# The Field of Competence of Physical & Rehabilitation Medicine Physicians



**PART TWO** 

European Union of Medical Specialists (UEMS) Section of Physical and Rehabilitation Medicine - Professional Practice Committee

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# **INTRODUCTION**

Following the edition of **Part One of this e-book in 2014**, we are happy today to introduce to all the colleagues of Physical and Rehabilitation Medicine the new e-book named as Part Two. This e-book contains a part of the work done the last 4 years (2014-18) in the Professional Practice Committee of the Physical and Rehabilitation Medicine Section of the European Union of Medicals Specialists (UEMS). A new methodological procedure was followed, with five Delphi rounds, for each evidenced based position paper, in a way that the recommendations in each paper reflect the consensus of the delegates of all the European countries, concerning the special field of competence to which the paper refers. This methodological procedure is presented in details in one of the papers included in this book.

All the papers included, have already been published in the European Journal of Physical and Rehabilitation Medicine. The field of competence of the papers refer to spinal deformities during growth, ageing people with disabilities, obesity and related comorbidities, cardiovascular conditions, respiratory conditions, spinal cord injuries, acute and chronic pain, acquired brain injuries in adults and stroke. Also it is included a special paper presenting the European effort for the system-wide implementation of the International Classification of Functioning, Disability and Health (ICF) in Physical and Rehabilitation Medicine (practice, science and governance in interaction).

As being Physical and Rehabilitation Medicine (PRM) one of the Sections of UEMS, working under its umbrella, our work reflects a part of the UEMS activity, concerning the field of competence of the medical profession in general and especially in the field of PRM. Our Section of Physical and Rehabilitation Medicine accepts delegates from the European Union States, as well as from associate countries and other European countries interested to participate as observers. Today our Section has about 70 delegates from 40 countries. With these numbers and its broad geographical distribution in Europe is considered the biggest, strongest and more significant European Body in Physical and Rehabilitation Medicine.

The Section has three wings, the Board which deals with Educational Affairs, the Professional Practice Committee which deals with the Field of Competence of our specialty and the Clinical Affairs Committee which deals with the standards of Clinical Practice. The overall aim of our work is the harmonization of education, professional and clinical services throughout Europe.

We would like to express our gratitude and appreciation for this work to all the delegates of our Section and especially the first authors of the papers, who managed to act, with a high sense of responsibility, to the provisions of the followed methodological procedure. Of course the contents of Part One and Part Two of these e-books do not cover all the field of competence of our specialty. I am sure that this effort will continue by the new leadership of our Section, leading to the publication of new papers and the Part Three e-book.

Prof. Nicolas Christodoulou President of the UEMS PRM Section September 2018.

# Methodology of "Physical and Rehabilitation Medicine practice, Evidence based position papers: The European position" Produced by the UEMS-PRM Section

https://www.ncbi.nlm.nih.gov/pubmed/26681647

Stefano Negrini , Carlotte Kiekens , Mauro Zampolini , Daniel Wever , Enrique Varela Donoso, Nicolas Christodoulou

# Methodology of "Physical and Rehabilitation Medicine practice, Evidence based position papers:

## The European position Produced by the UEMS-PRM Section

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#### ABSTRACT

Since 2009 the Professional Practice Committee of the Physical and Rehabilitation Medicine (PRM) Section of the European Union (EU) of Medical Specialists (UEMS) is producing Position Papers (PPs) on the role of PRM physicians for patients with different health conditions or related topics of PRM Interest. These PPs represent the Official Position of the EU in the specific field. Until now, sixteen papers have been produced, recently collected in an e-book. To proceed with the future PPs, the UEMS PRM Section  $_{7_{\rm A}}$ defines with this paper the methodological approach to a PP, so to have a common and validated scientific structure. The final aim is to increase the quality, representativeness and visibility of this production for the benefit of all PRM specialists in (and out) of Europe. The Position Papers must be Evidence Based (EBPP). Therefore it comprises a systematic review as well as a Consensus procedure among the EU Countries delegates. All the sections of an EBPP are presented in details (title, authors, abstract, introduction, material and methods, results, discussion, conclusion). The systematic review must focus on Cochrane reviews, randomised controlled trials and guidelines of PRM professional practice interest. The Consensus on the recommendations must be reached through a Delphi procedure, usually in four major rounds (each round can have repeated voting). The EBPP must produce Final Recommendations for Physical and Rehabilitation Medicine Professional Practice in Europe. The following overall structure for recommendations is suggested: one overall general recommendation

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on PRM professional practice; PRM physicians' role in Medical Diagnosis – ICD; PRM diagnosis and assessment according to ICF; PRM process (Project definition, Team, PRM interventions, Outcome criteria, Length and continuity of treatment); future research on PRM professional practice.

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**Key words:** Methods - Physical and Rehabilitation Medicine - Guidelines as Topic.

Since 2009 the Professional Practice Committee (PPC) of the Physical and Rehabilitation Medicine(PRM) Section of the European Union of Medical Specialists (UEMS) is producing Position Papers (PPs) on the role of PRM physicians for people with different health conditions or related topics of PRM Interest.1-3

A conceptual framework of these PPs is the International Classification of Functioning, Disability, and Health (ICF),4 that is part of the "family" of international classifications developed by the World Health Organization (WHO). The ICF classification system focuses on human functioning and provides a unified, standard language and framework that captures how people with a health condition function in their daily life rather than focusing on their diagnosis or the presence or absence of disease. These PPs are of particular interest in professional terms: in fact, the UEMS is the Official European Body representing Medical Specialists of the

European Union (EU); consequently, these PPs represent the Official Position of the EU in the specific field. Until now, the following papers have been produced:

—a position paper on physical and rehabilitationmedicine in acute settings;<sup>5</sup>

—a position paper on Physical & Rehabilitation Medicine programmes in post-acute settings;<sup>6</sup>

—european models of multidisciplinary rehabilitation services for traumatic brain injury;<sup>7</sup>

—generalised and regional soft tissue pain syndromes. The role of physical and rehabilitation medicine physicians;<sup>8</sup>

—inflammatory arthritis. The role of physical and rehabilitation medicine physicians;<sup>9</sup>

—interdisciplinary team working in physical and rehabilitation medicine;<sup>10</sup>

—local soft tissue musculoskeletal disorders and injuries. The role of physical and rehabilitation medicine physicians;<sup>11</sup>

-musculoskeletal perioperative problems. The role of physical and rehabilitation medicine physicians;<sup>12</sup>

