus cancer
  - Sequelae of certain infectious and parasitic diseases: *e.g.* sequelae of leprosy, sequelae of poliomyelitis, lymphatic filariasis, HIV disease, brucellosis
  - Age-related disorders: *e.g.* muscle wasting and atrophy-sarcopenia, senile asthenia and debility
  - Diseases in children: *e.g.* congenital scoliosis, juvenile osteochondrosis of spine, congenital malformations (*e.g.* cleft lip, cleft palate, congenital heart anomalies), chromosomal abnormalities (*e.g.* Down Syndrome)
  - Complex status of various and multiple cause: bed rest syndrome, effort deconditioning, multisystem failure
-

### Spectrum of health conditions treated by PRM physicians

In accordance with the conceptual description of PRM,<sup>3, 4</sup> any disease, pathology, or health condition causing impairments of body functions and/or structures, activity limitations, or participation restrictions is in the scope of PRM. The most important groups of health conditions (diseases and disorders, including congenital anomalies, stress, and age-related problems, as well as injuries and trauma) which PRM physicians treat are listed in Table II (a comprehensive list can be found in Appendix 2).<sup>1, 2, 18</sup> The list refers to the most current version of the International Statistical Classification of Diseases and Related Health Problems (ICD) of the World Health Organization (WHO).<sup>19</sup> The list has been expanded based on the results of a workshop held by the International Society of Physical and Rehabilitation Medicine (*ISPRM*) which identified health conditions requiring rehabilitation<sup>20, 21</sup> (Box 2).

The involvement of PRM physicians in these conditions are mainly related to the promotion of functioning and reduction of unfavorable functional consequences arising in acute or post-acute phases as well as for patients with long-term conditions.<sup>18</sup>

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#### Box 2.—Patient example with health condition and need for PRM treatment

A 25-year-old man suffered a very severe traumatic brain injury following a road traffic accident. His impairments included confusion, disorientation, agitation and an inability to swallow. He was therefore at serious risk of developing a life-threatening aspiration pneumonia, which could impair the recovery of his cerebral functioning further. In addition, he quickly developed lower limb contractures as a result of immobilization and muscular over-activity (spasticity).

Appropriate, coordinated rehabilitation ensured that he was provided with a quiet environment and helped to communicate and understand his situation. Treatment was aimed at lowering his anxiety through a behavior management approach. He was fitted with a percutaneous endoscopic gastrostomy (PEG) feeding tube to prevent aspiration pneumonia and ensure adequate nutrition. The treatment of his contractures included the reduction of his spasticity, physical therapy and serial splinting. After many months of intensive rehabilitation, he was able to return home with improving behavior. His swallowing recovered so that he could eat normally and his PEG was removed. He began to walk and he was later able to return to paid employment.

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PRM physicians may also provide treatments for certain gynecological and urological conditions<sup>1, 2</sup> or disorders of the skin and subcutaneous tissue relevant to PRM (*e.g.* decubitus ulcers, skin breakdown secondary to contractures).

There is a number of general problems across the many health conditions, which PRM physicians face on a daily basis.<sup>1, 2</sup> These may include:

- prolonged bed rest and immobilization, deconditioning patients and causing loss of physical and psychological functioning;
- motor deficits producing weakness and/or sensory deficits with loss of personal functioning;
- spasticity leading to limb deformity and self-image problems;
- pain syndromes;
- communication difficulties;
- mood, behavior, and personality changes;
- bladder and bowel dysfunctions commonly found in disabled patients;
- pressure ulcers as a risk of immobility in spinal cord injured, diabetic, deconditioned and elderly patients;
- dysphagia — people with swallowing disorders who lose the enjoyment of eating and who are also at risk of aspiration pneumonia and malnutrition;
- sexual dysfunction covering identity and self-image issues as well as organ functioning;
- changes to family dynamics, personal relations, career opportunities and financial security.

As reported in the World Report on Disability,<sup>22</sup> disability is expected to increase worldwide, and it remains a challenge for PRM physicians to be able to intervene in a wide variety of rehabilitation-relevant health conditions. This increase affords an opportunity for promoting the PRM medical specialty and emphasizing its importance.

The importance of PRM in the treatment of various diseases sometimes is neglected with regard to the tasks of PRM in rehabilitation. However, PRM in most countries is the specialty that treats acute and chronic musculoskeletal diseases (*e.g.* low back pain, neck and shoulder pain, pelvic and knee pain and many others), disorders of the nervous system (*e.g.* spasticity, imbalance, ataxia) chronic widespread pain syndromes, as well as cardiovascular, metabolic and respiratory dysfunction, lymphatic disease and bladder and bowel dys-

functions. Additionally, PRM has specific competence in the treatment of specific syndromes such as burn-out syndrome, sleep disorders, fatigue, as well as dysfunction of abdominal and pelvic organs (chronic pelvic pain syndrome, irritable bowel syndrome and others).<sup>23</sup>

### Diagnosis of diseases in PRM (medical diagnosis)

Diagnosis in PRM includes medical diagnosis and functional assessment. Health condition is an umbrella term for disease, disorder, injury, or trauma as well as other circumstances such as pregnancy, ageing, congenital anomaly or genetic predisposition.<sup>12</sup> As a broad range of health conditions are covered by the PRM, the PRM physician recognizes the need for a (or several) definite medical diagnosis prior to treatment and problem-oriented PRM interventions.

For medical diagnosis, PRM physician focuses on patient's history and clinical examination as well as the clinical diagnostic procedures such as laboratory tests, imaging techniques, electrophysiological tests, etc. The International Classification of Diseases and Related Health Problems (ICD-10) is the current used classification system for coding the diagnosis of health conditions.<sup>19</sup>

PRM physicians take a detailed history about the present health condition, past medical conditions, review of systems as well as functional status (mobility, self-care activities, cognition, communication, vocational and recreational activities), and family and social history.<sup>24</sup> A thorough physical examination including general medical, neurological and musculoskeletal examination is of paramount importance. Special tests or provocative maneuvers, such as shoulder impingement tests, Finkelstein test, McMurray test or others, might be necessary for the diagnosis of some musculoskeletal conditions.<sup>24</sup>

For the diagnosis of many health conditions, imaging techniques are of major relevance. One of the common methods is X-ray imaging. It enables diagnosis and monitoring inpatients. Primarily, X-rays provide information on bone lesions, but also on calcifications on tumors, soft tissue, blood vessels and so on. Because of its many advantages, ultrasound of the locomotor apparatus plays a significant role in diagnosis, but also in monitoring of various disorders of the musculoskeletal system. Unlike X-ray and CT scan, it does not require

radiation exposure, it is non-invasive and above all there are no known contraindications. Besides, there is a possibility of repeated ultrasound examination and it is highly sensitive on changes. It allows potential use of ultrasound in monitoring disease progression and in evaluating therapeutic efficacy of local and systemic treatment. In addition to a standard ultrasound examination, there is a growing use of color and Power Doppler ultrasound in the diagnosis of synovitis, tenosynovitis, enthesitis and bursitis. Power Doppler, which is very sensitive in illustrating inflammation, is usually used in rheumatic diseases, for diagnosis and monitoring of synovitis, traumatic injuries, *e.g.* during tendinitis treatment, or in evaluating mass lesions (comparison of benign and malignant changes).<sup>25</sup>

Computerized tomography (CT) is highly sensitive, modern diagnostic method. It is painless and of satisfactory accuracy, but it exposes patient to X radiation. It is superior to MRI in diagnosis of bleeding, calcification and changes in head bones. Magnetic resonance imaging (MRI), together with computerized tomography, is one of the most important medical innovations in terms of patient's care improvement.<sup>27</sup> If clinical examination indicates neuromuscular disease or bladder dysfunction, complete evaluation of these patients includes electrodiagnostic or urodynamic testing respectively. In order to obtain most likely diagnosis and exclude others, testing should be conducted in technically competent manner and results should be correctly interpreted. Results of this analysis should enable identification of the basics of pathological processes such as, in case of neuromuscular disease: sensory, motor, or sensorimotor polyneuropathy, mononeuropathy, multiple mononeuropathy, polyradiculoneuropathy, radiculopathy, myopathy, disturbances at the level of the neuromuscular junction; in case of bladder dysfunction: detrusor overactivity or underactivity or contractile detrusor, incompetent sphincter mechanism, detrusor-sphincter dyssynergia, sensory dysfunction. In certain cases, physical examination, urodynamic and electrodiagnostic data can be used to evaluate the prognosis of recovery or for assessing disease progression or management approach itself.<sup>28</sup> If clinical examination indicates bladder dysfunction, complete evaluation of these patients includes in some cases, usually in neurogenic disorders, urodynamic tests and in rarer cases electro-diagnostic testing focused on thoraco-lumbar and sacral neurotomes and



roots as well. In order to obtain most likely diagnosis and exclude others, testing should be conducted in technically competent manner and results should be correctly interpreted. Results of this analysis should enable identification of the basics of pathological processes such as: detrusor overactivity during filling phase of the bladder, incompetent sphincter mechanism during filling phase of the bladder, detrusor hypoactivity or acontractile detrusor during emptying phase of bladder, detrusor-sphincter dyssynergia during emptying phase of bladder, sensory dysfunction during filling & emptying phase of the bladder. In certain cases, physical examination, urodynamic & electrodiagnostic data can be used to evaluate the prognosis of recovery, or the progression of bladder dysfunction or for assessing the results of the management approach itself.

To improve the efficiency of the diagnosis and definition of the patient's condition and his/her physical capacities, the PRM physician can use a validated set of technologies which inform with remarkable precision about basic features like muscle strength (power, work), of most muscle groups, three-planar range of motion of body segments, the way of walking (kinetic and kinematic analysis), equilibrium capacity in different conditions and muscular electrical activity with surface or needle electrodes during motion or rest. All these studies prove to be excellent tools to define the status and for monitoring the therapeutic process engaged. Taking into account characteristics of most commonly used diagnostic methods in injuries and diseases of locomotor apparatus, the PRM physician has considerable responsibility when choosing them. She/he has the task to diagnose the problem as precisely as possible, but at the same time not to harm the patient. In addition, upon completion of the rehabilitation program and exhaustion of all further treatment possibilities, specialist in physical and rehabilitation medicine has to give a final assessment of the functionality of the patient. Based on that information, estimation of the patient's independence in daily living activities is made, *i.e.* need for someone else's care and work capacity assessment *i.e.* need to change the job or go to disability pension. It is of big health significance, but also of social and economic one. The large spectrum of laboratory testing may be used by PRM physicians as well.

In addition to clinical examination, imaging and laboratory testing, measurement of functional restric-

tions and functional potential with respect to the PRM program constitute a major part of diagnostics in PRM. These measurements may include muscle function analysis (strength, electrical activity and others), goniometry for joint range of motion, testing of circulatory functions (blood pressure, heart rate, exercise stress test), pulmonary function, balance and gait, hand grip and others.<sup>18</sup>

### **Multidimensional assessment of functioning (functional assessment)**

In addition to medical diagnosis, functional assessment as medical specialty mainly focusing on the improvement of functioning is a prerequisite for the PRM physician.<sup>4</sup> Diagnostic process in rehabilitation has traditionally been termed as "assessment,"<sup>26</sup> thus "assessment of functioning" is the preferred term for functional assessment.<sup>4</sup> Table III gives an overview of frequently used tests and assessment tool in PRM.

Functioning is the lived experience of human being, in which body, person and society are intertwined.<sup>12</sup> According to the WHO's conceptual model of the International Classification of Functioning, Disability, and Health (ICF), functioning is an umbrella term including body functions and structures, and activities and participation.<sup>5</sup> Assessment of functioning should be performed based on the conceptual framework provided by the ICF and should include body functions and structures, as well as activities and participation<sup>3</sup> (Box 3). In order to fully depict functioning of a specific individual, there is a need for assessment data of the dimensions of functioning, including impairments of body functions and structures, activity limitations, participation restrictions, environmental barriers and facilitators, as well as individuals' perceptions and expectations.<sup>26</sup>

Body functions and body structures are classified systematically in eight corresponding sections in the ICF.<sup>5</sup> Body functions requiring assessment in most musculoskeletal conditions are pain, mobility of joints, stability of joints, muscle power, muscle tone, muscle endurance, energy, sleep, emotional functions, exercise tolerance, gait pattern and sexual functions. Assessments of body functions in neurological conditions should also include cognitive functions (consciousness, orientation, attention, memory, language, perception), touch and other sensory functions, voice and speech func-

TABLE III.—*Diagnostic Tools and Assessments in Physical and Rehabilitation Medicine: activities, participation and contextual factors.*

Special clinical and technical assessments of activities and participation
<ul style="list-style-type: none"> <li>• Dexterity: Nine Hole Peg Test, Box &amp; Block test, Jebsen-Taylor hand function test</li> <li>• Hand and arm use: Motor Activity Log, ABILHAND, Action Research Arm Test, Cochin Hand Scale, The Disabilities of the Arm, Shoulder and Hand (DASH) Score, and other scales</li> <li>• Balance: Berg Balance Scale, Timed “Up and Go Test”, Functional Reach Test, Balance Subscale of the Fugl-Meyer test, Postural Assessment Scale for Stroke, static and dynamic posturography, wearable inertial sensors, and other performance scales</li> <li>• Mobility: Functional Ambulation Category, 10-Meter Walking Test, 6-Minute Walking Test, Rivermead Mobility Index, and others</li> <li>• Activities of daily living: Health Assessment Questionnaire, Barthel Index, Functional Independence Measure (FIM™)</li> <li>• Instrumental/extended activities of daily living: Frenchay Activities Index, Rivermead ADL Scale, and others.</li> <li>• Activities &amp; participation: World Health Organization Disability Assessment Schedule II (WHODAS II), Modified Rankin Scale, London Handicap Scale, Impact on Participation and Autonomy Questionnaire, Participation Profile, Participation Scale, Keele Assessment of Participation, LIFE-H, EuroQol 5 and other self-report scales</li> <li>• Telemonitoring systems for rehabilitation</li> <li>• Electromyographic devices</li> <li>• Diagnostic ultrasounds devices</li> <li>• Work: Assessment of work and productive activities (including functional capacity evaluation and job site analysis), self-report questionnaires (<i>e.g.</i> Work Limitations Questionnaire, World Health Organization Health and Work Performance Questionnaire, Workplace Activity Limitations Scale, etc.)</li> <li>• Driving assessment</li> </ul>
Assessment of contextual factors and needs
<ul style="list-style-type: none"> <li>• Relevant environmental factors: Products and technology for personal use in daily living, indoor/outdoor mobility and transportation; natural and physical environment; support from family, friends, caregivers, community, health professionals, employer etc.; attitudes of individuals and society, services, systems and policies</li> <li>• Personal factors: lifestyle, habits, education, race/ethnicity, life events or social background care needs</li> <li>• Equipment needs, personal transportation (<i>e.g.</i> wheelchairs)</li> <li>• Environmental adaptation needs (<i>e.g.</i> accommodation)</li> <li>• Access to information technology, health literacy</li> </ul>

tions, control of voluntary movement, defecation and urination. Joint deformities, muscle atrophy, structural impairments of various musculoskeletal regions determined by X-rays or other imaging methods, structural impairments of brain or spinal cord demonstrated by various imaging techniques and pressure ulcers of the skin are examples of impairments of body structures usually assessed in the field of PRM. Body functions and body structures can be assessed by means of history taking, physical examination, laboratory investigations, imaging techniques, some clinical, electrophysiological or neurophysiological tests or self-report questionnaires. Beck Depression Inventory for depression, Mini Mental State Examination for some cognitive functions, and the Modified Ashworth Scale for muscle tone are examples of widely used assessment instruments of body functions.<sup>27</sup>

PRM physicians may also use standardized technical assessments of performance such as gait analysis, dynamometric muscle testing and other movement functions. In the PRM process of patients with certain conditions, specialized diagnostic measures will be required,

*e.g.* dysphagia evaluation in stroke, electro-diagnostic tests in peripheral nerve injury, urodynamics measurements in spinal cord injury, or cognitive function tests in brain injury.<sup>1,2</sup>

“Activities and participation” are presented in 9 domains as a single list in the ICF.<sup>5</sup> Activities are basic tasks or actions which represent the individual perspective of functioning. In PRM, it would be reasonable to operationalize ‘activities’ as a separate level of assessment. In this case, the domains, learning and applying knowledge, general tasks and demands, communication, mobility, self-care and to some extent domestic life could be considered as “activities.” “Participation” represents the societal perspective of functioning and includes interpersonal interactions and relationships, life activities such as domestic life, education, work and employment, and community, social and civic life.<sup>28</sup> The term ‘functional assessment’ used in the medical literature corresponds to assessing “activities and participation.” Assessments can be made of performance, describing what an individual is doing in his or her current environment, or on capacity, which describes an

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**Box 3.—Example for testing of functions and capacity as well as multidimensional assessment of functioning**

A 55-year-old man with Parkinson's disease visited the out-patient multi-professional PRM team service. He was sent by his family doctor to assess if additional rehabilitation treatments may improve his daily activities and if he had a chance to go back to work after vocational rehabilitation.

After clinical examination by the PRM physician, the patient filled in a set of assessment questionnaires including the Pain Disability Scale, the Multidimensional Assessment of Fatigue Scale, the Hospital Anxiety Depression Scale, the Unified Parkinson Disease Rating Scale, and the Medical Outcomes Study Short Form 36, and the Work Ability Index.

Following the European Physiotherapy Guidelines for Parkinson's Disease, the Physiotherapist (PT) assessed body functions and activities such as balance, exercise tolerance, changing body position, and walking. She performed the timed-up and go-test and a gait analysis. The Occupational Therapist (OT) tested hand function with the nine-hole-peg test and performed daily activities such as eating, toileting dressing and washing. Additionally, he did assessed functions relevant for his vocational participation as an administrator such as writing, using a computer and handling of paper files. The Psychologist tested the concentration ability and explored the mental problems. Last but not least the Social Worker explored the patient's social situation and the possibilities for social compensation and work place adaptation.

The results of the assessment were discussed in the PRM team meeting together with the patient and under the leading of the PRM physician. It was concluded that a 6-weeks multi-professional rehabilitation including PT, OT, Psychotherapy may improve the patient's overall fitness and work ability. It was seen realistic that the patient could return-to-work, but most probably with reduced daily working hours. The patient was instructed where and how to apply for social compensation and a program for part-time work integration.

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individual's ability to execute a task or an action and ought to be done in a "standardized" environment.<sup>28</sup> Although moderate to high correlations have been observed between capacity and performance, environmental and personal factors (such as motivation) have a great impact on the performance of activities.<sup>29</sup>

Assessment of activities and participation can be performed by various methods including directly questioning the functional history, observing the activity, standardized functional scales (questioning activities of daily living, instrumental activities of daily living, cognitive functioning, participation etc.) or by special performance tests such as dexterity, balance or walking. Most of the assessment tools used in the PRM field assess ac-

tivities.<sup>30, 31</sup> The assessment may focus upon a special activity such as mobility or dexterity or a combination of such activities. For example, the Rivermead Mobility Index assesses mobility whereas the Nine Hole Peg Test evaluates dexterity. The Barthel Index and the Functional Independence Measure (FIM™) are commonly used generic activity limitation scales, the former assessing physical activities of daily living, the latter evaluating both physical and cognitive aspects of daily life<sup>32</sup> (a comprehensive list of questionnaires and other assessment tools used in PRM can be found in Appendix 3).

Due to their impact on functioning, environmental and personal factors should certainly be assessed in the PRM process either as a barrier or facilitator. Assessment of environmental factors can be considered according to the framework of ICF, being listed in five sections as products and technology, natural environment and human-made changes to environment, support and relationships, attitudes, and services, systems and policies.<sup>5</sup> Personal factors such as lifestyle, habits, education, race/ethnicity, life events or social background should also be noted, although not listed in the ICF. The relevant contextual factors with respect to the social and physical environment are evaluated by interviews or standardized ICF-based checklists. For the identification of personal factors, standardized questionnaires may be used (*e.g.* assessment of coping strategies).<sup>18</sup>

While medical and functional assessment (assessment of functioning) are discussed separately in this chapter, the two-way interaction between a health condition and functioning properties is well established in the ICF.<sup>5</sup> The impact of a health condition on functioning is unquestionable and functioning is an inseparable part of our health perception.<sup>33</sup> The World Health Organization is pursuing the goal of the integration of the ICD and ICF during the ICD revision process (ICD-11).<sup>34</sup> The joint use of the ICD and ICF in the ICD-11 will make holistic information available regarding a medical diagnosis and its impact on the functioning (*i.e.* functional assessment) at the same time in a common framework.<sup>35</sup>

### Interventions in PRM

Physical and Rehabilitation Medicine uses a wide range of biomedical and technological interventions. PRM interventions, which fit to the International Classification of Health Interventions (ICHI) (under develop-

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**Box 4.—Example for treating a patient with diabetes mellitus treated in a PRM program**

A 52-year-old man with type 2 diabetes mellitus and a gangrenous foot had a trans-tibial amputation. He was given preoperative counselling to allow him to cope with the coming changes to his body and lifestyle. This included measures to prepare him for dealing with sensory changes, body image and balance alterations and enable him to engage in rehabilitation.

Physiotherapy started in the early postoperative phase with respiration therapy and prevention of thrombosis and contractures. Attention was given to the production of an adequate stump with bandaging and reduction of stump edema. He began walking with a temporary prosthesis and was measured for a permanent one. This was done with discussion with the patient on the level and nature of his physical requirements and goals. Consideration was given to the possible need for home, workplace or car adaptations. His journey to work parking, distance walked at work and other relevant factors such as leisure and family activities were explored. The patient was taught how to manage the stump and the prostheses. Three months after the amputation, he was independent in self-care, including monitoring of his residual limb. He was able to return to work and will be followed up for the rest of his life.

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ment)<sup>36</sup> include medical interventions (*e.g.* medication and practical procedures), physical treatments and physiotherapy, occupational therapy, speech and language therapy, dysphagia management, neuropsychological interventions, psychological interventions (including counselling of patients, families, and caregivers), nutritional therapy, assistive technology, prosthetics, orthotics, technical supports and aids, patient education, and PRM/rehabilitation nursing (Box 4). More details are shown in Table IV (a comprehensive list of interventions can be found in Appendix 4).

There is growing scientific evidence on efficacy and effectiveness of most of the applied interventions. The new Cochrane field of rehabilitation aims at being a bridge between the available evidence and the field of PRM practice (<http://rehabilitation.cochrane.org/>).

### Standardized PRM programs

As mentioned above, Physical and Rehabilitation Medicine physicians play a complex role in health-related rehabilitation programs. It starts with a clear medical diagnosis, a functional and social assessment and continues with the definition of different goals to achieve, according to the patient needs, the set-up of

a comprehensive strategy, the achievement of personal intervention and the supervision of team or network cooperation. It ends after a final assessment of the overall process. Such process can be named a “PRM Program of Care.”

The Clinical Affairs Committee of the UEMS-PRM Section developed standards for accreditation of such programs and published a series of those already accredited (Table V). Such accreditation is based on the following (Appendix 5):

- epidemiological needs and scientific evidence sustaining the program design;
- a target population, with inclusion and exclusion criteria;
  - general goals, expressed with respect to the ICF;
  - a well-structured content, with details about its agenda with possible stages, diagnosis and assessment tools (for the initial, follow up and final periods), scheduled interventions (direct treatment, education and training, rehabilitation), and the exact role of each participant in the program;
  - adapted equipment and manpower, with relevant team management. Assessment tools should help to make individual decisions and to provide objective data for the overall assessment of the program;
  - discharge criteria and final report, with recommendation for long-term follow-up.

PRM Programs of Care are a good basis for a quality approach. Defining a Program of Care leads to emphasize the strong points of PRM activity, but also raising some points that may be improved through a further action plan. Structured assessments will produce interesting data about outcomes in real life conditions.

PRM Programs of Care can adapt general principles to any local need and condition. For instance, PRM early intervention in an acute care hospital will make a different program for brain injured people than a community based unit, dealing with people suffering from brain damage. And a Posture and Movement Analysis Unit will provide a third kind of additional assessment and advisory program. In some cases, PRM programs may address a very specific population, referred by other specialists. On the opposite, you may have to satisfy the various needs with less technology, but more personal relationship. Therefore, any kind of program is worth being considered with the same attention.

Programs of Care must address one specific issue,

TABLE IV.—*Interventions in PRM.*

Medical interventions	Medication aiming at restoration or improvement of body structures and/or function, <i>e.g.</i> pain therapy, inflammation therapy, regulation of muscle tone, improvement of bone health, treatment of depression, and others Practical procedures, <i>e.g.</i> injections ( <i>e.g.</i> anesthetics, corticosteroid, hyaluronic acid injections-intra-articular or epidural or trigger point injections, botulinum toxin), neural therapy, regenerative injection therapies ( <i>e.g.</i> dextrose prolotherapy, platelet rich plasma), nerve blocks, and other techniques of drug administration ( <i>e.g.</i> iontophoresis, phonophoresis, use of intrathecal pumps-baclofen pumps etc.)
PRM interventions with physical agents and therapeutic exercises	Kinesiotherapy and exercise therapy Neurofacilitation techniques, <i>e.g.</i> neurodevelopmental treatments ( <i>e.g.</i> Bobath, Brunnstrom approach), proprioceptive neuromuscular facilitation and sensory integration therapy as well as repetitive task practice ( <i>e.g.</i> constraint-induced movement therapy) Manual therapy techniques for reversible stiff joints and related soft tissue dysfunctions as well as manual traction (traction with devices is also possible) Respiratory physical therapy (methods and techniques for respiratory pathway hygiene, inhalation therapies, breathing exercises) Massage therapy and vibration therapy ( <i>e.g.</i> whole-body vibration) Electrotherapy ( <i>e.g.</i> electrostimulation techniques-TENS, FES, NMES, spinal cord stimulation) Neuromodulation/non-invasive brain stimulation techniques ( <i>e.g.</i> tDCS, rTMS) Magnetic therapy Lymph therapy ( <i>e.g.</i> manual lymphatic drainage, bandaging) Meditative movement therapies ( <i>e.g.</i> qigong, yoga, and tai chi) Maneuvers ( <i>e.g.</i> specific repositioning maneuvers, physical counter-maneuvers for the management of orthostatic hypotension) Other physical therapies including ultrasound, extracorporeal shock wave therapy, heat and cold applications, short wave diathermy, tecartherapy, ozonotherapy, etc. Exergaming using virtual reality systems/game consoles/video games Phototherapy ( <i>e.g.</i> UV therapy, bright light therapy, laser therapy) Hydrotherapy and balneotherapy Climatotherapy Acupuncture Animal-assisted activities and animal-assisted therapy ( <i>e.g.</i> hippotherapy, use of service animals) Hyperbaric oxygen therapy
Occupational therapy	Analyzing and training of activities of daily living and occupation and teaching the patient to develop skills to overcome barriers to activity of daily living Training of cognition and teaching strategies to circumvent cognitive impairments Return-to-work interventions and ergonomic interventions to facilitate functioning Driving rehabilitation interventions ( <i>e.g.</i> driving simulator evaluations) Splinting Adjusting work & home environments Facilitating access to and use of information technology including telerehabilitation interventions
Speech and language therapy	In addition to conventional speech-language therapies, innovative approaches to speech-language pathologies ( <i>e.g.</i> telehealth technology applications)
Dysphagia management	Interventions to facilitate swallowing, and adaptation aids ( <i>e.g.</i> the use of specific postures, swallowing maneuvers, consistency and bolus size modifications)
Neuropsychological interventions	Cognitive retraining, cognitive stimulation, and computer-based interventions in the context of cognitive rehabilitation
Psychological interventions and counselling	Cognitive or behavioral techniques ( <i>e.g.</i> cognitive behavioral therapy, relaxation strategies, mind-body therapies, meditation, biofeedback, mirror therapy, guided imagery)
Nutritional therapy	Dietary interventions including advice and counselling on nutrition
Assistive technology, prosthetics, orthotics, technical supports, and aids	Assistive technology (Appendix 5) ranging from low technology aids such as canes to high technology equipment or systems such as motorized wheelchairs or computerized systems (communication systems; <i>e.g.</i> telemonitoring or telerehabilitation-mentioned above) and others in rehabilitation practice including robot-assisted therapies (robotic rehabilitation)
Patients, families/caregivers, professionals' education including self-management education	Educational interventions for patients including self-management education ( <i>e.g.</i> back schools) Educational interventions for families/caregivers ( <i>e.g.</i> family-centered interventions) Educational interventions for professionals ( <i>e.g.</i> evidence-based medicine training, research training, CME/CPD)
PRM/rehabilitation nursing	Care, education, and assistance on safety ( <i>e.g.</i> prevention of in-hospital falls), skin, bladder and bowel management, nutrition, sleep) Case managing through communication between the rehabilitation team, patient and the family Facilitating discharge/care transitions

rather than describe the overall activity of a PRM Department. For example, the focus may be on a “stroke program” instead of speaking about “neurological conditions” at large. The main entrance to the program may be:

TABLE V.—PRM programs accredited by the UEMS-PRM Section Clinical Affairs Committee (from: [www.euro-prm.org/index.php?option=com\\_content&view=article&id=33&Itemid=187&lang=en](http://www.euro-prm.org/index.php?option=com_content&view=article&id=33&Itemid=187&lang=en)).

Accredited programs
N012 - PRM program for patients with Spinal Cord Injury in the post-acute phase - Anda Nulle (Latvia)
N011 - PRM Program for patients with increased fall risk - Andreas Dinsbacher (Luxemburg)
N010 - PRM Program for Peripheral Nerves Injuries - Primoz Novak (Slovenia)
N009 - PRM Program for patients with Traumatic Brain Injury - Klemen Grabljevec (Slovenia)
N008 - Myotel: A myorelaxation-feedback based tele-treatment for neck and shoulder pain - Daniel Wever (The Netherlands)
N007 - Multi-professional management of the diabetic foot - Martinus Terburg (The Netherlands)
N006 - SAMSAH TC-CL 13: PRM Program for the long-term accompaniment of patients with acquired brain lesions - Alain Delarque (France)
N005 - PRM Program for Spinal Cord Injury and Trauma - Rajmond Šavrin (Slovenia)
N004 - PRM Program for patients with Spinal Cord Injury - Sasa Moslovac (Croatia)
N003 - PRM PC for patients with low back pain and lombo-sacral radiculopathy - Svetlana Lenickiene (Lithuania)
N002 - PRM program after hip and knee arthroplasty - Ieva Michailoviene (Lithuania)
N001 - PRM follow up after ACL reconstruction - Georges de Korvin (France)
Programmes from the trial phase
P2 (2008) - Post-traumatic Geriatric Rehabilitation. M. Quittan (Austria)
P3 (2008) - Rehabilitation of oncological patients. V. Fialka-Moser (Austria)
P4 (2008) - General Physical and Rehabilitation Medicine. G. de Korvin (France)
P5 (2008) - PRM and patients with stroke. Nika Goljar (Slovenia)
P8 (2008) - PRM and patients with neurological disorders. Zoltan Denes (Hungary)
P9 (2008) - PRM and patients with neurological disorders. A. Giustini (Italy)
P17 (2008) - Assessment and treatment of patients with walking troubles in a day hospital in acute settings. A. DELARQUE (France)
P18 (2008) - PRM and patients with a spinal cord injury. Jurate Kesiene (Lithuania)
P19 (2008) - Rehabilitation of people after amputation. Metka Presern-Strukelj (Slovenia)
P21 (2008) - Inpatient programme of rehabilitation of children. Hermina Damjan (Slovenia)
P22 (2008) - PRM and patients with stroke. Tomas Sinocevicus (Lithuania)
P24 (2008) - PRM and patients with osteoporosis. Katalin Bors (Hungary)
P26 (2008) - PRM program for adults with neurological disorders. Erzsébet Boros (Hungary)

— an impairment (as a consequence of a health condition): hemiplegia, amputation, spinal cord injury, knee ligament reconstruction, low back pain and others;

— an activity limitation and participation restriction: walking disability, limitation in self-care, not being able to perform household, leisure or sports activities and others;

— a vocational goal or independent living for brain injured people;

— a period of life, with some specific features: children with cerebral palsies, athletes with musculoskeletal injuries, manual workers with low back pain, elderly people with falling hazards and others.

The number of accredited PRM programs is continuously growing.

Another approach for more standardization of PRM interventions in treatment and rehabilitation programs for specific health conditions is given by the Professional Practice Committee of the UEMS-PRM Section. It described the Field of Competence of PRM in specific areas in detail. The results of this effort are published in an E-Book of the Field of Competence of PRM which is available from the UEMS-PRM Section and Board website.<sup>37</sup>

### Management skills and advisory role of PRM

Physical and Rehabilitation Medicine Physicians have a wide range of management skills. Those include:

— At the micro-level of care provision: to manage a patient-case in its complexity and, in particular, to support the patient/client to choose the right services, to get social and legal support, to adapt the environment etc. This also includes the management of the multi-professional rehabilitation team, *e.g.* in organizing meetings, documentation of outcomes, follow-up of decisions.

— At the meso-level of service organization: to manage a rehabilitation hospital or other service, to run a PRM department in a bigger institution. This also includes the implementation and follow-up of quality management programs. Aspects of qualification of team members, appropriate technical equipment and financial resources are part of this area of work.

— At the macro-level of health systems and policies: to influence health policies and environmental design to facilitate participation of persons with disabilities and disabling conditions, including access to rehabilitation

services. To manage this part of the environment is an important factor for successful rehabilitation. In most cases this will not be done by an individual practicing PRM physician but will be done in context of PRM societies or responsible committees and other stakeholder bodies

To fulfil these tasks PRM training includes many aspects of management skills: team work, planning skills, health systems knowledge, process management, principles of service provision including financial aspects, basics of health policies and others.

### **Multi-professional collaboration and collaborative teamwork**

In the literature dealing with team work and collaboration in rehabilitation, terms sometimes are used differently from their definition in scientific literature on team models and interaction between team members. Therefore, a clarification of terms is needed here.

In PRM literature the terms are mostly used to describe collaboration partners working together in the team:

- multi-professional team: team consisting of multiple rehabilitation professionals (*e.g.* PRM, PT, OT, SLT, nurses and/or others);

- inter-disciplinary collaboration: collaboration among different medical specialties (*e.g.* PRM, trauma surgeon, neurologist, cardiologist and/or others).

- In team theory, the terms are used to describe the way of collaboration and the interaction between team members irrespective of their professional background:

- multi-disciplinary team work: team work without systematic structure and without an organized decision-making process. Such teams are mostly based on hierarchy, do not meet regularly, discuss only parts of work (or specific patients), have less room for discussion and, in many cases, communicate bilaterally;

- inter-disciplinary team work: collaboration of team members with different backgrounds putting together their knowledge, expertise and experience to solve problems together. Such teams gather regularly, discuss all problems and work based on equality of contribution of every team member. Decisions are taken as a team (mostly based on consensus). Communication is always multilateral.

The term “multi-professional team” will be used for a

rehabilitation team consisting of different rehabilitation professionals collaboratively working under the leadership of a PRM physician, the term “interdisciplinary counselling” for collaboration of PRM physicians with other medical specialists and the term “collaborative team work” for a team working in an interdisciplinary, multidisciplinary or transdisciplinary way according to the setting and needs.

As mentioned before, PRM treatment goals, assessments and interventions are multidimensional and very complex. Thus, they must be carried out on the basis of professional knowledge and responsibility requiring the involvement of other health professionals such as physiotherapists, occupational therapists, nurses, speech therapists, orthotist, prosthetist and/or other health professionals. Each of them contributes with his/her specific competences, however, in most cases the medical responsibility for the patient will remain on the PRM physician.

Depending on the phase (acute, post-acute or long-term rehabilitation) and the setting (hospital, rehabilitation center, outpatient service or community based rehabilitation) the collaboration modalities may differ. In most cases, structured multi-professional teams working collaboratively under the leadership of PRM physicians, based on shared ethical and scientific bases as well as common methodology and language, are needed. This is fundamental to achieve optimal level of outcome.

Multi-professional team work is essential for the diagnosis and assessment of impairments, activity limitations and participation restrictions, selection of treatment options, co-ordination of varied interventions to achieve agreed goals, and critical evaluation and revision of plans/goals to respond to changes in the patient’s health and function (Box 5).

In many cases, rehabilitation requires interdisciplinary counselling with other specialized physicians, in particular after surgery, in the diagnostic phase of a disease and for planning a multidimensional treatment plan. The medical specialists need to agree a common strategy, which incorporates all their interventions at the right times to achieve a common approach to the overall treatment strategy. Continued input may be required from other medical specialists either in acute rehabilitation wards, or in long term rehabilitation (mainly cooperation with the primary care physician).

PRM teams not only comprise members from many different professional backgrounds, but also work towards agreed aims by using shared strategies. It is more than adding different health professionals work if work-

**Box 5.—Example for patient-centered decision making in a multi-professional rehabilitation team**

Michael is a 48-year-old informatician, married and father of 3 teenaged daughters. On the way to work, on his motorbike, he is hit by a truck and sustains a complete paraplegia T10. Prognosis of recovery is very reserved, as Michael is being told quite soon by the surgeon. After a 2 week stay at the acute hospital he is admitted to the rehabilitation center. The rehabilitation team members (PRM physician, rehabilitation nurse, physiotherapist, occupational therapist, psychologist, social worker and sports therapist), under the leadership of the PRM physician, complete the assessment and set short term goals for the first weeks: verticalization on the tilting table, sitting in a modular wheelchair, strengthening of the upper limbs, upper body ADL training, bladder/bowel scheme by the nurses. Michael is quite distressed, sleeps little and motivation for therapy is low. In the second team meeting the psychologist shares with the team that the patient is in a depressive mood, misses his family and sees no point in the future. He states life has no sense and asks questions about end of life possibilities. On the “what matters to you” question he replies being home and cooking for his family during the weekends is very important. Cooking is his great passion and hobby. With three old school-friends they have a “cooking club” one Saturday a month at their respective homes, and in the evening their wives join for dinner.

A new team meeting together with Michael and his wife is scheduled rapidly in order to set common goals. There, he can express his feelings and lived experience at the SCI unit. New goals are being set for the short as well as the long term. On the long-term, home adaptations are being proposed, including the kitchen infrastructure. Return to work seems feasible considering the installation of a wheelchair accessible toilet at his company. As the family went skiing twice per year, some indoor ski sessions with the sports therapist will be scheduled as soon as his condition allows, and if successful a sit-ski will be added to the list of assistive devices for the insurance company of the truck driver, whose responsibility for the accident has been pronounced. As Michael very much wants to participate in the cooking club also when at his friends, with this objective, gait/standing training will be provided, first with circular casts of the legs, then with knee-ankle-foot orthoses and a Walkabout. On the short term, the nurses will teach him clean intermittent self-catheterization, physiotherapists will focus on wheelchair and transfer training and occupational therapists on independence for personal Activities of Daily Life. A home visit with the occupational therapist and a first weekend home are scheduled after some weeks, followed by a second round table, attended also by the couple’s daughters.

Thanks to the close involvement of Michael and his family with goal setting, therapy becomes much more meaningful to Michael and he finds the energy to participate actively.

ing in a multi-professional team (under the leadership of a PRM physician) and understanding the roles and values of the colleagues. The team works to set goals adjusted over time and according to clinical and functional progress of the patient. Most important principles of successful team work are:<sup>38</sup>

- appropriate range of knowledge and skills for the agreed task;
- mutual trust and respect;
- willingness to share knowledge and expertise;
- speak openly.

The team involves directly the patient and his/her significant others/family to establish appropriate and realistic treatment goals within an overall coordinated rehabilitation program. These goals should be patient-centered, endorsed by the team and adjusted repeatedly as the PRM program proceeds.

Cooperation within the rehabilitation team is ensured by structured team communication and regular team meetings, discussing the diagnosis, the functional impact on functioning and activities, the ability of the patient to participate in the society as well as the possible risks and the prognosis of the disease. The team members’ assessments are incorporated into the rehabilitation plan, which is reviewed regularly.

Successful teams will need to include a wide range of knowledge, aptitudes and professional skills, and members will primarily include: PRM physicians, nurses with rehabilitation expertise, physiotherapists, occupational therapists, speech and language therapists, clinical psychologists and neuropsychologists, social workers, prosthetists and orthotists, bioengineers as well as dieticians.<sup>39</sup> The structure of the teams may vary in different European countries and depends on specificity of each rehabilitation department.

Team members must be appropriately qualified with a focused scientific and professional education (basic and continuous). Knowledge and respect for the skills and aptitudes of the other team members is required. PRM physicians have a duty to provide adequate information, training and clinical support, but each health professional has an individual responsibility to uphold his or her profession’s standards.

The competencies of the members of the team should be:<sup>39</sup>

- physicians: diagnosing the underlying pathology and impairments, prognosis, medical assessment and



treatment, setting-up treatment and rehabilitation plan, prescription of pharmacological and non-pharmacological treatments and assessment of response to these;

- rehabilitation nurses: addressing and monitoring day-to-day care needs. Expertise in the management of tissue viability and continence problems. Providing emotional support to patients and their families. Education to patients and their families;

- physiotherapists: detailed assessment of posture and movement problems, administering physical treatments including exercise to restore movement and alleviate pain, etc.;

- occupational therapists: assessing the impact of physical or cognitive problems on activities of daily living, return to work, education and/or leisure activities, etc. Providing expertise on strategies that can be used by the patient and his/her family, use of assistive technology and environmental adaptations to facilitate independence;

- speech and language therapists: assessing and treating cognitive, communication, orofacial motility problems and swallowing disorders;

- clinical psychologists and neuropsychologists: detailed assessment of cognitive, perceptual and emotional/behavioral problems. Development of strategies to manage these with the patient, his/her family and with other health professionals;

- social workers: promoting participation, community reintegration and social support;

- prosthetists and orthotists: expertise in the provision of technologies ranging from splints and artificial limbs to environmental controls;

- bioengineers and rehabilitation engineers: regarding technologies and data collection;

- dieticians: assessing and promoting adequate nutrition.

The PRM physician's role in the team is essential for establishing the medical diagnosis, the functional evaluation, the prescription, the treatment plan and the leadership of the team. This is based on medical and ethical principles, the ICF-model of body function and structure, activities, participation and contextual factors as well as scientific results (evidence-based healthcare). The clinical intervention has to address the health condition, impairments, activity limitations and participation restrictions. However, virtually every rehabilitation intervention has risks that must be assumed with respon-

sibility. For this reason, a thorough medical diagnosis and assessment is essential prior to every rehabilitation intervention.

For optimizing PRM programs, team members must understand their specific contribution to the collaborative team, but PRM physicians have the responsibility for providing an integrated description of each individual's pattern and care pathway, leading the decision-making process.

Collaborative team working establishes a strong relationship with all stakeholders of the PRM team based on open and mutual respect and considering the technical skills of each other. The team's success lies in the communication established, making efforts in order to overcome the difficulties experienced by the patient.

PRM physicians have an essential role to play in collaborative teams: they lead it, diagnose, promote discussion, develop and evaluate new management strategies, in order to lead the rehabilitation plan and ensure the clinical success.

### Ethics in clinical PRM practice

PRM professionals centrally involve patients, families and caregivers in the goal setting process and address ethical dilemmas as part of this. This also applies for end of life decisions for which each specific country has its legal framework. For instance, in Belgium and the Netherlands patients in unbearable suffering due to a severe incurable health condition can choose for euthanasia if they comply with the prescriptions of the law.