-new technologies designed to improve functioning: the role of the physical and

rehabilitation medicine physician;<sup>13</sup>

—osteoarthritis. The role of physical and rehabilitation medicine physicians;<sup>14</sup>

—osteoporosis. The role of physical and rehabilitation medicine physicians;<sup>15</sup>

—position paper on PRM and persons with long term disabilities;<sup>16</sup>

—role of the physical and rehabilitation medicine specialist regarding of children and adolescents with acquired brain injury;<sup>17</sup>

—spinal pain management. The role of physical and rehabilitation medicine physicians.<sup>18</sup>

The methodology followed until now included the following steps:

-draft (Author(s)) (circulation by e-mail to the task force members);

—Professional Practice Committee consensus (to be circulated within the PPC committee) (circulation bye-mail to the committee members);

—approval by Professional Practice Committee (to be circulated within the section and board to all delegates). Also, rules for authorship and a template of the papers have been proposed and voted by the UEMS PRM Section assembly in Coimbra (Portugal), 17 March 2012. All these PPs have been recently collected in an e-book (http://issuu.com/parisstylianides/docs/ section\_of\_physical\_and\_rehabilitat/0).<sup>19</sup>

To proceed with the future PPs, the PPC felt the need to better define the methodological approach to a PP, in order to have a common and validated scientific format to be proposed to the various authors. The final aim isto increase the quality, representativeness and visibility of this production for the benefit of all PRM specialists and other health professionals in (and out) of Europe.

The aim of this paper was to present the details of the methodological structure of future PPs produced by the UEMS-PRM Section. Obviously, other European and International Bodies, either of PRM or not, can use this methodological contribution.

## Structure of position papers

The aim of a PP is to define the professional position of PRM specialists among Europe. This position comes from two different needs: evidence and national practice of each single EU Country. A PP must reflect both these requirements, that can methodologically be satisfied through a systematic review (for evidence) and a formal Consensus procedure (for everyday clinical practice). Consequently, a PP will be a systematic review in the first part, joined in a second part with a Delphi Procedure to reach a Consensus among all the EU National Societies members of the UEMS PRM Section. Due to the existing mutual agreement between the UEMS-PRM Section and the European Journal of Physical and Rehabilitation Medicine (EJPRM), the overall format proposed here is that accepted by the EJPRM. Nevertheless, minor editorial changes can be made according to the Journal where each single PP will be submitted.

## Title

For uniformity reasons, all the papers must have the same title: "Evidence Based Position Paper on Physical and Rehabilitation Medicine (PRM) professional practice for persons with... The European PRM position (UEMS PRM Section)" (EBPP), where the PRM specific topic should be reported in the title. The PRM specific topic can be health condition, activity limitation, but also structure/function participation or body restriction;<sup>20</sup> other possibilities could include PRM settings (acute, post-acute, chronic, community) legislation, or others.

## Authorship and participations

Authorship rules of the International Committee of Medical Journal Editors will be followed, specifically:

—substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; AND

—drafting the work or revising it critically for important intellectual content; AND

—final approval of the version to be published;

## AND

—agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Authors of an EBPP should be all PPC members who actively contributed to the writing and data collection for the paper, with the chairperson of the PPC and the UEMS Section president: they will publicly take responsibility for the EBPP in the name of the PPC and the Section. If PPC members feel the need to have other competences involved, they can include among the authors other delegates and/or external European recognised experts of the field. The PPC must be listed as a group author, including the names of all PPC members in notes to the text. Also all national delegates and/or representatives of each single EU Country involved in the Consensus gathering (Delphi) procedure must be listed into the text in a specific table and/or note.

The PRM specific topic could be linked to a pathology (ICD) for example Stroke, to functioning (ICF) for example swallowing disorders or the role of environmental factors, to heath intervention (ICHI) such as the use of ultra sounds in PRM.

## Abstract

The abstract must be structured as follows: Introduction, Aim, Material and Methods, Results, Conclusion. In the Introduction (and/ or Conclusion) it must be clearly stated that it is the EBPP representing the official position of the European Union through the UEMS PRM Section. The aim of the paper must clearly state "the aim of the paper is to improve Physical and Rehabilitation Medicine specialists' professional practice for ... defining the specific health condition, body structures/functions, activity limitations, or participation restrictions. In the Material and Methods section the Databases searched in the systematic review process, with the period of time considered, must be reported; the number of EU Countries actively involved in the Delphi procedure, and the number of those finally voting and approving the EBPP should be reported as well. In the Results sections the number of recommendations and their overall organization should be reported; it is suggested to have a general recommendation such as "The professional role of PRM physicians in favor of persons with... is..."; also the most important recommendations can be reported.

## Introduction

This section must shortly give the reason why an EBPP is produced in this specific topic. We suggest the following minimum structure (paragraphs):

—Epidemiology and general details on the topic; —importance for PRM and reasons for having an EBPP (mandate by UEMS PRM Section, differences among the different EU Countries...). Background on what is the PRM Field of Competence according to other official documents, such as UEMS White Books,<sup>21-25</sup>

ICF,<sup>20</sup> World Health Organization (WHO) World Report on Disability,<sup>26, 27</sup> WHO Action Plan on Disability,<sup>28</sup> United Nations (UN) Convention on the Rights of Persons with Disabilities <sup>29</sup> and so on.

-actual differences among the EU Countries, and actual specific problems of PRM in the specific topic;

-other reasons for the EBPP.

The Introduction must classically conclude with the aim of the paper.

## Material and methods

The methods to develop an EBPP must include two sections:

—Systematic review of the literature;

—Consensus among UEMS PRM Section national Societies.

If a different structure is used, it must be thoroughly justified in the EBPP and preliminarily voted by the UEMS-PRM Section General Assembly. In this case, the procedure followed must be reported in detail. All what follows relates to a classical structure as suggested here.

## Systematic review of the literature

The following inclusion criteria must be considered and listed in the paper: type of studies, type of participants including level of health service if relevant, and type of interventions. The search should include at least the following type of studies published in the literature:

—Cochrane reviews, systematic reviews and metaanalysis;

-Randomized Controlled Trials;

-Guidelines.

The main criterion for including the studies should beprofessional relevance for PRM physicians as judged byat least two of the authors of the EBPP (whose initialsmust be reported). Any other inclusion criterion must belisted. A flow chart such as the one presented in Figure 1 must be completed including all inclusion criteria used.

The literature search methods for identification of studies must be described. It should usually include an electronic search of the main databases (minimum MEDLINE, suggested also EMBASE, CINAHL, PEDro,...). The key words used and the date in which the search was run must be reported. Any language restriction should be listed, even if all European languages should be normally included. Details on any other search performed in the literature (other databases, grey literature, search from references) must be reported. The systematic review must be used to prepare the Introduction section of the final paper, as well as the literature premises to the recommendations to be reported in the Results section.



Figure 1.—Flow Chart of papers selection.

## Consensus with Delphi procedure

The Delphi procedure <sup>30</sup> must be organised in welldefined rounds of voting. It is suggested to use electronic means (emails and/or e-questionnaires), even if other procedures can be used. The procedure finally used must be reported in detail in the Material and Methods section of the EBPP. The UEMS PRM Section and Board could provide a platform to develop specific internet questionnaires.

# INITIAL DEVELOPMENT OF THE RECOMMENDATIONS

Two authors (initials to be possibly reported) must independently develop a document with the recommendations for each paragraph according to the literature review performed. Each draft recommendation must report the Importance of the Recommendation (IR) according to Table I. These should be based on the literature references (if there is any), and the Strength of Evidence (SE) (Table II). The recommendations must be organised with the following structure in paragraphs:

—one overall general recommendation such as:"The professional role of PRM physicians in…"(PRM topic as defined above) "… is…";

-recommendations on PRM physicians' role in Medical Diagnosis according to ICD,31 PRM diagnosis and assessment according to ICF; 20

-recommendations on PRM management and process:

—inclusion criteria (e.g. when and why to prescribePRM interventions);

—project definition (definition of the overall aims and strategy of PRM interventions);

—team work (professionals involved and specific modalities of team work);

—PRM interventions;

—outcome criteria;

—length/duration/intensity of treatment (overall
practical PRM approach);

-discharge criteria (e.g. when and why to end PRM interventions);

-follow up criteria and agenda.

-Recommendations on future research on PRM professional practice.

#### FIRST ROUND

Stre А В

С

D

The first Delphi round must be performed within the group of authors of the EBPP. The two documents for each paragraph must be evaluated through:

TABLE I.—Strength of Recommendations grading.

-votes and suggestions for changes of the existing

recommendations:

-fusion of duplicates;

-development of new recommendations.

All proposals will be sent to one author, who must resume them and eventually propose a second similar voting inside the commission. As soon as an acceptable draft will be ready, it will be sent out for the Second Round.

TABLE II.—Strength of Evidence grading.

ngth of recommendation	Meaning	Strength of evidence	Meaning
	It must be normally applied	Ι	Multiple Randomized Controlled Trials or Systematic Reviews of such studies
	It is important, but can be applied not in all situations	II	One Randomized Controlled Trial
	Less important, it can be applied on a voluntary basis	III	Multiple Controlled nonrandomized Studies or Systematic Reviews of such studies
	Very low importance	IV	Other studies

## SECOND ROUND

The first set of recommendations will be circulated among all UEMS-PRM Section delegates to collect other suggestion for new recommendations, as well as proposals to improve the actual recommendations.

## THIRD ROUND

The Third round will involve all members of the and will require PPC, to vote each recommendation as follows:

- —— accept;
- —— accept with modifications;
- --- reject.

Usually, all recommendations with 30% or more of "Reject" must be withdrawn at this stage: any other level of withdrawal must be specified. All the other recommendations will be adjusted by one author according to the suggestions received and submitted to a second similar voting in the PPC, together with eventual new recommendations suggested. The process will be repeated until all Recommendations will be enough refined.

## FOURTH ROUND

The Fourth round will involve all the National Delegates of the UEMS-PRM that will vote (one vote per European country) the final

Strength of evidence	Meaning
Ι	Multiple Randomized Controlled Trials or Systematic Reviews of such studies
II	One Randomized Controlled Trial
III	Multiple Controlled nonrandomized Studies or Systematic Reviews of such studies
IV	Other studies

recommendations as follows

during the General Assembly:

- —— accept;
- —— reject.

At this stage it is still possible to give some suggestions for adjustment of the recommendations, even if in this case they must be voted and accepted immediately. All recommendations not reaching at least 80% of positive answers will be withdrawn. Final recommendations also will report the Level of Agreement obtained (Table III).

#### FIFTH ROUND

The final paper will be voted to be approved by the PPC first, and by the General Assembly of delegates of the UEMS-PRM Section.

#### Results

The Results section must be split in two parts: results of the systematic review and Consensus, and recommendations.

## **RESULTS OF THE SYSTEMATIC REVIEW** AND THE CONSENSUS PROCEDURE

In part 1 the number of relevant papers found during the systematic review, and all the results of the Consensus procedure, round by round, must be reported. The results of the Consensus procedure must preferably be reported in a Table such as Table IV.

Final Recommendations for Physical and Rehabilitation Medicine Professional Practice in Europe. In the second part the recommendations must be listed progressively numbered, eventually with a literature premise as previously suggested (it can be general and/ or for each paragraph as listed above), according to the results of the systematic review. Each recommendation must be reported in this format:

TABLE	Ш	Results	of the	Consensus	procedure
			./		1

Round	Number of recommendations	Accept	Accept with suggestions	Reject
1		%	%	%
2		%	%	%
3		%		%

TABLE IV.—Level of Agreement grading.

Level of agreement	Abbreviation	Meaning
Unanimous	U	100%
Very High	VH	95-99.9%
High	Н	90-94.9%
Good	G	80-89.9%

TABLE V.—Overall view of the recommendations.

Content	Number of recommendations		Strength of Recommendations			Strength of Evidence				Level of Agreement				
	Number	%	А	В	С	D	Ι	II	III	IV	U	VH	Н	G
Overall recommendation			%	%	%	%	%	%	%	%	%	%	%	%
PRM physicians role in Medical Diagnosis - ICD			%	%	%	%	%	%	%	%	%	%	%	%
PRM diagnosis - ICF			%	%	%	%	%	%	%	%	%	%	%	%
PRM process			%	%	%	%	%	%	%	%	%	%	%	%
Future research on PRM professional practice			%	%	%	%	%	%	%	%	%	%	%	%
TOTAL														

Recommendation (literature references – if any), IR: letter as in Table I for the Importance of the Recommendation; SE: roman number as in Table II for the Strength of Evidence if appropriate; LA: Abbreviations as in Table IV for the Level of Agreement.

### Discussion

A Discussion section can be added, if felt appropriate by the authors. In this section a summary of the recommendations can be given, in term of number and overall importance and agreement can be reported (Table V), together with comments on the systematic reviews results, on the Delphi procedure (difficulties, etc), as well as the differences among the various EU Countries on the specific topic considered. Suggestions concerning the implementation of the recommendations in clinical practice could be given; stressing the role of PRM specialists in the process:

these statements can have a strategic function to emphasise the role of the PRM Specialist. Finally, indications for future research could be added.