PRM physicians thus routinely consider the rights of their patients in their daily practice and ethical and moral decisions are made on a daily basis in the field of PRM. Many of these are minor, such as the decision to explain the risks and obtain consent for a joint injection or electrodiagnostic procedure. Others, however, are more complex and difficult, and may involve the participation of several different people. Some issues are fairly specific to the specialty. Keeping in mind the ethical principles just mentioned, ethical issues in three settings commonly encountered in rehabilitation medicine will be discussed: resource allocation and patient selection, the ethics of team care and ethical issues in goal setting. The aim is not necessarily to provide firm answers, but to consider the issues and the various pos-

sibilities that may be used to assist the decision-making process. This text cannot go into this in great detail, but two examples are patient selection and resource allocation. Who decides on which patients should be admitted to rehabilitation facilities and which should not and how do clinicians deal fairly with the allocation of limitation of stretched resources?

Siegert, *et al.*<sup>40</sup> looked at the way that rehabilitation professionals were protecting their patients' human rights and dignity amid the rapidly growing literature on human rights particularly as it relates to health and rehabilitation. This article aimed to introduce rehabilitation professionals to the place of human rights in rehabilitation practice and to stimulate further discussion and debate. It highlighted some important milestones in the recent history of the human rights movement and explained some important terms in the rights literature. It described the Ward and Birgden model of the structure of human rights as an example of a rights perspective that might have particular relevance for health and social services and rehabilitation.<sup>41</sup>

Ultimately, the goal of rehabilitation medicine is to ensure patient autonomy, beneficence and justice, while striving to give the best care possible, at the same time as respecting the wishes and guidelines of society as a whole within the restraints of the available resources. Other factors include the selection of patients for rehabilitation, the PRM team's activities & competencies, goal setting in context of PRM, and resource allocation.<sup>42</sup>

In conclusion, in rehabilitation practice, we are increasingly confronted with often very delicate ethical questions. The macro level exists as a framework, but decisions are taken daily on the micro- and meso-levels. This evolution is the consequence of a number of significant medical, technical and societal evolutions during the last decades. Ethical values and cultural beliefs of professionals as well as patients influence choices in rehabilitation. We need to be aware that cultural differences can affect outcome of treatment. Ethical and cultural issues should be part of rehabilitation curricula and postgraduate training. Professionals delivering PRM services should take time to reflect on these issues.

### Outcomes of PRM interventions and programs

As Physical and Rehabilitation Medicine is defined as "medicine of functioning" with "rehabilitation" as its

core strategy,<sup>3, 4, 43</sup> "functioning" as well as various aspects of quality of life and the perception of health and well-being<sup>4, 44</sup> are most important goals of PRM treatments and programs. Therefore, the essential outcome specific to PRM is "functioning."

There are extensive examples where the PRM programs and rehabilitation services have been shown to be effective in improving functioning (functional outcomes) and reducing disability.

### *The importance of functional outcomes*

Functional outcomes relate to three dimensions including body functions and structures, activities, and participation as defined under the umbrella term, "functioning," in the International Classification of Functioning, Disability and Health (ICF),<sup>5</sup> covering domains of life including understanding and communicating, mobility, self-care, interacting with other persons, domestic life, work/employment, school, leisure, and joining in community activities/participation in society.<sup>5, 45</sup> Functioning is experienced by all humans and any person may experience problems in functioning, ranging from mild to severe, in his/her lifespan.<sup>46</sup> The consensus view of the World Health Organization (WHO) is that health is not merely non-occurrence of a certain disease or injury, but it contains functioning (*i.e.* capability to perform physical and mental actions/tasks).<sup>47</sup> Hence, functioning is a core element of health and improvement in functional outcomes is a vital goal.

Indeed, evidence suggests that an individual's level of functioning in interaction with the current environment, termed as "lived health," is more important than biological health. Self-reported general health has been demonstrated as highly relevant in large cohort of about eighteen thousand community-dwelling and about ten thousand institutionalized individuals. The perception of general health in the institutionalized population with a lower level of biological health is closer to those of the community-dwelling population when assistive devices and/or personal assistance was provided.<sup>48</sup> This finding clearly points to the value and importance of functional outcomes specifically relevant to PRM on the evaluation of health from the perspectives of individuals. To conclude, real benefit to functional outcomes provided by PRM approaches

focusing on function seems to be the entity that matters most for individuals. The initiative of the WHO on the integrated use of the International Statistical Classification of Diseases and Related Health Problems (ICD)<sup>19</sup> and the ICF<sup>5</sup> in the ICD revision process aiming to represent the effect of the health condition on functioning is an important endeavor (35) underlining the importance of functional outcome in PRM.

### *Person-centered outcomes*

The primary responsibility of PRM physicians is to produce treatment outcomes to affect persons' lives in accordance with their valued aspects. It may be argued that despite the notion that PRM physicians pay attention to quality of life of the person as a whole, PRM targets health-related quality of life which forms an important portion of whole quality of life.<sup>49</sup>

Therefore, PRM outcomes are associated with various aspects of health-related quality of life resulting from improvements in functioning and/or perceptions of health and well-being.<sup>4, 44</sup> Demonstrating a person's well-being and social participation is an important feature of the fundamental outcome of patient-centered rehabilitation.<sup>50</sup> Well-being is probably a more secure indicator of success than quality of life. Many current quality of life measures implicitly make judgments about the relevance of specific objective factors, such as the ability to climb stairs, which may not be perceived as equally important by all people with disabilities.<sup>1, 2</sup>

To meet persons' outcome expectancies, shared goal-setting is a central issue in PRM and a core competency of PRM physicians and the rehabilitation team. Goal-setting is associated with improvement in PRM outcomes enhancing persons' functioning as well as evaluation of treatment outcomes.<sup>51</sup> Mutually agreed goals and outcomes are essential in person and goal oriented rehabilitation process prioritizing functional outcomes. ICF tools such as ICF Categorical Profile, ICF Evaluation Display, and ICF Assessment Sheets can be used for the identification, definition, and illustration of rehabilitation goals, intervention targets, and goal achievement.<sup>13</sup> The assessment of changes in functioning after a goal and outcome oriented rehabilitation intervention and goal achievement are significant outcome measures in rehabilitation settings.<sup>17</sup> At an individual level, outcome measures are very

important to show the evidence of the effectiveness of particular rehabilitation interventions and services. These outcome measures have to relate directly to the specifically set goals addressed in the rehabilitation plan. The evaluation of rehabilitation has fundamental differences from the evaluation of disease-orientated medical treatments aimed at limiting pathology or curing disease.<sup>1, 2</sup> It is important to determine which outcome to measure in person-centered outcome measurement approach to see whether specific goals set for a particular individual were achieved. If the problem of an individual is an impaired function, then the primary outcome should relate to that function. If the goal is the achievement of "participation in society," which is the ultimate goal of rehabilitation, then participation restrictions should be measured as the primary outcome.<sup>28</sup> Patient-centered outcome measurements in research serve as cornerstones for evidence-based medicine defined as "the integration of best research evidence with clinical expertise and patient values."<sup>52</sup> Evidence-based practices do improve outcomes of care if the best compromise between person deemed goals (goals which are important and meaningful to the persons) and rehabilitation plan can be achieved.

In summary, rehabilitation has the ability to reduce the burden on disability both for individuals and for society. It is shown to be effective in enhancing individual functioning and independent living by achieving greater activity, better health and by reducing complications and the effects of comorbidities. This benefits the individual and society to include greater personal autonomy, improved opportunities for employment and other occupational activity. While many societal factors are involved in return to independent living and work, PRM can prepare the individual and families/carers to take maximal advantage of the opportunities that are available.<sup>1, 2</sup>

### *Cost-effectiveness outcomes*

The effectiveness of rehabilitation is not only associated with enhanced functioning and living independently but also with reduced costs of dependency due to disability.<sup>1, 2</sup> The effects of PRM on cost-savings has been discussed in the chapter on economic burden of disability.

### Survival outcomes

Finally, PRM outcomes are also associated with survival. There is considerable evidence that rehabilitation reduces the risk of mortality in certain groups of patients as can be exemplified for exercise-based cardiac rehabilitation for coronary heart disease which leads to a decrease in cardiovascular mortality.<sup>53</sup> There are other examples where rehabilitation has been shown to be effective in improving survival.

Rehabilitation can be successfully achieved in conditions where there is no biological recovery and indeed in conditions that are intermittently or steadily deteriorating. In the latter, rehabilitation may need to be delivered in a continuing program that enables the patient to maintain levels of participation and well-being that would otherwise not have been achieved. It should be standard practice to audit services.<sup>1, 2</sup>

In conclusion, PRM programs and rehabilitation services for persons with disabilities produce concrete benefits including improvement in functioning (via reducing impairments in body functions, activity limitations, and participation restrictions) and reduction in costs as well as decrease in mortality for certain groups of patients which justify the importance of PRM outcomes. The outcome measures related to functioning, patient-centered, should be considered as primary outcome in rehabilitation clinical studies.

### References

1. Section of Physical and Rehabilitation Medicine Union Européenne des Médecins Spécialistes (UEMS), European Board of Physical and Rehabilitation Medicine, Académie Européenne de Médecine de Réadaptation, European Society for Physical and Rehabilitation Medicine. White book on physical and rehabilitation medicine in Europe. *Eur Medicophysica*. 2006 Dec;42(4):292-332.
2. White book on Physical and Rehabilitation Medicine in Europe. *J Rehabil Med*. 2007 Jan;(45 Suppl):6-47.
3. Stucki G, Melvin J. The International Classification of Functioning, Disability and Health: a unifying model for the conceptual description of physical and rehabilitation medicine. *J Rehabil Med*. 2007 May;39(4):286-92.
4. Gutenbrunner C, Meyer T, Melvin J, Stucki G. Towards a conceptual description of Physical and Rehabilitation Medicine. *J Rehabil Med*. 2011 Sep;43(9):760-4.
5. WHO. International Classification of Functioning, Disability and Health WHO Geneva 2001. 2001.
6. Reinhardt JD, von Groote PM, DeLisa JA, Melvin JL, Bickenbach JE, Li LSW, *et al*. Chapter 3: International non-governmental organizations in the emerging world society: the example of ISPRM. *J Rehabil Med*. 2009 Sep;41(10):810-22.
7. Stucki G, Bickenbach J, Gutenbrunner C, Melvin J. Rehabilitation: The health strategy of the 21st century. *J Rehabil Med*. 2017 Jan 31;
8. Gutenbrunner C, Meyer T, Stucki G. The field of competence in physical and rehabilitation medicine in light of health classifications: an international perspective. *Am J Phys Med Rehabil*. 2011 Jul;90(7):521-5.
9. Gutenbrunner C, Nugraha B. Physical and rehabilitation medicine: responding to health needs from individual care to service provision. *Eur J Phys Rehabil Med*. 2017 Feb;53(1):1-6.
10. Lexell J. What's on the horizon: defining physiatry through rehabilitation methodology. *PM R*. 2012 May;4(5):331-4.
11. Wade DT. Describing rehabilitation interventions. *Clin Rehabil*. 2005 Dec;19(8):811-8.
12. Stucki G, Kostanjsek N, Üstün B, Ewert T, Cieza A. Applying the ICF in Rehabilitation Medicine. Philadelphia: Lippincott Williams & Wilkins, 2010. Frontera W.; 301-324 p. (section 11).
13. Rauch A, Cieza A, Stucki G. How to apply the International Classification of Functioning, Disability and Health (ICF) for rehabilitation management in clinical practice. *Eur J Phys Rehabil Med*. 2008 Sep;44(3):329-42.
14. Lexell J, Brogårdh C. The use of ICF in the neurorehabilitation process. *NeuroRehabilitation*. 2015;36(1):5-9.
15. Tyson S, Greenhalgh J, Long AF, Flynn R. The use of measurement tools in clinical practice: an observational study of neurorehabilitation. *Clin Rehabil*. 2010 Jan;24(1):74-81.
16. Levack WMM, Weatherall M, Hay-Smith EJC, Dean SG, McPherson K, Siegert RJ. Goal setting and strategies to enhance goal pursuit for adults with acquired disability participating in rehabilitation. *Cochrane Database Syst Rev*. 2015 Jul 20;(7):CD009727.
17. Hurn J, Kneebone I, Cropley M. Goal setting as an outcome measure: A systematic review. *Clin Rehabil*. 2006 Sep;20(9):756-72.
18. Gutenbrunner C, Lemoine F, Yelnik A, Joseph P-A, de Korvin G, Neumann V, *et al*. The field of competence of the specialist in physical and rehabilitation medicine (PRM). *Ann Phys Rehabil Med*. 2011 Jul;54(5):298-318.
19. WHO. Statistical Classification of Diseases and Related Health Problems: 10th Revision (ICD-10) [Internet]. 2001. Available from: <http://apps.who.int/classifications/icd10/browse/2016/en>
20. Kohler F, Selb M, Escorpizo R, Kostanjsek N, Stucki G, Riberto M, *et al*. Towards the joint use of ICD and ICF: a call for contribution. *J Rehabil Med*. 2012 Oct;44(10):805-10.
21. Selb M, Kohler F, Robinson Nicol MM, Riberto M, Stucki G, Kennedy C, *et al*. ICD-11: a comprehensive picture of health, an update on the ICD-ICF joint use initiative. *J Rehabil Med*. 2015 Jan;47(1):2-8.
22. World Health Organization, World Bank. World Report on Disability. 2011.
23. Gutenbrunner C, Liebl ME, Reißhauer A, Schwarzkopf SR, Korallus C, Ziegenthaler H, *et al*. Rehabilitationsmedizin neu denken - Das Profil des Facharztes für Physikalische und Rehabilitative Medizin (PMR). *Phys Med Rehab Kuror*. 2014;62-74.
24. The physiatric history and physical examination. Elsevier Saunders. 2011: Physical Medicine and Rehabilitation. Braddom RL; 2011. 3-39 p.
25. Özçakar L, Tok F, De Muynck M, Vanderstraeten G. Musculoskeletal ultrasonography in physical and rehabilitation medicine. *J Rehabil Med*. 2012 Apr;44(4):310-8.
26. Wade DT. Diagnosis in rehabilitation: woolly thinking and resource inequity. *Clin Rehabil*. 2002 Jun;16(4):347-9.
27. Barak S, Duncan PW. Issues in selecting outcome measures to assess functional recovery after stroke. *NeuroRx J Am Soc Exp Neurother*. 2006 Oct;3(4):505-24.
28. Küçükdeveci AA, Tennant A, Grimby G, Franchignoni F. Strategies for assessment and outcome measurement in physical and rehabilitation medicine: an educational review. *J Rehabil Med*. 2011 Jul;43(8):661-72.
29. Holsbeeke L, Ketelaar M, Schoemaker MM, Gorter JW. Capacity, capability, and performance: different constructs or three of a kind? *Arch Phys Med Rehabil*. 2009 May;90(5):849-55.
30. Haigh R, Tennant A, Biering-Sørensen F, Grimby G, Marincek C, Phillips S, *et al*. The use of outcome measures in physical medicine and rehabilitation within Europe. *J Rehabil Med*. 2001 Nov;33(6):273-8.

31. Skinner A, Turner-Stokes L. The use of standardized outcome measures in rehabilitation centres in the UK. *Clin Rehabil.* 2006 Jul;20(7):609-15.
32. Salter K, Jutai JW, Teasell R, Foley NC, Bitensky J. Issues for selection of outcome measures in stroke rehabilitation: ICF Body Functions. *Disabil Rehabil.* 2005 Feb 18;27(4):191-207.
33. Cieza A, Oberhauser C, Bickenbach J, Chatterji S, Stucki G. Towards a minimal generic set of domains of functioning and health. *BMC Public Health.* 2014 Mar 3;14:218.
34. World Health Organization. The International Classification of Diseases 11th Revision (ICD 11) [Internet]. [cited 2016 Aug 11]. Available from: <http://www.who.int/classifications/icd/revision/en/>
35. Escorpizo R, Kostanjsek N, Kennedy C, Nicol MMR, Stucki G, Ustün TB, *et al.* Harmonizing WHO's International Classification of Diseases (ICD) and International Classification of Functioning, Disability and Health (ICF): importance and methods to link disease and functioning. *BMC Public Health.* 2013 Aug 12;13:742.
36. World Health Organization. International Classification of Health Interventions (ICHI), under development. [Internet]. [cited 2016 Jun 19]. Available from: [www.who.int/classifications/ichi/en/](http://www.who.int/classifications/ichi/en/).
37. European Union of Medical Specialists, Section of Physical and Rehabilitation Medicine-Professional Practice Committee (PPC-ebook). The field of competence in physical and rehabilitation medicine physicians. Part I [Internet]. N. Christodoulou, A. Delarque, E. Varela Donoso; 2014. Available from: [www.euro-prm.org](http://www.euro-prm.org)
38. Neumann V, Gutenbrunner C, Fialka-Moser V, Christodoulou N, Varela E, Giustini A, *et al.* Interdisciplinary team working in physical and rehabilitation medicine. *J Rehabil Med.* 2010 Jan;42(1):4-8.
39. King JC, Blankenship KI, Schalla W, Mehta A. Rehabilitation team function and prescriptions, referrals and order writing. Fifth Edition. Philadelphia: Lippincott Williams & Wilkins, 2010. Philadelphia: Frontera WR; 359-386 p.
40. Siegert RJ, Ward T, Playford ED. Human rights and rehabilitation outcomes. *Disabil Rehabil.* 2010;32(12):965-71.
41. Ward T, Birgden A. Human rights and correctional clinical practice. *Aggress Violent Behav.* 2007;628-43.
42. Blackmer J. Ethical issues in rehabilitation medicine. *Scand J Rehabil Med.* 2000 Jun;32(2):51-5.
43. Meyer T, Gutenbrunner C, Bickenbach J, Cieza A, Melvin J, Stucki G. Towards a conceptual description of rehabilitation as a health strategy. *J Rehabil Med.* 2011 Sep;43(9):765-9.
44. Stucki G, Cieza A, Melvin J. The International Classification of Functioning, Disability and Health (ICF): a unifying model for the conceptual description of the rehabilitation strategy. *J Rehabil Med.* 2007 May;39(4):279-85.
45. World Health Organization. Disability Assessment Schedule 2.0 (WHODAS 2.0) [Internet]. [cited 2016 Jul 1]. Available from: [http://www.who.int/classifications/icf/more\\_whodas/en/](http://www.who.int/classifications/icf/more_whodas/en/)
46. Bickenbach JE, Chatterji S, Badley EM, Ustün TB. Models of disablement, universalism and the international classification of impairments, disabilities and handicaps. *Soc Sci Med* 1982. 1999 May;48(9):1173-87.
47. Salomon JA, Mathers CD, Chatterji S, Sadana R, Ustün TB, Murray CJL. Quantifying Individual Levels of Health: definitions, concepts, and measurement issues. Geneva, WHO: Murray CJL, Evans DB; 2003. 301-318 p.
48. Bostan C, Oberhauser C, Stucki G, Bickenbach J, Cieza A. Biological health or lived health: which predicts self-reported general health better? *BMC Public Health.* 2014 Feb 21;14:189.
49. Johnston MV, Ottenbacher KJ, Graham JE, Findley PA, Hansen AC. Systematically assessing and improving the quality and outcomes of medical rehabilitation programs. Fifth Ed. Philadelphia: Lippincott Williams & Wilkins. Frontera WR, DeLisa J, Gans B, Walsh N, Robinson L; 2010. 325-355 p.
50. Wade DT. Community rehabilitation, or rehabilitation in the community? *Disabil Rehabil.* 2003 Aug 5;25(15):875-81.
51. Levack WMM, Dean SG, Siegert RJ, McPherson KM. Purposes and mechanisms of goal planning in rehabilitation: the need for a critical distinction. *Disabil Rehabil.* 2006 Jun 30;28(12):741-9.
52. Sackett DL, Rosenberg WM, Gray JA, Haynes RB, Richardson WS. Evidence based medicine: what it is and what it isn't. *BMJ.* 1996 Jan 13;312(7023):71-2.
53. Anderson L, Oldridge N, Thompson DR, Zwisler A-D, Rees K, Martin N, *et al.* Exercise-Based Cardiac Rehabilitation for Coronary Heart Disease: Cochrane Systematic Review and Meta-Analysis. *J Am Coll Cardiol.* 2016 Jan 5;67(1):1-12.
54. Stewart G, Sara G, Harris M, Waghorn G, Hall A, Sivarajasingam S, *et al.* A brief measure of vocational activity and community participation: development and reliability of the Activity and Participation Questionnaire. *Aust N Z J Psychiatry.* 2010 Mar;44(3):258-66.
55. Baum CM, Edwards D. Activity card sort. AOTA Press. Bethesda; 2008.
56. Fougeyrollas P, Noreau L, Bergeron H, Cloutier R, Dion SA, St-Michel G. Social consequences of long term impairments and disabilities: conceptual approach and assessment of handicap. *Int J Rehabil Res Int Z Rehabil Rev Int Rech Readaptation.* 1998 Jun;21(2):127-41.
57. Berry HL, Rodgers B, Dear KBG. Preliminary development and validation of an Australian community participation questionnaire: types of participation and associations with distress in a coastal community. *Soc Sci Med* 1982. 2007 Apr;64(8):1719-37.
58. Bedell G. Further validation of the Child and Adolescent Scale of Participation (CASP). *Dev Neurorehabilitation.* 2009;12(5):342-51.
59. Willer B, Ottenbacher KJ, Coad ML. The community integration questionnaire. A comparative examination. *Am J Phys Med Rehabil.* 1994 Apr;73(2):103-11.
60. Smith MK, Ford J. A client-developed functional level scale: The Community Living Skills Scale (CLSS). *J Soc Serv Res.* 1990;61-84.
61. Resnik L, Plow M, Jette A. Development of CRIS: measure of community reintegration of injured service members. *J Rehabil Res Dev.* 2009;46(4):469-80.
62. Holbrook M, Skilbeck CE. An activities index for use with stroke patients. *Age Ageing.* 1983 May;12(2):166-70.
63. Post MWM, de Witte LP, Reichrath E, Verdonschot MM, Wijlhuizen GJ, Perenboom RJM. Development and validation of IMPACT-S, an ICF-based questionnaire to measure activities and participation. *J Rehabil Med.* 2008 Aug;40(8):620-7.
64. Cardol M, de Haan RJ, van den Bos GA, de Jong BA, de Groot IJ. The development of a handicap assessment questionnaire: the Impact on Participation and Autonomy (IPA). *Clin Rehabil.* 1999 Oct;13(5):411-9.
65. Wilkie R, Peat G, Thomas E, Hooper H, Croft PR. The Keele Assessment of Participation: a new instrument to measure participation restriction in population studies. Combined qualitative and quantitative examination of its psychometric properties. *Qual Life Res Int J Qual Life Asp Treat Care Rehabil.* 2005 Oct;14(8):1889-99.
66. Haley SM, Jette AM, Coster WJ, Kooyoomjian JT, Levenson S, Heeren T, *et al.* Late Life Function and Disability Instrument: II. Development and evaluation of the function component. *J Gerontol A Biol Sci Med Sci.* 2002 Apr;57(4):M217-222.
67. Mars GMJ, Kempen GJMJ, Post MWM, Proot IM, Mesters I, van Eijk JTM. The Maastricht social participation profile: development and clinimetric properties in older adults with a chronic physical illness. *Qual Life Res Int J Qual Life Asp Treat Care Rehabil.* 2009 Nov;18(9):1207-18.
68. Malec JF, Kragness M, Evans RW, Finlay KL, Kent A, Lezak MD. Further psychometric evaluation and revision of the Mayo-Portland Adaptability Inventory in a national sample. *J Head Trauma Rehabil.* 2003 Dec;18(6):479-92.
69. Baecke JA, Burema J, Frijters JE. A short questionnaire for the measurement of habitual physical activity in epidemiological studies. *Am J Clin Nutr.* 1982 Nov;36(5):936-42.
70. Brandt A, Löfqvist C, Jónsdóttir I, Sund T, Salminen A-L, Werngren-Elgström M, *et al.* Towards an instrument targeting mobility-related participation: Nordic cross-national reliability. *J Rehabil Med.* 2008 Oct;40(9):766-72.
71. Bushnik T. Norwegian Function Assessment Scale. New York: Springer. *Encyclopedia of Clinical Neuropsychology*; 2011. 1796-1797 p.

72. Coster W, Law M, Bedell G, Khetani M, Cousins M, Teplicky R. Development of the Participation and Environment Measure for Children and Youth: conceptual basis. *Disabil Rehabil.* 2012;238-46.
73. Whiteneck GG, Dijkers MP, Heinemann AW, Bogner JA, Bushnik T, Cicerone KD, *et al.* Development of the participation assessment with recombined tools-objective for use after traumatic brain injury. *Arch Phys Med Rehabil.* 2011 Apr;92(4):542-51.
74. Heinemann AW, Lai J-S, Magasi S, Hammel J, Corrigan JD, Bogner JA, *et al.* Measuring participation enfranchisement. *Arch Phys Med Rehabil.* 2011 Apr;92(4):564-71.
75. Gandek B, Sinclair SJ, Jette AM, Ware JE. Development and initial psychometric evaluation of the participation measure for post-acute care (PM-PAC). *Am J Phys Med Rehabil.* 2007 Jan;86(1):57-71.
76. Brown M, Dijkers MPJM, Gordon WA, Ashman T, Charatz H, Cheng Z. Participation objective, participation subjective: a measure of participation combining outsider and insider perspectives. *J Head Trauma Rehabil.* 2004 Dec;19(6):459-81.
77. van Brakel WH, Anderson AM, Mutatkar RK, Bakirtzief Z, Nicholls PG, Raju MS, *et al.* The Participation Scale: measuring a key concept in public health. *Disabil Rehabil.* 2006 Feb 28;28(4):193-203.
78. Gray DB, Hollingsworth HH, Stark SL, Morgan KA. Participation survey/mobility: psychometric properties of a measure of participation for people with mobility impairments and limitations. *Arch Phys Med Rehabil.* 2006;189-97.
79. Rejeski WJ, Ip EH, Marsh AP, Miller ME, Farmer DF. Measuring disability in older adults: the International Classification System of Functioning, Disability and Health (ICF) framework. *Geriatr Gerontol Int.* 2008 Mar;8(1):48-54.
80. Pallant JF, Misajon R, Bennett E, Manderson L. Measuring the impact and distress of health problems from the individual's perspective: development of the Perceived Impact of Problem Profile (PIPP). *Health Qual Life Outcomes.* 2006 Jun 29;4:36.
81. Derogatis LR. The psychosocial adjustment to illness scale (PAIS). *J Psychosom Res.* 1986;30(1):77-91.
82. Sandström M, Lundin-Olsson L. Development and evaluation of a new questionnaire for rating perceived participation. *Clin Rehabil.* 2007 Sep;21(9):833-45.
83. Jelles F, Van Bennekom CA, Lankhorst GJ, Sibbel CJ, Bouter LM. Inter- and intra-rater agreement of the Rehabilitation Activities Profile. *J Clin Epidemiol.* 1995 Mar;48(3):407-16.
84. Pinsonnault E, Dubuc N, Desrosiers J, Delli-Colli N, Hébert R. Validation study of a social functioning scale: The social-SMAF (social-Functional Autonomy Measurement System). *Arch Gerontol Geriatr.* 2009 Feb;48(1):40-4.
85. Densley K, Davidson S, Gunn JM. Evaluation of the Social Participation Questionnaire in adult patients with depressive symptoms using Rasch analysis. *Qual Life Res Int J Qual Life Asp Treat Care Rehabil.* 2013 Oct;22(8):1987-97.
86. Harris M, Gladman B, Hennessy N, Lloyd C, Mowry B, Waghorn G. Reliability and validity of a measure of role functioning among people with psychiatric disabilities. *Aust Occup Ther J.* 2011 Jun;58(3):203-8.
87. Duncan PW, Wallace D, Lai SM, Johnson D, Embretson S, Laster LJ. The stroke impact scale version 2.0. Evaluation of reliability, validity, and sensitivity to change. *Stroke.* 1999 Oct;30(10):2131-40.
88. Tate RL, Simpson GK, Soo CA, Lane-Brown AT. Participation after acquired brain injury: clinical and psychometric considerations of the Sydney Psychosocial Reintegration Scale (SPRS). *J Rehabil Med.* 2011 Jun;43(7):609-18.
89. Rosenblum S. Validity and reliability of the Time Organisation and Participation Scale (TOPS). *Neuropsychol Rehabil.* 2012;22(1):65-84.
90. Post MWM, van der Zee CH, Hennink J, Schafrat CG, Visser-Meily JMA, van Berlekom SB. Validity of the utrecht scale for evaluation of rehabilitation-participation. *Disabil Rehabil.* 2012;34(6):478-85.
91. Ustün TB, Chatterji S, Kostanjsek N, Rehm J, Kennedy C, Epping-Jordan J, *et al.* Developing the World Health Organization Disability Assessment Schedule 2.0. *Bull World Health Organ.* 2010 Nov 1;88(11):815-23.
92. Kelly L, Jenkinson C, Dummett S, Dawson J, Fitzpatrick R, Morley D. Development of the Oxford Participation and Activities Questionnaire: constructing an item pool. *Patient Relat Outcome Meas.* 2015;6:145-55.
93. Morley D, Dummett S, Kelly L, Dawson J, Fitzpatrick R, Jenkinson C. Validation of the Oxford Participation and Activities Questionnaire. *Patient Relat Outcome Meas.* 2016;7:73-80.
94. VAN DE Velde D, Bracke P, VAN Hove G, Josephsson S, Viaene A, DE Boever E, *et al.* Measuring participation when combining subjective and objective variables: the development of the Ghent Participation Scale (GPS). *Eur J Phys Rehabil Med.* 2016 Aug;52(4):527-40.
95. Ballert CS, Hopfe M, Kus S, Mader L, Prodinge B. Using the refined ICF Linking Rules to compare the content of existing instruments and assessments: a systematic review and exemplary analysis of instruments measuring participation. *Disabil Rehabil.* 2016 Jul 14;1-17.

For this paper, the collective authorship name of European PRM Bodies Alliance include:

- European Academy of Rehabilitation Medicine (EARM)
- European Society of Physical and Rehabilitation Medicine (ESPRM)
- European Union of Medical Specialists PRM section (UEMS-PRM section)
- European College of Physical and Rehabilitation Medicine (ECPRM) – served by the UEMS-PRM Board
- the Editors of the 3<sup>rd</sup> edition of the White Book of Physical and Rehabilitation Medicine in Europe: Christoph Gutenbrunner, Pedro Cantista, Maria Gabriella Ceravolo, Nicolas Christodoulou, Alain Delarque, Carlotta Kiekens, Saša Moslavac, Enrique Varela-Donoso, Anthony B. Ward, Mauro Zampolini, Stefano Negrini
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## Appendix 1.—ICF-based Conceptual Description of Physical and Rehabilitation Medicine

Physical and Rehabilitation Medicine is the medical specialty that, based on WHO's integrative model of **functioning, disability and health** and rehabilitation as its core health strategy,  
 diagnoses health conditions,  
 assesses **functioning** in relation to **health conditions, personal and environmental factors**,  
 performs, applies and/or prescribes biomedical and technological interventions to treat health conditions in order to:  
   stabilize, improve or restore **impaired body functions and structures**  
   prevent **impairments** and medical complications, and manage risks  
   compensate for the absence or loss of **body functions and structures**,  
 leads and coordinates intervention programs to optimize **activity and participation**  
 in a patient-centered problem-solving process  
 in partnership between person and provider and/or carer and in appreciation of the person's perception of his or her position in life  
 performing, applying and integrating biomedical and technological interventions, psychological and behavioral; educational and counseling,  
   occupational and vocational, social and supportive, and physical environmental interventions,  
 provides advice to patients and their immediate social **environment**, service providers and payers  
 over the course of a **health condition**  
 for all age groups  
 along and across the continuum of care  
   including hospitals, rehabilitation facilities and the community  
 and across sectors  
   including health, education, employment and social affairs,  
 provides education to patients, relatives and other important persons to promote functioning and health,  
 manages rehabilitation and health across all areas of health services,  
 informs and advises the public and decision makers about suitable policies and programs in the health sector and across other sectors that  
 provide a **facilitative larger physical and social environment**  
 ensure access to rehabilitation services as a human right  
 and empower PRM specialists to provide timely and effective care,  
 with the goal  
 to enable persons with health conditions experiencing or likely to experience disability to achieve and maintain optimal functioning in  
 interaction with their environment.

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ICF terms are marked in bold.

## Appendix 2.—Comprehensive list of conditions PRM physicians treat or can be involved in

The table is adapted from the White Book on Physical and Rehabilitation Medicine in Europe<sup>1, 2</sup> and from the paper demonstrating the field of competence of PRM physicians<sup>18</sup> and expanded using the list created in a workshop of conditions relevant to the ICD-11.<sup>20, 21</sup> Publications relevant to the rehabilitation needs of persons with some health conditions and research activities of PRM physicians can be found in Supplementary references.

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Traumatic diseases: Traumatic brain injury, spinal cord injury, multiple trauma, plexus and peripheral nerve injuries, sports trauma/injuries, trauma during long-term disabling disease, work-related trauma, traumatic amputations involving multiple body regions, birth injury, injuries to body regions (*e.g.* fracture of femur and other lower limb fractures, vertebral fractures, upper limb fractures, traumatic rupture of tendons or ligaments, strains and sprains involving ligaments, and others), burn injury

Non traumatic diseases of the nervous system: stroke- including subarachnoid hemorrhage, extrapyramidal and movement disorders including Parkinson disease and parkinsonism, dystonias (*e.g.* spasmodic torticollis and others, restless legs syndrome, stiff-man syndrome), multiple sclerosis, infection or abscess of the central nervous system (CNS) including sequelae of central nervous system tuberculosis, poliomyelitis, tumors of the CNS, spinal cord paralysis whatever the cause, complex consequences of neurosurgery, muscular dystrophy and neuromuscular disorders, systemic atrophies affecting the CNS (*e.g.* ataxias, spinal muscular atrophies, motor neuron disease including amyotrophic lateral sclerosis, post-polio syndrome), other degenerative diseases of the nervous system (*e.g.* Alzheimer disease), other paralytic syndromes (*e.g.* locked-in syndrome, peripheral neuropathies (among them Guillain-Barré polyradiculopathy), nerve entrapment/compression, congenital diseases (cerebral palsy, spina bifida, and others), episodic and paroxysmal disorders relevant to rehabilitation (*e.g.* epilepsy, vertebro-basilar artery syndrome, sleep disorders), metabolic or biochemical genetic diseases

Mental and behavioral disorders with relevance to rehabilitation (*e.g.* dementias, bipolar affective disorder, post-traumatic stress disorder, depression, schizophrenia)

Disorders of psychological development relevant to rehabilitation (*e.g.* childhood autism, Rett syndrome)

Behavioral and emotional disorders with onset usually occurring in childhood relevant to rehabilitation (*e.g.* Attention deficit hyperactivity disorder)

Acute or chronic pain from various causes such as amputation, post-surgical care, critical illness polyneuropathy

Some general symptoms and signs relevant to PRM (*e.g.* chronic intractable pain, other chronic pain, fatigue, localized hyperhidrosis)

Complex status of various and multiple cause: bed rest syndrome, effort deconditioning, multisystem failure

Non traumatic diseases of the musculo-skeletal system: spinal column (chronic and acute low back pain, cervical or dorsal pain), infectious, degenerative and inflammatory arthropathies (mono and poly arthritis) (*e.g.* osteoarthritis, rheumatoid arthritis, ankylosing spondylitis and other spondylopathies including spinal stenosis or spondylopathies in diseases such as Pott curvature or Brucella spondylitis), vascular amputation, soft tissues disorders including disorders of synovium and tendon (*e.g.* calcific tendinitis, trigger finger, DeQuervain tenosynovitis), soft tissue disorders related to use, overuse and pressure (*e.g.* bursitis, chronic crepitant synovitis of hand and wrist), fibroblastic disorders (*e.g.* Dupuytren disease, plantar fasciitis), shoulder lesions (*e.g.* adhesive capsulitis, rotator cuff syndrome, bicipital tendinitis, calcific tendinitis), enthesopathies of limbs (*e.g.* epicondylitis, tendinitis, iliotibial band syndrome, calcaneal spur, metatarsalgia), other soft tissue disorders (*e.g.* myalgia, fibromyalgia), disorders of bone density and structure (*e.g.* osteoporosis, osteomalacia), disorders of continuity of bone (*e.g.* delayed union of fracture), other disorders of bone (*e.g.* Sympathetic reflex dystrophy/Complex regional pain syndrome), other joint disorders including acquired deformities affecting limbs/limb regions, unequal limb length, patellofemoral disorders, chondromalacia patellae, internal derangement of knee (*e.g.* meniscus derangements), chronic instability, ligament disorders, spontaneous rupture/disruption of ligaments or tendons, dislocation, subluxation, contracture of joints, hemarthrosis, joint effusions), systemic connective tissue disorders including other rheumatic disorders and hypermobility syndrome), benign myalgic encephalomyelitis (chronic fatigue syndrome), occupational exposure to vibration (*e.g.* hand-arm vibration syndrome), deforming dorsopathies (*e.g.* kyphosis and lordosis, scoliosis, spondylolysis, spondylolisthesis, torticollis).

Disorders of vestibular function relevant to rehabilitation (*e.g.* vertigo)

Cardiovascular diseases: ischemic heart diseases, acute myocardial infarction, heart failure, valve diseases, lower limb atherosclerosis, myocarditis, high blood pressure, atrial fibrillation, heart transplant, Chagas disease with heart involvement, rheumatic heart disease

Diseases of the lymphatic system relevant to rehabilitation (*e.g.* breast cancer related lymphoedema and other lymphoedema).

Diseases of the respiratory system: asthma, chronic obstructive pulmonary disease, pulmonary hypertension, pulmonary fibrosis, lung transplant, pneumoconiosis, asbestosis

Endocrine, nutritional, and metabolic diseases: diabetes mellitus, complications of the metabolic syndrome, obesity, protein-energy malnutrition)

Diseases of the genito-urinary and gastrointestinal system: *e.g.* vesico-sphincter disorders, stress urinary or bowel dysfunction, neurogenic bladder and bowel dysfunction, pelvic floor pain syndromes, genito-sexual disorders, chronic renal failure

Diseases of the gastrointestinal system relevant to rehabilitation (*e.g.* noninfective inflammatory bowel disease)

Hematological diseases: functional consequences of leukemia, lymphoma, transplant of the bone marrow

Functional consequences of cancer including head/neck cancer, breast cancer, corpus uteri cancer, ovary cancer, pancreas cancer, prostate cancer, esophagus cancer)

Sequelae of certain infectious and parasitic diseases relevant to rehabilitation (*e.g.* Sequelae of leprosy, sequelae of poliomyelitis, lymphatic filariasis, HIV disease resulting in multiple other diseases, brucellosis).

Diseases of jaws relevant to PRM (*e.g.* temporomandibular joint disorders)

Complications of medical and surgical care relevant to rehabilitation (*e.g.* radiotherapy leading to contractures)

Age-related disorders (*e.g.* muscle wasting and atrophy-sarcopenia, senile asthenia and debility)

Other diseases in children: congenital scoliosis, juvenile osteochondrosis of spine (*e.g.* Scheuermann disease), congenital malformations (*e.g.* cleft lip, cleft palate, congenital heart anomalies), chromosomal abnormalities (*e.g.* Down syndrome)

Disorders of the skin and subcutaneous tissue relevant to PRM (*e.g.* Decubitus ulcers)

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### Appendix 3A.—An overview of assessment in osteoarthritis

From the taxonomy of International Classification of Functioning, Disability, and Health (ICF) and Quality of Life.

Assessment domain	Assessment method/tool
<i>Body functions</i>	
Sensation of pain	Visual Analogue Scale, Numerical Rating Scale, Verbal Rating Scale, WOMAC-Pain, Multidimensional Pain Inventory, McGill Pain Questionnaire, AIMS2-Pain, NHP-Pain, SF-36 Pain, AUSCAN-Pain
Mobility of joint functions	Joint range of motion measured by goniometry
Muscle power functions	Grip strength, manual muscle test, isokinetic test
Sensation of muscle stiffness	Duration of morning stiffness, WOMAC-Stiffness, AUSCAN-Stiffness
Energy and drive functions	Multidimensional Assessment of Fatigue Scale, VAS
Gait pattern functions	Gait analysis
Sleep functions	Medical Outcomes Study (MOS) Sleep measure
Emotional functions	Hospital Anxiety Depression Scale, Beck Depression Inventory
<i>Body structures</i>	
Structures related to movement	Joint deformity by physical exam or imaging Joint damage by imaging (Kellgren-Lawrence grading scale)
<i>BF/BS/Activities/Participation</i>	
Disease severity/status	Patient global assessment
Composite	WOMAC, Harris Hip Score, KOOS, Lequesne Index, AUSCAN, Oxford Knee Scale, Oxford Hip Scale,
<i>Activities and participation</i>	
Activities	WOMAC-Function, Health Assessment Questionnaire, AIMS2-Mobility, AIMS2-walking&bending, AIMS2-hand&finger function, AIMS2-arm function, AIMS2-selfcare, AIMS2-household tasks, Cochin Hand Scale, AUSCAN-Physical, Functional Index for Hand Osteoarthritis
Participation	AIMS2-social activity, AIMS2-support, AIMS2-work, Work Limitations Questionnaire
Activities and participation	London Handicap Scale, WHODAS II
<i>Environmental factors</i>	
Immediate family	Social history
Products and technology for personal use in daily living	Functional history
Health services, systems and policies	Social history
Design, construction and building products and technology of buildings for public use	Social history
<i>QoL / Health-related QoL</i>	
QoL	SF-36, NHP, EuroQoL, WHOQOL-BREF, OAKHQOL, OAQoL
<p>WOMAC: Western Ontario and McMaster Universities Arthritis Index; AIMS2: Arthritis Impact Measurement Scales 2; NHP: Nottingham Health Profile; SF-36: Medical Outcomes Study Short Form 36; AUSCAN: Australian/Canadian Hand Osteoarthritis Index; KOOS: Knee injury and Osteoarthritis Outcome Score; WHODAS II: World Health Organization Disability Assessment Schedule II; WHOQOL-BREF: World Health Organization Quality of Life-BREF; OAKHQOL: The osteoarthritis knee and hip quality of life questionnaire; OAQoL: Osteoarthritis Quality of Life scale.</p>	

### Appendix 3B.—An overview of assessment in stroke

From the taxonomy of International Classification of Functioning, Disability, and Health (ICF) and Quality of Life.

Assessment domain	Assessment method/tool
<i>Body functions</i>	
Consciousness functions	Glasgow Coma Scale
Global cognitive functions	Mini-mental State Examination, Neurobehavioral Cognitive Status Examination
Memory functions	Rivermead Behavioral Memory Test
Attention functions	Behavioral Inattention Test, Star Cancellation Test
Visual perception functions	Motor-free Visual Perception Test
Mental functions of language	Boston Diagnostic Aphasia Examination
Emotional functions	Beck Depression Inventory, Hospital Anxiety and Depression Scale
Muscle power functions	Manual muscle test
Muscle tone functions	Modified Ashworth Scale, Tardieu Scale
Control of voluntary movement functions	Fugl-Meyer Assessment, Brunnstrom's stages of motor recovery
<i>Body structures</i>	
Structures of brain	Imaging: MRI, CT
Structure of upper extremity	Joint contractures detected by physical exam
Structure of areas of skin	Pressure ulcer grading
Structures of muscles	Muscle atrophy detected by physical exam
<i>BF/BS/Activities/Participation</i>	
Composite neurological functions	National Institutes of Health Stroke Scale, Canadian Neurological Scale
<i>Activities and participation</i>	
Activities of daily living	Barthel Index, FIM
Instrumental activities of daily living	Frenchay Activities Index, Rivermead ADL Scale
Mobility	Berg Balance Scale, Rivermead Mobility Index, Timed Up and Go Test
Dexterity	Nine Hole Peg Test
Upper limb function	Motor Activity Log, ABILHAND
Activities and participation	Modified Rankin Scale, London Handicap Scale, WHODAS II, Impact on Participation and Autonomy Questionnaire, Participation Profile, Participation Scale, Keele Assessment of Participation
<i>Environmental factors</i>	
Immediate family	Social history
Products and technology for personal use in daily living	Functional history
Design, construction and building products and technology of buildings for private use	Social history
<i>QoL / Health-related QoL</i>	
QoL	SF-36, NHP, EuroQoL, Stroke Impact Scale, Stroke Specific Quality of Life Scale, Stroke Adapted Sickness Impact Profile

MRI: magnetic resonance imaging; CT: computed tomography; FIM: Functional Independence Measure; ADL: Activities of daily living; WHODAS II: World Health Organization Disability Assessment Schedule II; SF-36: Medical Outcomes Study Short Form 36; NHP: Nottingham Health Profile.