## Figures and graphs

Beyond the figure and table reported in this paper, three boxes should be included: one for the recommendations, one for the implementation in clinical practice and another box for the indication for research.

## Conclusion

In the Conclusion section the overall general recommendation

must be reported, eventually together with some of the key recommendations and/or other conclusions.

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# Evidence based position paper on physical and rehabilitation medicine (PRM) practice for people with spinal deformities during growth. The European PRM position (UEMS PRM Section)

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# Evidence based position paper on physical and rehabilitation medicine (PRM) practice for people with spinal deformities during growth.

# The European PRM position (UEMS PRM Section)

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### ABSTRACT

#### Introduction:

Scoliosis and other spinal deformities involve 3-4% of the population during growth. Their so-called conservative treatment is in the field of competence of physical and rehabilitation medicine (PRM) physicians. This evidence based position paper represents the official position of the European Union through the European Union of Medical Specialists (UEMS) - PRM Section. The aim of the paper was to improve PR M specialists' professional practice for patients with spinal deformities during growth.

#### **Evidence Acquisition:**

A systematic review of the literature and a Consensus procedure with 26 recommendations by means of a Delphi method process has been performed involving the delegates of all European countries represented in the UEMS-PR M Section.

### **Evidence Synthesis**

The systematic literature review is reported together with 26 recommendations coming from the Consensus Delphi procedure.

### Conclusions

The professional role of PR M physicians in spinal deformities during growth is to propose a complete PR M treatment for the patients considering all the concurring diseases and pathologies, impairments, activity limitations and participation restrictions. The PR M physician's role is to coordinate the individual PR M project developed in team with other health professionals and medical specialists, in agreement with the patient and his family, according to the specific medical diagnoses.

(Cite this article as: Negrini S, Dincer F, Kiekens C, Kruger L, Varela-Donoso E, Christodoulou N. Evidence based position paper on physical and rehabilitation medicine (PR M) practice for people with spinal deformities during growth. The European PR M position (UEMS PR M Section). Eur J Phys Rehabil Med 2017;53:125-31. DOI : 10.23736/S1973-9087.16.04406-3) **Key words:** Scoliosis - Physical and rehabilitation medicine - Guidelines.

# Introduction

The main spinal deformities during growth include scoliosis, sagittal curves changes (increased or reduced kyphosis and/or lordosis), and spondylolisthesis1. They involve 3-4% of the population during growth.<sup>1, 2</sup> They can be secondary to another pathology (neurological, syndromic, congenital bone malformation, and others).<sup>2, 3</sup> The so-called conservative treatment (rehabilitation and orthopedic not surgical) are in the field of competence of physical and rehabilitation medicine (PR M) physicians. This is even more true in patients with pathologies that give raise to a secondary spinal deformity, that are usually followed-up by PR M specialists during growth. Nowadays there is no uniformity among different countries across Europe and in the world in the PR M approach.<sup>4-6</sup> For these reasons the European Union of Medical Specialists (UEMS) - PR M Section decided to develop one of its evidence based position papers, representing the official position of the European Union. The aim of the paper was to improve PR M specialists' professional practice for patients with spinal deformities during growth.

# **Evidence acquisition**

This paper has been developed according to the Methodology defined by the Professional Practice Committee of the UEMS-PR M Section.7 The systematic review of the literature has been performed in PubMed the 24th of November 2014. The string used for the first selection has been "("scoliosis" [MeSH Terms]) OR ("kyphosis" [MeSH Terms]) OR ("spondylolisthesis" [MeSH Terms])", activating the filters: "Filters activated: Systematic Reviews, Meta-Analysis, Randomized Controlled Trial, Child: birth-18 years". The selection process is reported in the Supplementary Figure 1, online content only. The only criterion for including the studies has been the professional relevance for PR M physicians as judged by at least two of the authors, with the main author resolving conflicts. The strengh of evidence (SoE) and the strength of recommendation (SoR) are given according to the methodology paper. The Consensus with Delphi procedure has followed the 4 steps proposed by the methodology paper.<sup>7</sup>

# **Evidence** synthesis

Systematic review

All paper found in the systematic review are listed in the Supplementary Appendix I, online content only.

The professional role of the PRM physician in the diagnosis and assessment of patients with idiopathic deformities during growth as a member of a multiprofessional working-group is essential.8 Historically, these pathologies have been followed mainly by orthopedic surgeons, but the evolution of that specialty toward surgery reduced the attention to the so called conservative treatment.4 In 2004 started an international effort of the conservative community that gave rise to a new scientific society, SOSORT (international Society On Scoliosis Orthopedic and Rehabilitation Treatment), whose name clearly states the importance of PRM in this field. Moreover, treatment of spinal deformities during growth is based on a team approach,<sup>9,</sup> <sup>10</sup> and most of the allied professionals involved are in the field of PRM: physiotherapists and orthotists mainly, but also psychologist and, according to the country, chiropractors, trainers etc.<sup>10, 11</sup>

The goal of PRM physicians should be in the diagnosis, prognosis, treatment and management of the team, including patients and parents.8 They should accurately determine which curves are at risk of worsening and which of these can be influenced by treatment, versus those curves that are at high risk of requiring surgery. Today possible treatments include:<sup>11</sup>

—physiotherapeutic
scoliosis-specific exercises (PSSE);
—bracing;
—surgery.

It is today accepted that these treatments are not alternative one to the other, but complimentary and have to be offered to different patients, or to the same patient in different moments.<sup>11</sup> The alternative used for years in some countries, the so-called "wait and see" strategy (i.e., observation and eventual surgery), has now been mostly abandoned due to the new strong evidence on the effectiveness of braces.<sup>5, 12</sup> Electrostimulation, traction and manual therapy have also been used, but there is no evidence of the effectiveness of those methods.<sup>11</sup> Once accepted that evidence-based clinical practice comes from the best evidence, combined with clinical expertise and patient preferences,<sup>13, 14</sup> the patient should be made aware of the possible options. The final choice should come from a multidisciplinary shared decision making discussion, because both surgery and bracing require specific clinical expertise.

Most of the papers we found focus on adolescent idiopathic scoliosis (Supplementary Appendix I), with one exception on secondary scoliosis,<sup>15</sup> two on kyphosis <sup>16, 17</sup> and one on spondylolisthesis.<sup>18</sup> Consequently research in these understudied fields is to be supported.

#### BRACING

Scientific evidence support bracing, but even if all good quality papers are in favor, the epidemiological quality of evidence is low.<sup>1, 5, 12</sup> Historically two kind of braces have been used to curb progression of the pathological curves: the rigid spinal orthosis and the elastic orthosis.<sup>1,</sup> <sup>5</sup> One RCT showed the efficacy of rigid,<sup>12</sup> and another of elastic bracing over natural history;<sup>11</sup> another demonstrated that rigid braces are more effective than elastic ones.<sup>19</sup> A new super-rigid generation of braces has been developed, with promising results also in high degree surgical curves.<sup>20</sup> Nevertheless there is no evidence in favor of any particular rigid brace over another.<sup>5</sup> Brace treatment for adolescent idiopathic scoliosis continues to be frequently used, and the number of brace types has increased. Predicting progressive curves and refining indications requires additional investigation. Choosing the best possible intervention for each patient demands good knowledge of the alternatives and discussion about the possible effects that can be reached. In-depth discussion with the patient and possibly with the family is unconditional. Also very important is to follow up the benefit of the intervention and to identify the need of change of intervention, especially the need of surgery in case of worsening of the situation.

#### PSSE

The aim of PSSE is to affect Cobb angles and also secondary outcomes, such as strength, mobility, and balance.<sup>6, 21</sup> The present evidence is enough to consider PSSE as an appropriate intervention for AIS, even if it is not possible to support a specific exercise regimen.<sup>6, 21</sup> Experts <sup>22</sup> and two good quality prospective studies <sup>23-25</sup> support the importance of Scoliosis-Specific Exercises based on autocorrection. Nevertheless, we presently do not know which approach is more effective between inpatient or outpatient, intrinsic or extrinsic autocorrection exercise, and symmetric or asymmetric exercise. Three RCT s showed effectiveness of PSSE at 6 months <sup>26, 27</sup> and at the end of growth.<sup>24, 25</sup> Other studies have confirmed the efficacy of exercises in reducing the progression rate (mainly in early puberty) and/or improving the Cobb angles (around the end of growth).<sup>28-31</sup> Exercises have been shown to be effective in reducing brace prescription.<sup>23</sup>

#### SURGERY

No strong evidence has been found in terms of prospective controlled studies to support surgical intervention from the medical point of view,<sup>32, 33</sup> even if the methodological and ethical difficulty to perform these studies must be recognized. Surgery has been defined as the failure of conservative treatment,<sup>34</sup> meaning that it should be applied only when everything before fails: in fact it creates a problem (loss of movement function due to fusion of the spine) to avoid another one (progression of the curve). Actual indications during growth include very high degree curves (mainly secondary) with possible impact on cardiorespiratory functions, and cosmetic reasons, only if the patient and the family agree.

# Recommendations

The results of the Consensus procedure are reported in Supplementary Tables I, II, online content only.

### Overall general recommendation

1. The professional role of PRM physicians in spinal deformities during growth is to propose a complete PR M treatment for the patients

considering all concurring diseases and pathologies, impairments, activity limitations and participation restrictions. The PRM physician's role is to coordinate the individual PRM project developed in team with other health professionals and medical specialists, in agreement with the patient and family, according to the specific medical diagnoses. (SoE: IV; SoR:A)

## Idiopathic spinal deformities

Recommendations on PRM physicians' role in medical diagnosis according to ICD

2. I It is recommended that PR M physicians dealing with spinal deformities gain specific and wide expertise in the specific medical diagnosis and treatment approaches of these patients. If this is not possible, they should work in team with spinal deformities experts of other specialties to develop the required PR M treatments. (SoE: IV; SoR: B)

3. I It is recommended that PRM physicians start the PRM process with a definite expert medical diagnosis of the spinal deformity. (*SoE: IV*; *SoR:B*)

*Recommendations on PRM physicians' role in PRM diagnosis according to ICF* 

4. I It is recommended that spinal deformities patients requiring a PRM intervention (so-called conservative treatment: mainly bracing and/or exercises) are evaluated by PRM physicians to diagnose their impairments, activity limitations and participation restrictions so to better focus a complete

PR M approach. (SoE: IV; SoR: A)

*Recommendations on PRM physicians' role in PRM assessment according to ICF* 

5. I It is recommended that PR M treatment is proposed and regularly monitored through a complete PR M assessment including evaluation of disease and impairment (classical radiographic and clinical parameters), but also activity limitations and participation restrictions due to health condition and/or treatments. (SoE:

### IV; SoR: B)

Recommendations on PRM management and process

## INCLUSION CRITERIA (E.G. WHEN AND WHY PRESCRIBE PRM INTERVENTIONS)

6. I It is recommended that PR M interventions are proposed to spinal deformity patients with an actual impairment, activity limitation or participation restriction, or with a possible or proven progression that could drive to a future activity limitation or participation restriction in adulthood. (SoE: IV; SoR: A)

## PROJECT DEFINITION (DEFINITION OF THE OVERALL AIMS AND STRATEGY OF PRM INTERVENTIONS)

6. I It is recommended that PR M interventions are proposed to spinal deformity patients with an actual impairment, activity limitation or participation restriction, or with a possible or proven progression that could drive to a future activity limitation or participation restriction in adulthood. (SoE: IV; SoR: A)

7. I It is recommended that the PR M projects are proposed in PR M centres specialised in spinal deformities treatment where all the team is present (PR M doctor, physiotherapist, orthotist, trainer, eventually psychologist and others) and an adequate expertise is granted to patients (PR M structure project). **(SoE: IV; SoR: B)** 

8. I I t is recommended that the project is defined on a totally individualised basis in agreement with patient and family. (SoE: IV; SoR: A)

### TEAM WORK (PROFESSIONALS INVOLVED AND SPECIFIC MODALITIES OF TEAM WORK)

9. It is recommended that a coordinated and organized team follow the patient, including at least a PR M physician, a medical specialist expert in spinal deformities (usually an orthopaedic surgeon, or another PRM physician consultant) in case the PRM physician has not a specific expertise, an orthotist, and a physiotherapist. The patient and his family are part of the team. For the possible surgical choices, an orthopaedic surgeon must be part of the team as well. (SoE: IV; SoR: B)

### **PRM INTERVENTIONS**

10. I It is recommended that PRM interventions are developed according to the actual Guidelines produced by the international Society On Scoliosis Orthopaedic and Rehabilitation Treatment (SOSORT),<sup>1</sup> including mainly specific exercises and/or bracing, as well as recommendations on activities of daily living. (SoE: IV; SoR: A)