### Appendix 3C.—Activities and participation assessment/measurement instruments

Instruments	Features	Reference
Activity and Participation Questionnaire (APQ-6)	An 11-item instrument with 6 main questions assessing educational, vocational, and social participation	Stewart <i>et al.</i> <sup>54</sup>
Activity Card Sort (ACS)	An instrument assessing a person's participation in domestic, leisure and social activities (e.g. cleaning, shopping, driving)	Baum <i>et al.</i> <sup>55</sup>
Assessment of Life Habits (LIFE-H)	A 77-item instrument with 12 domains, 6 of which covering social roles (responsibilities, interpersonal relationships, community life, education, employment, and recreation) and others covering communication, nutrition, personal care, mobility, fitness, and housing with 92.7% of items linked to the "Activities and participation" component of the ICF	Fougeyrollas <i>et al.</i> <sup>56</sup>
Australian Community Participation Questionnaire (ACPQ)	A 30-item instrument with 14 domains (contact with immediate, extended family, friends, neighbors, and workmates, learning, religion, organized community, voluntary sector, and charity activities, interest in current affairs, public expression of opinions, community activism, and political protest with 97.6% of items linked to the "Activities and participation" component of the ICF	Berry <i>et al.</i> <sup>57</sup>
Child and Adolescent Scale of Participation (CASP)	A 20-item scale assessing social participation (immediate environment, school, and community in children over the age of three and adolescents with acquired brain injury	Bedell <sup>58</sup>
Community Integration Questionnaire (CIQ)	A 15-item instrument with 3 subscales including home integration, social integration, and productive activities (school, work, or voluntary activities in those with traumatic brain injury	Willer <i>et al.</i> <sup>59</sup>
Community Living Skills Scale (CLSS)	A 57-item scale assessing functioning properties in chronically mentally ill individuals in the community	Smith <i>et al.</i> <sup>60</sup>
Community Reintegration of Service Members (CRIS)	A 28-item instrument assessing extent of, limitation and satisfaction in participation with 83.1% of items linked to the "Activities and participation" component of the ICF as well as some items relevant to environmental factors	Resnik <i>et al.</i> <sup>61</sup>
Frenchay Activities Index (FAI)	A 15-item instrument with 3 subscales (work/leisure, outdoors, and domestic activities) covering 100% of the 'activities and participation' component of the ICF	Holbrook <i>et al.</i> <sup>62</sup>
ICF Measure of Participation & Activities Screener (IMPACT-S)	A 33-item ICF-based instrument covering all 9 sections in the "Activities and participation" component of the ICF	Post <i>et al.</i> <sup>63</sup>
Impact on Participation and Autonomy Questionnaire (IPAQ)	A 41-item instrument with 5 subscales (Autonomy indoors, Autonomy outdoors, Role in the family, Relationships and social life, and Education and work) assessing perceived disability and autonomy with 94.3% of items linked to the "Activities and participation" component of the ICF along with some items relevant to environmental factors	Cardol <i>et al.</i> <sup>64</sup>
Keele Assessment of Participation (KAP)	An 11-item instrument assessing getting around, self-care, activities of daily living, education and social activities with 92% of items linked to the "Activities and participation" component of the ICF	Wilkie <i>et al.</i> <sup>65</sup>
Late Life Function and Disability Instrument (LLFDI)	A 48-item instrument covering function and disability domains with 81.9% of items linked to the "Activities and participation" component of the ICF	Haley <i>et al.</i> <sup>66</sup>
Maastricht Social Participation Profile (MSPP)	A 26-item instrument including 4 subscales (consumptive, formal, informal social participation-relevant to family and acquaintances) with 88.6% of items linked to the "Activities and participation" component of the ICF	Mars <i>et al.</i> <sup>67</sup>
Mayo-Portland Adaptability Inventory-4 (MPAI-4)	A 37-item instrument assessing ability, adjustment, and participation with only 46.9% of items linked to the "Activities and participation" component of the ICF; however, with some items relevant to environmental and personal factors	Malec <i>et al.</i> <sup>68</sup>
Measurement of a Person's Habitual Physical Activity (MPHPA)	A 22-item instrument with 3 subscales (work, sports, and leisure activities with 90.9% of items linked to the "Activities and participation" component of the ICF	Baecke <i>et al.</i> <sup>69</sup>
Nordic Mobility-related Participation Outcome Evaluation of Assistive Device Intervention (NOMO)	A 28-item instrument rating mobility in relation to dependence, assistance, frequency, difficulty, and participation with 84.4% of items linked to the "Activities and participation" component of the ICF	Brandt <i>et al.</i> <sup>70</sup>
Norwegian Function Assessment Scale (NFAS)	A 39-item instrument covering 7 domains (standing/walking, picking/holding, lifting/carrying, sitting, managing, communication/cooperation, and senses with 97.7% of items linked to the "Activities and participation" component of the ICF	Bushnik <sup>71</sup>
Participation and Environment Measure for Children and Youth (PEM-CY)	An instrument assessing participation and environmental factors in children and adolescents aged between 5 and 17 years with or without disability	Coster <i>et al.</i> <sup>72</sup>
Participation Assessment with Recombined Tools-Objective (PART-O)	A 17-item instrument comprising of 3 subscales relevant to productivity, social relationships and outdoor activities originally developed for individuals with traumatic brain injury with 89.7% of items linked to the "Activities and participation" component of the ICF	Whiteneck <i>et al.</i> <sup>73</sup>

(To be continued)

Instruments	Features	Reference
Participation Enfranchisement (PE)	A 19-item questionnaire assessing getting around, community activities considering choices, expectations, responsibilities, and values with 85.7% of items linked to the “Activities and participation” component of the ICF	Heinemann <i>et al.</i> <sup>74</sup>
Participation Measure for Post-Acute Care (PM-PAC)	A 51-item instrument including 9 domains (Mobility, Role functions, Domestic life/self-care, Interpersonal relationships, Community, Social and civic life, Major life areas, Communication, Education and work) with 91.5% of items linked to the “Activities and participation” component of the ICF	Gandek <i>et al.</i> <sup>75</sup>
Participation Objective, Participation Subjective (POPS)	A 26-item ICF-based instrument comprising of 5 subscales (domestic life, interpersonal interactions and relationships, major life areas, transportation, and community, recreational and civic life covering 100% of the “Activities and participation” component of the ICF	Brown <i>et al.</i> <sup>76</sup>
Participation Scale/P-scale	An 18-item instrument assessing social participation with 88.9% of items linked to the “Activities and participation” component of the ICF	Van Brakel <i>et al.</i> <sup>77</sup>
Participation Survey/Mobility (PARTS/M)	A 161-item instrument including 6 domains (Self-care, Mobility, Domestic life, Interpersonal interactions and relationships, Major life areas, and Community, social and civic life with 82.7% of items linked to the “Activities and participation” component of the ICF	Gray <i>et al.</i> <sup>78</sup>
Pepper Assessment Tool for Disability (PAT-D)	A 19-item instrument with 3 subscales (basic and instrumental activities of daily living, and mobility covering 100% of the “Activities and participation” component of the ICF	Rejeski <i>et al.</i> <sup>79</sup>
Perceived Impact of Problem Profile (PIP)	A 23-item instrument including 5 sub-scales (self-care, mobility, relationships, participation, and psychological well-being with 80.6% of items linked to the ‘activities and participation’ component of the ICF	Pallant <i>et al.</i> <sup>80</sup>
Psychosocial Adjustment to Illness Scale (PAIS)	A 46-item instrument with 7 domains (health care, vocational activities, domestic life, relationships- immediate and extended family, social environment, and psychological distress) developed for individuals with chronic health conditions	Derogatis <sup>81</sup>
Rating of Perceived Participation (ROPP)	A 16-item instrument covering 100% of the “Activities and participation” component of the ICF	Sandström <i>et al.</i> <sup>82</sup>
Rehabilitation Activities Profile (RAP)	A 71-item instrument comprising of 5 domains (communication, mobility, self-care, occupation, and relationships with 93.8% of items linked to the “Activities and participation” component of the ICF	Jelles <i>et al.</i> <sup>83</sup>
Social-Functional Autonomy Measurement System (Social SMAF)	A 35-item instrument assessing mental functions, communication, mobility, basic and instrumental activities of daily living, and social functioning with 80.5% of items linked to the “Activities and participation” component of the ICF	Pinsonnault <i>et al.</i> <sup>84</sup>
Social Participation Questionnaire (SPQ)	A 22-item questionnaire assessing social relationships and involvement in social activities with 90.3% of items linked to the “Activities and participation” component of the ICF	Densley <i>et al.</i> <sup>85</sup>
Socially Valued Role Classification Scale (SRCS)	A 25-item instrument comprising of 5 domains (home tasks and self-care, personal development and rehabilitation, caring for others, formal education and training, and employment with 85.7% of items linked to the “Activities and participation” component of the ICF	Harris <i>et al.</i> <sup>86</sup>
Stroke Impact Scale (SIS)	A 64-item instrument developed for patients with stroke covering 8 domains (strength, hand function, communication, memory, emotions, reasoning, activities of daily living, and participation)	Duncan <i>et al.</i> <sup>87</sup>
Sydney Psychosocial Reintegration Scale Version 2 (SPRS-2)	A 12-item instrument comprising of 3 domains (work/leisure, interpersonal relationships, and independent living skills) originally developed for traumatic brain injury with 96.2% of items linked to the “Activities and participation” component of the ICF	Tate <i>et al.</i> <sup>88</sup>
Time Organisation and Participation Scale (TOPS)	A 32-item instrument including 3 subscales (performance of daily tasks, organization of activities, and emotional responses) with 86.7% of items linked to the “Activities and participation” component of the ICF	Rosenblum <sup>89</sup>
Utrecht Scale for Evaluation of Rehabilitation-Participation (USER-Participation)	A 32-item instrument covering 100% of the “Activities and participation” component of the ICF and assessing with rating scales in terms of frequency, restrictions, and satisfaction	Post <i>et al.</i> <sup>90</sup>
WHO Disability Assessment Schedule 2.0 (WHODAS 2.0)	A wholly ICF-based instrument with 36 items in 6 domains (understanding and communicating, getting around, self-care, getting along with others, life activities, and participation in society)	Üstün <i>et al.</i> <sup>91</sup>
Recently-developed instruments		
Oxford Participation and Activities Questionnaire (Ox-PAQ)	A 23-item ICF-based instrument with 3 domains assessing routine activities, emotional well-being, and social engagement	Kelly <i>et al.</i> <sup>92</sup> Morley <i>et al.</i> <sup>93</sup>
Ghent Participation Scale (GPS)	An ICF-based instrument including 15 subjective components relevant to activities significant for the individual and 2 objective components relevant to activity limitations	Van de Velde <i>et al.</i> <sup>94</sup>

Source for content coverage percentage values in relation to the ICF: Ballert *et al.*<sup>95</sup>

## Appendix 4A.—Interventions in PRM

Medical interventions	<p>Medication aiming at restoration or improvement of body structures and/or function, <i>e.g.</i> pain therapy, inflammation therapy, regulation of muscle tone, improvement of cognition, improvement of physical functioning, improvement of bone health, treatment of depression or mood disturbances, treatment of bladder, bowel or sexual dysfunction or other sequelae or complications of disabling neurological conditions (<i>e.g.</i> heterotopic ossification, autonomic dysreflexia, orthostatic hypotension)</p> <p>Practical procedures, including injections — <i>e.g.</i> anesthetics, corticosteroid, hyaluronic acid injections-intra-articular or epidural or trigger point injections), neural therapy, regenerative injection therapies/tissue engineering approaches/biological therapies (<i>e.g.</i> dextrose prolotherapy, platelet rich plasma, autologous conditioned serum, autologous protein solution, autologous mesenchymal or other stem cells), botulinum toxin injections, ozone-oxygen therapies/injections —, nerve blocks, and other techniques of drug administration (<i>e.g.</i> iontophoresis, phonophoresis, use of intratechal pumps-baclofen pumps etc.)</p> <p>Assessment and review of interventions, including electromyography and diagnostic ultrasounds</p> <p>Prognostication</p>
PRM interventions with physical agents and therapeutic exercises	<p>Kinesiotherapy and exercise therapy</p> <p>Neurofacilitation techniques (<i>e.g.</i> neurodevelopmental Treatment/Bobath, Brunnstrom approach, Rood technique, proprioceptive neuromuscular facilitation, sensory integration therapy, Vojta therapy) and repetitive task practice (<i>e.g.</i> constraint- induced movement therapy)</p> <p>Vibration therapy as an exercise intervention (<i>e.g.</i> whole-body vibration)</p> <p>Exergaming using virtual reality systems/game consoles/video games</p> <p>Meditative movement therapies (<i>e.g.</i> qigong, yoga, and tai chi)</p> <p>Manual therapy techniques for reversible stiff joints and related soft tissue dysfunctions as well as manual traction (traction with devices is also possible)</p> <p>Maneuvers (<i>e.g.</i> specific repositioning maneuvers — Epley, Liberatory, Semont in the context of vestibular/vertigo rehabilitation; physical counter maneuvers for the management of orthostatic hypotension)</p> <p>Respiratory physical therapy — methods and techniques for respiratory pathway hygiene, inhalation therapies, breathing exercises</p> <p>Massage therapy</p> <p>Electrotherapy (<i>e.g.</i> electrostimulation techniques-TENS, FES, NMES, Spinal cord stimulation)</p> <p>Neuromodulation/noninvasive brain stimulation techniques (<i>e.g.</i> tDCS, rTMS, CES, RINCE)</p> <p>Magnetic therapies (<i>e.g.</i> PEMF for pain relief, bone and cartilage repair, wound healing; use of magnetic chairs in the context of urogynecological rehabilitation)</p> <p>Other physical therapies including ultrasound, extracorporeal shock wave therapy, heat and cold applications, short wave diathermy, tecartherapy, ozonotherapy etc.</p> <p>Phototherapy (<i>e.g.</i> UV therapy, laser including low level laser therapy [LLLT] and high-intensity laser therapy [HILT])</p> <p>Hydrotherapy and balneotherapy</p> <p>Climatotherapy</p> <p>Animal-assisted activities and animal-assisted therapy (<i>e.g.</i> hippotherapy, use of service animals)</p> <p>Lymph therapy (manual lymphatic drainage, intermittent pneumatic compression, bandaging, kinesiotaping)</p> <p>Hyperbaric oxygen therapy for pressure ulcers, digital ulcers, fracture healing and ischemic neurological conditions (stroke, TBI, Bell's palsy)</p> <p>Acupuncture and others including complementary and alternative medicine approaches (<i>e.g.</i> cupping therapy)</p>
Occupational therapy	<p>Analyzing and training of activities of daily living and occupation</p> <p>Teaching the patient to develop skills to overcome barriers to activity of daily living</p> <p>Training in the presence of impaired function and cognition</p> <p>Teaching strategies to circumvent cognitive impairments</p> <p>Driving rehabilitation interventions (<i>e.g.</i> driving simulator evaluations, in-vehicle evaluations-behind the wheel tests, retraining)</p> <p>Support of impaired body structures (<i>e.g.</i> splints)</p> <p>Ergonomic interventions to facilitate functioning</p> <p>Adjusting work &amp; home environments</p> <p>Return-to-work interventions/ work disability management interventions (person or work directed) in the context of vocational or occupational rehabilitation, <i>e.g.</i> counselling, encouraging, education, job coaching, on-the-job support, psychosocial consulting, training in coping skills, problem solving therapy, and vocational/occupational training interventions as well as communication with or between employers/managers, peers, and health professionals in addition to other interventions aiming to reduce activity limitations and participation restrictions, assistive technology, and workplace adjustments</p>

(To be continued)

Occupational therapy (continues)	Nature-assisted therapies/horticultural therapy Art/music/dance therapy Facilitating access to and use of information technology including telemonitoring and telerehabilitation interventions Smart home technologies Enhance motivation
Speech and language therapy within the framework of complex specialized PRM programs	In addition to conventional speech-language therapies, innovative approaches to speech-language pathologies (e.g. telehealth technology applications)
Dysphagia management	Improving impaired functions, using compensating interventions to facilitate swallowing, and adaptation aids (e.g. the use of specific postures, swallowing maneuvers, consistency and bolus size modifications, exercises for structures involved, thermal/tactile stimulation, NMES, feeding tubes, intraoral prosthetics)
Neuropsychological interventions	Cognitive retraining, cognitive stimulation, and computer-based interventions in the context of cognitive rehabilitation
Psychological interventions including counselling of patients and their families/caregivers	Cognitive or behavioral techniques including complementary and alternative medicine interventions (e.g. cognitive behavioral therapy, acceptance and commitment therapy, relaxation strategies, mind-body therapies [mindfulness], meditation, hypnosis, biofeedback, mirror therapy, guided imagery)
Nutritional therapy	Dietary interventions Advice and counselling on nutrition
Disability equipment, assistive technology, prosthetics, orthotics, technical supports, and aids	Assistive technology* ranging from low technology aids such as canes to high technology equipment or systems such as motorized wheelchairs or computerized systems (communication systems; e.g. telemonitoring or telerehabilitation mentioned above) and others in rehabilitation practice including robot-assisted therapies (robotic rehabilitation)
Patients, families/caregivers, professionals' education including self-management education	Educational interventions for patients including self-management education (e.g. back schools) Educational interventions for families/caregivers (e.g. family-centered interventions) Educational interventions for professionals (e.g. evidence-based medicine training, research training, CME/CPD)
PRM/rehabilitation nursing	Care, education, and assistance on safety (e.g. prevention of in-hospital falls), skin, bladder and bowel management, nutrition, sleep, and adaptation to a changed lifestyle Case managing through communication between the rehabilitation team, patient and the family Facilitating discharge/care transitions

\*Definition of assistive technology: "Any item, piece of equipment, or product, whether it is acquired commercially, modified, or customized, that is used to increase, maintain, or improve the functional capabilities of individuals with disabilities." (Assistive Technology Act. United States Congress 2004. Public Law 108-364. Available from: [www.ataporg.org/atap/atact\\_law.pdf](http://www.ataporg.org/atap/atact_law.pdf))

CBT: cognitive behavioral therapy; CES: cranial electrotherapy stimulation; CME: continuous medical education; CPD: continuous professional development; FES: functional electrical stimulation; NMES: neuromuscular electrical stimulation; RINCE: reduced impedance non-invasive cortical electrostimulation; TENS: transcutaneous electrical nerve stimulation; PEMF: pulsed electromagnetic field; tDCS: transcranial direct-current stimulation; TBI: traumatic brain injury; rTMS: repetitive transcranial magnetic stimulation; UV: ultraviolet.

There may be overlapping of the listed interventions as to the subheadings at the left-hand column (i.e. some physical treatments may relate to occupational therapy or vice versa; psychological interventions may also relate to various practice areas).

Adapted/revised/extended/expanded from the White Book on PRM in Europe,<sup>1,2</sup> as well as from later publications regarding the field of competence of PRM physicians.<sup>18</sup> The literature which serves as a proof of concept on the use of PRM interventions added to the previous list of interventions in the White Book<sup>1,2</sup> can be found in supplementary references including selected reviews/systematic reviews (and few other types of trials setting good examples on the specific intervention in case of unavailability of reviews).

### Appendix 4B.— Neuromodulation

Neuromodulation as an important PRM intervention which targets functioning properties at different levels including impairments, activity limitations and participation restrictions (from Grabljevec).<sup>98</sup>

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Neuromodulation presents any method used with non-invasive or invasive approach, aiming to influence adaptation, plasticity, structural change of central or peripheral nervous system. Variety of methods are used in different stages after neuronal injury with different goals of therapies that work on the level of body structures and functions as well as activities and participation.

Targeting specific / single part / center in the brain for treatment of movement disorders

- Deep brain stimulation (DBS)

Targeting greater areas of cortical and subcortical brain tissue, with the aim of induction of “modulation” across cortico-subcortical and cortico-cortical networks by means of transsynaptic spread, resulting in distant but specific changes in brain activity along functional networks

- Transcranial magnetic stimulation (TMS)

- Transcranial direct current stimulation (tDCS)

- Low-level laser therapy (LLLT)

Deliver drug in the intrathecal space to induce changes at the synaptic level (treatment of intractable spasticity and pain)

- Intrathecal drug delivery (IDD)

Targeting spinal cord to relieve chronic, intractable pain of the trunk and/or limbs

- Spinal cord stimulation (SCS)

Stimulation of the sacral nerves or afferent fibers of tibial nerve to modulate the neural activity that influences the behaviour of the pelvic floor, lower urinary track, urinary and anal sphincters and colon.

- Sacral neurostimulation

- Percutaneous tibial neurostimulation, intravesical neurostimulation

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### Appendix 5.—Criteria for accreditation of PRM programmes

Criteria for accreditation of PRM programmes (UEMS-PRM Section Clinical Affairs Committee (from: [www.euro-prm.org/index.php?option=com\\_content&view=article&id=33&Itemid=187&lang=en](http://www.euro-prm.org/index.php?option=com_content&view=article&id=33&Itemid=187&lang=en)))

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The following set of criteria will be displayed on the website and added to the template in order to inform both the applicant and the reviewers.

Reviewers will have to check that those items have been fulfilled.

- Providing relevant information on each item of the template

- The program must be under the responsibility of a PRM doctor

- Foundations of the program must be linked to EBM and/or official data and/or official documents

- PRM care principles must not be confused with the description of the program content

- Environment description should be brief and not redundant with other chapters

- ICF terms have to be used in expressing the goals; the goals should also be summarized in a brief text

- In the PRM organization chapter, a difference should be made between the staff of the facility and those specifically involved in the program

- Number of PRM physicians involved in the PRM program should be mentioned

- Comparison with legal national standards or other available standards should be made for staff devoted to the program and team management

- Patients records are mandatory

- Statistics about general organization are required

- References must be cited within the description of the program; they must be freely accessible on the Internet or provided to the reviewers in a “pdf” file

- A short summary in English should be provided for the documents in other languages

- Additional requirement: prior to final accreditation by the UEM PRM Section, a program of care should be submitted at a national level, at least as an oral paper in a PRM congress. (This requirement does not apply to the preliminary oral presentation in CAC workshop where the author can benefit from the questions and comments of his/her European colleagues)

- Approved References

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# White Book on Physical and Rehabilitation Medicine (PRM) in Europe. Chapter 8. The PRM specialty in the healthcare system and society

European Physical and Rehabilitation Medicine Bodies Alliance

## ABSTRACT

In the context of the White Book of Physical and Rehabilitation Medicine (PRM) in Europe, this paper deals with a global overview of the role of PRM in healthcare systems in Europe. Several documents and reports by WHO and the UN call for the worldwide strengthening of rehabilitation as a key health strategy of the 21<sup>st</sup> century. Therefore, further implementation of PRM in healthcare systems is crucial. Many aspects need to be considered when implementing PRM in a health system. Since PRM should be provided along the whole continuum of care, a specific phase model has been developed. Those phases depend on patients' functional needs as well as on temporal aspects of a health condition: it can be congenital or acquired, and the disorder can have an acute onset or a progressive or degenerative course. The following phases are described in the paper: habilitation, prehabilitation, PRM in acute settings, in post-acute and in long-term settings. Regular triage and reassessment to assign the patient to the appropriate level and setting of rehabilitation care is mandatory. Therefore, rehabilitation services should be stratified and organized in networks, in order to allow for the best possible care adapted to the individual's needs and goals, over the continuum of care. Providing correct PRM services requires good planning of service delivery, capacity building and resource allocation. The needed resources are human (with complex multi-professional teams), technical (diagnostic and therapeutic equipment, equipment for performing complementary diagnostic means, rehabilitation technology and assistive devices), and financial. Decisions on the allocation of the usually limited resources require a reasoned process and clear and fair criteria. Principles of clinical governance must be respected, and appropriate competencies are required. Disease prevention (primary, secondary and tertiary), health maintenance and support in chronic conditions as well as global health promotion are gaining growing importance in PRM. They include encouraging physical activity and promoting healthy behavior aiming at the maintenance of maximum function and avoiding complications in disabling or progressive conditions. This is discussed in the paper together with some ethical reflections on the choices PRM physicians continuously have to make during service delivery.

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**Key words:** Physical and rehabilitation medicine - Europe - Delivery of health care - Health plan implementation.

## Introduction

The White Book (WB) of Physical and Rehabilitation Medicine (PRM) in Europe is produced by the 4 European PRM Bodies and constitutes the reference book for PRM physicians in Europe. It has multiple values, including to provide a unifying framework for the European Countries, to inform decision-makers at the European and national level, to offer educational material for PRM trainees and physicians and information about PRM to the medical community, other rehabilitation professionals and the public. The WB states the importance of the PRM specialty, that is a primary medical specialty. The contents include definitions and concepts of PRM, why rehabilitation is needed by individuals

and society, the fundamentals of PRM, history of PRM specialty, structure and activities of PRM organizations in Europe, knowledge and skills of PRM physicians, the clinical field of competence of PRM, the place of PRM specialty in the healthcare system and society, education and continuous professional development of PRM physicians, specificities and challenges of science and research in PRM and challenges and perspectives for the future of PRM.

A healthcare system is the organization of people, institutions, and resources that deliver health care services to meet the health needs of target populations. According to WHO its primary intent is to promote, restore or maintain health.

The place of PRM relates to different aspects and



phases of healthcare for people with many different health conditions. This chapter gives a global overview of the role of PRM in healthcare systems in Europe, more specifically with regard to: implementation of PRM in a healthcare system, capacity building and resource allocation, clinical governance and competencies, the different phases of the PRM process and finally disease prevention, health maintenance and health promotion in PRM.

### Implementation of PRM in healthcare systems

According to WHO, rehabilitation is part of universal health coverage and should be incorporated into the package of essential services along with prevention, promotion, treatment and palliation.<sup>1</sup> Physical and Rehabilitation Medicine has to take an important role in health systems, in particular in rehabilitation, but also in prevention, treatment and support.<sup>2</sup> The World Report on Disability describes the central role of the specialty as “*improving functioning through the diagnosis and treatment of health conditions, reducing impairments, and preventing or treating complications.*”<sup>3</sup> Consequently, the WHO Global Disability Action Plan 2014-2021<sup>4</sup> defines the “number of graduates from educational institutions per 10,000 population — by level and field of education (for example, physical and rehabilitation medicine, physical therapy, occupational therapy, and prosthetics and orthotics)” as one of the success indicators for the implementation of rehabilitation services. As some rehabilitation interventions are applied by other medical specialties and health professionals, the role of PRM in health and rehabilitation systems must be considered carefully.<sup>1</sup>

Like rehabilitation in general, PRM has to take a role at all levels of the healthcare system and along the continuum of care (Table I). These rehabilitation services are categorized as following (the subgroups of services not taken into consideration), more details are described below in the paragraph on the different phases of the PRM process:

a. Acute rehabilitation services are delivered in hospitals at the secondary and tertiary levels. Acute rehabilitation services should start even during intensive care

and should be performed in multi-professional teams (including PRM physician, PT, OT, and other rehabilitation professionals) working in a collaborative way under the leadership of the PRM physician. Acute rehabilitation services may be delivered in specialized acute rehabilitation wards or by mobile acute rehabilitation teams.

b. Post-acute rehabilitation services: Post-acute rehabilitation services are being delivered immediately or shortly after discharge from acute care units. For more severe cases (substantial nursing and medical needs, important limitations in mobility and activities of daily living) post-acute rehabilitation should be done in in-patient post-acute rehabilitation units. Patients with less restrictions also can be referred to out-patient post-acute rehabilitation services. For patients with minor deficits more simple interventions may be sufficient, even at the primary healthcare level. Post-acute rehabilitation services at secondary/tertiary level should be specialized for the specific health condition (disease or trauma) and also must have a multi-professional rehabilitation team.

c. Long-term rehabilitation services: Long-term rehabilitation services aim to maintain (and improve) functioning for persons with long-term disability or disabling health conditions including congenital disability, acquired disability and chronic disease. They can be an entrance point for more specialized rehabilitation if needed. Long-term rehabilitation must be under the prescription and coordination of a PRM physician, even in primary health scenarios. There is growing evidence for the benefit of exercise and adapted physical activity in this phase (see below under the paragraph “Prevention, health maintenance and health promotion in PRM”). If no specialized rehabilitation exists, Community Based Rehabilitation (CBR) is a model to provide minimum rehabilitation services to persons in need. It should be closely connected to an inclusive Community Development Policy (CBP). Intermittent in-patient rehabilitation services can be used to induce and boost rehabilitation effects in patients with chronic health conditions, also if they are related to psychosocial stress and vocational problems.

To fulfil their tasks in the different phases of the rehabilitation trajectory PRM physicians may work in many settings such as acute, general or university hospitals, rehabilitation centers (for in-patients and/or out-patients) as well as in private practices, community health centers and others. Models of PRM delivery may vary

1 For the specific role of PRM in the prevention, treatment and rehabilitation in specific disorders or disabilities see the Book on the Field of Competence of PRM, edited by the Professional Practice Committee of the UEMS-PRM Section ([www.euro-prm.org](http://www.euro-prm.org))

TABLE I.—*Matrix of rehabilitation services.*

Healthcare level	Types of services		
	A. Acute care	B. Post-acute care	C. Long-term care
Tertiary level of healthcare	A.1: Acute rehabilitation wards A.2: Mobile acute rehabilitation teams	B.1: In-patient post-acute rehabilitation units	C.1: Intermittent in-patient rehabilitation services
Secondary level of healthcare	A.1: Acute rehabilitation wards A.2: Mobile acute rehabilitation teams	B.1: In-patient post-acute rehabilitation units B.2: Out-patient post-acute rehabilitation units B.3: Mono-professional post-acute services under supervision/leadership of a PRM Physician	C.1: Intermittent in-patient rehabilitation services
Primary level of healthcare	–	B.2: Out-patient post-acute rehabilitation units B.3: Mono-professional post-acute services under supervision/leadership of a PRM physician	C.2: Primary care rehabilitation centers C.3: Mono-professional long-term services under supervision/leadership of a PRM physician C.4: Community-based rehabilitation (CBR) services

in organizational details within different countries but the essential elements have to be availability, accessibility, acceptability and scientifically and clinically appropriate quality. In principle, all kinds of care provision should be open for PRM physicians too. Last but not least it should be mentioned that the expertise of PRM physicians can be of importance for advice in decision making for policy makers, insurance institutes and companies, city planners and many other professions and institutions in the field of health and disability as well as designing the environment.

When it comes to the actual implementation of PRM in a health system, the UN Convention on The Rights of Persons with Disabilities calls on state parties to organize, strengthen and extend comprehensive habilitation and rehabilitation services and programs, particularly in the areas of health, employment, education and social services (Art. 26).<sup>5</sup>

Strengthening health-related rehabilitation services is one of the aims of the WHO’s Global Disability Action Plan.<sup>5</sup> For this purpose, and as part of the WHO-ISPRM Collaboration Plan 2014-2017, Gutenbrunner *et al.* propose the following activities:<sup>6</sup>

- to develop a matrix and checklists to analyze existing rehabilitation services as well as to identify gaps in service provision;
- to establish a Rehabilitation Services Advisory Team (RAT) of experts with global and regional health systems understanding who can provide guidance;
- to provide advice to the requesting country by Rapid Response Projects providing support to build up rehabilitation services and educational programs for the rehabilitation workforce, as requested by the WHO.

An essential issue when strengthening health systems to respond to patients’ health and rehabilitative needs is information on functioning. Health systems should address what matters to people about their health, their “lived health” and not only the “biological health.” So functioning is the third health indicator, beyond morbidity and mortality. The ICF is the best prospect for the documentation and collection of functioning information.<sup>7</sup> Health systems can profit from using functioning information to improve interprofessional collaboration and achieve cross-cutting disease treatment outcomes.<sup>8</sup>

An example of this way of collecting data is the International Spinal Cord Injury Survey (InSCI), which is at the core of the ‘Learning Health System for Spinal Cord Injury Initiative.’<sup>9</sup>

In February 2017, WHO launched “REHABILITATION 2030: a call for action.” This is an important initiative with the objective to scale up rehabilitation services in countries around the world in light of current global trends in health (rising prevalence of noncommunicable diseases and injuries) and ageing. The extent of disability worldwide has been studied in the Global Burden of Disease Study 2013.<sup>10</sup>

To ensure that rehabilitation is available and affordable for those who need it, WHO made seven recommendations on rehabilitation in health systems:

1. rehabilitation services should be integrated into health systems;
2. rehabilitation services should be integrated into and between primary, secondary and tertiary levels of health system;
3. a multi-disciplinary rehabilitation workforce should be available (NOTE: multi-disciplinary has been

defined by the WHO, while the term multi-professional is the correct one- see glossary);

4. both community and hospital rehabilitation services should be available;

5. hospitals should include specialized rehabilitation units for inpatients with complex needs;

6. financial resources should be allocated to rehabilitation services to implement and sustain the recommendations on service delivery;

7. where health insurance exists, or is to become available, it should cover rehabilitation services.

Within the Disability and Rehabilitation department of WHO, guidelines on health-related rehabilitation are under development, which will provide recommendations to assist Member States and relevant stakeholders to make informed decisions when building or strengthening rehabilitation systems.<sup>11</sup> The research questions and subsequent recommendations of the guidelines are based on the six building blocks of the health system: leadership and governance, service delivery, workforce, information systems, access to essential medicines/assistive technologies, and financing. The Guidelines on health-related rehabilitation therefore will provide recommendations about systems-level implementation of rehabilitation as a health strategy, rather than specific rehabilitation interventions.

Service delivery is one of these six building blocks of health systems. So for the area of health-related rehabilitation, a conceptual description of rehabilitation services has been proposed.<sup>12</sup> In order to close gaps in national and/or regional rehabilitation systems and to further develop appropriate rehabilitation services, it is crucial to define uniform criteria and a widely-accepted language to describe and classify rehabilitation services. A working group of the ISPRM-WHO-Liaison Committee is developing a list of dimensions and categories to describe the organization of health-related rehabilitation services within an International Classification System for Service Organization in Health-related Rehabilitation (ICSO-R).<sup>13</sup> In a European initiative for the implementation of ICF and ICSO-R in a rehabilitation quality management system, a workshop of experts of the UEMS PRM Section and Board was held in Nottwil, Switzerland, in January 2016. During this workshop feasibility and applicability of ICSO-R to describe health-related rehabilitation was clearly demonstrated.<sup>14</sup> The use of ICSO-R leads to more precise and comparable descrip-

tion of rehabilitation services as compared to a narrative approach. Thus, it is recommended to use the ICSO-R to describe and compare existing rehabilitation services as well as model services for benchmarking, implementation of rehabilitation services into health systems, and within a clinical quality management schedule.

In most European countries PRM — as a medical specialty — and rehabilitation services are quite well developed over the continuum of care for patients with rehabilitation needs and goals. However, some gaps remain. As such, the specialty is currently absent in one European Union (EU) country (Denmark) as well as in some European countries that are not EU members.

In Russia, and now also in Ukraine a taskforce of the UEMS PRM Section is supporting the development of the PRM specialty. In Russia, an implementation pilot project has recently been set up: “Development of the System of Medical Rehabilitation in the Russian Federation (DOME).” The main goal is to demonstrate the effectiveness of the “new” model of the medical rehabilitation system compared to the traditional model in three categories of patients (with acute cerebrovascular event, acute coronary syndrome and after hip arthroplasty).

Up to now, there has been very little literature available on the implementation of rehabilitation projects in high and middle-income countries. In 2013, an Australian Agency for Clinical Innovation published a very detailed “Rehabilitation Implementation Toolkit” that can be consulted as a reference model describing six care settings in which rehabilitation services are delivered.<sup>15</sup> They state that it is fundamental to the effective and efficient delivery of Rehabilitation Services, that the patient receives “the right care in the right place at the right time” with overarching key components of the patient journey common to all care settings. As a patient enters rehabilitation and transitions between care settings there is a repeating pattern of the following stages: referral/admission, assessment/service delivery and discharge/transfer of care.

Some other important building blocks for implementation of PRM in a health system will be discussed in the next chapters (workforce, financing and clinical governance including accreditation).

Lastly, the implementation of PRM in health care systems needs to be context-specific, based on evidence informed decision making including best practices and in close collaboration with all stakeholders, including the patients or other consumers.

### Capacity building and resource allocation in PRM

Capacity building can be defined as interventions which have changed an organization's or community's ability to address health issues by creating new structures, approaches and/or values.<sup>16</sup>

It is any specific action or series of actions that improves the effectiveness of individuals, organizations, or systems — including organizational and financial stability, program service delivery, and program quality — to create positive change and perform better for improving public health results.<sup>17</sup>

In some European settings, medical and rehabilitation services for people with disabilities or disabling health conditions are still less than optimal. Articles 20, 25 and 26 of the Convention on The Rights of Persons with Disabilities<sup>4</sup> require Member States to develop initial and continuing training for professionals and staff to improve access to disability-inclusive health care, assistive devices and technologies and rehabilitation services. The objectives of the WHO Global Disability Action Plan 2014-2021 also call for Member States to strengthen and improve access to rehabilitation services, assistive technology and community-based rehabilitation (CBR). Building these capacities is of growing importance in light of the rising trends of noncommunicable diseases, ageing populations and the increasing number of people living with the consequences of injuries.<sup>18</sup> To build and plan the appropriate PRM capacity in the different European countries different types of resources are needed, such as human resources and technical resources.

Concerning the human resources there are first of all the PRM physicians, who need to be trained properly (Chapter 9). The number of PRM physicians in a country needs to be sufficient to cover the rehabilitation needs of the population but should not exceed this number in order to avoid overconsumption of rehabilitation care. Policy makers need to make evidence informed decisions based on correct data and prognoses. This obviously also applies to the other rehabilitation health professionals composing the rehabilitation teams (Chapters 3 and 7). Not all professions are yet well represented in all countries and this issue should be tackled on a European level by the European bodies. PRM physicians have an important role in the training curricula of rehabilitation health professionals such as for example physiotherapists or occupational therapists.

Technical resources comprise facilities, equipment and rehabilitation technologies, dependent on the type of health condition and specific rehabilitation goals of the patients.

The way financial resources are provided to rehabilitation services are different across the European countries (Chapter 2). In most of the European countries, PRM interventions are covered by the public insurance package, especially for acute specialist rehabilitation, often completed with an out of pocket supplement for the patient, usually largest in more chronic and long-term care. So, resource allocation towards PRM activities is mostly being decided by health policy makers. Adequate data collection as well as research on the effectiveness of rehabilitation interventions is crucial to help politicians and administrators make equitable and evidence informed budgetary decisions. Research that is likely to enhance clinical practice presupposes the existence of a critical mass of investigators working as teams in supportive environments. Unfortunately, far too little research capacity of that kind exists in rehabilitation medicine to ensure a robust future for the field. So also in the field of rehabilitation science capacity building is an important issue.<sup>19</sup>

Deciding on the macro-level how to allocate resources for rehabilitation versus other health care foci — mainly treatment and (primary) prevention — and how to allocate resources among the various areas of rehabilitation — amputation rehabilitation, stroke rehabilitation, cardiac rehabilitation, spinal injury rehabilitation, and more — requires a reasoned process. There is more than one way of determining what is fair, *e.g.* according to severity of a health problem (whereupon the more severely health-challenged a population is, the more deserving it is) *versus* according to prospects of (healthcare) success. Different values underlie such different ways of determining fairness, *e.g.* need underlies severity, implying a welfare theory of justice, whereas outcome underlies success, implying a utilitarian theory of justice (recognizing that these approaches are not mutually exclusive or exhaustive). The solution to this and other such problems of resource allocation in relation to rehabilitation may require policy making that is highly informed by formal public debate, grounding ethics in the political realm in a broad sense.<sup>20</sup>

At the meso- and micro-level selection of patients who are to be admitted to a rehabilitation service should

be made by the PRM physician. Because in many centers demand for admission exceeds the number of available beds, difficult decisions have to be made daily. PRM physicians often are forced to play the role of gatekeeper to the rehabilitation center. If patients' needs exceed available resources, then resource allocation decisions must be made. The PRM physician must attempt to strike a balance between beneficence and justice.<sup>21</sup>

### Clinical governance and competencies in PRM

Physical and Rehabilitation Medicine is a medical specialty that focuses on the successful management, from an individual's perspective, of change and loss. PRM is most distinctive when it teaches and disseminates a way of thinking that equips patients and clinicians to manage disabling situations rather than focusing on the treatment of the underlying condition.<sup>22</sup> PRM physicians are most effective and necessary in the management of more complex and disabling conditions, in such a context the PRM physician will fulfil several roles including a public health role that addresses marginalization and disempowerment from environmental or social structures and establishes rehabilitation as a key part of all medical interventions. Disabled people and people with disabling health conditions are at particular risk for poor quality healthcare.<sup>23</sup>

#### *Clinical governance*

Clinical governance is a transparent and accountable process that scrutinizes both individual and service performance in order to prevent or remedy problems before patients suffer injury or staff are disciplined. It should enhance the quality of person-centered care and demonstrate to both commissioners, managers and patients that the service meets acceptable standards.<sup>24</sup> It depends upon:

- the implementation of national and international standards and guidelines;
- the design, undertaking and dissemination of audits conducted against such standards, the implementation of recommendations and subsequent re-audit (The Audit Cycle);
- institutional visits to ensure that the needs of vulnerable people attending rehabilitation services are being met (Table II);

- the collection of nationally agreed performance data for rehabilitation services within such institutions (Table II). Larger services may seek individual accreditation by international bodies such as the Clinical Affairs Committee of the UEMS PRM Section or CARF;

- regular supported appraisal of the performance and development needs of PRM physicians (Table III);
- peer review. The performance of a PRM physician cannot be separated from the performance of a rehabilitation team. A multi-professional visit that includes a PRM physician, a nurse, a manager and therapists can assess how both a whole team or service are functioning and the PRM physicians within it;

- patient and family feedback. PRM should be a highly person-centered discipline with due weight given to capturing the lived experience of both patients and families.

PRM physicians work in relative medical isolation in some countries and have to address a broad range of complex medical conditions. Governance arrangements should ensure that senior clinicians are in regular professional contact with other PRM physicians and integrated with, and supported by, colleagues in other specialties<sup>25</sup> so that they do not need to practice beyond the limits of their expertise.

In order to achieve this, it is recommended that each service identifies a lead clinician who has particular responsibility for governance. This clinician would:

1. identify relevant guidelines and standards;
2. organize and lead regular local and regional governance meetings and promote contact with linked specialties;
3. describe governance activity to relevant bodies and report adverse incidents and complaints together with a proposed plan to address perceived difficulties;
4. promote quality improvement throughout the service. This is only feasible if there is a common management structure and budget. Services should avoid team members being employed by different agencies and having multiple line managers.