### **OUTCOME CRITERIA**

11. I It is recommended to use the classical main outcome criteria, including Cobb degrees thresholds as described in the literature, aesthetics and overall spinal balance on the frontal and sagittal plane. It is recommended that also patient-centred outcomes (quality of life, activity limitations, participation restrictions, impact of treatments) are monitored regularly together with the usual impairment and disease-centred parameters. (SoE: IV; SoR: B)

## LENGTH / DURATION / INTENSITY OF TREATMENT (OVERALL PRACTICAL PRM APPROACH)

12. It is recommended that treatment (bracing and/or exercises according to the actual SOSORT SOSORT Guidelines) is continued until the impairments (pain, aesthetic impact...) are resolved and/or the risk of progression is

finished (enough bone maturity according to the quantity of deformity), so to grant to the patient the best possible future in terms of activity and participation according to the actual prognostic instruments. (SoE: IV; SoR: A)

# DISCHARGE CRITERIA (E.G. WHEN AND WHY END PRM INTERVENTIONS)

13. I It is recommended that patients are followed up until any further progression of the deformity is not expected anymore (stabilization) and/ or impairments (pain, aesthetic impact...) have been resolved as far as possible. (SoE: IV; SoR:A)

Recommendations on future pesearch on PRM Professional Practice

14. It is recommended to develop ICF compatible evaluation instruments for spinal deformities during growth. (SoE: IV; SoR: B)

### Secondary spinal deformities

Literature search yielded a few research related with Secondary Deformities. So most of the recommendations in Secondary Spinal Deformities are based on evidence extrapolated from Evidence, Research and Recommendations of Idiopathic Spinal deformities and is therefore supported by expert opinion in Secondary Spinal Deformities.

Recommendations on PRM physicians' role in Medical Diagnosis according to ICD

15. I It is recommended that PR M physicians dealing with pathologies that can give rise to secondary spinal deformities monitor regularly patients to immediately screen any spinal pathology. (SoE: IV; SoR: A)

16. I It is recommended that PR M physicians dealing with pathologies that can give rise to secondary spinal deformities gain specific expertise also in the diagnosis of spinal secondary disorders and treatment approached to integrate them in the overall approach to the main pathology. If this is not possible, they should work in team with another medical specialist expert in secondary spinal deformities (usually an orthopaedic surgeon or a neurosurgeon) to develop the required PR M treatments. (SoE: IV; SoR: A)

17. I It is recommended that PR M physicians dealing with pathologies that can give rise to secondary spinal deformities plan the PR M process approaching also the spinal deformity eventually present according to a definite expert medical diagnosis. (SoE: IV; SoR:A)

*Recommendations on PRM physicians' role in PRM diagnosis according to ICF* 

18. I It is recommended that patients with secondary spinal deformities requiring a PR M intervention are evaluated by PR M physicians to diagnose their impairments, activity limitations and participation restrictions so as to have a complete PR M approach. (SoE: IV; SoR: A)

*Recommendations on PRM physicians' role in PRM assessment according to ICF* 

19. I It is recommended that, before and during PR M treatment of patients with secondary spinal deformities, the PR M assessment includes the evaluation of the spinal disease and impairment (classical radiographic and clinical parameters) together with those of the main pathology. (SoE: IV; SoR: A)

Recommendations on PRM management and process

# INCLUSION CRITERIA (E.G. WHEN AND WHY PRESCRIBE PRM INTERVENTIONS)

20. I It is recommended that PR M interventions include an approach to the spinal deformity as soon as it is discovered, due to the high risk of progression, possibly leading with time to a big impairment of trunk statics (and consequently gait and/or posture) and even cardiopulmonary dysfunctions. (SoE: IV; SoR: A)

## PROJECT DEFINITION (DEFINITION OF THE OVERALL AIMS AND STRATEGY OF PRM INTERVENTIONS)

21. I It is recommended that, in case of spinal deformities, the PRM projects include also specific

treatments of the spine (such as bracing, and/or exercises to improve spinal posture and control) according to individual needs. (SoE: IV; SoR: A)

## TEAM WORK (PROFESSIONALS INVOLVED AND SPECIFIC MODALITIES OF TEAM WORK)

22. I It is recommended that a coordinated and organized team follow the patient, including at least: a PR M physician; a medical specialist expert in spinal deformities in case the PR M physician is not an expert (usually an orthopaedic surgeon, a neurosurgeon, or another PR M physician consultant); an expert in the original pathology (e.g. paediatrician, neuropaediatrician, neurologist, syndromes expert, orthopaedic surgeon, neurosurgeon etc) causing the spinal deformity; an orthotist; a physiotherapist. The patient and his family are part of the team. (SoE: IV; SoR: B)

## PRM INTERVENTIONS, OUTCOME CRITERIA AND OVERALL PRACTICAL PRM APPROACH

23. I It is recommended that PR M interventions are developed according to the actual Guidelines produced by the international Society On Scoliosis Orthopaedic and Rehabilitation Treatment (SOSORT),1 including mainly specific exercises and/or bracing, as well as recommendations on activities of daily living, but they have to be modified according to the underlying cause of secondary spinal deformity. (SoE: IV; SoR: A)

# DISCHARGE CRITERIA (E.G. WHEN AND WHY TO END PRM INTERVENTIONS)

24. I It is recommended that patients with secondary spinal deformities are followed up until any further progression of the deformity is not expected anymore (stabilization). (SoE: IV; SoR: B)

# *Recommendations on future research on PRM professional practice*

25. I It is recommended to start systematic research on the epidemiology of secondary spinal deformities and possible conservative rehabilitation approach to patients with secondary spinal deformities during growth. (SoE: IV; SoR: B) 26. I It is recommended to start a systematic research to identify the best PR M interventions, their length/ duration/intensity, and the correct outcome criteria for secondary spinal deformities during growth(**SoE: IV; SoR: B**)

# Conclusions

The professional role of PRM physicians in spinal deformities during growth is to propose a complete PRM treatment for patients considering all the concurring diseases and pathologies, impairments, activity limitations and participation restrictions. The PRM physician's role is to coordinate the individual PRM projects developed in team with other health professionals and medical specialists, in agreement with the patient and family, according to the specific medical diagnoses.

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# SUPPLEMENTARY MATERIALS

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#### Supplementary Figure 1.—Flow Chart of papers selection.

Supplementary Table1 *Results of the Consensus procedure.* 

Round	Number of recommendations	AcceptA	ccept with suggestions	Reject
12	6	57.7%	42.3%0	
22	6	92.3%7	.7%0	
3	26	100%	00	
42	6	100%	00	

Supplementary Table 2 *Overall view of the recommendations.* 

Contract	Number of recommendations	Stren	gth of Reco	ations	Strength of Evidence				
Content	Number	AB		CD		II I		III	IV
Overall recommendation1		100%	00		0	000			100%
PRM physicians' role in medical diagnosis - ICD	5	60%	40%	00		000			100%
PRM diagnosis and assessment- ICF4		75%	25%	00		000			100%
PRM management and process	13	61.5%	38.5%	00		000			100%
Future research on PRM professional practice3		0	100%	00		000			100%
Total2	6	57.7%	42.3%0		0	000			100%

# Evidence based position paper on Physical and Rehabilitation Medicine (PRM) professional practice for ageing people with disabilities. The European PRM position (UEMS PRM Section)

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# Evidence based position paper on Physical and Rehabilitation Medicine (PRM) professional practice for ageing people with disabilities.

## The European PRM position (UEMS PRM Section)

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#### ABSTRACT

Ageing people with disabilities (APwDs) are faced with challenges of ageing which is straightforwardly related to disability that adds to the burden related to their early-onset disability. The aim of the paper is to improve Physical and Rehabilitation Medicine (PRM) physicians' professional practice for APwDs (as a distinct group from those who are disabled due to the ageing process) in order to promote their functioning properties and to reduce activity limitations and/or participation restrictions. A systematic review of the literature and a Consensus procedure by means of a Delphi process have been performed involving the delegates of all European countries represented in the UEMS PRM Section. The systematic literature review is reported together with the 30 recommendations resulting from the Delphi procedure. The professional role of PRM physicians in relation to APwDs is extending, expanding and/or improving healthrelated rehabilitation services worldwide in various settings (getting beyond the rehabilitation facilities) emphasizing the concept of integrated care with collaboration across other sectors to meet the specific needs of APwDs. This evidence based position paper (EBPP) represents the official position of the European Union through the UEMS PRM Section and designates the professional role of PRM physicians in APwDs.

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**Key words:** Aging - Disability - Disabled persons - Rehabilitation - Physical and Rehabilitation Medicine.

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#### Introduction

It is well known that the population of the world is ageing with great speed. According to statistics, while the estimated number of individuals at 65 years and over is 524 million in 2010, this figure is expected to reach to almost 1.5 billion in 2050.<sup>1</sup> On the other hand, the World Report on Disability (WRD) emphasizes the straightforward relationship between ageing and disability with the ageing of the world's population leading to an increase in the prevalence of disability.<sup>2</sup> Therefore, the interaction between ageing and disability is multi-faceted. While even healthy ageing itself is associated with significant losses in intrinsic capacity and functional abilities resulting in substantial disability,3 many individuals with an early-onset disability have now chance to reach older ages with increased life expectancy. <sup>4,5</sup> The longevity of persons with disabilities (PwDs) is a big success; however, ageing persons with disabilities (APwDs) are now faced with two burdens including both the burden of ageing and also the burden related to their early-onset disability. The focus has long been on disability associated with the ageing process and APwDs, who are in a doubly jeopardized position, have been overlooked for a long time.<sup>6</sup> Following the United Nations Convention on the Rights of People with Disabilities (CRPD) advocating full inclusion of PwDs in society as a human rights issue,7 the Graz Declaration on Disability and Ageing is an important document which viewed the distinction between disability as a consequence of ageing and ageing with a disability declaring that APwDs have an equal right to health care and promotion, disease prevention, and proper systems of support for making their health-related quality of life (HRQoL) more favorable, and consequently assisting the progress of active ageing and full participation in society.8 Subsequently, Council of Europe released a report which prioritized participation of APwDs.9 The critical issue is that adults/elderly with lifelong disabilities have significantly higher odds of various chronic health conditions than those without any limitations with the more likelihood of poor health <sup>10</sup> in addition to their disability, making them a disadvantaged group for successful/active ageing. The key goals for successful ageing of PwDs include living long with good health and productivity, assessing, diagnosing, and treating primary and secondary health conditions, promoting and maintaining healthy lifestyles and independence via appropriate health care and supportive services with the principle of holistic approach not focusing on the disability alone.11, 12 The most recent World Report on Ageing and Health emphasizes the provision of services to facilitate functioning for the elderly for healthy ageing.3 The concept of successful ageing/ optimal ageing as defined 'the ability to optimize adaptation despite impairment in function or losses or limitations in physical, cognitive, emotional, and social domains and using available capabilities to the greatest advantage'13 as the best fitting definition for APwDs can well be linked to rehabilitation conceptually described as a health strategy "applying and integrating approaches to assess functioning, to optimize a person's capacity, to build on ... the resources of the person, to develop a facilitating

environment, to develop a person's performance, to enhance the person's HRQoL ... in all age groups; along and across the continuum of care, including ... the community, and across sectors, including health, education, labor and social affairs; with the goal ... to achieve and maintain optimal functioning based on WHO's integrative model of functioning, disability and health"<sup>14</sup> (p. 768). Issues surrounding successful APwDs may well be addressed by Physical and Rehabilitation Medicine (PRM) profession, the core strategy of which is rehabilitation with a wide variety of competencies as described in the White Book on PRM in Europe.<sup>15</sup> The conceptual description of PRM based on the International Classification of Functioning, Disability and Health (ICF)<sup>16</sup> adopted by the UEMS-PRM Section and Board and the ESPRM includes aspects of "... treating health conditions ... stabilizing, improving or restoring and compensating for impaired or lost body functions and structures, preventing .... medical complications, ... managing risks ..., leading and coordinating intervention programs to optimize activity and participation by performing, applying and integrating biomedical and technological interventions, psychological and behavioral; educational and counseling, occupational and vocational, social and supportive, and physical environmental interventions, providing advice to patients and their immediate social environment, service providers and payers, informs and advises the public and decision makers about suitable policies and programs ... to provide a facilitative larger physical and social environment;... to ensure access to rehabilitation services as a human right" <sup>17</sup> (p. 762, Table I), in accordance with rehabilitation strategy.<sup>14</sup> Both the WRD 2 and WHO Global Disability Action Plan (GDAP) 2014- 2021 <sup>18</sup> strongly supports PRM profession for addressing disability at all ages.<sup>19</sup>

The aim of this evidence based position paper (EBPP) was to improve PRM physicians' professional practice for APwDs (as a distinct group from those who are disabled due to the ageing process) in order to promote their functioning properties and to reduce activity limitations and/or participation restrictions and to designate the professional role of PRM physicians in APwDs through a systematic search of relevant evidence leading to evidence-based recommendations.