PRM depends upon the application of multiple skills in a customized and coordinated way to address complex and individual problems. As such, it depends for its success on good communication and relationships within the rehabilitation team and on the confident trust by the patient in the expertise of those given responsibility for their treatment.

TABLE II.—*Appraisal of PRM physicians.*

Relevant skills and behaviors	
1.	Communication and interpersonal skills
2.	Respect, courtesy and compassion towards staff, patients and families
3.	The effective management of PRM inpatients
4.	Effective PRM as practiced in clinic and in the community
5.	Procedural skills and prescribing
6.	Team development
7.	Service development
8.	Appropriate response and learning from complaints and adverse incidents
9.	Participation in continuing professional development, clinical governance and quality improvement
10.	Participation in multi-professional teaching and research
Relevant documentation and assessment methods	
1.	Self-appraisal and individual reflection
2.	Service reports: activity and outcomes
3.	Multi-source feedback
4.	Audit reports, anonymized clinic letters and discharge summaries
5.	Patient satisfaction
6.	Adverse incident reporting
7.	Complaints and compliments
8.	Education record
9.	Teaching record and feedback
10.	Grant applications, research output and publications
11.	Multi-professional peer review
12.	Personal Development Plan

The competencies and clinical governance structures described in this chapter should go some way to ensure that this trust is not misplaced.

### Different phases of the PRM process

The phase model of the PRM process comprises phases over the continuum of care. These different phases of the PRM process depend on the temporal aspects of a health condition: congenital or acquired, and if acquired whether it is acute or rather progressive or degenerative.

During growth, the term ‘habilitation’ is used. Habilitation refers to a process aimed at helping disabled people attain, keep or improve skills and functioning for daily living (Rehabilitation International: [www.riglobal.org/projects/habilitation-rehabilitation/](http://www.riglobal.org/projects/habilitation-rehabilitation/)).<sup>25</sup> This term comes from the high adaptability and connection of all body functions during growth, and includes: the best possible residual development of the impaired function, the acquisition of new (compensatory) skills, and avoiding interference with the normal development of functions not di-

TABLE III.—*Service reporting.*

Underlying values (Respect, Compassion, Care)	
Core behaviors (Safe, Effective, Caring, Responsive and Well-Led)	
Documentation and assessments	
1.	National standards for that particular rehabilitation service with regard to staffing, facilities and training
2.	National outcome measurement (this may require reporting to a national database) case mix wait times length of stay rehabilitation inputs rehabilitation outcomes discharge location and long-term outcome at a minimum it is suggested that all patients should have at least one agreed outcome measure assessed on admission and discharge from a program
3.	Goal negotiation and achievement At a minimum it is suggested that all patients entering into a rehabilitation program should have a set of goals established and agreed between the team and the patient/family within a defined time from admission
4.	Untoward event reporting, near misses and other adverse patient experiences
5.	Real-time patient feedback, patient satisfaction on discharge from the rehabilitation program or at clinic, reports of focus groups, compliments and complaints

rectly affected. Habilitation in children with a (congenital or early acquired) impairment or disability consists of a continuous process, with more intensive phases according to the developmental milestones. These services are often provided within Child Development Services.

When a health condition is acutely acquired the phases of PRM are traditionally divided in an acute, a post-acute and a long-term phase. More recently also “prehabilitation” has been developed as a PRM strategy. It consists of an educational program and pre-operative physical and/or psychological conditioning enhancing functional and mental capacity aimed at improving post-operative functional outcomes. Literature, mostly in the field of orthopedic or oncologic surgery, provides early evidence that prehabilitation may reduce length of stay and possibly provide postoperative physical benefits.<sup>26</sup>

### PRM in acute settings

Acute or early PRM consists of a program of specialist medical rehabilitation during an acute hospital

admission following injury or illness or in response to complex medical treatment or its complications. It can also apply to an acute event in a person with an established disability (for example a sudden Multiple Sclerosis relapse, but also a hip fracture in a stroke patient, or a severe infection in a spina bifida patient). The rehabilitation activities are under the clinical responsibility of a PRM physician, including the contribution of the multi-professional rehabilitation team as well as other relevant medical and surgical specialties, starting as from the intensive care episode. This has extensively been described by Ward, and the clinical activities have been detailed by Stam.<sup>25, 27</sup> Acute rehabilitation aims to prevent complications of immobilization (*e.g.* sarcopenia, orthostatic dysfunction, contractures, thrombosis) and of secondary conditions (*e.g.* neurogenic bladder and bowel, heterotopic ossification or spasticity) and improve functions and activities (*e.g.* mobility, coordination, activities of daily living). The emphasis of rehabilitation therapy also includes pain management, informing and educating patients and their families, educating acute care staff, prognostication and establishing a rehabilitation plan in order to provide a triage for further rehabilitation programs. So the role of the PRM physician in acute rehabilitation is to assess and monitor the health status of the patients (*e.g.* respiration, swallowing, motor functions or autonomic nervous system functions, cardio-vascular, bladder or bowel and GI functions, swallowing disorders) applying pharmaceutical and physical treatments and coordinating the multi-professional rehabilitation team.<sup>25</sup> This requires a high level of training in acute medicine and intensive care and must be done in close collaboration with other medical specialists. Team work with regular consultations and team meetings is crucial for a successful acute rehabilitation care.<sup>25, 28</sup> In many European countries such as Germany the leadership of acute rehabilitation teams by a PRM physician is mandatory due to health care regulations.<sup>29</sup>

Acute rehabilitation can be delivered in several ways which can also be combined, depending on the size and context of the hospital:

- transfer of patients to PRM beds or to a PRM unit in the acute hospital (acute rehabilitation unit or ARU);
- PRM department with mobile visiting PRM teams under the responsibility of the PRM physician (acute rehabilitation team or ART) while the patient re-

mains in the referring specialist's bed. PRM diagnostic procedures and treatment can be performed in the PRM department or at the ward, depending of the general and medical condition of the patient;

- mobile visiting PRM team under the responsibility of a PRM physician, while the patient remains in the referring specialist's bed (acute rehabilitation team or ART);

- daily visits to the acute wards by PRM physicians from a standalone PRM facility;

- acute facilities in PRM centers or rehabilitation hospitals able to treat patients with persisting acute medical treatment, to accept patients very early to start their PRM program;

- in university hospitals and larger acute hospitals, a PRM unit or department should be present to provide acute phase rehabilitation.

Acute and early acute setting PRM programs accelerate the rate of recovery of independence and result in an earlier discharge. Furthermore, they reduce complications and pain, optimize functioning, identify cognitive and emotional problems of TBI in the absence of physical impairments, and improve chances of living independently and returning to work.

There is an increasing trend for "early acute rehabilitation." Recent studies evaluating the early introduction of rehabilitation in the intensive care unit (ICU) have demonstrated improvements in physical function and quality of life, and in post-hospital readmissions, institutionalization, and mortality, as well as reductions in mechanical ventilation duration and ICU and hospital length of stay (LOS).<sup>30</sup> Cost savings or neutral cost may be attained with early rehabilitation programs in ICU. The reader is referred to Bailey *et al.*<sup>31</sup> for a selection strategy on good candidates for early rehabilitation to combat ICU-acquired comorbidities. In academic tertiary centers, acute PRM beds or units are sometimes installed close to or alongside ICU.<sup>32, 33</sup>

#### *PRM in post-acute settings*

Patients with (potential) residual disability after an acute illness or injury and/or remaining rehabilitation needs and goals will be referred for further PRM interventions after the acute phase to a post-acute PRM service. This can be an inpatient rehabilitation facility or an ambulatory facility in PRM departments.<sup>34</sup> Patients

enter a program of goal-oriented multi-professional rehabilitation under the responsibility of a PRM physician. PRM services should be planned and delivered through coordinated networks (“hub and spokes”), in order to cover the whole continuum of care, based on the triage process. The patient should be assigned to the appropriate level of rehabilitation care, based on the results of the triage assessment using a patient classification system (Figure 1). These levels depend on the complexity of the rehabilitation needs and goals as well as on the incidence/prevalence of the health condition: general or primary, specialized or secondary and highly specialized or tertiary level.<sup>35, 36</sup> After triage, a rehabilitation program will be defined, based on the assessment, and then interventions are being delivered. On a regular basis evaluation needs to be performed in order to define new targets, to be achieved either in the same service, or at another level of care if appropriate. This reiterating process is also called rehab-cycle (see chapter 7). Patients can be admitted to a post-acute care setting when: 1) medically sufficiently stable and fit to actively participate in a PRM program; 2) they can benefit from a multi-professional approach; 3) defined goals, motivation and enough learning potential are present. The PRM physician will refine the diagnosis, communicate the prognosis to patient, family and caregivers, and lead the team and service in all aspects. Post-acute settings will treat mostly patients with sudden onset conditions. However also patients with intermittent, progressive or stable conditions can benefit in phases of changing needs.

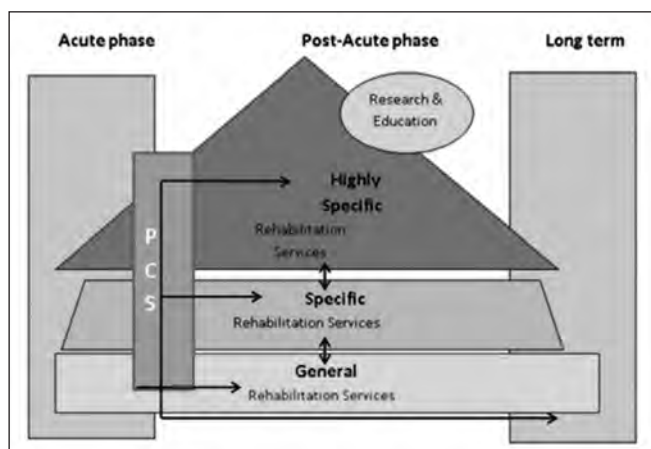


Figure 1.—Stratified rehabilitation model.<sup>93</sup> PCS: patient classification system.

In post-acute rehabilitation services, PRM physician will take care of the comprehensive rehabilitation process.<sup>34</sup> This includes continuing the treatment of the underlying health condition and/or consequences of surgery or other invasive therapies, as well as training of body functions and activities. In the post-acute phase, to plan and prepare for reintegration into society moves into the foreground more and more. This includes independent living, employment, education and other participation areas. This also means working with families, social services and employers as well as education and training of the patient.

*PRM in long-term settings*

After a period of post-acute care, whether inpatient or outpatient based, some patients may need long-term care. Long-term rehabilitation is assistance given over a long-term period of time to people who are experiencing long-term disabilities or difficulties in functioning. Long-term care may also be associated to chronic disease.<sup>37</sup> Long-term rehabilitation services can be provided in the form of intermittent inpatient care, or continuous outpatient/community/home based rehabilitation.

In long-term care, PRM can provide many important rehabilitation services. The spectrum reaches from the continuous monitoring of functioning and disability, long-term medication, prescription of therapies (e.g. physical, occupational, speech and language therapy or (neuro-psychology) provision or assistive devices. PRM physicians are also trained to give advice to patients, families and caregivers as well as to employers and other society institutions. PRM physicians should participate in CBR Programs, e.g. as advisor and/or trainer of community rehabilitation workers. PRM physicians can support general practitioners and other medical specialists by giving advice and/or coordinating rehabilitation networks. This is of particular importance in rare diseases or disabilities respectively.

In the long-term phase of PRM care special emphasis lays on maintenance and secondary prevention activities but this will be further explained in the next chapters.

The following case history gives an example of a patient throughout the different phases of the PRM process:



*Case history of a patient with limb loss*

A 55-year-old man suffers from chronic osteomyelitis and open wounds at the left calcaneus since a motor vehicle accident five years earlier. Multiple surgical and medical interventions have been performed but no healing occurred, and his quality of life is severely impaired. He had stopped working as a technician for the previous 3 years. He is referred to a PRM physician for counseling with regard to an eventual amputation. After multidisciplinary assessment, a transtibial amputation is being advised and the patient is included in a prehabilitation program comprising reconditioning, reinforcement of the right lower and both upper extremities, walking with crutches and an educational program. Two months later the amputation is being performed, followed by immediate post-operative rehabilitation without prosthesis (“acute rehabilitation”). After discharge, there is post-acute follow-up and two months later a 4 weeks’ inpatient rehabilitation program is provided after fitting of a prosthesis (“post-acute rehabilitation”). Two months later the patient can drive his car after assessment and can return to work. On a long-term base, a yearly follow-up is being organized for calibration and/or renewal of the prosthesis (“long-term phase”).

*Conclusions*

Depending on the type of health condition and functioning needs the PRM process will comprise different phases. Regular reassessment and triage with assignment of the patient to the appropriate level and setting of rehabilitation care is mandatory. Rehabilitation services should be stratified and organized in networks in order to allow for the best possible care adapted to the individual’s needs and goals, over the continuum of care.

### **Prevention, health maintenance and health promotion in PRM**

In literature the terms prevention, health maintenance and health promotion are often used interchangeably, and related activities overlap substantially (*e.g.* physical activity or healthy nutrition). Therefore, they are dealt with in one section. There is no clear consensus on the respective definitions. After a general introduction in order to distinct the different terms, the different topics will be dealt with from a PRM perspective.

Health can be seen as a continuum with neutral health in the middle, negative health (illness) at the left and positive health (wellness) at the right and relate respectively to each of the three concepts.<sup>38</sup>

Disease prevention involves actions to reduce or eliminate exposure to risks that might increase the chances that an individual or group will incur disease, disability, or premature death. Primary prevention refers to actions to avoid or remove the cause of a health problem in an individual or a population before it arises.<sup>3</sup> Secondary prevention involves actions to detect a health problem at an early stage in an individual or a population, facilitating cure, or reducing or preventing spread, or reducing or preventing its long-term effects.<sup>3</sup> Tertiary prevention aims to reduce the impact of an already established disease by restoring function and reducing disease-related complications.<sup>3</sup>

Health maintenance relates to maintaining the level of a stable health situation and maximum function for example by means of screenings, respecting a healthy lifestyle and taking care of a psychosocial and spiritual issues.<sup>39</sup>

When health stability is present, improvement of health and wellbeing can be achieved through health promotion: the development of behaviors that improve bodily functioning and enhance an individual’s ability to adapt to a changing environment. Health promotion is defined by WHO as the process of enabling people to increase control over their health and its determinants, and thereby improve their health.<sup>40</sup> So, health promotion helps individuals move upwards the health continuum.

### *Prevention, health maintenance and health promotion related to PRM*

The work of PRM physicians focuses among other issues on strategies to enable people with chronic disease and long-term or pre-existing disabilities to achieve as high a level of health and quality of life as possible through health promotion efforts and preventive and maintenance strategies. Health promotion efforts targeted at people with disabilities can have a substantial impact on improving lifestyle behaviors, increasing quality of life, and reducing medical costs.<sup>41</sup>

Maintaining or improving health can be more challenging for people with disabilities because they are at increased risk for several physical, psychological, so-

cial, and emotional problems that are referred to in the published literature as secondary conditions. These conditions appear to have a profound negative impact on the health and function of people with disabilities and, in the aggregate, have the potential to severely restrict participation in general activities.<sup>42</sup>

The prevention or management of secondary conditions, the risk factors and mediating variables associated with them or both, is an important priority.<sup>3</sup> Several cross-sectional studies reported an average of 4 to 13 secondary conditions in people with physical and cognitive disabilities.<sup>43-45</sup> Although many of these conditions (*e.g.*, pain, fatigue, weight gain, depression) also occur in people without disabilities, what makes them unique in people with disabilities and disabling health conditions is that they occur at a much higher frequency in both children and adults with disabilities. This higher frequency is one of the criteria that is used in considering a condition to be a secondary condition.<sup>46</sup>

A decision-making algorithm for the management of secondary conditions begins with the identification and management of risk factors (*i.e.*, the primary condition that predisposes an individual to the secondary condition) and continues with subsequent management (*e.g.*, through interventions) of the secondary condition.<sup>46</sup> It embraces the onset and course of secondary conditions (non-modifiable antecedents and modifiable risk factors) and identifies the outcomes associated with secondary conditions at the individual and societal levels.

Non-modifiable antecedents are sociodemographic factors, pre-existing conditions, disability related factors, and associated conditions.

Modifiable risk factors are separated into personal and environmental risk factors. Personal risk factors include behaviors such as overuse or disuse, reduced or no physical activity, poor diet, poor use of medications, poor participation in rehabilitation, and increased use of substances (*e.g.*, tobacco, alcohol, prescribed medications, and illicit drugs). Environmental risk factors include reduced or poor-quality health care, decreased access to the built environment, poor health promotion access (*e.g.*, a lack of transportation to community health promotion programs), and limited or no social support.

Additionally, addressing social and environmental barriers that hinder adults with disability from adopting more healthy lifestyles and improving health is needed.<sup>47</sup>

### *Disease prevention in PRM*

As mentioned above, disease prevention is classified as primary, secondary or tertiary.

Medical rehabilitation is traditionally considered a tertiary prevention strategy,<sup>48</sup> but PRM physicians may be involved in disease or injury prevention at all levels.

The PRM physician plays a role within primary prevention, through various stimulus in the field of PRM (*e.g.* physical therapy or exercise) that can significantly improve the regulatory mechanisms of almost all organ systems. Benefit can be achieved by delaying or preventing the incidence of number of chronic diseases, for example cardiovascular, such as hypertension or atherosclerosis, metabolic *e.g.* metabolic syndrome, or musculoskeletal *e.g.* osteoporosis. Physical activity is associated with lower risks of many cancer types.<sup>49</sup>

As proposed in the Exercise Prescription for Health initiative of the European Federation of Sports Medicine Associations (EFSMA), physical activity and exercise should be standard parts of disease prevention and medical treatment, urging healthcare providers to assess and review patients' physical activity programs at every visit. Also in the Lancet a call for scaling up physical activity interventions worldwide has been published recently promoting stepping up to larger and smarter approaches to get people moving.<sup>50</sup> In addition to morbidity and premature mortality, physical inactivity is responsible for a substantial economic burden.<sup>51</sup>

PRM also has an important role in prevention of low-back and cervical pain, circulatory and metabolic diseases and in the prevention of job-related complaints. There is a wide range of preventive measures applied by PRM physicians such as aerobic exercise programs, muscle and balance training, back school, job prevention programs and education and advice for healthy behavior.<sup>52</sup> In the elderly, PRM program also can prevent falls and independence of patients.<sup>53</sup> Concerning road traffic accidents PRM physicians can for example support the promotion of wearing a helmet when biking.

In people with disabilities, primary prevention comprises efforts toward preventing a worsening of impairments and should include appropriately tailored measures to eliminate risk factors for chronic conditions.<sup>48</sup>

Secondary prevention through physical therapeutic modalities is an example in case of regulatory disorders of blood pressure, back pain or osteoporosis. In hypertension, functional adaptation can lead to improvement

of regulatory mechanisms that can prevent or at least delay the onset of clinically manifest hypertension. The first line of treatment for hypertension are lifestyle changes, including physical exercise. In secondary prevention of back pain, a muscle strengthening and improving of movement patterns can play a significant role. In osteoporosis, it is important to prevent bone degradation by a loading dose of physical activity.<sup>54</sup> Cardiac Rehabilitation/Secondary Prevention programs are considered standard of care and provide critically important resources for optimizing the care of cardiac patients.<sup>55</sup> There is strong evidence for rehabilitation interventions favoring intensive high repetitive task-oriented and task-specific training in all phases post stroke.<sup>56</sup> Interventions in medical rehabilitation focused on the enhancement of activity, such as provision of assistive technology, can be considered as secondary prevention.<sup>48</sup>

For people with disabilities or disabling health conditions, tertiary prevention is designed to limit the restriction of a person's participation in some area by the provision of a facilitator or the removal of a barrier. Environmental modifications, provision of services, removal of physical barriers, changes in social attitudes, and reform in legislation and policy are tertiary prevention strategies.<sup>48</sup>

Tertiary prevention involves treatment once a disease becomes symptomatic to avoid complications (*e.g.*, deep venous thrombosis prophylaxis and appropriate mobilization to prevent skin breakdown in post stroke patients). Tertiary prevention incorporates ongoing interval efforts to maximize and maintain functional capacity over the life course. Thus, longer-term contact with the person with disabilities or disabling health conditions is important in order to provide rehabilitation until natural recovery is complete and to prevent the later development of avoidable complications.

Many survivors of a critical illness experience significant physical, psychological and cognitive deficits, especially in case of long "bed-rest" regimen. Emerging research supports the inclusion of physical activity and movement programs into the care routines of intensive care patients as tertiary prevention.<sup>57</sup>

### *Health management in PRM*

Maintenance and support are also part of the field of competence of PRM. This has a great importance in elderly patients, but also in chronic conditions such as

chronic pain, spinal cord injury, limb loss, brain damage and many others. Maintenance interventions are necessary to prevent the loss of the achieved functional level after a more intensive rehabilitation phase.

Maintenance interventions in PRM aim at the maintenance of maximum function and the avoidance of predictable and preventable complications in stable, chronic disabling and progressive deteriorating conditions. Therefore, when PRM physicians address the longitudinal health care needs of those with chronic disabilities, they must view disability-related health management and general health-promoting strategies as equally important components of care. In order to do this, they must enhance their frames of reference and incorporate the concepts of health promotion and secondary condition risk reduction.<sup>58</sup>

Medical rehabilitation has several features that overlap with both primary care and health promotion: all emphasize education and encouragement of self-management and responsibility, address the potential or actual impact of a given physical or cognitive/emotional condition across several dimensions of health. Finally, all address both health maintenance and disease prevention so as to enhance and protect functional capacity over the life span.<sup>58</sup>

As physicians concerned with function, PRM physicians understand the dangers of activity reduction in all settings from all causes; both medical and environmental. In fact, often PRM physicians are the only physicians who have familiarity with the maintenance of function via physical activity in collaboration with physiotherapists, motor scientists, occupational therapists, nurses, caregivers and family members. The knowledge of how to modify physical and social environments to maximize functional movement and overall function for their patients allows PRM physicians to improve and maintain function in their patients. The focus on activities of daily living (ADLs) is an effort to return functional movements to an individual who is disabled allowing him to maintain his baseline degree of physical activity required for autonomy and independent movement.<sup>46</sup> Maintenance activities include programs established by a PRM physician that consist of activities and/or mechanisms that will assist a beneficiary in maximizing or maintaining the progress he or she has made during therapy or to prevent or slow further deterioration due to a disease or illness, on the long-term.

Maintenance, as well as disease prevention and health promotion, must be individually tailored to the person's health status, functional level and personal life project.

There is extensive evidence that physical activity reduces the risk of non-communicable diseases and promotes health.<sup>59</sup>

The term "adapted physical activity" refers to physical activities adapted to the specific needs of each individual with a disability.<sup>60</sup> Adapted physical activity-based rehabilitation is based on the adaptation of different activities to fit each individual's needs in the rehabilitation setting.

Physical disability and dysfunction through physical inactivity and deconditioning leads to additional/perpetuated physical disability and dysfunction.<sup>61</sup> Health promotion and related educational efforts for those with disabilities would therefore be incomplete without the provision of a physical fitness component.<sup>58</sup> Such measures also encompass participation issues, such as return to and maintain at work or avoidance of early retirement caused by health problems. Methods used include therapeutic exercise, adapted physical activity and sports, lifestyle changes including dietary and psychological interventions and health education. Individuals with chronic disabilities who participated in an adapted physical activity-based intervention showed statistically significant increases in both physical and mental functioning across the 12 months after the intervention.<sup>62</sup>

Regular exercise, physical activity, and maintenance of a high level of cardio respiratory fitness are considered necessary elements in cardiovascular disease prevention and treatment and play an important role in reducing the risk of suffering from coronary heart disease in primary and secondary prevention.<sup>63</sup>

All over the world, a lack of physical activity causes 6% of the disease load of coronary heart disease.<sup>64</sup> After a cardiac rehabilitation program, sedentary lifestyle has a negative impact on the major risk factors.<sup>65</sup> Exercise capacity is the strongest predictor of mortality compared with the other risk factors.<sup>66</sup> Exercise maintenance is one of the factors which improve the quality of life and physical activity level.<sup>67</sup> Although the maintenance phase (phase 2) of a cardiopulmonary rehabilitation is the most important part of the program, it often receives the least attention. The benefits of a phase 2 program can be lost in as little time as a few weeks if a patient ceases to exercise. Because of this, patient education about the

importance of making exercise a part of their new health habits has to be emphasized and the patient needs to integrate exercise as a part of a healthy lifestyle.<sup>48</sup>

In many European centers, a significantly longer course of initial pulmonary rehabilitation is offered (e.g. six months), but evidence that this confers greater benefit and preservation of performance is lacking.<sup>68</sup> In pulmonary rehabilitation (PR) the continuation of physical activity beyond the supervised component of PR is also recommended, as there is evidence to suggest that maintenance programs offer advantages in preserving the benefits of pulmonary rehabilitation.<sup>69</sup>

Barriers to participation in exercise maintenance programs, which need to be overcome, are fear, lack of motivation, financial and transportation issues, environmental factors, such as social isolation and changes in physical health. Rehabilitation professionals and social supporters can make rehabilitation more long-lasting and facilitate people with chronic obstructive pulmonary disease to participate in activity by motivating and encouraging them, reducing their fears and reinforcing the benefits of activity participation.<sup>70</sup> These exercise, fitness and sports activities are rarely reimbursed which increases the threshold for people with disabilities or chronic disease who often have a limited income.

Effectively supporting stroke survivors to participate in physical activity after stroke is now a priority. Participation in moderate or high-intensity exercise, reduces the risk of secondary ischemic or hemorrhagic stroke,<sup>71, 72</sup> improves walking speed, functional mobility,<sup>73-75</sup> muscle strength, and bone density<sup>76</sup> and positively affects quality of life.<sup>77, 78</sup> Cardiorespiratory training and to a lesser extent, mixed training reduce disability during or after usual stroke care; this could be mediated by improved mobility and balance. There is sufficient evidence to incorporate cardiorespiratory and mixed training, involving walking, within post-stroke rehabilitation programs to improve the speed and tolerance of walking; some improvement in balance could also occur.<sup>79</sup> However, stroke leads to complex disability, which makes participation in physical activity difficult, intensifying cardiovascular deconditioning,<sup>80</sup> which, in turn, negatively affects well-being, disability, and functional independence<sup>81</sup> and increases the risk of secondary stroke.<sup>82</sup> Therefore, understanding how best to support survivors to participate in regular physical activity is vital for their health and well-being.

To improve physical fitness in people with spinal cord injury the following evidence-informed physical activity guidelines are recommended: for important fitness benefits, adults with a SCI should engage in (a) at least 20 min of moderate to vigorous intensity aerobic activity two times per week and (b) strength training exercises two times per week, consisting of three sets of 8-10 repetitions of each exercise for each major muscle group.<sup>83</sup>

In some European countries (*e.g.* Austria, Germany, Italy, Poland), inpatient or day-clinic rehabilitation plays an important role in the management of more chronic conditions, *e.g.* chronic musculoskeletal or neuromuscular disorders, chronic circulatory, respiratory and metabolic diseases as well as skin diseases and urological or gynecological conditions. Intermittent bursts of intensive rehabilitation may also be used to combat decline in function even several years after an acute event.<sup>84</sup>

#### *Global health promotion in PRM*

The contribution of PRM physicians to “global health promotion” must be described in reference to the conceptual perspective and objectives of the Global Disability Action Plan 2014-21.<sup>4</sup> PRM physicians can play a role in supporting the achievement of the three main objectives of the Action Plan, namely: to remove barriers to health services and programs; to strengthen and extend rehabilitation, habilitation, and other supportive technology and services; to strengthen data collection and support research on disability and related services.<sup>85</sup>

The Plan recognizes Disability as a “global public health issue,” and Rehabilitation as an effective measure to reduce the societal impact of a broad range of disabling conditions, thereby concluding that rehabilitation must be included in the concept of universal health coverage.

Social and clinical-epidemiological trends, such as the ageing of populations, the increasing prevalence of chronic conditions leading to functional limitations, the increased survival rate in many different entities, and the increasing public awareness of the value of social participation, call for an increasing role of rehabilitation in health care. Under the general umbrella of rehabilitation, PRM is the medical specialty that, with respect to many other clinical disciplines, may give a major contribution to the global promotion of health among persons with disabilities or disabling health conditions and chronic disease.

PRM physicians operate at the clinical level (aim-

ing at improving people’s ability to interact with the environment) and at the environmental level (aiming at providing an optimal milieu to put in practice such abilities).

The positive impact of the PRM specialty on global health promotion can be defined in terms of:

- increase of the overall level of health, functioning, well-being and social participation for persons with chronic disease or disability or disabling health conditions at a population level (*e.g.* at the level of a region, country or worldwide);
- reduction of burden of disease and disability at a societal level, that is mitigating the impact of disabling conditions on families, health care systems and social services;
- contribution to the recognition of the value and dignity of the differences among human beings, thereby promoting the development of an attitude of social inclusion in the community.

The International Classification of Functioning, Disability and Health (ICF)<sup>86</sup> is the widely diffused and acknowledged reference conceptual model of PRM and can serve as a reference model for global health promotion. A relevant aspect of the ICF model is the emphasis put on “component of health” rather than on “consequences of diseases,” thereby stressing the concept of a continuum in health conditions, as opposed to a dualism between health and illness. Another aspect is that ICF is explicitly aimed at operationalizing the bio-psycho-social model which is widely accepted in PRM.

The strategies by which PRM specialty can contribute to global health promotion are based on:

- the relationship with a broad range of health care professionals, not only in the field of rehabilitation, but also in other disciplines. Under this perspective, the relationship with the general practitioners and other primary care professionals seem to play a crucial role;
- the relationship and cooperation with a range of professionals and services in the areas of social protection, welfare and community services, labor, education etc.;
- the relationship and cooperation with communities, volunteer organizations, associations of persons with disability or other consumers, families etc.;
- the cooperation with many professional and non-professional organizations in fostering an interdisciplinary and multi-professional approach in the delivery of rehabilitation services.

The actions by which PRM physicians can contribute to global health promotion are:

- facilitate the access of persons with disability or disabling health conditions to health services and programs;

- educate health professionals on disability and the effects of disabling health conditions on medical issues, as well as the reverse;

- increase the awareness of institutions, professionals and community at large on the themes of disability and participation;

- promote healthy lifestyles of persons with disability. In particular, PRM is involved in actions to promote engagement in regular physical activity;

- promote the recognition of “functioning” as a relevant clinical feature in several areas of health care, including primary care and acute care settings;

- promote the widespread inclusion of functional assessment in health care systems, and the adoption of a common language for the description of functioning (*e.g.* by fostering the development of simple, intuitive evaluation tools based on the ICF taxonomy;<sup>87-89</sup>

- cooperate with primary care professionals (general practitioners and other professionals) to extend primary rehabilitation services, and provide links and connections of primary services with secondary and tertiary rehabilitation centers and facilities, thereby fostering the development of integrated networks of rehabilitation services at a local, regional and national level;

- cooperate in promoting community based rehabilitation and in connecting this area of intervention with more specialized levels of rehabilitation;

- increase the awareness and improve access and attitudes of institutions and health professionals concerning preventive health screenings (*e.g.* dental care) for people with disabilities, in particular women with regard to gynecological screenings;<sup>90</sup>

- contribute to data collection and research on disability at a population level (*e.g.* epidemiology of functional limitations) and on development and implementation of innovative models to satisfy the emerging needs of persons with disability.

### Ethics and PRM services

Rehabilitation has been proposed by WHO as the key health strategy of the 21<sup>st</sup> century.<sup>91</sup> Moreover, re-

habilitation needs are increasing due to current trends in healthcare such as ageing populations, improved knowledge and new medical technologies, growing survival rates and life expectancy, expanding chronic conditions, early start of rehabilitation and early discharge from acute care. Consequently, rehabilitation costs are growing in contrast with shrinking budgets. This implies choices, at the macro- meso- and micro-level of healthcare.<sup>92</sup> Bioethical problems (ethical problems in the context of healthcare) are linked to three main moral principles: respect for autonomy, beneficence *versus* non-maleficence and justice.<sup>20</sup> Respecting these principles can result in conflicting situations and ethical dilemmas.

Ethical issues submerging at the macro- (healthcare policy), and micro-level (level of patient interaction) have been discussed in Chapters 2 and 7. This chapter deals with choices that need to be made at the meso-level (healthcare organization: hospitals, rehabilitation services, etc.).

An important task of PRM physicians is the selection of patients or “triage” to access a rehabilitation program or service.<sup>21</sup> The objective is to have the right patient at the right level of care at the right moment with the appropriate financing. The triage should be based on the patient’s multidimensional functional status and include medical as well as non-medical factors. Therefore, a patient classification system or triage instrument is needed. This should also take into account the complexity of the patient’s rehabilitation needs and goals as well as his preferences. The incidence and prevalence of the underlying health condition is another parameter and less frequent conditions require more specific services, especially in the case of complex goals. The patient classification/evaluation system should be used as from the acute phase in order to assign the patient to a service offering the right level of rehabilitation care, throughout the continuum of care (Figure 1). However, most rehabilitation services have a limited number of in- or outpatients and difficult decisions on admission and discharge of patients must be made daily. The best choice for the patient (beneficence principle) should prevail but this choice may be in conflict with the available budget and more utilitarian considerations. The same conflict may occur when discharging a patient. In most of the European countries the number of specialized facilities for adults with severe disabilities, not able

to return home, is insufficient. This creates discharge problems and consequently admission problems (“bed-blockers”). Moreover, some patients are being discharged to inadequate facilities, such as non-specialized elderly homes. Within the limited (and currently shrinking) budgets the available financial resources must be allocated in a “just” way (principle of justice).

Another issue at the meso-level concerns the attitude of healthcare professionals towards persons with disabilities and chronic disease. This may vary depending on the vision and priority setting of the healthcare institution. For example, the accessibility of gynecological and obstetrical services to women in a wheelchair, as well as the lack of awareness and knowledge of the concerned health professionals are often a barrier to the regular medical screenings of these women with specific needs.

The inclusion of the patient and his/her family, as well as the involvement of peer counsellors in the rehabilitation team, will depend on the patient-centeredness of a particular rehabilitation service or institution in general.

The last decades the use of technology in rehabilitation has increased significantly. Robotics and bionics belong to daily practice. So the ethical question here is not anymore whether to use technology but rather “how to use technology” or “how does technique influence our life and our behavior as technique shapes our actions and experiences.”<sup>93</sup>

In conclusion, in rehabilitation practice, we are increasingly confronted with delicate ethical questions. Decisions must be taken daily on the micro- meso- as well as the macro-level of healthcare. Ethical values and cultural beliefs of professionals as well as patients influence choices in rehabilitation practice. We need to be aware of the fact that cultural differences can affect the outcome of treatment. Therefore, ethical and cultural issues should be part of rehabilitation curricula and postgraduate training, also with regard to the use of technology. Rehabilitation professionals should take time to reflect on these issues with colleagues and peer counsellors.

### References

1. Krug E, Cieza A. Strengthening health systems to provide rehabilitation services. *Eur J Phys Rehabil Med.* 2017 Apr;53(2):153-4.
2. Gutenbrunner C, Lemoine F, Yelnik A, Joseph P-A, de Korvin G, Neumann V, *et al.* The field of competence of the specialist in physical and rehabilitation medicine (PRM). *Ann Phys Rehabil Med.* 2011 Jul;54(5):298-318.
3. World Health Organization, World Bank. *World Report on Disability.* 2011.

4. World Health Organization. *Global Disability Action Plan* [Internet]. 2014. Available from: [http://apps.who.int/iris/bitstream/10665/199544/1/9789241509619\\_eng.pdf?ua=1](http://apps.who.int/iris/bitstream/10665/199544/1/9789241509619_eng.pdf?ua=1)
5. The United Nations. “Convention on the Rights of Persons with Disabilities.” Treaty Series 2515 (CRPD) [Internet]. 2006. Available from: <https://www.un.org/development/desa/disabilities/convention-on-the-rights-of-persons-with-disabilities/convention-on-the-rights-of-persons-with-disabilities-2.html>
6. Gutenbrunner C, Bickenbach J, Melvin J, Lains J, Nugraha B. Strengthening health-related rehabilitation services at national levels. *J Rehabil Med.* 2017 Apr 6;
7. Stucki G, Bickenbach J, Melvin J. Strengthening Rehabilitation in Health Systems Worldwide by Integrating Information on Functioning in National Health Information Systems. *Am J Phys Med Rehabil.* 2016 Dec 15;
8. Hopfe M, Prodinge B, Bickenbach JE, Stucki G. Optimizing health system response to patient’s needs: an argument for the importance of functioning information. *Disabil Rehabil.* 2017 Jun 6;1-6.
9. Bickenbach J. The International SCI Survey and the Learning Health System for SCI. *Am J PMR.*
10. Global Burden of Disease Study 2013 Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet Lond Engl.* 2015 Aug 22;386(9995):743-800.
11. WHO. *Rehabilitation Guidelines* [Internet]. Available from: [http://www.who.int/disabilities/rehabilitation\\_guidelines/en/](http://www.who.int/disabilities/rehabilitation_guidelines/en/)
12. Meyer T, Gutenbrunner C, Kiekens C, Skempes D, Melvin JL, Schelder K, *et al.* ISPRM discussion paper: Proposing a conceptual description of health-related rehabilitation services. *J Rehabil Med.* 2014 Jan;46(1):1-6.
13. Gutenbrunner C, Bickenbach J, Kiekens C, Meyer T, Skempes D, Nugraha B, *et al.* ISPRM discussion paper: proposing dimensions for an International Classification System for Service Organization in Health-related Rehabilitation. *J Rehabil Med.* 2015 Oct 5;47(9):809-15.
14. Kiekens C, Meyer T, Gimigliano F, Baffone C, Gutenbrunner CM, UEMS PRM ICF Workshop moderators and rapporteurs. European initiative for the application of the International Classification of Service Organization in Health-related Rehabilitation (ICSO-R). *Eur J Phys Rehabil Med.* 2017;53(2):308-18.
15. Agency for Clinical Innovation. *ACI Rehabilitation Implementation Toolkit* [Internet]. 2013. Available from: [http://www.aci.health.nsw.gov.au/\\_data/assets/pdf\\_file/0008/190871/ACI-Rehabilitation-Implementation-Toolkit.pdf](http://www.aci.health.nsw.gov.au/_data/assets/pdf_file/0008/190871/ACI-Rehabilitation-Implementation-Toolkit.pdf)
16. Crisp B, Swerissen H, Duckett S. Four approaches to capacity building in health: consequences for measurement and accountability. *Health Promot Int.* 2000;99-107.
17. MSH. *Capacity Building* [Internet]. Available from: <https://www.msh.org/our-work/practice/capacity-building>
18. WHO. *Capacity Building* [Internet]. Available from: [http://www.who.int/disabilities/capacity\\_building/en/](http://www.who.int/disabilities/capacity_building/en/)
19. Frontera WR, Fuhrer MJ, Jette AM, Chan L, Cooper RA, Duncan PW, *et al.* Rehabilitation medicine summit: building research capacity executive summary. *J Neuroengineering Rehabil.* 2006 Jan 3;3:1.
20. Rudnick A. *Ethics in Rehabilitation* [Internet]. International Encyclopedia of Rehabilitation. JH Stone, M Blouin; Available from: <http://cirrie.buffalo.edu/encyclopedia/en/article/16/>
21. Blackmer J. Ethical issues in rehabilitation medicine. *Scand J Rehabil Med.* 2000 Jun;32(2):51-5.
22. Wade D. Rehabilitation - a new approach. Part four: a new paradigm, and its implications. *Clin Rehabil.* 2016 Feb;30(2):109-18.
23. Royal College Physicians. *Medical Rehabilitation 2011 and beyond. Report of a Working Party.* 2010.
24. British Society of Rehabilitation Medicine and Royal College of Physicians. *Clinical Governance in Rehabilitation Medicine* [Internet]. Available from: [www.rcplondon.ac.uk/guidelines-policy](http://www.rcplondon.ac.uk/guidelines-policy)
25. Ward AB, Gutenbrunner C, Damjan H, Giustini A, Delarque A. European Union of Medical Specialists (UEMS) section of Physical & Rehabilitation Medicine: a position paper on physical and rehabilitation

- medicine in acute settings. *J Rehabil Med.* 2010 May;42(5):417-24.
26. Santa Mina D, Clarke H, Ritvo P, Leung YW, Matthew AG, Katz J, *et al.* Effect of total-body prehabilitation on postoperative outcomes: a systematic review and meta-analysis. *Physiotherapy.* 2014 Sep;100(3):196-207.
  27. Henk J, Stam H.M, Buyruk J.L, Melvin and G. Stucki. *Acute Medical Rehabilitation.* 2012 Rotterdam, Erasmus MC. 2012. 289-98 p.
  28. Neumann V, Gutenbrunner C, Fialka-Moser V, Christodoulou N, Varela E, Giustini A, *et al.* Interdisciplinary team working in physical and rehabilitation medicine. *J Rehabil Med.* 2010 Jan;42(1):4-8.
  29. Beyer J, Berliner M, Glaesener JJ, Liebl ME, Reiners A, Reißhauer A, *et al.* Positionspapier zur fachübergreifenden Frührehabilitation - 2. aktualisierte Auflage. *Phys Med Rehabil Kuror.* 2015;260-80.
  30. Lord RK, Mayhew CR, Korupolu R, Manthey EC, Friedman MA, Palmer JB, *et al.* ICU early physical rehabilitation programs: financial modeling of cost savings. *Crit Care Med.* 2013 Mar;41(3):717-24.
  31. Bailey P, Thomsen GE, Spuhler VJ, Blair R, Jewkes J, Bezdjian L, *et al.* Early activity is feasible and safe in respiratory failure patients. *Crit Care Med.* 2007 Jan;35(1):139-45.
  32. Adler J, Malone D. Early mobilization in the intensive care unit: a systematic review. *Cardiopulm Phys Ther J.* 2012 Mar;23(1):5-13.
  33. Peiris CL, Taylor NF, Shields N. Extra physical therapy reduces patient length of stay and improves functional outcomes and quality of life in people with acute or subacute conditions: a systematic review. *Arch Phys Med Rehabil.* 2011 Sep;92(9):1490-500.
  34. Ward A, Gutenbrunner C, Giustini A, Delarque A, Fialka-Moser V, Kiekens C, *et al.* A position paper on Physical & Rehabilitation Medicine programmes in post-acute settings. Union of European Medical Specialists Section of Physical & Rehabilitation Medicine (in conjunction with the European Society of Physical & Rehabilitation Medicine). *J Rehabil Med.* 2012 Apr;44(4):289-98.
  35. Kiekens C, Van Rie K, Leys M, Cleemput I, Smet M, Kesteloot K, *et al.* Organisation and financing of musculoskeletal and neurological rehabilitation in Belgium. KCE study 2005-18 Health Services Research (HSR). [Internet]. Available from: <https://kce.fgov.be/publication/report/organisation-and-financing-of-musculoskeletal-and-neurological-rehabilitation-in>.
  36. Italian Health Ministry. Rehabilitation Plan: an Italian Act. *Eur J Phys Rehabil Med* 2012;47:621-38.
  37. Takáč P, Petrovičová J, Delarque A, Stibrant Sunnerhagen K, Neumann V, Vetra A, *et al.* Position paper on PRM and persons with long term disabilities. *Eur J Phys Rehabil Med.* 2014 Aug;50(4):453-64.
  38. Brubaker BH. Health promotion: a linguistic analysis. *ANS Adv Nurs Sci.* 1983 Apr;5(3):1-14.
  39. AHRQ. Health maintenance in the long term care setting. [Internet]. Available from: <https://www.guideline.gov/summaries/summary/45523>
  40. World Health Organization. Milestones in Health Promotion. Statements from Global Conferences. 2009.
  41. Rimmer JH, Rowland JL. Health promotion for people with disabilities: implications for empowering the person and promoting disability-friendly environments. *Journal of Lifestyle Medicine.* :409-20.
  42. Lollar D, Crews JE. Prevention. Albrecht GA *Encyclopedia of Disability.* 2005. 1288-1293 p.
  43. Campbell ML, Sheets D, Strong PS. Secondary health conditions among middle-aged individuals with chronic physical disabilities: implications for unmet needs for services. *Assist Technol Off J RESNA.* 1999;11(2):105-22.
  44. Kinne S, Patrick DL, Doyle DL. Prevalence of secondary conditions among people with disabilities. *Am J Public Health.* 2004 Mar;94(3):443-5.
  45. Santiago M, Coyle C. Leisure-time physical activity and secondary conditions in women with physical disabilities. *Disabil Rehabil.* 2004 Apr 22;26(8):485-94.
  46. Rimmer JH, Chen M-D, Hsieh K. A conceptual model for identifying, preventing, and managing secondary conditions in people with disabilities. *Phys Ther.* 2011 Dec;91(12):1728-39.
  47. Froehlich-Grobe K, Jones D, Businelle MS, Kendzor DE, Balasubramanian BA. Impact of disability and chronic conditions on health. *Disabil Health J.* 2016 Oct;9(4):600-8.
  48. Cifu, David X. *Braddom's physical medicine & rehabilitation.* Fifth edition. Philadelphia, PA: Elsevier, 2016; 1232 p.
  49. Moore SC, Lee I-M, Weiderpass E, Campbell PT, Sampson JN, Kitahara CM, *et al.* Association of Leisure-Time Physical Activity With Risk of 26 Types of Cancer in 1.44 Million Adults. *JAMA Intern Med.* 2016 Jun 1;176(6):816-25.
  50. Reis RS, Salvo D, Ogilvie D, Lambert EV, Goenka S, Brownson RC, *et al.* Scaling up physical activity interventions worldwide: stepping up to larger and smarter approaches to get people moving. *Lancet Lond Engl.* 2016 Sep 24;388(10051):1337-48.
  51. Ding D, Lawson KD, Kolbe-Alexander TL, Finkelstein EA, Katzmarzyk PT, van Mechelen W, *et al.* The economic burden of physical inactivity: a global analysis of major non-communicable diseases. *Lancet Lond Engl.* 2016 Sep 24;388(10051):1311-24.
  52. Moser N-T, Fischer K, Korsukéwitz C. Prevention as a pension insurance task: innovative models complementing proven concepts. *Rehabil.* 2010 Apr;49(2):80-6.
  53. Wald A, Rössy W, Frauendorf H. Prevention of falls among the elderly - therapy of gait disturbance. *Phys Med Rehab Kuror.* 2002;41-4.
  54. Chahal J, Lee R, Luo J. Loading dose of physical activity is related to muscle strength and bone density in middle-aged women. *Bone.* 2014 Oct;67:41-5.
  55. Savage PD, Sanderson BK, Brown TM, Berra K, Ades PA. Clinical research in cardiac rehabilitation and secondary prevention: looking back and moving forward. *J Cardiopulm Rehabil Prev.* 2011 Dec;31(6):333-41.
  56. Veerbeek JM, van Wegen E, van Peppen R, van der Wees PJ, Hendriks E, Rietberg M, *et al.* What is the evidence for physical therapy poststroke? A systematic review and meta-analysis. *PloS One.* 2014;9(2):e87987.
  57. Berry A, Beattie K, Bennett J. *Physical Activity and Movement : A Guideline for Critically Ill Adults.* 2014.
  58. Frontera W. *DeLisa's Physical Medicine and Rehabilitation.* Lippincott Williams & Wilkins; 2010. Frontera W.; 1594 p.
  59. Powell KE, Paluch AE, Blair SN. Physical activity for health: What kind? How much? How intense? On top of what? *Annu Rev Public Health.* 2011;32:349-65.
  60. Hutzler Y, Sherrill C. Defining adapted physical activity: international perspectives. *Adapt Phys Act Q APAQ.* 2007 Jan;24(1):1-20.
  61. Fioni SF. *Cycle of Disability: National Handicapped Sports-Adapted Fitness Instructor Handbook.* Rockville.
  62. Preede L, Saebu M, Perrin PB, Nyquist A, Dalen H, Bautz-Holter E, *et al.* One-year trajectories of mental and physical functioning during and after rehabilitation among individuals with disabilities. *Health Qual Life Outcomes.* 2015 Aug 28;13:135.
  63. Archer E, Blair SN. Physical activity and the prevention of cardiovascular disease: from evolution to epidemiology. *Prog Cardiovasc Dis.* 2011 Jun;53(6):387-96.
  64. Lee I-M, Shiroma EJ, Lobelo F, Puska P, Blair SN, Katzmarzyk PT, *et al.* Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. *Lancet Lond Engl.* 2012 Jul 21;380(9838):219-29.
  65. Freyssin C, Blanc P, Verkindt C, Maunier S, Prieur F. Effect of long-term physical activity practice after cardiac rehabilitation on some risk factors. *Int J Rehabil Res Int Z Rehabil Rev Int Rech Readaptation.* 2011 Dec;34(4):357-9.
  66. Myers J, Prakash M, Froelicher V, Do D, Partington S, Atwood JE. Exercise capacity and mortality among men referred for exercise testing. *N Engl J Med.* 2002 Mar 14;346(11):793-801.
  67. Izawa KP, Yamada S, Oka K, Watanabe S, Omiya K, Iijima S, *et al.* Long-term exercise maintenance, physical activity, and health-related quality of life after cardiac rehabilitation. *Am J Phys Med Rehabil.* 2004 Dec;83(12):884-92.
  68. Scott A, Gidlow C. *Clinical Exercise Science.* Routledge. 2016. 336 p.
  69. British Thoracic Society. *Quality Standards for Pulmonary Rehabilitation in Adults* [Internet]. Vol. 6. 2014. 29 p. Available from: <https://www.brit-thoracic.org.uk/document-library/clinical-information/>



- pulmonary-rehabilitation/bts-quality-standards-for-pulmonary-rehabilitation-in-adults/
70. Meshe OF, Claydon LS, Bungay H, Andrew S. The relationship between physical activity and health status in patients with chronic obstructive pulmonary disease following pulmonary rehabilitation. *Disabil Rehabil.* 2017 Apr;39(8):746-56.
  71. Furie KL, Kasner SE, Adams RJ, Albers GW, Bush RL, Fagan SC, *et al.* Guidelines for the prevention of stroke in patients with stroke or transient ischemic attack: a guideline for healthcare professionals from the american heart association/american stroke association. *Stroke.* 2011 Jan;42(1):227-76.
  72. Lee CD, Folsom AR, Blair SN. Physical activity and stroke risk: a meta-analysis. *Stroke.* 2003 Oct;34(10):2475-81.
  73. van de Port IGL, Kwakkel G, Bruin M, Lindeman E. Determinants of depression in chronic stroke: a prospective cohort study. *Disabil Rehabil.* 2007 Mar 15;29(5):353-8.
  74. English C, Hillier SL. Circuit class therapy for improving mobility after stroke. *Cochrane Database Syst Rev.* 2010 Jul 7;(7):CD007513.
  75. Brazzelli M, Saunders DH, Greig CA, Mead GE. Physical fitness training for stroke patients. *Cochrane Database Syst Rev.* 2011 Nov 9;(11):CD003316.
  76. Pang MYC, Ashe MC, Eng JJ, McKay HA, Dawson AS. A 19-week exercise program for people with chronic stroke enhances bone geometry at the tibia: a peripheral quantitative computed tomography study. *Osteoporos Int J Establ Result Coop Eur Found Osteoporos Natl Osteoporos Found USA.* 2006;17(11):1615-25.
  77. Carin-Levy G, Kendall M, Young A, Mead G. The psychosocial effects of exercise and relaxation classes for persons surviving a stroke. *Can J Occup Ther Rev Can Ergother.* 2009 Apr;76(2):73-80.
  78. Chen M-D, Rimmer JH. Effects of exercise on quality of life in stroke survivors: a meta-analysis. *Stroke.* 2011 Mar;42(3):832-7.
  79. Saunders DH, Sanderson M, Hayes S, Kilrane M, Greig CA, Brazzelli M, *et al.* Physical fitness training for stroke patients. *Cochrane Database Syst Rev.* 2016 Mar 24;3:CD003316.
  80. Ivey FM, Hafer-Macko CE, Macko RF. Exercise rehabilitation after stroke. *NeuroRx J Am Soc Exp Neurother.* 2006 Oct;3(4):439-50.
  81. Sveen U, Thommessen B, Bautz-Holter E, Wyller TB, Laake K. Well-being and instrumental activities of daily living after stroke. *Clin Rehabil.* 2004 May;18(3):267-74.
  82. Lennon O, Carey A, Gaffney N, Stephenson J, Blake C. A pilot randomized controlled trial to evaluate the benefit of the cardiac rehabilitation paradigm for the non-acute ischaemic stroke population. *Clin Rehabil.* 2008 Feb;22(2):125-33.
  83. Ginis KAM, Hicks AL, Latimer AE, Warburton DER, Bourne C, Ditor DS, *et al.* The development of evidence-informed physical activity guidelines for adults with spinal cord injury. *Spinal Cord.* 2011 Nov;49(11):1088-96.
  84. British Society of Rehabilitation Medicine. Working Party Report on Traumatic Brain Injury. 1998 London;
  85. Gutenbrunner C, Negrini S, Kiekens C, Zampolini M, Nugraha B. The Global Disability Action Plan 2014-2021 of the World Health Organization (WHO): a major step towards better health for all people with disabilities. Chance and challenge for Physical and Rehabilitation Medicine (PRM). *Eur J Phys Rehabil Med.* 2015 Feb;51(1):1-4.
  86. WHO. International Classification of Functioning, Disability and Health. Geneva: World Health Organization, 2001 [Internet]. 2001. Available from: <http://www.who.int/classifications/icf/en/>
  87. Li J, Proding B, Reinhardt JD, Stucki G. Towards the system-wide implementation of the International Classification of Functioning, Disability and Health in routine practice: Lessons from a pilot study in China. *J Rehabil Med.* 2016 Jun 13;48(6):502-7.
  88. Selb M, Gimigliano F, Proding B, Stucki G, Pestelli G, Iocco M, *et al.* Toward an International Classification of Functioning, Disability and Health clinical data collection tool: the Italian experience of developing simple, intuitive descriptions of the Rehabilitation Set categories. *Eur J Phys Rehabil Med.* 2017 Apr;53(2):290-8.
  89. Proding B, Scheel-Sailer A, Escorpiso R, Stucki G. UEMS PRM Workshop report: toward the development of clinical assessment schedules for specified rehabilitation services. *Eur J Phys Rehabil Med.* 2016;
  90. Schopp LH, Sanford TC, Hagglund KJ, Gay JW, Coatney MA. Removing service barriers for women with physical disabilities: promoting accessibility in the gynecologic care setting. *J Midwifery Womens Health.* 2002 Apr;47(2):74-9.
  91. Stucki G. Olle Höök Lectureship 2015: The World Health Organization's paradigm shift and implementation of the International Classification of Functioning, Disability and Health in rehabilitation. *J Rehabil Med.* 2016 Jun 13;48(6):486-93.
  92. Kiekens C, DE Tavernier J. Ethical choices in rehabilitation. *Eur J Phys Rehabil Med.* 2016 Aug;52(4):419-21.
  93. Peter Paul Verbeek. *Moralizing Technology. Understanding and designing the morality of things.* The University of Chicago Press Books. 2011.

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# White Book on Physical and Rehabilitation Medicine (PRM) in Europe. Chapter 9. Education and continuous professional development: shaping the future of PRM

European Physical and Rehabilitation Medicine Bodies Alliance

## ABSTRACT

In the context of the White Book of Physical and Rehabilitation Medicine (PRM), this paper deals with the education of PRM physicians in Europe. To acquire the wide field of competence needed, specialists in Physical and Rehabilitation Medicine have to undergo a well organised and appropriately structured training of adequate duration. In fact they are required to develop not only medical knowledge, but also competence in patient care, specific procedural skills, and attitudes towards interpersonal relationship and communication, profound understanding of the main principles of medical ethics and public health, ability to apply policies of care and prevention for disabled people, capacity to master strategies for reintegration of disabled people into society, apply principles of quality assurance and promote a practice-based continuous professional development. This paper provides updated detailed information about the education and training of specialists, delivers recommendations concerning the standards required at a European level, in agreement with the UEMS rules of creating a Common Training Framework, that consists of a common set of knowledge, skills and competencies for postgraduate training. The role of the European PRM Board is highlighted as a body aimed at ensuring the highest standards of medical training and health care across Europe and the harmonization of PRM physicians' qualifications. To this scope, the theoretical knowledge necessary for the practice of PRM specialty and the core competencies (training outcomes) to be achieved at the end of training have been established and the postgraduate PRM core curriculum has been added. Undergraduate training of medical students is also focused, being considered a mandatory element for the growth of both PRM specialty and the medical community as a whole, mainly in front of the future challenges of the ageing population and the increase of disability in our continent. Finally, the problems of continuing professional development and medical education are faced in a PRM European perspective, and the role of the European Accreditation Council of Continuous Medical Education (EACCME) of UEMS is outlined.

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**Key words:** Physical and Rehabilitation Medicine - Europe - Education, medical - Curriculum - Training.

## Introduction

The White Book (WB) of Physical and Rehabilitation Medicine (PRM) in Europe is produced by the 4 European PRM Bodies and constitutes the reference book for PRM physicians in Europe. It has multiple values, including to provide a unifying framework for the European Countries, to inform decision-makers at the European and national level, to offer educational material for PRM trainees and physicians and information about PRM to the medical community, other rehabilitation professionals and the public. The WB states the importance of PRM specialty, that is a primary medical specialty. The contents include definitions and concepts of PRM, why rehabilitation is needed by individuals and society, the fundamentals of PRM, history of PRM

specialty, structure and activities of PRM organizations in Europe, knowledge and skills of PRM physicians, the clinical field of competence of PRM, the place of PRM specialty in the healthcare system and society, education and continuous professional development of PRM physicians, specificities and challenges of science and research in PRM and challenges and perspectives for the future of PRM.

This chapter deals with the education of PRM physicians in Europe. Detailed information is provided about the education and training of medical specialists, discussing the standards required at a European level – even if these are not (yet) the actual reality in all European countries. Undergraduate training of medical students is focused, being considered a mandatory element for the

growth of both PRM specialty and the medical community as a whole, mainly in front of the future challenges of the ageing population and the increase of disability in our continent. The problems of continuing professional development and medical education are faced in a PRM European perspective. Finally, the principles and the contents of the European curriculum are detailed.

### Education and training

PRM practice is uniquely characterized by a team-based, patient-centered, goal-directed approach aimed to optimize patient function and quality of life, prevent complications and increase community participation. Therefore, PRM physicians are required to develop not only medical knowledge, competence in patient care and specific procedural skills, but also attitudes

towards interpersonal relationship and communication, profound understanding of the main principles of medical ethics and public health, ability to apply policies of care and prevention for disabled people and people with disabling conditions, capacity to master strategies for reintegration of disabled people and people with disabling conditions into society, apply principles of quality assurance and promote a practice-based continuous professional development.

As leaders of the multi-professional rehabilitation teams involved in the continuum of care delivery from hospital to the community, they must also exhibit managerial competences, know and apply the principles of evidence-based medicine, incorporate considerations of cost awareness and risk-benefit analysis in patient and/or population-based care as appropriate.

PRM is an independent medical specialty in all Euro-

TABLE I.—Name of the PRM Specialty in UEMS Member States.

Country	Name of specialty	Duration	Country	Name of specialty	Duration
Austria	Physikalische Medizin und allgemeine Rehabilitation	5y3mo	Italy	Medicina Fisica e Riabilitativa	4y
Belgium	Fysische Geneeskunde en Revalidatie Médecine Physique et de Réadaptation	5y+1y specialized	Latvia	Fizikālā un rehabilitācijas medicīna	4y
Bosnia and Herzegovina	Fizikalna medicina i rehabilitacija	4y	Lithuania	Fizine medicina ir reabilitacija	4y
Bulgaria	Физикална и рехабилитационна медицина (Fizikalna i rehabilitacionna medicina)	4y	Luxembourg	Médecine Physique et de Réadaptation	Abroad
Croatia	Fizikalna medicina i rehabilitacija	4y 4mo	Malta	Rehabilitation Medicine	4y2mo
Cyprus	Φυσική Ιατρική και Αποκατάσταση (Fisiki Iatriki & Apokatastasi)	Abroad	The Netherlands	Revalidatie Geneeskunde	4y change to 3y7mo
Czech Republic	Rehabilitační a fyzikální medicina	2y +3y	Norway	Fysikalsk medisin og rehabilitering	1y +4y
Denmark	Fysiurgi	-	Poland	Rehabilitacja Medyczna	5y
Estonia	Taastusravi ja füsiaatria	3y	Portugal	Medicina Fisica e de Reabilitação	5y
Finland	Fysiatria	5y	Romania	Medicină Fizică și Reabilitare	4y
France	Médecine Physique et de Réadaptation	4y	Russia	-	-
Germany	Physikalische und Rehabilitative Medizin	1y Int Med/Neurology 1y Orthopedics +3y PRM	Serbia	Fizikalna Medicina I Rehabilitacija	4y
Greece	Φυσική Ιατρική και Αποκατάσταση (Fisiki Iatriki & Apokatastasi)	5y	Slovak Republic	Fyziatria, balneológia & liečebná rehabilitácia	4y
Hungary	Rehabilitációs Medicina	5y	Slovenia	Fizikalna in rehabilitacijska medicina	2y3mo +2y9mo
Iceland	Endurhæfingarlækningar	-	Spain	Medicina Fisica y Rehabilitación	4y
Ireland	Rehabilitation Medicine	4y	Sweden	Rehabiliterings Medisin	5y
			Switzerland	Médecine Physique et de Réadaptation Physikalische Medizin und Rehabilitation	5y
			Turkey	Medicina Fisica e Riabilitativa Fiziksel Tip ve Rehabilitasyon	4y (can be extended to 4.5y)
			Ukraine	Фізична та реабілітаційна медицина	4y
			United Kingdom	Rehabilitation Medicine	4y

pean countries, except Denmark. The recognition of the specialty is under way in Russia, thanks to an action of the UEMS PRM Section and Board, whose delegates have organized several educational activities, in strict collaboration with local physicians, claiming for the establishment of PRM as a full and independent medical specialty.

#### *Standards in education and training of PRM physicians*

According to the UEMS rules, the establishment of a common set of knowledge, skills and competencies for postgraduate training allows to create a Common Training Framework, enabling specialists in that discipline to move from one country to another. In line with the aims of the UEMS, the European PRM Board aims to promote patient safety and quality of care through the development of the highest standards of medical training and health care across Europe and the harmonization of PRM physicians' qualifications. In doing so, the European PRM Board does not aim to supersede the National Authorities' competence in defining the content of postgraduate training in their own State but rather to complement these and ensure that high quality training is provided across Europe.

#### *Training duration*

To acquire the wide field of competence needed, specialists in Physical and Rehabilitation Medicine (PRM physicians) have to undergo a well organized and appropriately structured training of adequate duration. Their basic medical training must give them certain competencies, which are enhanced by knowledge and experience acquired during their common trunk training in internal medicine, orthopedics, neurology, etc. Due to different national traditions and laws, the name and focus for the PRM specialty varies, as well as the duration of the training (Table I). Although the mean duration of all specialties training in Europe has increased in the period 1989-2013 (Figure 1),<sup>1</sup> there is a trend, at the moment, in a few European countries, towards decreasing the duration of the medical specialty training for economic and societal accountability reasons.<sup>2</sup> The PRM educational program in Europe is usually configured in 48-month format, rising up to 72 months in some countries, including a minimum 36 months of clinical training (of which 24 months spent in a PRM department).

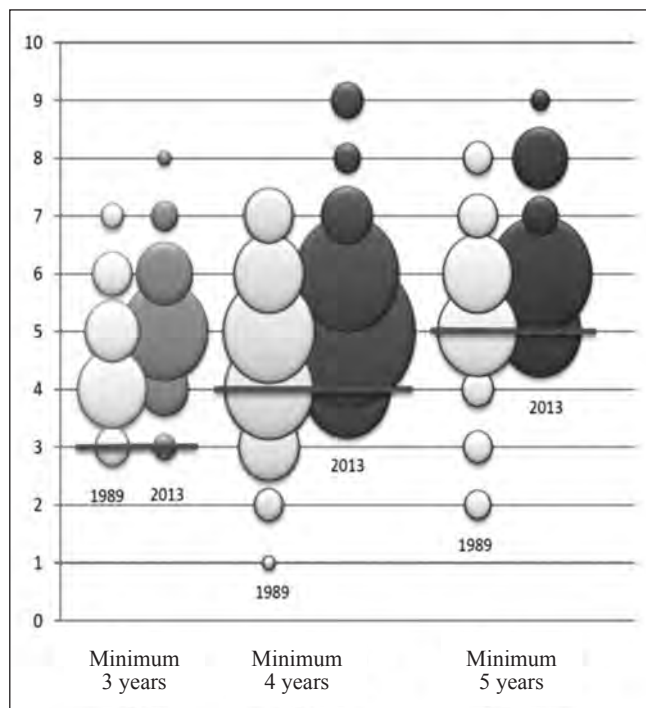


Figure 1.—Distribution of specialties with legal course lasting at least 3, 4 or 5 years, respectively, across different European countries: results from two different surveys conducted in 1989 and 2013.<sup>1</sup>

However, considering the tremendous increase in life expectancy all over Europe, and the consequent increase in age-related disabling illnesses with acute onset and chronic course, the frequency and complexity of comorbidities in rehabilitation wards have markedly increased. Patients are admitted to wards much earlier after the onset of acute illness or injury and the complexity of the disabilities is also rising. For this reason, the PRM Board advocates a duration of training of 60 months including 12 month rotations in external departments (like internal medicine, neurology, intensive care and others). Moreover, in order to provide patients with optimal care, PRM trainees are expected to develop decision-making abilities, based on finding, understanding and using the best available evidence. On such premise, it is recommended that PRM trainees are offered at least six months training in research methods, as a mandatory component of their postgraduate education. Rehabilitation is a complex activity and affected by multiple factors. Specific research methodology issues have to be learnt and applied in order to achieve those levels of

evidence, in the scientific literature, that can help the specialty to flourish and compete successfully in future health economies. Hence, potential academics should be supported in pursuing PhD programmes within an appropriately staffed unit.

#### *Directors of training, trainers and training units*

The education of PRM physicians to practice independently is experiential, and necessarily occurs within the context of the health care delivery system. Training must be realized in dedicated centers where qualified personnel and adequate resources are available.

The Director of PRM training has the overall responsibility for the training programme; he/she oversees and ensures the quality of didactic and clinical education and monitors resident supervision in all sites that participate in the educational program. He/she must exhibit PRM specialty expertise and be recognized as a trainer in PRM by the responsible national authority in his/her own country. It is also recommended that he/she has achieved the status of PRM Board certified trainer.

Each trainee must receive supervision by one trainer (a PRM physician) with documented qualification to instruct and supervise residents. The trainers are continuously involved in a tutoring role, to help trainees to develop the skills, knowledge, and attitudes relevant to PRM practice and assume graded and progressive responsibility for the care of individual patients.

#### *Assessment of learning /training outcomes*

The achievement of learning/training outcomes must be assessed at least on an annual basis by the Director of Training together with the faculty. Adequate permanent records of the evaluation must be maintained. Such records must be available in the trainee file and must be accessible to the trainee and other authorized personnel. The assessment must be objective and document progressive trainee performance improvement appropriate to their educational level. In particular, the final year examination must verify that the trainee has demonstrated sufficient competence to enter practice without direct supervision. In the evaluation process, the trainee's rights must be protected by due process procedures. The trainee must be provided with the written institutional policy concerning his/her rights and the institution's obligations and rights.

#### *Certification procedures*

Specialists in PRM have freedom of mobility across UEMS member states, but require certification from their national training authorities.<sup>3</sup> Those with the latter are eligible to be recognised by the European Board of PRM, which has a comprehensive specification on several aspects of postgraduate education for PRM-specialists. This consists of:

- curriculum for postgraduate education containing basic knowledge and the application of PRM in specific health conditions;
- a specimen of a training course of at least four years in a PRM department with detailed registration in a specimen of a uniform official logbook;
- a single written annual examination throughout Europe;
- a system of national managers for training and accreditation to foster good contacts with trainees in their country;
- standard rules for the accreditation of trainers and a process of certification;
- quality control of training sites performed by site visits of accredited specialists; and
- continuing professional development within the UEMS covering the continuing medical education system for the purpose of ten yearly re-validation.

Further information on the regulations of this education and training system can be found on the UEMS PRM Section's website, [www.euro-prm.org](http://www.euro-prm.org), where application forms are also available.

There are currently around 20000 PRM physicians in Europe and 3000 PRM trainees; out of 3897 PRM physicians who have been European Board certified since 1993, 1094 are active Fellows of the PRM European Board: 260 of them have achieved the status of Senior Fellows; 24 training sites (whose list is available on the website at [http://euro-prm.org/certification\\_docs/TC.htm](http://euro-prm.org/certification_docs/TC.htm)) are Board certified centers for PRM education according to the European standard.

#### *Undergraduate training*

Disease management is a team-based aspect of medical practice that is patient-centered, goal directed and aims to optimize patient function and quality of life, prevent complications and increase community participation. Medical students will be responsible for the care

of patients with disabilities and people with disabling conditions, regardless of what field they choose to enter, as postgraduate trainees. In the present times, patients treated by virtually all specialties express rehabilitation needs, when we consider that people currently survive what had formerly been a lethal disease, but are now left to struggle on with impairment and disability, or to better say, with limitations in their activities and participation.<sup>4</sup>

As a result, all physicians need to gain a basic knowledge of rehabilitation, recognising that most will not practice as specialists in the field or carry out specific rehabilitation measures. It is thus important that well-trained PRM physicians teach PRM in all undergraduate medical faculties and the following topics are required as a minimum:

- the principles of PRM and the bio-psycho-social model of the international classification of functioning, disability and health;
- the organization and practice of PRM (acute and post-acute rehabilitation, as well as rehabilitation programmes for patients with chronic conditions);
- the principles and aims of functional assessment and the main adverse factors of functional recovery;
- the principles and potential of physiotherapy, occupational therapy, (neuro)psychology, speech and language therapy and other rehabilitation therapies;
- the principles and effects of drug treatments used to improve function, prevent complications, alleviate pain or any other source of discomfort;
- comprehensive rehabilitation programmes and their main indications;
- the rehabilitative needs of patients with special conditions (e.g. stroke, multiple trauma, low back pain, arthritis, cancer, etc.);
- knowledge of the social system and legislation concerning disability and rehabilitation at national level, as well as ethical and human rights issues in rehabilitation.

These concepts already form part of obligatory training in PRM in most European countries. The European Board of PRM has defined a core for an Undergraduate Training Curriculum with practical skills and definition of training period in a PRM department. In the action plan of the European Board of PRM 2014-2018 an e-book supporting such a curriculum is provided.

### **Continuing Professional Development (CPD) and Medical Education (CME)**

In the interests of patient safety and good quality care, all doctors have a duty to engage in a continuum of education, training and life-long learning to maintain good professional practice. Quality assurance must demonstrate that national standards are comparable to international standards. In this global context, Continuing Professional Development (CPD) must take account of international innovations and good practices, requiring all practicing physicians to keep up to date, gain new skills and ensure that existing practices are updated to incorporate new evidence and guidelines as they become available. National regulatory authorities oversee the maintenance of this.

In line with the above requirements, CPD and Continuing Medical Education (CME) are an integral part of PRM physicians' professional practice. All PRM physicians must demonstrate their continued competence. This should be transparent, accountable, amenable to regulation and useful for assuring quality in the process of maintaining re-certification.

CPD consists of all the educative means of updating, developing and enhancing how doctors apply the knowledge, skills, attitudes (including behaviors and ethical standards) required in their working lives. CPD for example, involves activities to enhance team building, management, professionalism, interpersonal communication, information technology, teaching, research, peer review, audit and accountability. In this sense, CPD incorporates and goes beyond CME (clinical knowledge); however, CME credits can be regarded as a simple means of confirming involvement in CME/CPD, and as a common "CME currency". The UEMS has harmonised its CME accreditation around the European CME Credit (ECMEC) that can be used throughout Europe and, via a mutual recognition agreement with the American Medical Association, also in North America. The American Board of Physical Medicine and Rehabilitation (ABPMR) is one of 24 medical specialty boards that make up the American Board of Medical Specialties (ABMS).<sup>5</sup> The ABMS aims to protect the public by establishing common standards for physicians to achieve and maintain board certification in their respective specialties. The ABMS assesses and certifies physicians who meet specific educational and training requirements. The ABPMR establishes the requirements for certification and main-

taining certification, creates its examinations, strives to improve training, and contributes to setting the standards for physical medicine and rehabilitation (see for reference [www.abms.org](http://www.abms.org)).

The UEMS European Accreditation Council of CME (EACCME)® is an institution of the UEMS which formally represents European countries: therefore, its credits are recognized by National Accreditation Authorities, as complementary, not competitive, to their competence and activities. The European provisions are the same for all specialties. EACCME is responsible for coordinating its activity for all medical specialties and the UEMS website gives details of the continuing medical education requirements for all medical specialists in Europe (see for reference [www.uems.org](http://www.uems.org)). Obligatory CPD/CME is established in certain countries of Europe and is becoming increasingly required in medical practice. Professional competence schemes are the formal structures provided by member states, to ensure that registered specialists maintain their competence at the desired level. Each doctor has a duty to register with such a scheme. At the National level, these countries have developed their own rules and most have obligatory requirements. Some countries have made these legal requirements. The PRM-Board has created the CME/CPD Committee, which is responsible for the relevant continuing programs within our specialty, for the accreditation of the several scientific events at the European level and the scientific status of the Board Certified PRM physicians. The international teaching programmes serve to educate PRM physicians and their colleagues in rehabilitation teams; they cover basic science and clinical teaching topics, as well as investigational and technical programs. The CME/CPD programme organised on European level for accreditation of international PRM congresses and events is based on the provisions of the mutual agreement signed between the EACCME and the UEMS PRM Section and Board, whose details are published on the Board website ([http://www.euro-prm.org/index.php?option=com\\_content&view=article&id=23&Itemid=168&lang=en](http://www.euro-prm.org/index.php?option=com_content&view=article&id=23&Itemid=168&lang=en)).

According to this mutual agreement, the National Accreditation Authority of each Member State of the EU (and EEA):

- is the relevant authority guiding and controlling the accreditation of the Doctors working in its country and determining the number of credits required;

- is responsible for the relevant programmes within the specialty, for the accreditation of the scientific events at the European level and the scientific status of the Board certified PRM physicians.

Each Board recognized PRM physician is required to gain 250 educational credits over a five-year period for the purposes of revalidation ([www.euro-prm.org](http://www.euro-prm.org)). Credits can be achieved through different CME activities, including passive or active participation in scientific events, publications in journals/books, academic activities (*e.g.* Ph.D.), and self-education (through personal subscription to PRM journals, or documented attendance to internet PRM teaching lessons). In line with the UEMS rules, the PRM Board recognizes that considerable advances are being made in the methodologies by which CME and CPD can be provided, and by which these educational opportunities are accessed by medical doctors. Therefore, it acknowledges the use of new media for the delivery of CME/CPD, that go beyond traditional lectures, symposia and conferences. Doctors are required to fulfil their CME requirements before they can be validated and this is becoming an essential part of national as well as European life.

The PRM Board also takes the responsibility of enhancing the opportunities of education for PRM trainees and young PRM doctors through sponsoring international teaching programmes and delivering educational material. Even only considering the 2015, the PRM Board has accredited 18 International Courses, delivering a total 293 CME credits.

The first European Board sponsored event has been the European School in Marseille on Posture and Movement Analysis, which was established in 2000. This is an annual two-week course, which attracts doctors, engineers and other rehabilitation professionals from all over Europe. The Euro-Mediterranean Rehabilitation Summer School was started in Syracuse in 2005. It is an annual high level residential course on rehabilitation topics, offered for free to 40 PRM trainees from UEMS member states and Mediterranean countries.

Several e-books with educational content have been published and distributed to many Fellows and trainees for free. They are currently downloadable from the Board website ([http://www.euro-prm.org/index.php?option=com\\_content&view=article&id=28&Itemid=178&lang=en](http://www.euro-prm.org/index.php?option=com_content&view=article&id=28&Itemid=178&lang=en)).

### Curriculum in PRM: main principles

The different fields of competence and intervention of PRM physicians are typically described by categories taking into account the underlying medical conditions or the impaired body system. In fact, acute care medicine/general medicine is centered very much on organs, diseases and mechanisms of injury based on the International Classification of disease - ICD model of medicine. This influences the way of categorizing patients far beyond the medical world. This is not optimal for a function-centered medical specialty like PRM.<sup>6</sup> Instead, the fields of competence and intervention of PRM physicians should be listed using function-related categories based on the International Classification of Functioning, Disability and Health – ICF. According to this model, PRM physicians need:

- to know the biopsychosocial determinants of health and the complex interaction of factors that limit a disabled person's participation and autonomy in the context of their medical condition;

- to have the skill to communicate this to the patient, to the patient's family and to colleagues and the rehabilitation team so that there is an effective combined approach that is focused on the patient's particular priorities;

- to demonstrate highly person-centred clinical practice with an emphasis on assessment, planning and teaching in close liaison with team members and within a culture of empowerment and risk management.

On such premise, competencies to be acquired during the training, or expected to have by the end of training, concern:

- clinical and instrumental assessment to determine the pathophysiology mechanisms and the underlying diagnosis of the patient's condition;

- knowledge of learning principles/neuroplasticity/repair/recovery;

- functional assessment in the frame of ICF, including assessment of body function/structure impairment, assessment of activity limitation and participation restriction and discrimination between capacity and performance, based on the detection of contextual (personal characteristics) and environmental barriers/facilitators;

- implementation of clinical and instrumental assessment tools to explore motor, cognitive, behavioral and autonomic functions;

- prognosis of disease/disability course, detection

of adverse/favorable factors of functional recovery and definition of the means (ways) of recovery, compensation and adaptation;

- devising and conducting a rehabilitation plan, through a team-based approach that consists of setting achievable short, medium and long-term goals, agreed with the patient and carers, and eventually leading to patient's reintegration in the community and improved quality of life;

- prescription, as much evidence-based as possible, of medical and physical treatments (including drug treatment, physical modalities, innovative technologies, natural factors and others), as well as of technical aids (orthotics, prosthetics, wheelchairs and others), effective to achieve the goals of the rehabilitation plan;

- prevention and management of complications;

- leadership and teaching skills appropriate to coordinate and prioritize teamwork;

- communication skills appropriate to convey relevant information and explanations to the patient/carers, to colleagues in charge of the patient and other health professionals with the objective of joint participation in the planning and implementation of continuous health care from the initial stage to the post-acute and steady state;

- commitment to carrying out professional responsibilities and adherence to ethical principles, demonstrating compassion, integrity, and respect for others; responsiveness to patient needs, respect for patient privacy and autonomy, sensitivity and responsiveness to a diverse patient population, including but not limited to diversity in gender, age, culture, race, religion, disabilities, and sexual orientation;

- active cooperation with the public health agencies and other bodies involved in the health care system;

- identification of the health needs of the community and implementation of appropriate measures aimed at the preservation and promotion of health and healthy lifestyles and prevention of diseases;

- conducting programmes of therapeutic education for disabled people and caregivers;

- participation in education of physicians and other professionals involved in care for disabled people;

- implementation of cost awareness and risk-benefit analysis in patient and/or population-based care;

- ability to improve the quality of professional work through continuous learning and self-assessment,



managing practice and career with the aim of professional development;

— ability to apply the basic principles of research, including how research is conducted, evaluated, explained to patients, and applied to patient care.

Under the perspective of a disease-centered approach, PRM physicians must develop progressive responsibility in diagnosing, assessing, and managing the conditions commonly encountered in the rehabilitative management of patients of all ages in the following areas:

— acute and chronic musculoskeletal syndromes, including sports-related injuries, occupational injuries, rheumatologic disorders, post-fracture care and post-operative joint arthroplasty;

— acute and chronic pain conditions, including use of medications, physical modalities, exercise, therapeutic and diagnostic injections, and psychological and vocational counselling;

— congenital or acquired amputations;

— stroke;

— congenital or acquired brain injury;

— congenital or acquired spinal cord disorders;

— congenital or acquired myopathies, peripheral neuropathies, motor neuron and motor system diseases, and other neuromuscular diseases;

— pulmonary, cardiac, oncologic, infectious, immunosuppressive, and other common medical conditions seen in patients with physical disabilities or experiencing a disability condition;

— tissue disorders such as ulcers and wound care;

— medical conditioning, reconditioning, and fitness;

— metabolic conditions.

The postgraduate PRM curriculum details the theoretical knowledge necessary for the practice of the medical specialty of Physical and Rehabilitation Medicine and the core competencies (training outcomes) to be achieved at the end of training.

Although the route to start training varies across European countries, the curriculum has much similarity across the continent and is consistent with that of the American Board (see the [www.abprm.org](http://www.abprm.org) website for reference) or other Rehabilitation Medicine Senior Residency programs (<http://www.singhealthresidency.com.sg/Pages/RehabilitationMedicine.aspx>).

## References

1. Duchateau DC, Rol M Van Der, Smit Jongbloed LJ, Jong EM De, Vos P. Eindrapportage Quicksan Opleidingsduur en Bekostiging Medisch Specialistische Vervolgopleidingen in de EU. 2013.
2. Kiekens C, Moyaert M, Ceravolo MG, Moslavac S, Juocevicius A, Christodoulou N, et al. Education of physical and rehabilitation medicine specialists across Europe: a call for harmonization. *Eur J Phys Rehabil Med.* 2016 Dec;52(6):881–6.
3. The European Parliament and the Council of the European Union. Directive 2005/36/EC of the European Parliament and of the Council of 7 September 2005 on the recognition of professional qualifications. *Off J Eur Union.* 2005;22–142.
4. Ward AB, Gutenbrunner C, Damjan H, Giustini A, Delarque A. European Union of Medical Specialists (UEMS) section of Physical & Rehabilitation Medicine: a position paper on physical and rehabilitation medicine in acute settings. *J Rehabil Med.* 2010 May;42(5):417–24.
5. American Board of Physical Medicine and Rehabilitation. Curriculum of Knowledge [Internet]. Available from: [https://www.abprm.org/partI/documents/PartIOutline\\_Weights.pdf](https://www.abprm.org/partI/documents/PartIOutline_Weights.pdf)
6. Wade D. Rehabilitation - a new approach. Part four: a new paradigm, and its implications. *Clin Rehabil.* 2016 Feb;30(2):109–18.

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- European Society of Physical and Rehabilitation Medicine (ESPRM)
- European Union of Medical Specialists PRM section (UEMS-PRM section)
- European College of Physical and Rehabilitation Medicine (ECPRM) – served by the UEMS-PRM Board
- the Editors of the 3<sup>rd</sup> edition of the White Book of Physical and Rehabilitation Medicine in Europe: Maria Gabriella Ceravolo, Anthony B. Ward, Pedro Cantista, Nicolas Christodoulou, Alain Delarque, Christoph Gutenbrunner, Carlotte Kiekens, Saša Moslavac, Enrique Varela-Donoso, Mauro Zampolini, Stefano Negrini
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# White Book on Physical and Rehabilitation Medicine (PRM) in Europe. Chapter 10. Science and research in PRM: specificities and challenges

European Physical and Rehabilitation Medicine Bodies Alliance

## ABSTRACT

In the context of the White Book of Physical and Rehabilitation Medicine (PRM), this paper deals with Research, the future of PRM. PRM students and specialists are mainly involved in biomedical research, investigating the biological processes, the causes of diseases, their medical diagnosis, the evaluation of their consequences on functioning, disability and health and the effects of health interventions at an individual and a societal level.

Most of the current PRM research, often interdisciplinary, originates from applied research which, using existing knowledge, is directed towards specific goals. Translational medical research, research and development, implementation research and clinical impact research are in this field. PRM physicians, mainly master or PhD students, are nowadays increasing their participation in basic research and in pre-clinical trials.

PRM physicians are involved in primary research, which is an original first hand research, but also in secondary research, which is the analysis and interpretation of primary research publications in a field, with a specific methodology.

Secondary research remains an important activity of the UEMS PRM section and it will be the field of the new created Cochrane Rehabilitation. Secondary research with interest for persons with disabilities, will be developed world wide on the basis of evidence based medicine, with the participation of PRM physicians and of all other health and social professionals involved in rehabilitation.

The development of research activities with interest for PRM in Europe is a challenge for the future, which has to be faced now. The European PRM schools, the European master and PhD program with their supporting research and clinical facilities, the European PRM organizations with their websites, the PRM scientific journals and European congresses are a strong basis to develop research activities, together with the development of Cochrane Rehabilitation field and of our cooperation with European high level research facilities, European and international scientific societies in different fields. PRM will be a leader in this field of research.

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**Key words:** Physical and Rehabilitation Medicine - Europe - Biomedical research - Basic research - Translational medical research.

## Introduction

The White Book (WB) of Physical and Rehabilitation Medicine (PRM) in Europe is produced by the 4 European PRM Bodies and constitutes the reference book for PRM physicians in Europe. It has multiple values, including to provide a unifying framework for the European Countries, to inform decision-makers at the European and national level, to offer educational material for PRM trainees and physicians and information about PRM to the medical community, other rehabilitation professionals and the public. The WB states the importance of PRM, that is a primary medical specialty. The contents include definitions and concepts of PRM, why rehabilitation is needed by individuals and

society, the fundamentals of PRM, history of PRM specialty, structure and activities of PRM organizations in Europe, knowledge and skills of PRM physicians, the clinical field of competence of PRM, the place of PRM specialty in the healthcare system and society, education and continuous professional development of PRM physicians, specificities and challenges of science and research in PRM and challenges and perspectives for the future of PRM.

Science and research in Physical and Rehabilitation Medicine is relatively young, like the specialty, and have some peculiar challenges and specificities. This chapter starts presenting the spectrum of Science in PRM, with the possible organization of research on function-

ing and rehabilitation, an overlook on the international congresses topics and PRM journals, and notes about how to strengthen rehabilitation research. A thorough and complete description of the current situation of science and research activities of interest for Physical and Rehabilitation Medicine (PRM) in Europe is then faced, looking and the new possibilities and challenges. The importance of rehabilitation research is defined, and its peculiar methodology due to the problem to bridge the gap between biology and behavior is discussed, facing topics like the relationship between biomedicine and PRM (science is wider than biology), and PRM research (same game, different rules; the two sides of the same coin). The challenges of Evidence Based Medicine in PRM are presented, starting from the current situation and proposals on how to deal with these challenges: means are suggested to improve standards in PRM trials, create sound PRM specific trial designs, and standardize the interventions; finally, the representation of PRM in the “EBM world” and the transfer of scientific knowledge into clinical practice are faced. The last sub-chapters focus on research training and education.

### Spectrum of Science in PRM

The spectrum of science and research activities in PRM can be described with respect to the curriculum of the UEMS PRM Board, the field of competence of the UEMS PRM Section, the topics and programmes of ESPRM and ISPRM congresses, published in PRM journals<sup>1,2</sup> and listed in the Cochrane Rehabilitation Field.<sup>3</sup>

#### *Organizing human functioning and rehabilitation research*

The field of competence for PRM — as described in the conceptual description of PRM<sup>4,5</sup> and represented in the European PRM curriculum<sup>6</sup> — requires the development of a strong scientific base for a broad range of distinct but related scientific fields. Figure 1 shows a framework of distinct scientific fields ranging from “cell to society” and from the basic to the applied and clinical sciences.<sup>7,8</sup> The core concept underpinning this conceptualization of distinct scientific fields in this framework is the integrative nature of functioning and of the ICF model.

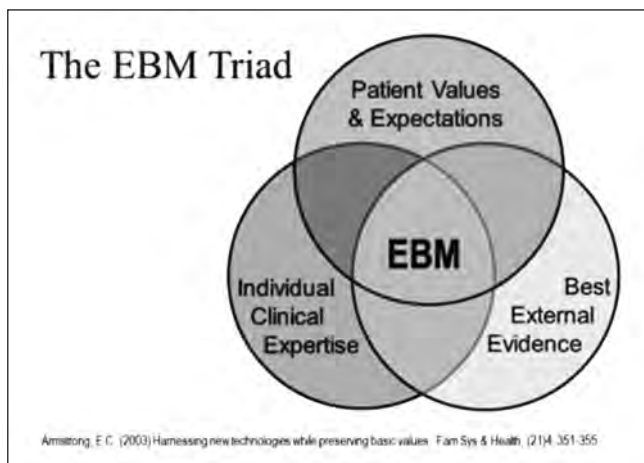


Figure 1.—It depicts the relationship of these 3 components forming the EBM concept.

#### *Congress topic lists: representing the spectrum of current science*

The conceptual framework for rehabilitation research shown in Figure 1 is a useful starting point to identify specific scientific topics. A concrete application of this framework is the list of scientific topics for PRM congresses as first developed and continuously updated by ESPRM.<sup>9-11</sup> Taking up this approach, ISPRM,<sup>12</sup> has also developed a scientific topic list useful for PRM congresses. ISPRM’s scientific topic list provides a comprehensive representation of the spectrum of sciences for PRM. As science is dynamic, the topic list is regularly updated in light of the emergence of new scientific approaches and priorities and the elimination of approaches that are no longer useful. Based on the experiences from the last ISPRM world congresses in Berlin 2015 and Kuala Lumpur in 2016 an updated scientific topic list has been developed.<sup>11</sup> Appendix A shows the current topic list.

#### *PRM journals in concert*

The publication of scientific studies after a rigorous review by peers is instrumental for the research process to work as well as for the translation of research into practice and evidence-based professional action.<sup>13</sup> In interaction with societies and congresses, PRM-journals shape the understanding of what constitutes the scientific field of PRM. This enhances the identification of

scientists within PRM and the visibility of the scientific field for those outside of PRM. Therefore, scientifically competing PRM journals have a common interest to promote the research process. As did ESPRM.<sup>14</sup> ISPRM has also developed a web of collaborating PRM journals coordinated by its publications committee.<sup>15</sup>

*Strengthening rehabilitation research: shaping the future of science in PRM*

Human functioning and rehabilitation research has an enormous potential to become a multi-faceted, coherent, research area in which researchers from various disciplines generate and integrate new knowledge, and coordinate efforts to study how to optimize human functioning and the quality of life of people experiencing disability.<sup>8, 16</sup> The realization of this potential requires the strengthening of research capacity and increased research funding.<sup>8, 17</sup> Important approaches include the education and training of researchers, development of dedicated research institutions, national and international collaboration networks and interdisciplinary university centers,<sup>18</sup> as well as the scaling up of existing and creation of new academic training programs in PRM.<sup>19</sup>

A new and important initiative to strengthen the evidence base for PRM is the development of a Cochrane field for Rehabilitation.<sup>20</sup> Since the optimization of functioning is the goal of rehabilitation, the proper application of the ICF both from a conceptual and methodological perspective is fundamental for this initiative.<sup>21</sup>

These efforts towards strengthening research capacity are important determinants of the future of science in PRM.

Figure 1. Distinct scientific fields in Human Functioning and Rehabilitation Research. The figure illustrates relationships in the process of communication of scientific knowledge between distinct scientific fields. The double arrows indicate that knowledge may be communicated in both directions. The horizontal dimension symbolizes the confluence of knowledge generated by the basic and applied sciences to serve the clinical sciences, and vice versa. The vertical dimension distinguishes the comprehensive perspective based on the integrative model of functioning from the more focused perspective of the biomedical aspects of functioning. Diagonal arrows illustrate the flow of knowledge with respect to both dimensions. Adapted from <sup>8, 19</sup>.

**Current situation of science and research activities of interest for Physical and Rehabilitation Medicine (PRM) in Europe, specificities and challenges for the future**

Scientific and research activities of interest for persons with disabilities is a wider scope which encompasses science and research activities “in” PRM.

The scientific medical research of interest for persons with disabilities or disabling health conditions increases the scientific knowledge which will improve the quality of life of persons with disabilities or disabling health conditions.

*The European Union (EU) PRM Section action plan for science in PRM*

The UEMS PRM Section developed an efficient strategy to publish evidence based medicine papers,<sup>22, 23</sup> including “physical and rehabilitation medicine” in their medical subject heading (MeSH).

There is a strong will of the European PRM organizations to develop science and research activities of interest for PRM in Europe. The European Society of PRM (ESPRM), the PRM Section and Board of the Union of European Medical Specialists (UEMS) and the Academy of Rehabilitation Medicine (AEMR) aim is:

- to support evidence based medicine <sup>24</sup> by means of research, teaching and training programs, involving medical students, PRM trainees and PRM physicians;
- to facilitate, promote, evaluate and carry out, all research capable of advancing knowledge in the field of persons with chronic disease or disabling health conditions and bringing social, cultural, and economic benefits for society,
- to encourage collaboration between specialists from different disciplines and to develop interdisciplinary programs, which bring together several medical departments as well as other research institutions and industry,
- to bridge gaps between basic and medical research and to translate basic knowledge into better clinical practice,
- to contribute to the promotion and application of research results in the field of persons with disabilities or disabling health conditions,
- to develop scientific information and communication in the field of persons with disabilities or disabling health conditions,

— to participate in the analysis of the European scientific orientation and its potential for evolution in order to develop a European research policy in the field of persons with disabilities,

— to facilitate the participation of students and other persons with disabilities or with disabling health conditions in higher education and research activities.<sup>25</sup>

*European citizens have a positive attitude toward biomedical research*

A recent survey for the French national institute for health and medical research (INSERM) including 4000 EU citizens has shown that for 82% of them, medical research will bring a better life to their children. This underlines how important it is to spread information on PRM research to the citizens.

*Financial sources of funding research in PRM are numerous and not enough well known*

Despite the confidence for biomedical research of EU citizens, current research funding methods tend to dumb down health care and rehabilitation for disabled people and ageing population. PRM physicians push for a change.<sup>26</sup>

The information on funding opportunities needs to be developed within the PRM specialty, as there are many opportunities in and out of the EU.

EU research programmes such as Horizon 2020 (H2020)<sup>27</sup> offer opportunities to fund Post-Doctoral positions thanks to Marie Skłodowska Curie Actions (including Cofund schemes.<sup>28</sup> Information support on H2020 is available on the web Euraxess).<sup>29</sup> Technical support is offered in every European country and in some universities through the national contact points.

Europe and International charitable and nonprofit foundations, are often focused in specific topics, they provide financial supports to research. For example in the field of spinal cord injury, it is the case for Wings for life<sup>30</sup> and Christopher and Dana Reeve foundation.<sup>31</sup> Max Planck Institutes<sup>32</sup> are other well-known examples.

National research agencies are gathered in “Science Europe” which is an association of European Research Funding Organizations (RFO)<sup>33</sup> and Research Performing Organizations (RPO), based in Brussels.

Medical schools and universities have dedicated budgets for research activities.<sup>34</sup> The university research

budget composition for all EU countries is rather unbalanced, with government core funding clearly being the main source of income.<sup>34</sup> PRM Facilities at national or international level are supporting research programs: in France, the UGECAM,<sup>35</sup> French network of PRM facilities for stroke, in Italy, the Foundation Don Gnocchi,<sup>36</sup> for Evidence based medicine and Cochrane Rehabilitation and at world level Ramsay, for sport affairs, signed letters of intention to cooperate in research activities with the ESPRM.

The participation of the non-academic sector in EU research (H2020) is considered essential. The involvement of industrial participants, of small and medium-sized enterprises (SMEs) in particular, is crucial in maximizing the expected impact of the actions.

*The ethical issues and sciences/research activities in PRM*

The protection of human rights and dignity in the specific field of biomedical research is being stricter than it has been in the past. EU guidelines are available, such as the Additional protocol to the convention on Human Rights and Biomedicine,<sup>37</sup> concerning biomedical research and the protection of animals in research.<sup>38, 39</sup>

PRM specialists need to pay attention and to avoid conflicts of interest in their research activities.<sup>40, 41</sup> The non-publication of drug trials results raises also ethical issues in research.<sup>42</sup> It is the task of the Accreditation Council for Continuing Medical Education of the UEMS (EACCME)<sup>43</sup> to control the ethical quality of the PRM congresses.

*Publications on “Rehabilitation” had a steady growth, during the last decades*

Europe and PRM had a leading role in this evolution.<sup>44</sup> Publications of PRM during the last 16 years, with a high level of evidence, showed larger multiplication factors compared with those with a low level of evidence.<sup>45</sup> The publications on rehabilitation are issued not only from PRM specialists but also from researchers in other fields.<sup>46</sup>

*The scope of science and research activities in connection with PRM is wide*

The main fields of science and research activities of interest for PRM are numerous. They represent all

components and domains/chapters of the International Classification on Diseases and of the International Classification of Functioning, Disability and Health.<sup>47</sup>

The main fields of science and research activities of interest for PRM are linked to the domains of research organized at European research level in the following disciplines:<sup>48</sup>

- neurosciences, with all the scientific and medical fields dealing with the central and peripheral nervous system: its normal and pathological formation, development, functioning and ageing;<sup>49</sup>
- physiology, physiopathology, metabolism and nutrition, cardio-vascular system, respiratory system, bones and joints;
- public health, including epidemiology, biostatistics, economy and sociology applied in the health field,
- health technologies, in particular imaging, development of drugs, biotechnology, bioengineering, interventional techniques for medical diagnosis and treatment;
- cell biology, development and evolution;
- genetics, genomics and bioinformatics.

*The modalities of scientific and research activities of interest for PRM are numerous*

The scientific research of interest for PRM is mainly in the field of biomedical research which is the broad area of science that involves the investigation of the biological process, the causes of diseases, their medical diagnosis, the evaluation of their consequences on functioning, disability and health, at an individual and a societal level. The Alliance for Biomedical Research in Europe<sup>50</sup> is involved in this field.

PRM biomedical research is mainly represented by clinical research & clinical trials.

PRM researchers are more often than in the past involved in:

- inter disciplinary research programs, within teams including other disciplines or bodies of specialized knowledge. The Human Brain Project is an interdisciplinary program co-funded by the EU;<sup>51</sup>
- applied research programs, directed towards specific goals and discoveries, such as the development of a new medication, a new medical device, or a new rehabilitation procedure. They are using existing knowledge (gained from basic research) and methodically expand-

ing this knowledge to address the specific rehabilitation problems;<sup>46</sup>

- pre-clinical trials, involving experiment in cells and in non-human animal models;<sup>52</sup>
- translational research, research and development, from the laboratory to the patient's bed and home, are the aim of the European Advanced Translational Research Infrastructure in Medicine<sup>53,54</sup> but even the most promising findings of basic research take a long time to translate into clinical experimentation, and adoption in clinical practice is rare;<sup>55</sup>
- implementation research (IR), evaluate rehabilitation health interventions in "real world" settings;<sup>56</sup>
- information and communication technologies (ICT) robotics and devices research are cited in many of the EU research programs "ICT H2020" areas in order to tackle societal challenges;
- basic research programs, in which PRM physicians, are sometimes involved during their Master, PhD or Post Doc studies.

*The settings of scientific and research activities in PRM are numerous*

The number of academic professors in PRM is increasing in some EU countries, leading to the development of clinical research activities in their teams.

The number of PRM facilities with clinical research activities is also increasing, some having conventions with universities and/or EU PRM bodies such as the European society of PRM (Foundation Don Gnocchi,<sup>36</sup> UGECAM,<sup>35</sup> Ramsay Health Care).<sup>57</sup>

Research teams, departments, laboratories and institutes, are developing inter disciplinary research activities, from basic to applied research in one or more specific fields.<sup>58</sup> They are headed by scientists and/or PRM specialists. They are often part of national or international networks focused in a field.

THE ELECTRONIC SUPPORT FOR COMMUNICATION AND INFORMATION ON THE PRM SCIENTIFIC AND RESEARCH ACTIVITIES IS MAINLY BASED ON THE WEBSITES OF THE EUROPEAN PRM ORGANIZATIONS

The European Academy of Rehabilitation Medicine,<sup>59</sup> the UEMS PRM Section and Board<sup>60</sup> and the ESPRM spread scientific information all over the world. Other scientific websites are available in specific fields,

for example for stroke with the “evidence based review of stroke rehabilitation”.<sup>61</sup>

*ESPRM congresses and the European/Euromediterranean PRM schools are successful*

PRM physicians participate both in PRM congresses or in topic focused congresses. Topics can be pathologies such as stroke, spinal cord lesions, functional disorders such as swallowing, mental disorders, health interventions, such as ultrasound diagnosis, joint injections etc.

The congresses of the European Society of PRM are held every two years. They have gathered up to 2400 participants. The main PRM European organizations, PRM Section and Board of UEMS and European Academy of Rehabilitation Medicine participate in these congresses. Research, Education, Professional Practice, Field of Competence and Ethics are the main topics of these congresses. All the fields of PRM are reviewed.

Two new events have been held during the ESPRM congress in 2016, the “Labs’ Day session” and the “My Rehab Thesis in 180 seconds” (MRT180). They will be held again in the next congress in Vilnius May 2018. International and EU national congresses of PRM are listed on the website of the ESPRM in the calendar of events.<sup>62</sup>

Three international PRM schools are held every year. They spread evidence based knowledge and present recent research activities to PRM trainees (the Euro Mediterranean Rehabilitation Summer School Haim Ring in Syracuse of Italy, the Intensive Teaching Programme Cofemer Ajmer Sofmer and the European School Marseille of France on Motor Disabilities). A new European school for PRM trainees will be available in Vilnius 2018.

European and International congresses focusing on specific topics, such as Pain, ageing persons, Stroke, SCI, ENMG etc, welcome PRM physicians and all the professionals interested in the field. ESPRM has set up special interest scientific committees<sup>63</sup> which are the link between the ESPRM, scientific societies and all professionals focused on a topic, with dedicated congresses and scientific journals.

*PRM scientific journals are very active*

As for the oral communications in congresses, the written scientific communication from PRM physicians can be submitted either to PRM journals or to other scientific journals specialized in a topic. The emergence and development of open access has been and still is a

great challenge, both for the authors and the readers. It is not always easy to download the full paper.

The European Journal of PRM is the official journal of the ESPRM and of the UEMS Section of PRM.<sup>64</sup>

The Journal of Rehabilitation Medicine is the official journal of the European Academy of Rehabilitation Medicine and of the UEMS European Board of PRM.<sup>65</sup>

The other European PRM journals have been listed in a publication.<sup>66</sup>

*The Cochrane Rehabilitation field is a chance for the future of Rehabilitation*

Scientific literature review deals with secondary sources published in academic, peer reviewed journals and follow a methodology for the analysis of the available data (key words, MeSH, search engines such as PubMed). The scientific literature review provides the current state of the medical scientific knowledge in a field. For stroke, an example is the evidence-based review on stroke rehabilitation.<sup>61</sup>

Starting from the evidence based committee of the ESPRM,<sup>63</sup> under the guidance of Professor Stefano Negrini and co-workers (Carlotte Kiekens, Elena Ilieva and Frane Grubisic) PRM EU organizations and other international PRM organizations have been welcomed by Cochrane in a new “Cochrane Rehabilitation Field”<sup>67</sup> based on the fields of competence of PRM.

Cochrane Rehabilitation Field is aimed to ensure that all rehabilitation professionals can apply evidence based clinical practice, combining the best available evidence as gathered by high quality Cochrane systematic reviews, with their own clinical expertise and the values of patients. Our vision is a world where decision makers will be able to take decisions according to the best and most appropriate evidence in this specific field. Cochrane Rehabilitation Field wants to improve the methods for evidence synthesis, to make them coherent with the needs of people with disabilities or experiencing disability and the daily clinical practice in rehabilitation.

*Challenges for the future*

MAIN CHALLENGES ARE INFLUENCING RESEARCH ACTIVITIES IN PRM

— an ethical one, with the United Nations rights of persons with disabilities<sup>68</sup> for equal access to medicine

and rehabilitation, to quality of life in the society;

- a public health one, with the demography of chronic diseases, the development of ageing-related impairments<sup>43</sup> together with the societal impact of research;<sup>69</sup>

- a scientific one, with the development of the medical scientific knowledge in all fields;<sup>69</sup>

- a technological one, demonstrated by the increasing use of imaging and research laboratories with interdisciplinary activities, including clinicians.<sup>70</sup>

With also the development of e-medicine (database, search engines, eBooks) and of robotics.<sup>71, 72</sup>

- an economic one, with the increase of the health expenses at state level and the cost of research. The funding of research in EU is not one of the highest in the world, it varies from a country member to the other one. In 2020, 3% of the EU's gross domestic product (GDP) should be invested in research and development (R&D). Health and ageing are among the main topics of research for EU programs (Europa EU).

#### PRM IN EUROPE IS WILLING TO INCREASE THE NUMBER OF RESEARCHERS AND TO ELEVATE THE QUALITY OF RESEARCH

Education to research will be a key issue all along the medical studies, for undergraduate students, for postgraduate PRM trainees with access to the master and PhD programs, the post-doctoral programs.

Undergraduate programs in the medical schools, should include critical reading<sup>73</sup> and biostatistics. Postgraduate programs in the faculties of medicine, should support the development of the scientific thinking with journals club,<sup>74</sup> master programs with initiation to research during the first year. The topics are often: systematic reviews, medical literature databases to search, bibliography management, methods in therapeutic evaluation, principles of epidemiology, advanced biostatistics, critical thinking, training in a laboratory etc.

Articles, teaching and training programs, for scientific oral and written communication, either for academic meetings, interdisciplinary cooperation or for public oriented communication, are now available.<sup>75-77</sup>

During the ESPRM congress is organized a presentation in three minutes of research works from PhD students, so called, "My rehab thesis in 180 sec" which is a way to present a research project in rehabilitation, in a

short time using simple word, as for the Three Minutes Thesis.<sup>78</sup>

The Board/ESPRM school: during the next congress in Vilnius will be organized for the first time a school for PRM trainees which will cover the whole curriculum of the specialty. It will benefit from special sessions of the three schools for European PRM trainees which are organized every year, the Euro Mediterranean Rehabilitation summer school in Syracuse, the Intensive teaching program COFEMER, SOFMER, AJMER (during the French SOFMER congresses) and the European School Marseille on motor disabilities. Lessons on the main topics of our specialty will be held by experts in the field.

The access of PRM masters, PhD students and Post-docs to the EU research programs, such as H2020 is encouraged by the ESPRM. PhD disabled students could benefit from dedicated funding.<sup>79</sup>

The European PRM organizations are currently involved and willing to do more, in developing science and research activities of interest for the disabled persons. They are convinced that the future of PRM is research!

#### **Importance of rehabilitation research in establishing needs and the value of both current and new approaches to rehabilitation**

PRM has fully endorsed the principles of evidence-based medicine and research in PRM has made great progress during the last three decades. Whereas the physiological mechanisms of action of physical modalities of function have traditionally been central to scientific interest during the last decades of the 20<sup>th</sup> century, an increasing number of prospective trials have been performed, in which the clinical efficacy of rehabilitation in many diseases, such as low back pain, stroke, brain and spinal cord injury,<sup>78-80</sup> rheumatoid arthritis, cardiovascular, pulmonary and metabolic disorders, has been tested. For most conditions, meta-analyses and (inter)national guidelines and clinical pathways are available and provide levels of evidence for distinctive interventions.

#### *Relevance of research*

The specialty aims to foster an increased interest and involvement in research in rehabilitation. This has re-



sulted in an increasing number of publications in high impact international scientific journals. Its vision is that research is necessary to understand the basic processes of rehabilitation such as how individuals acquire new skills, and how the tissues of the body (for example, the muscles, or neuronal pathways in the central nervous system) can recover from or adapt to the effects of trauma or disease. Research can also delineate the incidence and prevalence of disabilities, and identify the determinants both of recovery and of the capacity to change, to acquire new skills, and to respond to rehabilitation.

New technologies emerge and should be adapted for use by people with disabilities. Rehabilitation technology is one of the most important and promising research fields today and in the future. Tissue engineering and other modern technologies are contributing to this field. The costs of health care and of rehabilitation services will increase and politicians will force health care providers to restrict their expenses and show that they organize this care efficiently. PRM specialty is a reliable partner in the discussion with patients, politicians, ministries of health and insurance companies, as it has the capacity to base its arguments on sound evidence in the public arena, which only research can provide.

*Methodology of research in Physical and Rehabilitation Medicine: bridging the gap between biology and behaviour. Biomedicine and Physical and Rehabilitation Medicine: science is wider than biology*

It seems that in Medicine there are two (not mutually exclusive) models: the one linked to Bio-medicine, and the other representing Clinical Medicine, including Physical and Rehabilitation Medicine (PRM).<sup>80</sup> What is respectively meant here by the terms “Bio-medicine” and “Clinical Medicine” is later detailed.

The dominant model is the bio-medical one, just a mild variant of the scientific paradigm, dating back to the 17<sup>th</sup> century, which is reductionist and deterministic. In order to understand the whole, the parts must be observed (reductionism, as in anatomy), and general invariant laws regulating the interactions across parts must be discovered (determinism, as in physiology). In principle, any “phenomenon” (what is appearing, according to the Greek etymology) is potentially predictable because it reflects physical laws. According to the biomedical model, the unit of observation is not

the person: it is a part of the person (no matter whether organ or molecule). Let’s imagine a gradient running from molecules to the person, and then to populations. At the “population” extreme, the field of epidemiology, the core topic is again not the person: persons appear as replicable individuals, whose properties can be summarized by measures of their central tendency (means, medians).

Conversely, the Clinical Medicine model –apparently in contrast with the bio-medical model — entitles the single person as a whole as its primary interest, and it aims at applying a person-centered healthcare (including shared decision-making): its relationship with social aspects is inseparable. In other words, the disciplines belonging to Clinical Medicine — such as PRM — are not bounded to any specific body ‘parts’ and encompass the patient-environment interaction (including the patient-therapist relationship, and optimal gathering of patient’s preferences, values, and goals). The person-to-person relationship (one of “cure and care”) is forcibly unique, sensitive to emotional and cultural factors, and in line with the growth of the so-called bio-psycho-social model of medicine. For sure, the unitary ‘phenomenon’ (the ill person and his/her signs and symptoms) conceals troubles in his/her biological parts, yet the patient’s behavior is also characterized by freedom and thus unpredictability. Not so clear understanding and ‘repairing’ the ill person is the specific goal of Clinical Medicine, yet it requires an approach wider than paradigm underlying biological sciences.

This chapter asserts the scientific status of PRM, an essentially-clinical medical specialty, by highlighting the specificity of its research paradigms. PRM aims to foster an increased interest and involvement in research in rehabilitation because research is necessary to understand the basic processes of rehabilitation, such as — for example — how individuals acquire new skills, or how different tissues in the body (e.g. muscles, or neural pathways) can recover from or adapt to the effects of trauma or disease. Research can also delineate the incidence and prevalence of disabilities and disabling health conditions, and new rehabilitation technologies emerge and should be adapted for use by people with disabilities. Moreover, the cost of healthcare and rehabilitation services is constantly increasing, and politicians force healthcare providers to restrict their expenses and to show that they efficiently organize this care.

PRM is a reliable partner in the discussion with patients, politicians, ministries of health, and insurance companies, to the extent that it has the capacity to base its arguments on sound evidence in the public arena, which only research can provide.

*PRM research: same game, different rules*

PRM has fully endorsed the principles of evidence-based medicine, and research in PRM has made great progress during the last decades.<sup>81, 82</sup> In our field, this process of knowledge and decision-making usually tries to include three essential points: best scientific evidence, clinical expertise, and need and wishes of patients. This process is complex because PRM has its roots in biology (deep knowledge of human anatomy, physiology, and various pathologies), but also spans to behavioral sciences.<sup>83</sup> Such a double nature of PRM is a source of charm, yet it requires high versatility in performing research, depending on the location of the research topic along the biology-behavior continuum. Studying the effect of shock-waves on soft tissues does not require the same method suitable for studying dependence in daily life, attention deficits, pain, fatigue, or social interaction, in individuals. The latter variables relate to the person as a whole; the object of observation is a unitary subject interacting with the observer. For these reasons, rehabilitation research does not sit comfortably with some standard approaches to basic science and biomedical research interventions.

Moreover, behavioral research is often considered – according to reductionist-deterministic model – to be “qualitative” and flawed by “subjectivity”. Conversely, there are no reasons why human behaviors and perceptions should not be amenable to rigorous scientific investigation. However, instruments and methods must be suitable to the study goals.

In short, the key differences between the biological (Bio-medicine) and the behavioral (Clinical Medicine) research paradigms relate to: 1) variables analyzed; 2) statistical methods, and 3) trial designs.<sup>80</sup>

*PRM research: the two sides of the same coin*

In summary, PRM research uses methods coming from both the biomedical field and clinical and behavioral sciences, in order to generate useful high-quality

evidence. The biomedical methods are strong and well-known, based on established disciplines, spanning from biomechanics to neurophysiology, from biochemistry to epidemiology. Conversely, methods coming from clinical and behavioral sciences need to be reinforced by specific research designs, and proudly claimed for as a key source of scientific identity of PRM. A wider diffusion of these designs may also help to promote communication and knowledge translation with other non-medical professionals, who also work with people with disability.

Even the name ‘Physical and Rehabilitation Medicine’ needs some reflection:<sup>89</sup> is the adjective ‘physical’ redundant or restrictive? Not at all, if this term is linked to its Greek etymology (*physis* means nature, the universe to which Mankind also belongs), as in other terms, such as “physician” or “physiology”. In this sense, ‘physical’ indicates a type of medicine ‘practiced from the outer world on the person as a whole’ (in agreement with the biopsychosocial model of medicine). On the other hand, ‘rehabilitation’ indicates the goal, which is aiming at restoring a person’s ability (*i.e.* the best possible interaction with the outer world). The intersection between the most various ‘physical’ means and the ‘rehabilitation’ goal is the cultural pillar of PRM. However, government agencies and providers often seek evidence of the cost-effectiveness of rehabilitation and usually require the services as a whole to be evaluated, because a wide range of different techniques has to be available to the treating team in order to meet the different needs of individuals in any group of patients. This really is the nub of the problem, as PRM practice produces results through a series of, or the interplay between, a number of interventions. Demonstrating the impact of a single rehabilitation intervention is not consistent with ‘real life’, and while it is essential for identifying effective individual procedures to be included in a rehabilitation program, it cannot in itself effectively evaluate the program as a whole. Unlike biomedical research, where a single treatment is usually tested on many individuals, in PRM several treatments are often applied to a single individual. The unit of treatment is thus the ‘program’ as a whole. This needs not to be arbitrary. It should follow the logic of rigorous decision-tree algorithms: different treatments are assigned to single individuals, yet according to reproducible rules. To sum up, in order to produce practice guidelines, it is important for PRM to

recognize also the value of dynamic learning (through the application of the so called ‘Plan-Do-Study-Act’ cycle), and move in the direction of systems knowledge, agreeing on the use of common sets of methods and measures for developing and disseminating evidence.<sup>88</sup> Specific research (also borrowed from different disciplines, including social sciences, and then optimized according to PRM research needs) using dedicated rules and skills should thus be encouraged from the cultural, political and financial point of view, and become explicit components for building a PRM curriculum.

### Challenges of evidence based medicine in PRM

“Absence of evidence is not evidence of absence”.<sup>90</sup> This provocative statement represents one side of the coin in an ongoing debate on evidence based medicine (EBM). On a closer look it means that the absence of external evidence for individual forms of therapies is not proof of their ineffectiveness.

So what is the concept of EBM?

According to the pioneers of EBM Gordon Guyatt and David Sackett, co-founders of the first international EBM working group (“evidence based medicine working group”), EBM is “the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients.” The practice of evidence-based medicine means integrating individual clinical expertise and patient values with the best available external evidence from systematic research.<sup>91</sup> Sackett demonstrated how these three areas of EBM form the valuation of therapy methods and how they have to be evaluated for each individual patient (Figure 1).<sup>24</sup>

#### Best external evidence

EBM has promulgated a hierarchy of best research evidence and ranks them according to the strength of their freedom from the various biases that beset medical research. The quality of external evidence may be judged on different levels:

- single studies;
- systematic reviews and meta-analysis;
- recommendations and guidelines.

For each of these levels, evaluation tools and methods have been elaborated. To judge the quality of a single study, checklists of items for reporting trials have

been published, assisting scientists and clinicians with evaluation, *e.g.* the Physiotherapy Evidence Database (PEDro) Scale.

The PEDro Scale is based on the Delphi list developed by Verhagen *et al.* at the Department of Epidemiology, University of Maastricht.<sup>92</sup> It is a criteria list for quality assessment of randomised clinical trials for conducting systematic reviews developed by Delphi consensus.<sup>93, 94</sup>

Alternatively, the Cochrane Collaboration promotes tools to evaluate the risk of bias in single studies. These evaluation tools contribute, among others like outcomes etc. to formulate systematic reviews and meta-analyses. Nevertheless, systematic reviews do not grade the overall quality of evidence across outcomes. Because systematic reviews do not — or at least should not — make recommendations, the quality of evidence is rated only for each outcome separately.

Caution should therefore comprise simple grading systems rating external evidence from 1 to 4 like the Oxford levels of evidence.

Finally, to get an overview of the entire body of evidence on a specific topic, results may be summarized and valued by different scoring systems. This is a task for guideline panels which have to determine the overall quality of evidence across all the critical outcomes essential to a recommendation they make. Guideline panels provide a single grade of quality of evidence for every recommendation, but the strength of a recommendation usually depends on evidence regarding not just one, but a number of patient-important outcomes and on the quality of evidence for each of these outcomes. This complex and multidimensional evaluation requires specific evaluation tools.

A widely used methodology that is also used by the Cochrane Collaboration is the Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) system.<sup>95</sup> This tool was developed for working groups of experts and scientific societies to evaluate the current evidence and formulate recommendations and suggestions for clinical practice.<sup>96</sup>

Outcomes in the GRADE system are the strength of recommendations and the quality of evidence.

Quality of evidence is classified as

- High: confidence that the true effect lies close to that of the estimate of the effect
- Moderate: there is moderate confidence in the ef-

fect estimate. The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different

— Low: confidence in the effect estimate is limited. The true effect may be substantially different from the estimate of the effect.

— Very low: very little confidence in the effect estimate. The true effect is likely to be substantially different from the estimate of effect.

Strength of recommendations means: the strength of a recommendation reflects the extent to which a guideline panel is confident that desirable effects of an intervention outweigh undesirable effects, or vice versa, across the range of patients for whom the recommendation is intended.

The GRADE system suggests using the terms strong and weak recommendations.

A strong recommendation is one for which the guideline panel is confident that the desirable effects of an intervention outweigh its undesirable effects (strong recommendation for an intervention) or that the undesirable effects of an intervention outweigh its desirable effects (strong recommendation against an intervention). Note: Strong recommendations are not necessarily high priority recommendations. A strong recommendation implies that most or all individuals will be best served by the recommended course of action.

A weak recommendation is one for which the desirable effects probably outweigh the undesirable effects (weak recommendation for an intervention) or undesirable effects probably outweigh the desirable effects (weak recommendation against an intervention) but appreciable uncertainty exists.

A weak recommendation implies that not all individuals will be best served by the recommended course of action. There is a need to consider more carefully than usual the individual patient's circumstances, preferences, and values. When there are weak recommendations caregivers need to allocate more time to share decision making, making sure that they clearly and comprehensively explain the potential benefits and harms to a patient.

Consequently, the GRADE system does not automatically rank RCT higher than observational studies (like the Oxford system would do). For instance, RCTs can be downgraded because of risk of bias, indirectness, imprecision and publication bias. However, observational

studies can be upgraded because of large effects, dose response and confounders.

It is of utmost importance that the GRADE system states that:

— clinicians, patients, third-party payers, institutional review committees, other stakeholders, or the courts should never view recommendations as dictates. Even strong recommendations based on high-quality evidence will not apply to all circumstances and all patients;

— users of guidelines may reasonably conclude that following some strong recommendations based on the high quality evidence will be a mistake for some patients. No clinical practice guideline or recommendation can take into account all of the often compelling unique features of individual patients and clinical circumstances. Thus, nobody charged with evaluating clinician's actions, should attempt to apply recommendations by rote or in a blanket fashion.

### *Situation of PRM*

There is no doubt about the importance and necessity of Evidence Based Medicine (EBM) in positioning and developing the specialty of PRM. In the past, trials of high quality, especially randomized controlled trials were sparse, leading to predominance of clinical experience and patient values. Especially in PRM, trials on a high scientific level bear a lot of challenges and controversies and are therefore difficult to execute.

### *Challenges of PRM*

The nature of the PRM specialty is fundamentally different from others, e.g. internal medicine or even surgery. Administering drugs to patients is relatively easy to standardize, both in dosage and compliance, and blinding can be done adequately.

Also surgery adheres to highly standardized procedures in reproducible settings. Recently, researchers have even implemented sham surgery to control for treatment effects (Arthroscopic partial meniscectomy *versus* sham surgery for a degenerative meniscal tear.).

The specialty of PRM adopted the ICF as concept for its clinical work (not applicable for medical diagnosis, refer publications on cases with imagery, ultrasounds etc.). This implies a number of influential variables, from body structures and function up to personal and

environmental factors. This concept reflects patient's reality but counterweighs standardization of procedures.

Many PRM interventions are heterogeneous in its application, dosage (intensity, duration, frequency of application) and individual preference, both by clinicians and patients. Fundamental experimental data on treatment effects are sparse. This makes it difficult to design an effective placebo method if the underlying mechanism is not clear. Often, up to date and scientifically sound knowledge on physical modalities comes from other specialties. For example, research on "sonoporation" (ultrasound-driven transport of drugs through the skin) is currently strongly promoted by oncological scientists. This scientific approach provides scientific models, which can be easily adopted for PRM purposes, e.g. delivering drugs in musculoskeletal problems.

The number of researchers is relatively small, although rapidly growing.

Funding of trials, especially of basic experimental research is too little and cannot be compared to pharmaceutically driven trials.

A major challenge in conducting high quality clinical trials is the understanding of placebo in our specialty. Fregni, Imamura and others published a fundamental paper as a result of the International Placebo Symposium Working Group on recommendations and challenges for placebo control in PRM.<sup>97</sup> They identified several challenges of placebo use in PRM clinical trials. Some of them are reflecting the framework, concept and working principles of the specialty.

- Development of placebo and sham devices
- Lack of standards in PRM therapies
- Treatment heterogeneity due to therapist skill differences
- Issues with adequate masking
- Personal interaction between therapist and patient
- Personal beliefs, previous experience and motivation
- Small effect sizes
- Long follow-up
- Lack of training to conduct clinical research
- Use of medical devices.

Furthermore, some clinical conditions, simply do not allow the use of placebo or sham device. These conditions comprise trials testing hydrotherapeutic interventions, effectiveness of lower limb prosthesis, or use of sham-orthosis for drop foot.

Another challenge is the use of combination therapies. In clinical practice PRM therapies are often combined with each other or are prescribed in combination with drug therapy. Because there are a lot of possibilities to combine therapies, it was, in the past, not possible to design clinical trials of all possible combinations. These designs make the interpretation of each single treatment used very difficult. The question often remains if the used interventions influence each other. Furthermore, PRM physicians, more than in other specialties, are often dealing with multi-morbid patients. For obvious reasons designing and executing adequate studies with suitable participants can be very challenging.

Many of the above mentioned reasons contribute to the fact that inadequate study design, small number of participants, different parallel group designs and insufficient blinding and placebos led, among others, to poorer trial quality, especially compared to pharmacologic trials. Subsequently, studies performed in the past in our field were often not included in meta-analyses and consequently many of our specific treatments lack higher grade of evidence. As a consequence, this leads to impaired recognition from clinicians and researchers in the scientific community and an underrepresentation in EBM textbooks. In times of increasing financial shortcuts there may be tendencies to misuse this "lack of evidence" by stakeholders of healthcare systems to reduce costs. Out of this attitude, considerable pressure by health care may occur not to fund diagnostic and therapeutic procedures in the field of PRM.

Besides methodological shortcomings in PRM studies, the difference between organ based medicine and PRM is also promoted by the fact that the former is highly influenced by industrial interests, which may explain those different levels of evidence-based knowledge.<sup>98</sup>

#### *How to deal with these challenges*

Fortunately, in recent decades strong efforts were undertaken to increase the number of high quality studies and RCTs in the field. Progress was made in design and statistical methodology. Also inclusion and exclusion criteria in reviews influence results. One example of the influence of the number of high quality studies influencing meta-analysis outcomes is the recent second update of a Cochrane review on TENS in acute pain. In the past years data were insufficient to support the effectiveness of TENS

treatments in acute pain. By increasing the number of high quality RCTs and by excluding studies with insufficient dosage of TENS the Cochrane conclusion was upgraded to a tentative recommendation for the use of TENS.<sup>99</sup>

#### *Improve standards in PRM trials*

The main road to improve the appreciation of PRM is improving clinical research in quality and quantity, both on the level of basic science in the laboratories and on the clinical level.

The latter nowadays makes the conduct of high quality clinical trials such as the placebo or sham-controlled randomized clinical trials mandatory. Only these trials have the chance to be included in meta-analysis, e.g. Cochrane reviews, that provides the basis of recommendations and guidelines. This is important because clinical recommendations and guidelines influence medical education ensuring the implementation in daily clinical routine.

#### *Create sound PRM specific trial designs*

Basically, one should not be misguided transferring all the principles of high quality trials in pharmacotherapy directly into the field of PRM. Several differences have to be taken into account requesting a specific concept of double-blinded randomized controlled trials (RCT) in the field of PRM. Generally, scientists made efforts elaborating recommendations recognizing the difference between pharmacologic and non-pharmacologic trials and facilitating recommendations conducting the latter.<sup>100</sup> This group also gives recommendations for design and manuscript preparation taking into account the nature of non-pharmacologic trials.

#### *Standardize interventions*

Interventions in PRM are not often homogeneous. Responsible for this are lack of basic scientific data, preferences of patients and clinicians, recommendations of manufacturers and others. As example for neuromuscular electrical stimulation of extensor muscles in osteoarthritis of the knee, a variety in amplitude, frequency, electrode size and location are published. Only few reviews up to date made efforts to determine parameters generating best clinical treatment effects.<sup>101</sup> This standardization is necessary to conduct trials with comparable interventions.

Recommendations and guidelines from adjacent scientific societies can be adopted for standardization of treatment interventions. For example, the American Heart Association and the American College of Sports Medicine published distinct recommendations for administering exercise therapy to different groups of patients.<sup>102</sup> These guidelines have to be adopted by PRM as standard procedures.

#### *Representation of PRM in the “EBM world”*

Up to now the specialty of PRM was not distinctly and uniquely represented in various databases of EBM. One has to look for “physiotherapy”, “physical therapy”, “rehabilitation”, or “exercise” to find EBM data in our field. The launch of Cochrane PRM is a major step to overcome this problem. Within the Cochrane Fields and Networks, Cochrane Rehabilitation Field was established in 2016 and can serve as a Field, whose aim is to function as a bridge between the stakeholders and Cochrane.<sup>1</sup> The available evidence with regard to rehabilitation will be disseminated to the different concerned health professionals by means of educational, communication or publication strategies. Methodological issues will be tackled.

#### *Transfer of scientific knowledge into clinical practice*

After this knowledge translation, it is crucial to transfer evidence and guidelines into clinical practice. Especially in PRM, this does not only comprise PRM physicians but furthermore the entire rehabilitation team. This underlines the importance of the PRM specialist as a leader of the therapeutic team who consequently promotes EBM based procedures in the therapeutic and rehabilitative process. This requests adequate communication skills to convince all team members and implement it in daily routine.

It may be supportive to establish national working groups to facilitate this process.

#### *Conclusion*

EBM is part of modern medicine and thus also part of PRM. Nevertheless, we have to be aware that EBM is often reduced to external evidence based on meta-analysis and randomized, placebo controlled trials. PRM trials cannot be compared to pharmaceutical ones. Corre-

TABLE I.

Table IA summarizes the main differences. The “variables“ related to the person are so-called “latent“ variables or “traits“.<sup>84</sup> They cannot be entirely observed, they are not ‘manifest’: independence, pain, fatigue, balance, language skills and the like are hidden in the person. Their presence and their quantity can only be inferred from representative observable behaviours. Typically, these are selected and listed as items in cumulative questionnaires or scales. The amount of the variable is reflected by the ordinal, integer scores (also said “raw scores“; e.g. an independence score achieved on the Functional Independence Measure scale). The construction and validation of outcome measures is at the core of PRM research methodology, not less than biomechanical and neurophysiological methods. This scientific field is known as psychometrics, due to its origin, in the early 20<sup>th</sup> century, from the study of ‘psychological’ phenomena; however, the term ‘person-metrics’ should be preferred.

Table IB summarizes the specificity of statistical analyses aiming at measuring “latent variables“. These are properties “hidden“ in the person (such as knowledge, perceptions, capacities, mood and the like), which can only be inferred from representative behaviours. Once the variable of interest is defined, scale construction becomes a priority. The methods of construction and validation of these tools are complex and imply not only clinical and mathematical skills, but also deep epistemic reflection (in order to create scales that reflect real, existing — albeit hidden — variables). A key point is the validity of raw scores as measures: indeed, raw scores given to items (e.g. 0/1: absence/presence; 0/1/2: no/moderate/intense; etc.) are just counts of observations (e.g. how many times it happened that 0 rather than 1 was observed, etc.) but they do not tell us “how much more” of the variable does “presence” mean compared to “absence”, nor they tell us “how much more” of the variable does “moderate” mean compared to “absent”, and how much “less” does it mean compared to “intense”. Sophisticated mathematical modelling is needed (e.g. the Rasch analysis), deeply nested in PRM culture<sup>85</sup> not only in educational and sociological research paradigms.

Once the appropriate measures of the proper variables have been achieved, conventional statistics come to play. Oversimplifying the topic, statistical models mainly try to answer the critical question: is a given difference (between groups, before-after treatment, etc.) observable by chance alone? In conventional “bio-medical” statistics a significance level is often the final criterion: if that difference can be observed by chance beyond an arbitrary percent of the potential replications of the same measurement (usually, 5%, i.e. P=0.05), results are said to be “non-significant”. This Neyman-Pearson hypothesis-rejection paradigm is best applied to indexes of central tendency in populations (usually means and medians) and gives protection against false-positive results (i.e. those that may come from pure chance). But, first the substantial protection against false-positive findings paradoxically decreases, the more the number of observations increase: in large samples irrelevant differences can easily become statistically “significant” despite being marginal or useless in clinical practice. Second, the more you are protected (which is the case with small samples), the more true-positive results will be also discarded. Therefore, an increasing interest can be observed for the estimation of “power” (the probability for detecting true-positive results) and of the sample ‘size’, and ultimately of the clinical ‘importance’ of the effects, together with their p-based significance (Table IB).

Along the same line, other sophisticated statistical approaches are available, and their use is growing in PRM literature, in order to understand changes in individuals (and not just in populations). An example is the search for: a) the “minimal detectable change” (MDC, also called “minimal real difference”), i.e. the smallest change (e.g. before and after a treatment) that likely reflects true change rather than measurement error alone, in single individuals. Its value is linked with reproducibility indexes, and distribution-based statistical models; and b) the “minimal clinically important difference” (MCID), that represents the smallest measurement change to be considered meaningful according to clinical criteria (linked to an external judgement, implying anchor-based statistical models), and must be equivalent to or higher than the MDC.

Table IC illustrates the third and last rule of the game to be considered, i.e. the trial design. Again oversimplifying this scientific topic, one can say that trial design aims at estimating the strength of causal relationship between treatment and outcome. The more a causal inference is sustainable, the more an observed outcome can be said to be a result. Statistics tells you whether the outcome is not incidental; trial design supports your claim that the cause was the one you supposed. In other words, the trial design strives to solve the unavoidable “third variable explanation problem” (a type of confounding in which a third’ variable –actually, one or many more, often unsuspected– leads to a spurious causal relationship between two others). Various forms of control can be imposed to the study procedures, in order to minimize the role of ‘third variables’; the archetype of these procedures is the randomized double-blind controlled study (RCT). This practice is useful, necessary, and feasible in some PRM areas. But, as Table IC shows, for many reasons such designs can be impractical in behavioural research. Often a combination of experimental, non-experimental, and qualitative designs can provide a scientifically sound analysis of effectiveness in rehabilitation. For example, refined “quasi-experimental” research paradigms—stemming from psychological and social research are available,<sup>86</sup> including single-case designs, time-series research designs, Small-N designs, and other special observational designs (e.g. the so-called practice-based evidence study designs).<sup>87</sup> These designs may represent the right solution to research questions that cannot be stretched on an arbitrary standard to which exact conformity is forced (like in the myth of the Procrustean bed), e.g. the RCT designs. Of course, the systematic reviews and associated methods of making practice recommendations need to be more sensitive to non-RCT evidence, in order to really identify and correctly grade best evidence for clinical practice.<sup>82, 88</sup> For example, well-conducted cohort, correlational, or matching studies may give information that is more applicable to practice than explanatory RCTs with narrow inclusion criteria.

Clinical medicine (including PRM)	Biomedicine
A) Variables	
Behavioral; properties of the person as a whole (e.g. independence, fatigue, pain, balance, communication, etc.); often described by items in questionnaires, assessed by an observer (sometimes the subject himself). “Latent”. Not entirely or directly observable. Their quantity can only be inferred from counts of behaviors representative of the subject’s property (e.g. counts of responses to a questionnaire may indicate more or less independence in daily life, fatigue, pain, etc.). “Measures” are ordinal, discrete (counts of events). Each response may be counted as ‘one more’, yet its “weight” is unknown. Heavy non-linearity and errors affect the sums of counts taken as proxies of the true “quantity”.	Properties of parts of the person (e.g. skin temperature, arterial pressure, nerve conduction velocity, blood tests, CT scans, etc.). “Manifest”: their quantity is entirely open to observation. Continuous, linear, measures. High precision and reliability through instrumental measurement.

(To be continued)

TABLE I.—(continues).

B) Statistics	
Statistical models ( <i>e.g.</i> Rasch analysis) is required to estimate linear measures and errors from raw counts.	Measurement units have established validity ( <i>e.g.</i> units of length, weight, voltage, time).
Uniqueness of the person. Averaging can be questionable. Error in individual measurement cannot be considered as equal to the error estimated on means.	Means and medians are surrounded by errors lower than individual measurements. Inferences can be made based on established parameters ( <i>e.g.</i> normal distribution, confidence limits, etc.)
Individual peculiarities are substantive ( <i>e.g.</i> in deciding treatment).	Outcomes are usually continuous or discrete (counts).
Outcomes are often discontinuous events ( <i>e.g.</i> return to work, discharge home etc.).	Established models applicable to means can be applied to predictions ( <i>e.g.</i> ANOVA, multiple regression) and identification of 'latent' variables ( <i>e.g.</i> factor analysis procedures).
Logistic regression and interaction-based modelling ( <i>e.g.</i> survival analysis, neural networks, Classification and Regression Trees) are more appropriate than conventional ANOVA or regression statistics, based on 'main' effects from means.	Size effects potentially large. Side effects potentially harmful. Protection against false-positive findings (significance) is usually prioritized.
Effect sizes moderate, sample sizes small, side effects moderate. Statistics should highlight also power (enhancing the true positive risk). Significance just prevents false positive findings but can conceal true positive findings not less than significance.	Outcomes mostly given as changes at aggregate level, rather than at individual level.
There is the need for estimating intrinsic precision of the instrument in order to evaluate individual changes (minimal detectable change, minimal clinically important difference).	
C) Trial design	
The patient-clinician interaction has often to be taken as a source of efficacy, not of measurement error. Effective randomization and blindness not always applicable. Quasi-experimental designs often necessary.	Research focus is on means/medians. Control by randomization and blindness is usually applicable.
Single-component, standard-dose treatments are rarely applicable. More and diverse treatments are assigned to single individuals. Standard decision-trees (programs), not standard treatments, must be developed.	Single-component, standard-dose treatments are usually applicable.

sponding to the holistic approach to patients, a holistic research concept, from basic research to meta-analysis has to be implemented reflecting the framework of PRM. As a major step the foundation of a Cochrane Rehabilitation field will give the opportunity not only to publish further reviews on important topics but also to implement the concept and values of PRM in the EBM community.

### Research training

Most European trained young physicians have little or no formal training in research methodologies. Only a minority of the students is exposed to actual research projects during their studies, usually by chance. The situation is, however, improving slowly by faculties introducing a basic research component in the medical undergraduate, as well as postgraduate curriculum in many countries. This represents a window of opportunity for the Physical and Rehabilitation Medicine (PRM) discipline, since many students have a strong interest to participate in clinical projects as is the case in our area, and exposure to research is probably a strong motivating factor.

It is therefore recommendable that academic teach-

ers and senior colleagues with an academic interest in PRM offer medical students a possibility to participate in a current rehabilitation project, involving them not only in data collection but also in helping to analyse the data and even developing a scientific text. It should be required that exposure to research training becomes a compulsory part of postgraduate PRM training. This may later lead to the possibility to recruit such junior co-workers to become PhD-students in Physical and Rehabilitation Medicine. From Sweden, we have had several such recent examples.<sup>103, 104</sup>

However, vital to research training in PRM is to develop academic centers with sufficient sustainability and critical mass, to allow a continuing and vivid scientific dialogue and production. These centers should contain several permanent research positions, necessary laboratory functions and technical staff. They should always be linked to a clinical department to facilitate the interplay between practice and research and to make translational research possible. Currently, in Europe, the distribution of academic positions in PRM is very patchy, if one considers that 47 and 46 PRM chairs can be counted in France<sup>105</sup> and Italy,<sup>106</sup> respectively, against one in Germany, and only a few in the UK.



The decrease in PRM academic capacity, together with the shortening in research personnel, equipment, space and technical support imposed to many public academic institutions by the financial crisis in European countries, represent a very severe threat to the provision of adequate PRM specialist education and training, as well as to the advance of rehabilitation research and evidence-based practice. Academic institutions and, even more, health organizations and national funding agencies, should invest to establish new rehabilitation research programs or strengthen ongoing ones, being aware of the key role played by rehabilitation towards the global improvement of population health, in a European society that is claimed to be inclusive, innovative and reflective.<sup>107</sup>

Today, parts of the necessary infrastructure for research, such as access to a scientific library and to most scientific journals, can be solved through contact via the internet. It is also necessary to have regular discussions with experienced supervisors and this can also occur, at least partly, via the internet. This means that it is possible, as has been done in Denmark, to produce rehabilitation research ‘over the surface’ of a country rather than in one center.<sup>108</sup> Such organizations may also carry the advantage to more easily permit multicenter studies, something that is often necessary in rehabilitation research due to the difficulty to recruit large homogenous patient groups.

To develop a reasonable quality of the research data to be produced, it is also necessary to provide more formal training of PhD students in research methodology. Such training is usually available at research-oriented medical faculties in the form of courses on statistics, ethics, study designs, library use and scientific writing.

Courses directed specifically to European PhD students in rehabilitation research have also been organized, usually in cooperation between two European universities. Such week-long courses not only allow rehabilitation PhD students from different European universities to meet and interact but they also give a basis for networking for future research. The structure of these courses has followed the International Classification of Functioning, Disability and Health<sup>109</sup> by WHO, with sections on methodology for impairment evaluation,<sup>110</sup> for activity assessment and for participation assessment. The emphasis has been on controlled study designs, underlining the need of

power calculations and the necessity of independent observers. Since many of the important instruments used in rehabilitation research produce ordinal data, an emphasis in the statistical part of the course has been on Rasch analysis and instruments that have undergone such analysis.<sup>111</sup> All the PhD students participating in the courses have been asked to bring a poster on some of their own data and these posters have been discussed among the participants and the teachers in much appreciated poster sessions. It is hoped that these courses can be developed further to include specific subareas such as spinal cord injury rehabilitation research, traumatic brain injury-related research, stroke rehabilitation-related research and musculoskeletal rehabilitation research.

### Education to research

As it is well known, physicians who practice also as academicians, have three paramount roles. First and foremost, they have to provide the best health care to their patients. Second, they need to train residents/students and last but not least, they should conduct research. From one perspective, these three steps seem to align in decreasing order of importance. Herewith, in this era of evidence-based medicine,<sup>112</sup> no physician is privileged to categorize him/herself as “expert” and bypass the necessity of research. Further, if one believes that he/she is treating his/her patients appropriately, they need first to prove it (research), convince others as well (peer-review) and then explain/share the “method” (scholarly publishing). This way, other colleagues will exploit the “method” and likely improve the efficacy of their interventions; yet we are physicians who are dealing with human beings.

Accordingly, the training of physiatrists must definitely be research-minded. This approach is also crucial for strengthening the “backbone” of physical and rehabilitation medicine. Concerning the potential threats to PRM specialty (*e.g.* lack of clear evidences as regards the efficacy of some rehabilitation procedures or certain overlaps with other musculoskeletal fields), we need to facilitate research. This can be readily done with countless assessment tools that are used by PRM physicians. These would include ultrasound imaging, isokinetic systems, electromyography, motor evoked potential recording, gait analysis or other technologies which sub-

stantially evaluate different parameters of structure and strength/function of the musculoskeletal system.<sup>113</sup> It should be kept in mind that quantification means new data that may enlighten previously obscure questions.

In recent years, the increase in the number of research/publications in the realm of physical and rehabilitation medicine seems to be promising.<sup>114, 115</sup> Herein, it is noteworthy that the broad spectrum of research areas -varying from the validation of assessment tools, to the definition of prognostic factors, to the establishment of novel rehabilitation techniques *i.e.* in the whole range of nervous and musculoskeletal diseases (*e.g.* stroke, spinal cord injury, osteoporosis, rheumatic diseases etc.)- is highly advantageous.<sup>75</sup> Likewise, depending on the individual professional cults or interests and local conditions (clinical facility, patient population, etc.), PRM physicians conduct different studies that are also reflected to the scientific output. Importantly, when a relevant search is performed in Web of Science, PRM publications can be found to have fallen into different journal categories (*e.g.* clinical neurology, rheumatology, sport sciences, orthopedics) other than rehabilitation (Table IA). A similar search can also provide a snapshot as regards the top ranking countries (Table IB) and journals in the rehabilitation category (Table IC). Of note, during this search “rehabil\* and med\*” have been used as key words in the address section of Web of Science in order to avoid the exclusion of authors who addressed their affiliations without using the word “physical medicine” and also to avoid the primary inclusion of nonmedical health professionals working in rehabilitation sciences. Indisputably, this type of a search can only be used to have an overall idea -not for a precise in-depth analysis.

In conclusion, the amount of research in our field is mounting, and it seems to be faster than the number of pages available in rehabilitation journals.

## References

- Negrini S, Kiekens C, Levack W, Grubisic F, Gimigliano F, Ilieva E, *et al.* Cochrane physical and rehabilitation medicine: a new field to bridge between best evidence and the specific needs of our field of competence. *Eur J Phys Rehabil Med.* 2016 Jun;52(3):417–8.
- Negrini S, Minozzi S, Taricco M, Ziliani V, Zaina F. A systematic review of physical and rehabilitation medicine topics as developed by the Cochrane Collaboration. *Eur Medicophysica.* 2007 Sep;43(3):381–90.
- Cochrane Rehabilitation. Evidence [Internet]. 2017. Available from: <http://rehabilitation.cochrane.org/evidence>
- Stucki G, Melvin J. The International Classification of Functioning, Disability and Health: a unifying model for the conceptual description of physical and rehabilitation medicine. *J Rehabil Med.* 2007 May;39(4):286–92.
- Gutenbrunner C, Meyer T, Melvin J, Stucki G. Towards a conceptual description of Physical and Rehabilitation Medicine. *J Rehabil Med.* 2011 Sep;43(9):760–4.
- Ceravolo MG. Curriculum for the Education of Specialists in Physical and Rehabilitation Medicine. White book on Physical and Rehabilitation Medicine in Europe. Chapter 9 of current 3<sup>rd</sup> edition.
- Stucki G, Grimby G. Organizing human functioning and rehabilitation research into distinct scientific fields. Part I: Developing a comprehensive structure from the cell to society. *J Rehabil Med.* 2007 May;39(4):293–8.
- Stucki G, Reinhardt JD, Grimby G, Melvin J. Developing “Human Functioning and Rehabilitation Research” from the comprehensive perspective. *J Rehabil Med.* 2007 Nov;39(9):665–71.
- Negrini S, Reinhardt JD, Stucki G, Giustini A. From Bruges to Venice 1: towards a common structure for international Physical and Rehabilitation Medicine Congresses. *J Rehabil Med.* 2009 Mar;41(4):297–8.
- Gutenbrunner C, Reinhardt JD, Stucki G, Giustini A. From Bruges to Venice 2: towards a comprehensive abstract topic list for international Physical and Rehabilitation Medicine Congresses. *J Rehabil Med.* 2009 Mar;41(4):299–302.
- Nugraha B, Paternostro-Sluga T, Schuhfried O, Stucki G, Franchignoni F, Abdul Latif L, *et al.* Evaluation of the topic lists used in two world Congresses (2015 and 2016) in Physical and Rehabilitation Medicine. *J Rehabil Med* 2017;49:469-74
- Stucki G, Cieza A, Melvin J. The International Classification of Functioning, Disability and Health (ICF): a unifying model for the conceptual description of the rehabilitation strategy. *J Rehabil Med.* 2007 May;39(4):279–85.
- Reinhardt JD, Hofer P, Arenz S, Stucki G. Organizing human functioning and rehabilitation research into distinct scientific fields. Part III: Scientific journals. *J Rehabil Med.* 2007 May;39(4):308–22.
- Stucki G, Giustini A. European Physical and Rehabilitation Medicine journals in concert: a European Society of Physical and Rehabilitation Medicine (ESPRM) initiative. *Eur J Phys Rehabil Med.* 2008 Sep;44(3):229–35.
- Stucki G, Reinhardt JD, von Groote PM, DeLisa JA, Imamura M, Melvin JL. Chapter 2: ISPRM’s way forward. *J Rehabil Med.* 2009 Sep;41(10):798–809.
- Fineberg HV. Science and medicine in the 21st century: opportunities for rehabilitation medicine. *Am J Phys Med Rehabil.* 2005 Dec;84(12):928–31.
- Frontera WR, Fuhrer MJ, Jette AM, Chan L, Cooper RA, Duncan PW, *et al.* Rehabilitation Medicine Summit: building research capacity. *Am J Phys Med Rehabil.* 2005 Dec;84(12):913–7.
- Stucki G, Celio M. Developing human functioning and rehabilitation research. Part II: Interdisciplinary university centers and national and regional collaboration networks. *J Rehabil Med.* 2007 May;39(4):334–42.
- Stucki G. Developing human functioning and rehabilitation research. Part I: Academic training programs. *J Rehabil Med.* 2007 May;39(4):323–33.
- Negrini S, Kiekens C, Meerpohl JJ, Thomson D, Zampolini M, Christodoulou N, *et al.* Contributing to the growth of Physical and Rehabilitation Medicine (PRM): call for a Cochrane Field in PRM. *Eur J Phys Rehabil Med.* 2015 Jun;51(3):239–43.
- Stucki G, Bickenbach J, Negrini S. Methodological notes on applying the International Classification of Functioning, Disability and Health in rehabilitation. *Eur J Phys Rehabil Med.* 2017 Feb;53(1):132-133.
- Delarque A, Michail X, Christodoulou N. The action plan of the UEMS Physical and Rehabilitation Medicine Section and Board 2008-2010. *Eur J Phys Rehabil Med.* 2009 Jun;45(2):265–70.
- Gutenbrunner C, Lemoine F, Yelnik A, Joseph P-A, de Korvin G,

- Neumann V, *et al.* The field of competence of the specialist in physical and rehabilitation medicine (PRM). *Ann Phys Rehabil Med.* 2011 Jul;54(5):298–318.
24. Sackett DL, Rosenberg WM, Gray JA, Haynes RB, Richardson WS. Evidence based medicine: what it is and what it isn't. *BMJ.* 1996 Jan 13;312(7023):71–2.
  25. Prats M, Kerzouf M, Bensoussan L, Agresti J-P, Delorge B, Vito J-M, *et al.* A census of students with disabilities and the support provided at the University of Aix-Marseille. *Int J Rehabil Res* 2015 Sep;38(3):195–8.
  26. Negrini S, Padua L, Kiekens C, Michail X, Boldrini P. Current research funding methods dumb down health care and rehabilitation for disabled people and aging population: a call for a change. *Eur J Phys Rehabil Med.* 2014 Dec;50(6):601–8.
  27. European Commission - Research & Innovation. H2020. National Contact Points [Internet]. Available from: [http://ec.europa.eu/research/participants/portal/desktop/en/support/national\\_contact\\_points.html](http://ec.europa.eu/research/participants/portal/desktop/en/support/national_contact_points.html)
  28. European Commission - Horizon 2020. Marie Skłodowska-Curie Actions (including Cofund schemes) [Internet]. Available from: <https://ec.europa.eu/programmes/horizon2020/> and <http://ec.europa.eu/research/mariecurieactions/>
  29. European Commission. Euraxess. Researchers in Motion [Internet]. Available from: <https://euraxess.ec.europa.eu/>
  30. Wings for Life [Internet]. Available from: <http://www.wingsforlife.com/en/>
  31. Christopher and Dana Reeve Foundation - Research [Internet]. Available from: <https://www.christopherreeve.org/research>
  32. Max-Planck-Gesellschaft. Max Planck Institutes [Internet]. Available from: <https://www.mpg.de/institutes>
  33. Science Europe - Shaping the future of research. European Research Funding Organisations (RFO) and Research Performing Organisations (RPO) [Internet]. Available from: <http://www.scienceeurope.org/>
  34. De Dominicis L, Pérez SE, Fernández-Zubieta A. European university funding and financial autonomy. A study on the degree of diversification of university budget and the share of competitive funding [Internet]. Available from: <http://ftp.jrc.es/EURdoc/JRC63682.pdf>
  35. Groupe UGECAM. [Internet]. Available from: <http://www.groupe-ugecam.fr/>
  36. Foundation Don Gnocchi. [Internet]. Available from: <http://www.dongnocchi.it/>
  37. Council of Europe, COE. Additional protocol to the convention on Human Rights and Biomedicine, concerning biomedical research [Internet]. Available from: <https://www.coe.int/en/web/conventions/full-list/-/conventions/treaty/195>
  38. IASP International Association for the Study of Pain. IASP Guidelines for the Use of Animals in Research [Internet]. Available from: <https://www.iasp-pain.org/Education/Content.aspx?ItemNumber=1217>
  39. European Commission - Environment. Animals used for scientific purposes. Protection of animals in research [Internet]. Available from: [http://ec.europa.eu/environment/chemicals/lab\\_animals/index\\_en.htm](http://ec.europa.eu/environment/chemicals/lab_animals/index_en.htm)
  40. Dunn AG, Coiera E, Mandl KD, Bourgeois FT. Conflict of interest disclosure in biomedical research: A review of current practices, biases, and the role of public registries in improving transparency. *Res Integr Peer Rev.* 2016;1.
  41. NCBI - Bookshelf. Conflict of Interest in Medical Research, Education, and Practice. Lo B, Field MJ, editors. Washington, DC: National Academies Press, 2009. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK22942/>
  42. Brænd AM, Straand J, Jakobsen RB, Klovning A. Publication and non-publication of drug trial results: a 10-year cohort of trials in Norwegian general practice. *BMJ Open.* 2016 Apr 11;6(4):e010535.
  43. Palazzo C, Ravaut J-F, Trinquart L, Dalichampt M, Ravaut P, Poiraudou S. Respective contribution of chronic conditions to disability in France: results from the national Disability-Health Survey. *PloS One.* 2012;7(9):e44994.
  44. Negrini S. Steady growth seen for research in physical and rehabilitation medicine: where our specialty is now and where we are going. *Eur J Phys Rehabil Med.* 2012 Dec;48(4):543–8.
  45. Mimouni M, Cismariu-Potash K, Ratmansky M, Shaklai S, Amir H, Mimouni-Bloch A. Trends in Physical Medicine and Rehabilitation Publications Over the Past 16 Years. *Arch Phys Med Rehabil.* 2016 Jun;97(6):1030–3.
  46. Alam M, Rodrigues W, Pham BN, Thakor NV. Brain-machine interface facilitated neurorehabilitation via spinal stimulation after spinal cord injury: Recent progress and future perspectives. *Brain Res.* 2016 Sep 1;1646:25–33.
  47. Stucki G. Olle Höök Lectureship 2015: The World Health Organization's paradigm shift and implementation of the International Classification of Functioning, Disability and Health in rehabilitation. *J Rehabil Med.* 2016 Jun 13;48(6):486–93.
  48. Inserm. Institut National de la santé et de la recherche - French National Institute of Health and Medical Research [Internet]. Available from: <http://english.inserm.fr/>
  49. Falkner S, Grade S, Dimou L, Conzelmann K-K, Bonhoeffer T, Götz M, *et al.* Transplanted embryonic neurons integrate into adult neocortical circuits. *Nature.* 2016 10;539(7628):248–53.
  50. Alliance for Biomedical Research in Europe [Internet]. Available from: <https://www.biomedeuropa.org/about/mission.html>
  51. Markram H, Muller E, Ramaswamy S, Reimann MW, Abdellah M, Sanchez CA, *et al.* Reconstruction and simulation of neocortical microcircuitry. *Cell.* 2015 Oct 8;163(2):456–92.
  52. Palmero E, Palmero S, Murrell W. Brain tissue banking for stem cells for our future. *Sci Rep.* 2016 Dec 19;6:39394.
  53. Brocard C, Plantier V, Boulenguez P, Liabeuf S, Bouhadfane M, Viallat-Lieutaud A, *et al.* Cleavage of Na(+) channels by calpain increases persistent Na(+) current and promotes spasticity after spinal cord injury. *Nat Med.* 2016 Apr;22(4):404–11.
  54. Eatris. European infrastructure for translational medicine [Internet]. Available from: <https://eatris.eu/>
  55. Contopoulos-Ioannidis DG, Ntzani E, Ioannidis JPA. Translation of highly promising basic science research into clinical applications. *Am J Med.* 2003 Apr 15;114(6):477–84.
  56. Elley CR, Robertson MC, Garrett S, Kerse NM, McKinlay E, Lawton B, *et al.* Effectiveness of a falls-and-fracture nurse coordinator to reduce falls: a randomized, controlled trial of at-risk older adults. *J Am Geriatr Soc.* 2008 Aug;56(8):1383–9.
  57. Ramsay Health Care [Internet]. Available from: <http://www.ramsay-health.com/>
  58. INT. Institut de Neurosciences de la Timone [Internet]. Available from: <http://www.int.univ-amu.fr/Institute>
  59. European Academy of Rehabilitation Medicine. Publications [Internet]. Available from: [http://www.aemr.eu/index.php?option=com\\_content&task=category&sectionid=8&id=19&Itemid=44](http://www.aemr.eu/index.php?option=com_content&task=category&sectionid=8&id=19&Itemid=44)
  60. Physical and Rehabilitation Medicine Section and Board of the European Union of Medical Specialist. e-Learning [Internet]. Available from: <http://www.euro-prm.org/index.php?lang=en>
  61. Evidence-Based Review of Stroke Rehabilitation, EBRSR [Internet]. Available from: <http://www.ebrsr.com/>
  62. ESPRM. Calendar of scientific events [Internet]. Available from: <http://www.esprm2018.com/> and <http://www.esprm.net/meetings>
  63. European Society of Physical & Rehabilitation Medicine. ESPRM committees-Evidence Based Medicine [Internet]. Available from: <http://www.esprm.net/committees-details/FMiL/evidence-based-medicine-ebm>
  64. European Journal of Physical and Rehabilitation Medicine [Internet]. Available from: <http://www.ejprm.org/>
  65. Journal of Rehabilitation Medicine. Available from: [www.medical-journals.se/jrm/](http://www.medical-journals.se/jrm/)
  66. Negrini S, Ilieva E, Moslavac S, Zampolini M, Giustini A. The European physical and rehabilitation medicine journal network: historical notes on national journals. *Eur J Phys Rehabil Med.* 2010 Jun;46(2):291–6.
  67. Cochrane Rehabilitation [Internet]. Available from: <http://rehabilitation.cochrane.org/>
  68. United Nations Human Rights - Office of the High Commissioner,

- OHCHR. Committee on the Rights of Persons with Disabilities [Internet]. Available from: <http://www.ohchr.org/EN/HRBodies/CRPD/Pages/CRPDIndex.aspx>
69. Bornmann L. Measuring the societal impact of research: research is less and less assessed on scientific impact alone--we should aim to quantify the increasingly important contributions of science to society. *EMBO Rep.* 2012 Aug;13(8):673–6.
  70. Donadieu M, Le Fur Y, Lecocq A, Maudsley AA, Gherib S, Soulier E, *et al.* Metabolic voxel-based analysis of the complete human brain using fast 3D-MRSI: Proof of concept in multiple sclerosis. *J Magn Reson Imaging JMRI.* 2016 Aug;44(2):411–9.
  71. Hakim RM, Tunis BG, Ross MD. Rehabilitation robotics for the upper extremity: review with new directions for orthopaedic disorders. *Disabil Rehabil Assist Technol.* 2016 Dec 30;1–7.
  72. Gama GL, Celestino ML, Barela JA, Forrester L, Whittall J, Barela AM. Effects of Gait Training With Body Weight Support on a Treadmill *Versus* Overground in Individuals With Stroke. *Arch Phys Med Rehabil.* 2017 Apr;98(4):738–45.
  73. Young JM, Solomon MJ. How to critically appraise an article. *Nat Clin Pract Gastroenterol Hepatol.* 2009 Feb;6(2):82–91.
  74. Lonsdale A, Sietsma Penington J, Rice T, Walker M, Dashnow H. Ten Simple Rules for a Bioinformatics Journal Club. *PLoS Comput Biol.* 2016 Jan;12(1):e1004526.
  75. Ozçakar L, Franchignoni F, Negrini S, Frontera W. Writing a case report for the American Journal of Physical Medicine & Rehabilitation and the European Journal of Physical and Rehabilitation Medicine. *Am J Phys Med Rehabil.* 2013 Feb;92(2):183–6.
  76. Youtube. The University of Chicago : Communicating Science With Alan Alda [Internet]. Available from: <https://www.youtube.com/watch?v=DwjfMzWfuG8>
  77. Youtube. Alan Alda: The Art of Science Communication [Internet]. Available from: <https://www.youtube.com/watch?v=UGo6pTcTgVw>
  78. Vimeo. 2016 UQ 3MT (Three Minute Thesis) final winner& people's choice - Anna-Liisa Sutt - "Dying to talk" [Internet]. Available from: <https://vimeo.com/183241953>
  79. Ministère de l'Enseignement supérieur, de la Recherche et de l'Innovation. Etudiants handicapés. Contrats doctoraux handicap [Internet]. Available from: <http://www.enseignementsup-recherche.gouv.fr/cid100602/contrats-doctoraux-handicap-campagne-nationale-2017.html>
  80. Tesio L. The good-hearted and the clever: clinical medicine at the bottom of the barrel of science. *J Med Pers.* 2010. *J Med Pers.* 2010 Dec;103–11.
  81. Grimby G. Research and publishing in rehabilitation medicine. *J Rehabil Med.* 2009 Nov;41(13):1021–3.
  82. Seel RT, Dijkers MP, Johnston MV. Developing and using evidence to improve rehabilitation practice. *Arch Phys Med Rehabil.* 2012 Aug;93(8 Suppl):S97–100.
  83. Reinhard J, Stucki S. Organizing human functioning and rehabilitation research into distinct scientific fields revisited: Reply to the letters from Jensen & Kartin and Graham & Cameron. *J Rehabil Med.* 2009;204–206.
  84. Borsboom D, Mellenbergh GJ, van Heerden J. The theoretical status of latent variables. *Psychol Rev.* 2003 Apr;110(2):203–19.
  85. Tesio L. Measuring behaviours and perceptions: Rasch analysis as a tool for rehabilitation research. *J Rehabil Med.* 2003 May;35(3):105–15.
  86. Shadish WR, Cook TD, Campbell DT, Jr- I. Experimental and quasi experimental designs for generalized causal inference.
  87. Horn SD, DeJong G, Deutscher D. Practice-based evidence research in rehabilitation: an alternative to randomized controlled trials and traditional observational studies. *Arch Phys Med Rehabil.* 2012 Aug;93(8 Suppl):S127–137.
  88. Jette AM. Toward Systems Science in Rehabilitation. *Phys Ther.* 2016 Mar;96(3):270–1.
  89. Tesio L, Franchignoni F. Don't touch the physical in "physical and rehabilitation medicine." *J Rehabil Med.* 2007 Oct;39(8):662–3.
  90. Alderson P. Absence of evidence is not evidence of absence. *BMJ.* 2004 Feb 28;328(7438):476–7.
  91. Evidence-Based Medicine Working Group. Evidence-based medicine. A new approach to teaching the practice of medicine. *JAMA.* 1992 Nov 4;268(17):2420–5.
  92. Verhagen AP, de Vet HC, de Bie RA, Kessels AG, Boers M, Bouter LM, *et al.* The Delphi list: a criteria list for quality assessment of randomized clinical trials for conducting systematic reviews developed by Delphi consensus. *J Clin Epidemiol.* 1998 Dec;51(12):1235–41.
  93. Maher CG, Sherrington C, Herbert RD, Moseley AM, Elkins M. Reliability of the PEDro scale for rating quality of randomized controlled trials. *Phys Ther.* 2003 Aug;83(8):713–21.
  94. de Morton NA. The PEDro scale is a valid measure of the methodological quality of clinical trials: a demographic study. *Aust J Physiother.* 2009;55(2):129–33.
  95. Guyatt GH, Oxman AD, Vist GE, Kunz R, Falck-Ytter Y, Alonso-Coello P, *et al.* GRADE: an emerging consensus on rating quality of evidence and strength of recommendations. *BMJ.* 2008 Apr 26;336(7650):924–6.
  96. Schüneman H, Brožek J, Guyatt G, Oxman A. GRADE Handbook [Internet]. Available from: <http://gdt.guidelinedevelopment.org/app/handbook/handbook.html>
  97. Fregni F, Imamura M, Chien HF, Lew HL, Boggio P, Kaptchuk TJ, *et al.* Challenges and recommendations for placebo controls in randomized trials in physical and rehabilitation medicine: a report of the international placebo symposium working group. *Am J Phys Med Rehabil.* 2010 Feb;89(2):160–72.
  98. Lexchin J, Bero LA, Djulbegovic B, Clark O. Pharmaceutical industry sponsorship and research outcome and quality: systematic review. *BMJ.* 2003 May 31;326(7400):1167–70.
  99. Johnson MI, Paley CA, Howe TE, Sluka KA. Transcutaneous electrical nerve stimulation for acute pain. *Cochrane Database Syst Rev.* 2015 Jun 15;(6):CD006142.
  100. Boutron I, Moher D, Altman DG, Schulz KF, Ravaud P, CONSORT Group. Extending the CONSORT statement to randomized trials of nonpharmacologic treatment: explanation and elaboration. *Ann Intern Med.* 2008 Feb 19;148(4):295–309.
  101. Filipovic A, Kleinöder H, Dörmann U, Mester J. Electromyostimulation--a systematic review of the influence of training regimens and stimulation parameters on effectiveness in electromyostimulation training of selected strength parameters. *J Strength Cond Res.* 2011 Nov;25(11):3218–38.
  102. Garber CE, Blissmer B, Deschenes MR, Franklin BA, Lamonte MJ, Lee I-M, *et al.* American College of Sports Medicine position stand. Quantity and quality of exercise for developing and maintaining cardiorespiratory, musculoskeletal, and neuromotor fitness in apparently healthy adults: guidance for prescribing exercise. *Med Sci Sports Exerc.* 2011 Jul;43(7):1334–59.
  103. Persson AL, Westermarck S, Merrick D, Sjölund BH. Validity of electrical stimulus magnitude matching in chronic pain. *J Rehabil Med.* 2009 Nov;41(11):898–903.
  104. Brogårdh C, Johansson FW, Nygren F, Sjölund BH. Mode of hand training determines cortical reorganisation: a randomized controlled study in healthy adults. *J Rehabil Med.* 2010 Sep;42(8):789–94.
  105. Ministère de l'Enseignement supérieur, de la Recherche et de l'Innovation. Les enseignants-chercheurs des disciplines de santé. Effectifs hospitalo-universitaires des centres hospitaliers et universitaires [Internet]. 2015. Available from: <http://www.enseignement-sup-recherche.gouv.fr/cid23806/effectifs-hospitalo-universitaires-des-centres-hospitaliers-et-universitaires.html>
  106. Cerca Università. Ricerca avanzata per docenti [Internet]. Available from: [http://cercauniversita.cineca.it/php5/docenti/vis\\_docenti.php](http://cercauniversita.cineca.it/php5/docenti/vis_docenti.php)
  107. Horizon 2020. Horizon 2020 projects - European Commission [Internet]. Available from: <https://ec.europa.eu/programmes/horizon2020/en/h2020-sections-projects>
  108. Kjaersgaard A, Nielsen LH, Sjölund BH. Randomized trial of two swallowing assessment approaches in patients with acquired brain injury: Facial-Oral Tract Therapy *versus* Fiberoptic Endoscopic Evaluation of Swallowing. *Clin Rehabil.* 2014 Mar;28(3):243–53.
  109. WHO. International Classification of Functioning, Disability and Health WHO Geneva 2001. 2001.

110. Barat M, Franchignoni F. Assessment in physical medicine and rehabilitation views and perspectives. Maugeri Foundation Books. 2004.
111. Arsalis. Outcome application [Internet]. Available from: <http://www.arsalis.com/outcome.html#outcome-overview-en/>
112. Franchignoni F, Özçakar L, Michail X, Vanderstraeten G, Christodoulou N, Frischknecht R. Publishing in Physical and rehabilitation medicine. An update on the European point of view. *Eur J Phys Rehabil Med.* 2013 Oct;49(5):711–4.
113. Ulaşlı AM, Kara M, Özçakar L. Publications of physical and rehabilitation medicine physicians concerning musculoskeletal ultrasonography: an overview. *J Rehabil Med.* 2011 Jul;43(8):681–3.
114. Franchignoni F, Muñoz Lasa S, Özçakar L, Ottonello M. Bibliometric indicators: a snapshot of the scientific productivity of leading European PRM researchers. *Eur J Phys Rehabil Med.* 2011 Sep;47(3):455–62.
115. Kara M, Özçakar L, Kaymak B, Ozel S, Aknc A. Scientific publications in physical and rehabilitation medicine: a glance from Turkey. *Am J Phys Med Rehabil.* 2011 Jul;90(7):612–4.

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## Appendix I.—Updated ISPRM Scientific Topic List

Based on above described principle considerations and the evaluation of the use of the first proposal of the ISPRM topic list the following updated list has been derived (*main changes underlined*):

This proposal includes topics that are not mentioned in the first proposal and an improved systematic order of the topics.

### A. Clinical Physical and Rehabilitation Medicine Sciences

**Description:** the clinical rehabilitation Sciences study how to provide best care with the goal of enabling people with health conditions experiencing or likely to experience disability to achieve and maintain optimal functioning in interaction with their immediate environment. It contains clinical research on best care including guidelines and standards, organization and quality management. No. A.1.-A.5. relate to specific health conditions; A.6. to A.11. to functioning issues and related rehabilitation goals

#### A.1. Pain<sup>1</sup>

A.1.1. Acute pain

A.1.2. Chronic generalized pain syndromes (*including fibromyalgia*)

A.1.3. Complex regional pain syndromes

A.1.4. Miscellaneous

#### A.2. Musculoskeletal conditions

A.2.1. Inflammatory joint diseases (*e.g. rheumatoid arthritis, ankylosing spondylitis*)

A.2.2. Degenerative joint diseases (*e.g. osteoarthritis*)<sup>2</sup>

A.2.3. Bone diseases (*e.g. osteoporosis*)

A.2.4. Local and regional pain syndromes of the neck and upper extremity (*including enthesopathy, tendinitis and others*)

A.2.5. Regional pain syndromes of the pelvis and lower extremity (*including enthesopathy, tendinitis and others*)

A.2.6. Back pain and spine disorders

A.2.7. Musculoskeletal trauma (*e.g. fractures*)

A.2.8. Sports injury

A.2.9. Miscellaneous

#### A.3. Health conditions of the nervous system

A.3.1. Stroke

A.3.2. Traumatic brain injury

A.3.3. Spinal cord injury and other spinal cord diseases

A.3.4. Autoimmune and inflammatory neurological conditions (*e.g. multiple sclerosis*)

A.3.5. Neurodegenerative diseases (*e.g. dementia*)

A.3.6. Peripheral nerve injury

A.3.7. Vegetative states, minimally conscious and low awareness states

A.3.8. Miscellaneous

#### A.4. Mental health conditions

A.4.1. Anxiety, depression, bipolar disorders

A.4.2. Learning disabilities

A.4.3. Addiction disorder

A.4.4. Other mental health conditions

#### A.5. Internal medicine and related conditions

A.5.1. Heart and cardiovascular system

A.5.2. Diseases of the lymphatic system

A.5.3. Pulmonary diseases

A.5.4. Oro-laryngeal-pharyngeal diseases

A.5.5. Metabolic disorders (*e.g. obesity, diabetes mellitus*)

A.5.6. Cancer

A.5.7. Infectious diseases

A.5.8. Skin disorder and allergies

A.5.9. Bladder and bowel disorders

A.5.10. Uro-gynaecological disorders (*incl. obstetric treatments*)

A.5.11. Miscellaneous

#### A.6. Post-surgery and post-traumatic rehabilitation<sup>3</sup>

A.6.1. Musculoskeletal injury, bone fractures

A.6.2. Multiple trauma

A.6.3. Burn injury

A.6.4. Organ transplantation

A.6.5. Joint arthroplasty/joint replacement

A.6.6. Limb amputation

A.6.7. Miscellaneous

#### A.7. Rehabilitation for children and youth

A.7.1. Developmental disorders

A.7.2. Cerebral palsy

A.7.3. Spina bifida

A.7.4. Traumatic brain injury in children

<sup>1</sup> Pain can be classified both as a health condition and a body function.

<sup>2</sup> Arthroplasty/joint replacement is classified under post-surgery rehabilitation.

<sup>3</sup> Traumatic brain injury and spinal cord injury under conditions of the nervous system.

- A.7.5. Juvenile rheumatoid arthritis
- A.7.6. Infectious diseases in children and youth
- A.7.7. Autism and other mental disorders in children (incl. Attention deficit disorder)
- A.7.8. Miscellaneous
- How about transitions of children with disabilities to adulthood?
- A.8. Rehabilitation for people with old age<sup>4</sup>
  - A.8.1. Dementia
  - A.8.2. Frailty
  - A.8.3. Sarcopenia
  - A.8.4. Depressive disorder in the elderly
  - A.8.5. risk of falls in the elderly
  - A.8.6. other geriatric conditions
- A.9. Rehabilitation for Rare (orphan) diseases<sup>5</sup>
- A.10. Rehabilitation addressing to specific functioning issues
  - A.10.1. Visual impairment and blindness
  - A.10.2. Auditory impairment and deaf
  - A.10.3. Speech and language dysfunction (including mute)
  - A.10.4. Sensory and motor control (*including postural control*)
  - A.10.5. Management of spasticity
  - A.10.6. Management of hemiplegia and paraplegia
  - A.10.7. Management of dysphagia
  - A.10.8. Respiratory impairment (incl. management of patients with artificial ventilation and weaning)
  - A.10.9. Malnutrition in rehabilitation
  - A.10.10. Sphincter dysfunction (*including incontinence*)
  - A.10.11. Management of wound and pressure sores
  - A.10.12. Management of fatigue and sleep disorders
  - A.10.13. Rehabilitation of disability-related mental dysfunction (*e.g. depression, anxiety*)
  - A.10.14. Sexual functioning in people with disability and chronic health conditions
  - A.10.15. Other specific functions
- A.11. Sports rehabilitation (are you referring to the use of sports in rehabilitation? Sports injuries have been included in A.2.8)
- A.12. Miscellaneous

<sup>4</sup> This chapter also includes functioning issues.

<sup>5</sup> Including case reports of specific rehabilitation issues.

## B. Biosciences in Rehabilitation

Description: The Biosciences in rehabilitation are basic sciences that aim to explain body injury, adaptation and repair from the molecular to the cellular, organ system and organism level; and to identify targets for biomedical interventions to improve body functions and structures.

- B.1. Mechanisms of tissue injury (*e.g. inflammation, repetitive strain*) and development of organ dysfunction (*e.g. atrophy, spasticity, chronic pain*)
- B.2. Cell and tissue adaptation and mal-adaptation (*e.g. plasticity, molecular mechanisms and mediators*)
- B.3. Autonomous regulation (incl. HPA-Axis, hormonal regulation systems)
- B.4. Biological mechanism of interventions (*e.g. pain relief, motor learning*)
- B.5. Miscellaneous

## C. Biomedical Rehabilitation Sciences and Engineering

Description: the Biomedical rehabilitation sciences and engineering are applied sciences that study diagnostic measures and interventions including physical modalities suitable to minimize impairment, control symptoms and to optimize people's capacity.

- C.1. Physical and rehabilitation Medicine (PRM) diagnostics (*e.g. cardio-vascular functions and physical endurance, lung function testing, or imaging techniques*) as related to organ systems and body functions (based on the first level of the International Classification of Functioning, Disability and Health (ICF) component body functions)
  - C.1.1. Diagnosis and assessment of mental functions (*including neuropsychological assessment*)
  - C.1.2. Diagnosis and assessment of sensory functions and pain
  - C.1.3. Diagnosis and assessment of voice and speech functions
  - C.1.4. Diagnosis and assessment of functions of the cardiovascular, haematological, immunological, and respiratory systems
  - C.1.5. Diagnosis and assessment of functions of the digestive, metabolic, and endocrine systems

- C.1.6. Diagnosis and assessment of genitourinary and reproductive functions
- C.1.7. Diagnosis and assessment of neurological, musculoskeletal and movement related functions (*including gait analysis, posturography*)
- C.1.8. Diagnosis and assessment of functions of the skin and related structures
- C.1.9. Assessment of health perception and quality of life
- C.1.10. Miscellaneous
- C.2. PRM interventions research
  - C.2.1. Exercise
  - C.2.2. Muscle training
  - C.2.3. Ergonomics
  - C.2.4. Joint mobilization and manipulation techniques
  - C.2.5. Prosthetics and orthotics
  - C.2.6. Massage and myofascial techniques
  - C.2.7. Vibration and other mechanical stimulation
  - C.2.8. Transcranial magnetic stimulation
  - C.2.9. Lymph therapy (manual lymphatic drainage)
  - C.2.10. Heat and cold
  - C.2.11. Hydrotherapy and balneotherapy
  - C.2.12. Light (*including UV*)
  - C.2.13. Climatotherapy
  - C.2.14. Electrotherapy (including functional electrophysiological stimulation)
  - C.2.15. Pharmacological interventions (*e.g.* for pain, spasticity, anti-inflammatory drugs)
  - C.2.16. Nerve root blockades and local infiltrations
  - C.2.17. Acupuncture and complementary and alternative therapies
  - C.2.18. Nutrition and diet
  - C.2.19. Virtual reality, exergaming
  - C.2.20. Rehabilitation technology, including implants, prosthesis, orthoses
  - C.2.21. Robots, aids and devices
  - C.2.22. Sports in rehabilitation
  - C.2.23. Injection techniques and infiltrations
  - C.2.24. Surgical interventions in rehabilitation
  - C.2.25. Miscellaneous
- C.3. Comprehensive rehabilitation program (continuum of care research)
  - C.3.1. Acute and early post-acute rehabilitation programs
  - C.3.2. Post-acute rehabilitation programs
  - C.3.3. Long-term rehabilitation programs
  - C.3.4. Intermittent (boost) rehabilitation programs for chronic conditions
  - C.3.5. Programs for prevention of disability

- C.3.6. Miscellaneous
- C.4. Miscellaneous

#### D. Integrative Rehabilitation Sciences

**Description:** the Integrative rehabilitation sciences design and study rehabilitation systems, services, comprehensive assessments and intervention programmes, which integrate biomedical, personal factor and environmental approaches suited to optimize people's performance. This chapter includes the principles and contents of education and training of professionals in rehabilitation, as well as the evaluation of the rehabilitation team and multidisciplinary care.

- D.1. Rehabilitation systems and services research
  - D.1.1. Health policy and law (including medical and social model of disability and rehabilitation)
  - D.1.2. Health strategies in Physical and Rehabilitation Medicine
  - D.1.3. Rehabilitation service organization
  - D.1.4. Rehabilitation economics
  - D.1.5. Community-based participation research
  - D.1.6. Miscellaneous
- D.2. Comprehensive rehabilitation intervention research
  - D.2.1. Rehabilitation service evaluation (including acute, post-acute and community rehabilitation services)
  - D.2.2. Rehabilitation programme evaluation (*e.g. home-based rehabilitation*)
  - D.2.3. Rehabilitation technology assessment (*e.g. telerehabilitation*)
  - D.2.4. Rehabilitation strategies for specific issues (including rehabilitation strategies for developing countries and rehabilitation after natural disasters)
  - D.2.5. Technology transfer
  - D.2.6. Patient and proxy education
  - D.2.7. Miscellaneous
- D.3. Social integration programmes and rehabilitation for specific socio-economic needs
  - D.3.1. Community based rehabilitation policy and management
  - D.3.2. Vocational rehabilitation
  - D.3.3. Support, assistance and independent living
  - D.3.4. Disability compensation
  - D.3.5. Miscellaneous



- D.4. Education and training in rehabilitation
  - D.4.1. Undergraduate medical education
  - D.4.2. Specialist training
  - D.4.3. Continuous medical education and professional development
  - D.4.4. Training in science and research
  - D.4.5. Training of other rehabilitation professionals  
Training of patients and their families??
  - D.4.6. Miscellaneous
- D.5. Rehabilitation management and administration
  - D.5.1. Rehabilitation service management (including integrated care and service concepts)
  - D.5.2. Case management
  - D.5.3. Structures and processes in rehabilitation institutions (maybe other health care institutions such as acute care hospitals?)
  - D.5.4. Miscellaneous
- D.6. Miscellaneous

### E. Human Functioning Sciences

Description: The human Functioning Sciences are basic sciences from the comprehensive perspective that

aim to understand human functioning and to identify targets for comprehensive interventions.

- E.1. Theories and models of functioning
- E.2. Classification of functioning (*e.g.* ICF core Sets; ICF up-date and revision)
- E.3. Measurement of functioning (*e.g.* psychometrics of assessment tools; operationalization of ICF categories)
- E.4. Functioning epidemiology (population-based comparative studies of functioning across conditions, cultures, and time, *e.g.* on employment of people with disability)
- E.5. Functioning impact assessment (*e.g.* prediction of the implications of policy and legislation on functioning)
- E.6. Ethical issues and human rights (should this be a new section; maybe together with E.7?; Humanities and Rehabilitation?) good idea, I would do E6 and E7 together indeed
- E.7. Cultural aspects of disability and rehabilitation (*e.g.* cultural influences, societal attitudes, religious beliefs)
- E.8. Miscellaneous



## THE WAY FORWARD

# White Book on Physical and Rehabilitation Medicine (PRM) in Europe. Chapter 11. Challenges and perspectives for the future of PRM

European Physical and Rehabilitation Medicine Bodies Alliance

### ABSTRACT

In the context of the White Book of Physical and Rehabilitation Medicine (PRM) in Europe, this paper deals with the future perspectives of PRM in Europe according to the actual vision of the European Bodies. All Chapters stress the big changes that Europe is facing in terms of demography, life expectancy, survival rates, disability burden, increasing prevalence of long-term health conditions, progress in technology, but also health costs and society changes in terms of requirements of wellness and quality of life together with health. All these challenges combined with the specificities of PRM, that is the medical specialty focusing on the whole person and its functioning in the various health conditions, with the aim to guarantee the best possible participation through improvement of activities and reduction of impairments. The possible consequences of these changes in the future evolution of PRM clinical practice, services, education, research are presented; moreover, the vision on the progress to harmonization of the development of PRM across Europe, and the possible contribution of PRM to policy planning are presented.

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**Key words:** Physical and rehabilitation medicine - Europe - Forecasting - Health services - Education - Research.

### Introduction

The White Book (WB) of Physical and Rehabilitation Medicine (PRM) in Europe is produced by the 4 European PRM Bodies and constitutes the reference book for PRM physicians in Europe. It has multiple values, including to provide a unifying framework for the European Countries, to inform decision-makers at the European and national level, to offer educational material for PRM trainees and physicians and information about PRM to the medical community, other rehabilitation professionals and the public. The WB states the importance of PRM specialty, that is a primary medical specialty. The contents include definitions and concepts of PRM, why rehabilitation is needed by individuals and society, the fundamentals of PRM, history of PRM specialty, structure and activities of PRM organizations in Europe, knowledge and skills of PRM physicians, the clinical field of competence of PRM, the place of PRM specialty in the healthcare system and society, educa-

tion and continuous professional development of PRM physicians, specificities and challenges of science and research in PRM and challenges and perspectives for the future of PRM.

This chapter focuses on the future perspectives of PRM in Europe according to the actual vision of the European Bodies. All Chapters focus on the big changes that Europe is facing in terms of demography, life expectancy, survival rates, disability burden, increasing prevalence of long-term health conditions, progress in technology, but also health costs and society changes in terms of requirements of wellness and quality of life together with health. All these challenges combine with the specificities of PRM, that is the medical specialty focusing on the whole person and its functioning in the various health conditions, with the aim to guarantee the best possible participation through improvement of activities and reduction of impairments. The aim of this chapter is to present the impact of these changes and challenges on clinical practice, service development,

education, and research; moreover, the vision on the progress to harmonization of the development of PRM across Europe, and the possible contribution of PRM to policy planning are presented.

### Physical and rehabilitation medicine service development

Even if no one can accurately predict the future, some trends in demography, epidemiology and societal attitudes are likely to continue for the next 10 to 30 years. Some of these are:

- life expectancy is going to grow further and people with long-term disabling health conditions and disabilities will live longer. Some problems of aged people such as frailty, dementia and difficulties in mobility, self-care and communication will grow. This will increase the need for rehabilitation;

- due to the progress in therapies, survival rates after severe disease (including cancer) and trauma will further increase. Many of these diseases will evolve in chronic health conditions, while many survivors will experience some kind of disability: most will need rehabilitation;

- also, new infectious diseases may lead to an increased need for rehabilitation (one recent example is the Zika virus epidemic);

- in almost all European countries the demographic change will put some pressure on social systems. One of the consequences will be the need for longer working life time. Thus, the need for vocational rehabilitation may also increase;

- other social evolutions, like growing inequalities and rich/poor gaps,<sup>2, 3</sup> or the function of families and caregivers, will greatly change the contextual factors, requiring new solutions to reduce activity limitations and achieve the best possible participation;

- the progress in technology and digital data management is developing with an extremely high speed. Some of these technologies are already used in rehabilitation but this trend will accelerate in the next few years. PRM must take part in these developments and take leadership in the development and use of new technologies to improve functioning of persons with disabilities;

- the expectancy of independent and active living and quality life in the population also will further in-

crease. This will increase the demand of sophisticated and innovative rehabilitation programs and strategies;

- as health costs will further increase it will be more and more required that treatments must be based on evidence and shown to be cost-effective. Thus, the need for scientific studies in the field of PRM will further increase;

- last but not least, low and lower-middle income countries will have an increased demand for rehabilitation service implementation and training of rehabilitation professionals (this will be in particular the case in sub-Saharan Africa and some south-east Asian countries). European PRM will be challenged to contribute to the solution of this problem that has humanitarian, public-health and developmental impact.

From these examples, it is clear that the need for rehabilitation will further increase in the future and many challenges lay ahead of us. It already has been stated that rehabilitation will be the health strategy of the 21<sup>st</sup> century.<sup>4</sup> What consequences for PRM can be derived from the above-mentioned challenges? This must be discussed in all European bodies for PRM, and a European strategy should be developed. However, some points can already be extracted:

- As the need for PRM physicians will grow, we must ensure:

- a sufficient capacity of residency and training programs and attract young doctors to a career in PRM

- a sufficient number of physicians are trained in PRM (this is mainly a political issue)

- available and fully qualified rehabilitation professionals to be part of the rehabilitation team

- We must make sure that the future PRM physicians have sufficient skills and aptitudes to train patients with severe and comprehensive problems and in all phases and at all levels of health care. This includes

- Rehabilitation in elderly people

- Rehabilitation in the acute and early post-acute phases

- “High-end” rehabilitation for patients with complex and specific needs, such as organ transplantation, regenerative therapies, multiple trauma, SCI specific types of malignancy and many others

- Knowledge and experience in modern rehabilitation technology
- Skills in solving complex psychosocial problems

— It has to be discussed whether different accreditation PRM areas will be needed in the future such as “Rehabilitation for the Elderly”, “Acute Rehabilitation,” “Pain Rehabilitation,” “SCI and TBI Rehabilitation,” “Vocational Rehabilitation,” “Musculoskeletal Rehabilitation,” “Cardio-respiratory Rehabilitation,” “Cancer Rehabilitation,” and others.

— Research activities must be significantly increased and improved, including pathophysiology of disabling health conditions, mechanism of rehabilitation interventions, assistive technologies, outcomes of rehabilitation programs.

— Strategies to adequately react to the societal challenges in Europe and the neighboring regions must be developed within the PRM community, *e.g.* response to the demographic change, the expectation shift of society, the need for more rehabilitation in low resources countries etc.

Another challenge needs to be taken into consideration (that also may be an opportunity). Other health professionals improve their knowledge and skills and tend to do rehabilitation on their own and/or claim to take leadership of the rehabilitation team. In some countries, professional groups of therapists fight against PRM physicians and claim for the care of the entire rehabilitation process. In many other countries, there is a good collaboration respecting each other’s tasks and expertise for working in a team. Of course, it cannot be accepted if one profession denies the role of another and in particular rehabilitation collaborative multi-professional teamwork under the leadership of PRM physicians must be the guiding principle.<sup>5</sup> It must be welcomed if any health profession intends to cooperate properly for the care of persons with disabilities or disabling conditions, participating in the multi-professional team under the leadership of a PRM physician. Also, all valid contributions of scientific research from any rehabilitation professional are welcome, when integrated in a multi-professional team work, including a PRM Physician. Another important challenge could become the pressure of National Health Systems, but also of patients, to better face the burden of disability and ageing, that could end-up in the creation of new PRM services in the hand

of non-PRM physicians, *i.e.* other specialists entering into the field of PRM. This could in fact also be the result of a shortage of PRM physician’s workforce, due to the increased needs. Governments and ministries of health should create or develop the PRM specialty in the countries where it does not exist yet or the PRM physicians are very few; they must create the conditions for the training of medical specialists of PRM in their countries (or at an early stage, with training in other countries with recognized expertise and suitability of training). The free movement of professionals among the European Union States, in this case of the PRM physicians, must be encouraged and facilitated. All in all, it seems to be clear that Physical and Rehabilitation Medicine specialty needs to work very intensively on the solution of future problems and take its responsibility for society, the health systems and the individuals suffering from severe and/or long-term health condition experiencing disability.

### Education

We are currently facing an impressive increase in life expectancy in both high and low or middle-income countries. Population ageing together with reduced mortality following severe injury and acute illness will result in an increased need for rehabilitation services in all European countries, where the expectation of a high quality of life will also increase. Moreover, technology development has favored a widespread access to information, leading disable people to claim for appropriate rehabilitation delivery, for equitable access to hospital and community facilities and for a responsible care of their chronic health problems. Last, but not least, the two recent decades have seen an exponential development in assistive and information technology, domotics, bioengineering, robotics and tele-rehabilitation; at the same time, the knowledge on the neural bases of motor control, decision making and functional recovery has flourished: the interdisciplinary research combining the neuroscience with engineering potential is expected to provide the rehabilitation professionals with a wide range of innovative diagnostic and therapeutic tools. As a result, the standard of rehabilitation care (including quality assurance and treatments based on scientific evidence) and of PRM physicians’ education as well, will be expected to grow. Postgraduate PRM

training will have to stimulate future specialists to adopt a rigorous scientific approach to clinical practice and cultivate their disposition towards continuous learning and self-assessment. Moreover, in order to satisfy a growing demand for services, without renouncing to equity, PRM physicians must be committed to assess and safeguard the sustainability of care pathways and treatment protocols, in strong alliance with policy makers. The increased circulation of EU citizens beyond national borders will be a further stimulus towards the need for harmonization of PRM training and rehabilitation delivery, across the European countries. All in all, these evolutions will require to be faced at two levels: undergraduate training, to improve the awareness about PRM in future physicians; PRM physicians' specialist training, on one side to increase their number due to the increased needs, on the other to improve their competence and capacity to manage more patients with reducing resources (using technology, but also adopting best practices on the base of efficacy, effectiveness but also efficiency). These challenges will be faced through the actions of the UEMS-PRM Board, with its contribution in defining the core-curricula for undergraduate and specialists training.

### Research

Speaking for future is always a big challenge. Moreover, when research is involved, there is another factor beyond unpredictability of human events: the unpredictability of researchers and of the ways in which knowledge grows, that are rarely drivable from outside. Nevertheless, there is a certainty in PRM: research is steadily growing,<sup>6</sup> and this will lead to big changes in our perspective. The rate with which general knowledge of the human being increases continually: this means that the future of research is even faster than what usually expected. In this chapter, instead of making any real pre-vision, we will look at the overall scenarios challenging research, and their respective needs. In a general scenario, we are facing a period of shrinking resources. The continuous improvement of medicine drove to growing rate of survivals, leading to ageing of the population and increase of disability and chronic conditions. Unfortunately, all health systems in Europe have reached what is considered to be their maximum possibility of absorbing resources (between

7% and 10% of the gross country incomes), and consequently research should focus on how to do with less expenses the same (or even better) procedures. A rapid development of molecular and genetic research will reveal backgrounds for different disorders with decreased function, for individual abilities for rehabilitation and an increased knowledge of neural plasticity. This will have an impact on the other parts of the ICF spectrum and it urges PRM to be an active part of translational research. Another interesting point is the progressive increase of technology. Apparently in medicine we are facing the same process faced in industrial production more than a century ago: technology seems to allow to increase our results, and in PRM this happens mainly through robotics and prosthetics/orthotics, but also with virtual reality and game-therapies. Another clear challenge of modern European Societies is the progressive movement of medical needs from into and out of hospitals: people want to stay home and prefer to be treated there, chronicity is increasing, and hospitals cost a lot. At the same time, telemedicine is growing in all fields of medicine. All these situations greatly challenge PRM and its research. This can clearly be combined with the need of increasing person-centered outcomes that are the most meaningful for both our patients and societies. Another crucial challenge is the need of a different distribution of funding, since the old ones are totally based on body anatomy/function specialties.<sup>7</sup> The routine of PRM work is greatly changing. While the introduction of the acute phase is already well established, new phases are being more studied and refined, like pre-rehabilitation,<sup>8</sup> and/or maintenance or post-rehabilitation. This challenges all PRM organization, that should probably move to a transversal Department including all PRM physicians and allied professionals to help the patients move properly in the various phases: Stroke Units or Spinal Cord Injury Units are already described, but the problem is common to all pathologies and not only to these two. Another challenge is the improvement of competencies, both clinical and organizational, of allied professionals, that involves our actual professional position and makes it evolve. The challenge of classifications (ICF, but not only) and reimbursement of PRM treatments remains world-wide relevant and not resolved. The place of PRM in the general picture of Health is becoming more and more clear. All these challenges in a PRM context would need specific research.

But research about organization is on the one hand more difficult and on the other, less rewarding in terms of Impact Factor. Financing is consequently more difficult, but nevertheless, it is urgently needed. In a general research scenario, there are some clear trends. Lower level research remains very practiced, but Evidence Based Medicine has clearly shown the importance of running Randomized Controlled Trials (RCTs). At the same time the importance of clinical expertise and patient preferences is growing, with new qualitative research methodologies being applied, including Narrative Medicine. Translational studies in order to find correlates between molecular findings and function, activity and participation become more and more important. In pharmacology, to be able to find little changes resulting from treatments, RCTs involve now thousands of patients: this calls for the creation of big networks, but also for a lot of money to do research. On the same trend is the increased production of meta-analyses and metastudies, with the creation of big databases and the call for open access data. The creation of registers and the development of observational studies from these clinical databases is increasing too: the difference from RCTs is that they offer real clinical everyday world information, sometimes strikingly different from the results coming from experimental trials, that look by definition to very specific and well selected populations. The concept of big data analysis is applied to clinics and all these data bases. In PRM we are far from these consequences, but we are at the same time inside them. Networks, data bases, open data are challenges to be faced. Anyway, we also cannot ignore that we are still looking if some treatments have any efficacy, and this can be achieved also with studies involving reduced populations; it cannot be ignored that our patients are almost always carrying many co-morbidities, and this makes observational trials and registers very interesting for us. All these research challenges could become occasions for growth. In the meantime, we cannot ignore that the general picture characterizes how research is financed: to avoid being excluded, we must in any case fit to this overall picture. Finally, a PRM research scenario. Functional assessment and outcome measurements are key factors still underdeveloped: we have now some tools, but the way is still long to go. Moreover, technology is increasing its help, but still needs to be made totally clinically meaningful. The understand-

ing of what PRM is,<sup>9</sup> makes us move also inside the so-called humanistic research, with its challenging qualitative methodology, while medical science is still dominated by the quantitative research methods and approaches. Also statistical analysis changed in these years: a clear example is Rasch analysis (a statistical approach to improve our outcome instruments based on questionnaires) and its importance in PRM. This is probably only an example, and in PRM there is the need to move forward beyond the classical statistics to understand how to better manage our data. PRM is by definition multi-professional, since it involves all the other non-physician members of the team. As in PRM, rehabilitation professionals also find that there are methodological problems to develop good and adequate research on their specific areas of interests. A good terminology, specific definitions of most of the practices applied to rehabilitation and measurement instruments are still lacking. We miss compliance. Good definitions are not yet refined on how to describe rehabilitation practices (even if some attempts have been made<sup>10</sup> — and recently adopted also by PRM journals<sup>11</sup> — and this applies to the material and methods section: research results are, most of the time, not replicable by other teams, since there are too many unknowns. Further basic work still needs to be well defined — as do the research results and their applicability. These are only some examples of the actual challenges of the PRM research scenario, but it is clear how much all the world of PRM science production is involved including, beyond researchers, also editors and third party payers. In conclusion, PRM research will face in the next years a series of challenges, coming from the general and PRM scenarios, as well as from research in general and specifically PRM research. If faced properly, through adequate research, performed with adequate methods, and presented with adequate quality of scientific writing, all these challenges will become occasions for growth of the reputation and importance of our PRM specialty.

### **Harmonizing the development of PRM across Europe**

The harmonization of PRM across Europe is an ongoing process faced by the UEMS PRM Section and Board, in collaboration with the European Society of

PRM and the European Academy of Rehabilitation Medicine. As a consequence, what will be done in the next future will be the direct prosecution of what has been done until now, and will be presented below. Life expectancy is increasing in both developed and developing countries. More importantly, improvements in survival following injury and illness, as well as an ageing population will result in an increased need for rehabilitation services in all European countries, where the expectation of a high quality of life will also increase.<sup>12</sup>

As a result, rehabilitation systems have to be developed continuously considering the following principles:

- rehabilitation following injury or illness and in chronic conditions is a basic human right;<sup>13</sup>
- equitable and easy access to all aspects of rehabilitation including specialist rehabilitation medicine, assistive technology and social support for the entire population in Europe;
- uniformly high standards of care in rehabilitation, including quality assurance and treatments based on scientific evidence;
- a scientific basis to develop rehabilitation models and standards of care to guide clinical practice.

In particular, the Professional Practice Committee (PPC) of the UEMS PRM Section has worked extensively over many years to describe the professional competence of PRM physicians. This is shown by the publication of papers in international journals. The White Book of PRM in Europe, which was published in 2006 in two referred PRM journals and the current 3<sup>rd</sup> edition of the White Book is one example of the contribution of the PPC and the high standard of collaboration with the other European PRM Bodies. A series of published research papers for the role and competence of PRM physicians have been collected in an e-book under the title “The Field of Competence of the Physical and Rehabilitation Medicine Physicians – Part One.”<sup>14</sup> This e-book contains the following published papers:

- action plan of the Professional Practice Committee-UEMS Physical and Rehabilitation Medicine Section: description and development of our field of competence;<sup>15</sup>
- describing and developing the field of competence in Physical and Rehabilitation Medicine in Europe — preface to a series of papers published by the

Professional Practice Committee of the PRM Section of the Union of European Medical Specialists (UEMS);<sup>16</sup>

- Interdisciplinary team working in physical and rehabilitation medicine;<sup>5</sup>
- physical and rehabilitation medicine in acute settings;<sup>17</sup>
- physical and rehabilitation medicine programs in post-acute settings;<sup>18</sup>
- physical and rehabilitation medicine and persons with long-term disabilities;<sup>19</sup>
- new technologies designed to improve functioning: the role of physical and rehabilitation medicine physician;<sup>20</sup>
- role of the physical and rehabilitation medicine specialist regarding of children and adolescents with acquired brain injury;<sup>21</sup>
- European models of multidisciplinary rehabilitation services for traumatic brain injury;<sup>22</sup>
- the role of Physical and Rehabilitation Medicine specialist in lymphoedema;<sup>23</sup>
- generalized and regional soft tissue pain syndromes. The Role of Physical and Rehabilitation Medicine Physicians. The European Perspective Based on the Best Evidence;<sup>24</sup>
- inflammatory arthritis: the Role of Physical and Rehabilitation Medicine Physicians. The European Perspective Based on the Best Evidence;<sup>25</sup>
- osteoporosis: The Role of Physical & Rehabilitation Medicine Physicians. The European Perspective Based on the Best Evidence;<sup>26</sup>
- osteoarthritis: The Role of Physical & Rehabilitation Medicine Physicians. The European Perspective Based on the Best Evidence;<sup>27</sup>
- spinal pain management: The Role of Physical and Rehabilitation Medicine Physicians. The European Perspective Based on the Best Evidence;<sup>28</sup>
- local soft tissue musculoskeletal disorders and injuries. The Role of Physical and Rehabilitation Medicine Physicians. The European Perspective Based on the Best Evidence;<sup>29</sup>
- shoulder pain management. The Role of Physical and Rehabilitation Medicine Physicians. The European Perspective Based on the Best Evidence;<sup>30</sup>
- musculoskeletal perioperative problems. The Role of Physical and Rehabilitation Medicine Physicians. The European Perspective Based on the Best Evidence.<sup>31</sup>

Research continues in the PPC for the Competence of our physicians in other health conditions and the results will be first published in referred journals. Also, the intensive work continues in the other committees in close collaboration with the European Society and the European Academy. The aim is to give helpful e-books to our colleagues for their daily practice and for defending and promoting the PRM specialty among medical professionals of other specialties and in the negotiations with the authorities of national health systems. A very important and significant work is done in the Clinical Affairs Committee (CAC) of the UEMS PRM Section concerning the accreditation of quality of care programs in Europe. This work continues with the contribution of all the members of the CAC. As an example of the work in front of us to achieve all these goals, we present here the UEMS PRM Section and Board ambitious Action Plan set for the period 2014-2018:

A. General:

1. Further development of the relations with UEMS
2. Development of the relations with all the other UEMS Sections & Boards, especially with the relevant to PRM Sections
3. Close cooperation with the ESPRM and EARM: revision of the 2006 White Book of PRM in Europe, coordinated action plans (with avoidance of redundant actions)
4. Balanced cooperation with ISPRM and other international PRM Bodies
5. Development of relations with the WHO Services for Disability And Rehabilitation (DAR)
6. Promote the WHO action plan for disability and implement some actions to practically implement it
7. Change the title of PRM specialty in Annex V of the EU Directive of Professional Qualifications to “Physical and Rehabilitation Medicine” and the minimum training period from 3 to 4 years
8. Support the development of Medical Rehabilitation Systems in Eastern European countries (e.g. Russia, Ukraine etc.)
9. Reorganize the website to promote our Section and Board activity
10. Circulate our documents to the other UEMS Sections & Boards to inform for our activities

11. Promote the implementation of the ICF (International Classification of Functioning, Disability and Health) into the daily practice of the PRM physicians.

B. Board:

1. Increase the participants for Board Certification by Examinations by:
  - a. Giving special incentives for a period of 2-3 years.
  - b. Advertising intensively through NM and national PRM societies the validity of being Fellow of the EBPRM which is a “Seal of Excellence” on European level.
  - c. Publishing of a paper promoting the status of a European Board Fellow (advantages, benefits, ways of achieving the Fellowship).
  - d. Cooperating with interested countries, the Board Examinations to be the national theoretical Examinations.
2. Increase the number of Accredited Training Sites in each EU country
3. Increase the Recertifications of Fellows, Senior Fellows, Trainers and Training Sites.
4. E-Book for the pre-graduate PRM lessons.
5. Harmonisation of the PRM curriculum and training among the EU countries. Re-write it in details for including it in the revised White Book of PRM in Europe.
6. Support continuing medical education and research in PRM field (accreditation of European Congress and teaching programmes, e-books and selected resources, etc.).

C. Professional Practice Committee:

1. E-book for the Field of Competence of PRM physicians – Part 2.
2. Publication of the papers on the role of PRM in several services, need for the E-book.
3. Cooperation for the Cochrane Rehabilitation Field.
4. Develop Standards of Practice in Europe.

D. Clinical Affairs Committee:

1. Further development of the European Accreditation of quality of care programs.
2. Position paper on patients’ rights.
3. Harmonized Guidelines of PRM Services on European level.



4. Promote Standards of Ambulatory Rehabilitation.

E. Permanent working group on Balneology:

1. Collect all papers for EBM Balneology Services

2. Publish a position paper on Balneology.

Another example on how to face the future harmonization is the opening of dialogue and relations in 2014 for PRM specialty with physicians from Russia, practicing a part of Rehabilitation Medicine or of Physical Medicine. They wished to collaborate with the UEMS PRM Section and Board to transform the way of their practice according to the model of the Western Europe and eventually create the specialty of Physical and Rehabilitation Medicine in Russia. A plan was set up in cooperation with the Russian Association called ARUR (All Russian Union Rehabilitators). Four Seminars were organized of one week each and were attended by 35 Russian colleagues, consultants of several Russian Rehabilitation departments. The first seminar was organized in Vilnius in December 2014, the second in Moscow in March 2015, the third in Kazan in June 2015 and the fourth in December 2015. The lectures presented covered all the fields of PRM specialty as they are described in our curriculum. Since September 2015 a pilot project started in thirteen Regions of Russia for comparing the old system of Rehabilitation with the new system. The project lasted for one year and the Section was asked for reviewing the process of this project. Several Professors accepted to contribute their knowledge and experience. They travelled all the 13 Regions of the project, from Moscow to St. Petersburg to Kazan, to Vladivostok, to Siberia to Urals, to Samara etc. The attendants of the seminars carried out the project successfully with enthusiasm and they have started teaching other younger physicians in Russia to become PRM physicians in their own country for the benefit of their patients. The collaboration of ARUR with the Section and Board will continue in the long run and delegates from ARUR participate as observers to the meetings of the Section and Board and of the European Society as well. In 2016, the UEMS PRM Section was asked by the newly found Ukrainian Society of PRM, to help for transforms in the country concerning the practice of Rehabilitation and implementing the EU standards for Physical and Rehabilitation Medi-

cine. The plan followed was to a large extent the same as the one described above for Russia.

### Contribution to policy planning

PRM specialty should be a major contributor to the establishment of modern health policies due to its specific focus on functioning and the entire person, instead on single diseases. The binomial health/disease relation is still more focused on “pathogenesis” (approach focusing on factors that cause disease) rather than in “salutogenesis” (approach focusing on factors that support human health and well-being). This paradigm however is slowly changing. Nevertheless, there isn't yet sufficient awareness of the population and of the politicians for the relevance of Functioning in what it really represents to health (in its holistic sense) and to the socioeconomic consequences of disability. It is a fact that statistical reports and political attention goes more to the figures of childhood mortality rate, diseases incidence and prevalence or life expectancy rather than on functional scales such as health quality of life, functional independence measure, healthy life expectancy (HALE) or disability-adjusted life-years (DALYs). It is of course an ethical principle to make all our efforts to make people survive; also, it is normal that it was the most important focus in Europe before the progresses of medicine in the last centuries. Nevertheless, it does not seem logical that with better chances of survival, patients are not given the necessary support to achieve a good life. Moreover, it is quite absurd measuring “health” by scales of mortality or evaluating our life by statistics of death. We all know that, while reaching the excellent figures of such a low rate in childhood mortality rate, we find ourselves with a significant number of severely disabled children, who also ethically deserve all our dedication. The same could be said with people that survive after very severe traumatic injuries, serious diseases or either live much longer under chronic and disabling conditions. They all deserve the needed rehabilitation care. While PRM focused its attention on all these aspects, this is not yet clear to politicians and the general population. ICF has been developed by the World Health Organization and taken up by PRM as its reference framework. This is not yet true at a more general level, even if there

are examples of applications not only in education, but even in fields like engineering and architecture. The contribution in the next years of PRM in shifting the focus from mortality and morbidity only to health and functioning is crucial. Another issue is the health resources distribution between services for acute and long-term health conditions, including disability and disabling health conditions. We see today the well-established enormous effort in providing acute care, with the noble goal of saving the greater number of lives possible. Conversely, there are no comparable investments on the immediate or subsequent care for the best recovery and to reach the maximal functional performance. Nevertheless, these investments would allow not only benefits for life quality and wellbeing of the patients, but also less expenses in future care. In the same line is all the hurry and priority to drive a patient to acute emergency units, while rehabilitation is frequently neglected or delayed. Assistance on acute states should be made comparable to support on the recovery process. In this endeavor, PRM is the medical specialty able to provide Governments with the necessary expertise in planning rehabilitation policies according to the population needs. PRM is able to help the planning of efficient Rehabilitation Care Networks; to give its expertise to develop facilities, equipment and human resources; to build the more desirable operative models. Another growing issue, is the concern about chronic patients continuously moving from one facility to another without a specific organizational model. While General Practitioners can offer the adequate competence in front of new morbidities, the patients disabled or with disabling health conditions or with chronic conditions facing relapses or requiring continuous care and maintenance, need a harmonization of their care creating a continuum of care throughout the actually existing “silos” of the National Health Systems in Europe. Chronic patients and disabled people move from acute to post-acute to long-term to outpatients to home care in various moments during their personal clinical history: this requires coordination. National Health Services should have specialized departments concerning Rehabilitation Care, and PRM should raise the knowledge about this need. The legislation should take into consideration the right to Rehabilitation Care by the population. This means that all the health insurances (pub-

lic or private) should take into account the possible need of Rehabilitation interventions after a trauma, an acute illness or within a chronic condition that may appear along our lives. In policy making, rehabilitation systems have to be developed continuously considering the following principles:

- rehabilitation following injury or illness and in chronic conditions is a basic human right;
- equitable and easy access to all aspects of rehabilitation including specialist rehabilitation medicine, assistive technology and social support for the entire population in Europe;
- uniformly high standards of care in rehabilitation, including quality assurance and treatments based on scientific evidence;
- a scientific basis to develop rehabilitation models and standards of care to guide clinical practice. Guidelines, pathways and recommendations should be implemented with the participation of PRM.
- In order to reach these the following measures are required:
  - to improve the general understanding and awareness of the needs of people with disabilities;
  - to publicize the benefits of rehabilitation. This will lead to a culture in which access to adequate rehabilitation is seen as a basic human right;
  - to deepen the understanding and cooperation between non-governmental organizations of people with and the specialty of PRM;
  - to establish comprehensive rehabilitation facilities across Europe with specialized and well-trained rehabilitation multi-professional teams led by PRM physicians and well-resourced rehabilitation facilities. Additionally, community based rehabilitation structures should be in place for the management of chronic disabling diseases;
  - to set up systems to ensure that Physical and Rehabilitation Medicine has sufficiently well-trained and competent PRM physicians available in all European countries;
  - to establish common high standards of care on the basis of current evidence. These should take into account quality control and access to assistive technology;
  - to incorporate new technical developments into PRM practice. This has a great deal to offer in assisting rehabilitation to produce better outcomes. Increasingly technology should contribute significantly to indepen-

dent living and quality of life of people with disabilities in Europe;

— to promote scientific activities and research in the field of rehabilitation with adequate funding to improve the outcomes for those experiencing disabilities;

— to support an environment where people with disabilities can fully participate in society. The PRM physician will work with people with disabilities in furthering this aim.

All these measures will better enable people with disability to contribute to society substantially.

## References

- WRD World Health Organisation & World Bank. World Report on Disability. 2011.
- Reeves A, McKee M, Stuckler D. The attack on universal health coverage in Europe: recession, austerity and unmet needs. *Eur J Public Health*. 2015 Jun;25(3):364-5.
- Reeves A, McKee M, Mackenbach J, Whitehead M, Stuckler D. Public pensions and unmet medical need among older people: cross-national analysis of 16 European countries, 2004-2010. *J Epidemiol Community Health*. 2017 Feb;71(2):174-80.
- Stucki G. Olle Höök Lectureship 2015: The World Health Organization's paradigm shift and implementation of the International Classification of Functioning, Disability and Health in rehabilitation. *J Rehabil Med*. 2016 Jun 13;48(6):486-93.
- Neumann V, Gutenbrunner C, Fialka-Moser V, Christodoulou N, Varela E, Giustini A, *et al*. Interdisciplinary team working in physical and rehabilitation medicine. *J Rehabil Med*. 2010 Jan;42(1):4-8.
- Negrini S. Steady growth seen for research in physical and rehabilitation medicine: where our speciality is now and where we are going. *Eur J Phys Rehabil Med*. 2012 Dec;48(4):543-8.
- Negrini S, Padua L, Kiekens C, Michail X, Boldrini P. Current research funding methods dumb down health care and rehabilitation for disabled people and aging population: a call for a change. *Eur J Phys Rehabil Med*. 2014 Dec;50(6):601-8.
- Jensen BT, Laustsen S, Jensen JB, Borre M, Petersen AK. Exercise-based pre-habilitation is feasible and effective in radical cystectomy pathways-secondary results from a randomized controlled trial. *Support Care Cancer Off J Multinat Assoc Support Care Cancer*. 2016 Aug;24(8):3325-31.
- Tesio L. I bravi e i buoni - Perche' la medicina clinica puo' essere una scienza. Roma: Il Pensiero Scientifico; 2015.
- Hoffmann TC, Glasziou PP, Boutron I, Milne R, Perera R, Moher D, *et al*. Better reporting of interventions: template for intervention description and replication (TIDieR) checklist and guide. *BMJ*. 2014 Mar 7;348:g1687.
- Negrini S. Application of the TIDieR checklist to improve understanding and replicability of studies in Physical and Rehabilitation Medicine. *Eur J Phys Rehabil Med*. 2015 Dec;51(6):667-8.
- The Department of Health and Social Security. OPCS Surveys of disability in Great Britain Report 1: The prevalence of disability among adults. 1988.
- WHO. Resolution 58.23, "Disability, including prevention, management and rehabilitation." 2005.
- UEMS PRM Section Professional Practice Committee. The Field of Competence of the Physical and Rehabilitation Medicine Physicians -Part One. 2014.
- Gutenbrunner A, Delarque A. Action plan of the Professional Practice Committee-UEMS Physical and Rehabilitation Medicine Section: description and development of our field of competence. *Eur J Phys Rehabil Med*. 2009 Jun;45(2):275-80.
- Gutenbrunner C, Neumann V, Lemoine F, Delarque A. Describing and developing the field of competence in Physical and Rehabilitation Medicine (PRM) in Europe - preface to a series of papers published by the Professional Practice Committee of the PRM section of the Union of European Medical Specialists (UEMS). *Ann Phys Rehabil Med*. 2010 Dec;53(10):593-7.
- Ward AB, Gutenbrunner C, Damjan H, Giustini A, Delarque A. European Union of Medical Specialists (UEMS) section of Physical & Rehabilitation Medicine: a position paper on physical and rehabilitation medicine in acute settings. *J Rehabil Med*. 2010 May;42(5):417-24.
- Ward A, Gutenbrunner C, Giustini A, Delarque A, Fialka-Moser V, Kiekens C, *et al*. A position paper on Physical & Rehabilitation Medicine programmes in post-acute settings. Union of European Medical Specialists Section of Physical & Rehabilitation Medicine (in conjunction with the European Society of Physical & Rehabilitation Medicine). *J Rehabil Med*. 2012 Apr;44(4):289-98.
- Takáč P, Petrovičová J, Delarque A, Stibrant Sunnerhagen K, Neumann V, Vetra A, *et al*. Position paper on PRM and persons with long term disabilities. *Eur J Phys Rehabil Med*. 2014 Aug;50(4):453-64.
- Giustini A, Varela E, Franceschini M, Votava J, Zampolini M, Berteau M, *et al*. UEMS--Position Paper. New technologies designed to improve functioning: the role of the physical and rehabilitation medicine physician. *Eur J Phys Rehabil Med*. 2014 Oct;50(5):579-83.
- Varela-Donoso E, Damjan H, Muñoz-Lasa S, Valero-Alcaide R, Neumann V, Cheignard M, *et al*. Role of the physical and rehabilitation medicine specialist regarding of children and adolescents with acquired brain injury. *Eur J Phys Rehabil Med*. 2013 Apr;49(2):213-21.
- McElligott J, Carroll A, Morgan J, Macdonnell C, Neumann V, Gutenbrunner C, *et al*. European models of multidisciplinary rehabilitation services for traumatic brain injury. *Am J Phys Med Rehabil*. 2011 Jan;90(1):74-8.
- Fialka-Moser V, Korpan M, Varela E, Ward A, Gutenbrunner C, Casillas JM, *et al*. The role of physical and rehabilitation medicine specialist in lymphoedema. *Ann Phys Rehabil Med*. 2013 Jul;56(5):396-410.
- Oral A, Ilieva EM, Küçükdeveci AA, Varela E, Valero R, Berteau M, *et al*. Generalised and regional soft tissue pain syndromes. The role of physical and rehabilitation medicine physicians. The European perspective based on the best evidence. A paper by the UEMS-PRM Section Professional Practice Committee. *Eur J Phys Rehabil Med*. 2013 Aug;49(4):535-49.
- Küçükdeveci AA, Oral A, Ilieva EM, Varela E, Valero R, Berteau M, *et al*. Inflammatory arthritis. The role of physical and rehabilitation medicine physicians. The European perspective based on the best evidence. A paper by the UEMS-PRM Section Professional Practice Committee. *Eur J Phys Rehabil Med*. 2013 Aug;49(4):551-64.
- Oral A, Küçükdeveci AA, Varela E, Ilieva EM, Valero R, Berteau M, *et al*. Osteoporosis. The role of physical and rehabilitation medicine physicians. The European perspective based on the best evidence. A paper by the UEMS-PRM Section Professional Practice Committee. *Eur J Phys Rehabil Med*. 2013 Aug;49(4):565-77.
- Ilieva EM, Oral A, Küçükdeveci AA, Varela E, Valero R, Berteau M, *et al*. Osteoarthritis. The role of physical and rehabilitation medicine physicians. The European perspective based on the best evidence. A paper by the UEMS-PRM Section Professional Practice Committee. *Eur J Phys Rehabil Med*. 2013 Aug;49(4):579-93.
- Valero R, Varela E, Küçükdeveci AA, Oral A, Ilieva E, Berteau M, *et al*. Spinal pain management. The role of physical and rehabilitation medicine physicians. The European perspective based on the best evidence. A paper by the UEMS-PRM Section Professional Practice Committee. *Eur J Phys Rehabil Med*. 2013 Oct;49(5):715-25.
- Oral A, Ilieva EM, Küçükdeveci AA, Varela E, Valero R, Berteau M, *et al*. Local soft tissue musculoskeletal disorders and injuries. The role of physical and rehabilitation medicine physicians. The European perspective based on the best evidence. A paper by the UEMS-PRM Section Professional Practice Committee. *Eur J Phys Rehabil Med*. 2013 Oct;49(5):727-42.
- Varela E, Valero R, Küçükdeveci AA, Oral A, Ilieva E, Berteau M,

*et al.* Shoulder pain management. The role of physical and rehabilitation medicine physicians. The European perspective based on the best evidence. A paper by the UEMS-PRM Section Professional Practice Committee. Eur J Phys Rehabil Med. 2013 Oct;49(5):743-51.

31. Varela E, Oral A, Ilieva E, Küçükdeveci AA, Valero R, Berceanu M,

*et al.* Musculoskeletal perioperative problems. The role of physical and rehabilitation medicine physicians. The European perspective based on the best evidence. A paper by the UEMS-PRM Section Professional Practice Committee. Eur J Phys Rehabil Med. 2013 Oct;49(5):753-9.

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