#### Materials and methods

This EBPP is produced according to the methodology proposed by the UEMS-PRM Section,<sup>20</sup> compris experiencing of two parts: "Systematic review of the literature" and "consensus with Delphi procedure among UEMS PRM Section delegates." For the systematic review (SR) of the literature, the main inclusion criterion was the relevance of the article with the PRM profession according to the judgment of two authors. The literature search for the identification of studies relevant to APwDs was conducted with a relevant PICO question (Supplementary Table I, online content only) using the following search terms/ strings in Cochrane library and Pubmed/ MEDLINE, respectively): (age OR old OR elderly) AND (disability) AND (rehabilitation OR physical therapy), publication Year from 2000 to 2016 in Cochrane Reviews searching all text and ("ageing" OR "aging" OR "aged" OR "old" OR "elderly" [MeSH Terms]) AND ("disability" OR "disabled" [MeSH Terms]) AND ("rehabilitation" OR "physical therapy" OR "conservative intervention" OR "physical medicine" [MeSH Terms]) AND ("care" OR "functioning" OR "activity" OR "participation" OR "quality of life" [MeSH Terms]) with the activated filters of publication date from 2000/01/01 to 2016/03/25, humans, aged: 65+ years, and article types including comparative studies, controlled clinical trials, guidelines, meta-analysis (MA), multicenter study, observational study, randomized controlled trial (RCT), review, and SRs, languages of English. We also included grey literature for other guidelines not published in Journals (www. guideline.gov/) and DART -Europe E-theses Portal (www.dart-europe.eu) for theses and dissertations and also searched from cited references in the retrieved articles. General reports/position papers on the subject by major international bodies (e.g. the UN, the WHO, the UEMS PRM Section and others) were also included.

### Results

SR of literature on APwDs (Supplementary Figure 1, online content only) revealed the following central issues. Service provision and organization for APwDs and their caregivers In the Council of Europe Report, service provisionincluding a wide variety of services is the main theme for enhancing autonomy and promoting an independent and active life for this population. Underlined issue is the need for close cooperation, coordination, and integration between health and social services as well as improving service quality and access.<sup>9</sup> Lack of parental support,

successful ageing and deficits in service provision and organization and/or coordination of long-term support services are major issues in this population and coordination and sustainability of care, health promotion, and issues relevant to caregivers are areas of focus to meet the needs of APwDs.<sup>21</sup> Indeed, the crucial policy area which emerged from "the Growing Older With a Disability (GOWD) Conference" (the Toronto declaration on bridging knowledge, policy and practice in aging and disability)<sup>22</sup> was to promote building bridges across ageing and disability sectors which have the similar center of attention i.e. participation and inclusion in the society with direct involvement of APwDs and disabled while ageing and their families and strengthening partnership between stakeholders and bridging advantageous circumstances relevant to long-term services and supports including technologies.<sup>23,24</sup> As an important attempt, an article by Ruiz et al. evaluating the state of long-term support services in several states in the US identified some important indicators to see how efficiently these services have been working and further needs for services and supports for APwDs. These indicators included "health promotion programs" offered, the percentage of persons having received "healthcare visits" for prevention reasons, effectively organized and simple "access systems," "support of caregivers," and "care coordination" between services (i.e. institutional and home and community based).<sup>21</sup>However, the important concept of 'coordinated care' involving the integration of services was noted to be superficially expressed in the literature and all of its required elements of collaboration, partnership, networking, knowledge sharing, person-centered approach and support for selfmanagement were not put in practice.<sup>25</sup> It is apparent that there seems to be neither sufficient suitable services nor a consensus on the definition and the properties of services for APwDs with the most important concepts of "care coordination" and "integration of services." Recently, a conceptual definition of health-related rehabilitation services is proposed that would comprehensively meet the needs of APwDs encompassing the important indicators<sup>21</sup> (important issues for APwDs are in bold) as "offers of personal or non-personal intangible products to persons with a health condition experiencing....disability (patient groups with specified healthrelated needs) or to their informal care-givers within an organizational setting in interaction between providerand person.... with the aim of enabling persons to achieve and maintain optimal functioning considering the integration of other services addressing the individual functioning needs, including health, social, labour and educational services and delivered by rehabilitation professionals, other health professionals, or appropriately trained community-based workers." <sup>26.</sup> (p. 4, Table I).

This definition of health-related rehabilitation services is intended to overcome the deficits in rehabilitation care provision for people with disabilities in general identified in the WRD <sup>2</sup> in relation to full inclusion in the society as indicated in CRPD.7 In a following paper, the dimensions of health-related rehabilitation services are proposed specifying service provider, service funding and service delivery with various examples of rehabilitations services which would also address the needs of APwDs.<sup>27</sup> In response to the WHO GDAP,<sup>18</sup> international PRM bodies' proposal explicitly underpinned the "respect for the continued dignity and value of PwDs as they grow older" and also emphasized "the need for rehabilitation throughout all phases of health care services" <sup>19</sup> (p. 2). This proposed definition of 'health-related rehabilitation services' and their proposed dimensions <sup>26, 27</sup> seem to cover all issues relevant to APwDs and provide the required approach as suggested in the Council of Europe Report<sup>9</sup> and the Toronto declaration.<sup>22</sup> There is an urgent need to translate the relevant items described in the proposed definition <sup>26, 27</sup> into good practice models and to test their effectiveness. Therefore, it is strongly recommended that the professional role of PRM physicians in favor of APwDs should be extending, expanding, and improving healthrelated rehabilitation services worldwide to meet specific needs of APwDs as well as "advice on appropriate policies and programs in the health sector and across other sectors, and also to public and decision makers" in accordance with the conceptual descriptions of rehabilitation as a health strategy and the PRM profession 14, 17 in response to the call of the WHO GDAP as to the "provision of leadership and governance for developing and strengthening policies, strategies and plans on habilitation, rehabilitation, assistive technology, support and assistance services, community based rehabilitation (CBR) and related strategies" <sup>18</sup> (p. 17).

#### Access to health care

Despite the criticality of health disparity research for PwDs to improve their HRQoL at later life, the required attention does not seem to have been given to accessing to health care including preventive, primary, and secondary health care which is very important to minimize additional health-related problems in APwDs and might be a new role for the PRM profession.<sup>28</sup> Among the recommendations of the WRD, "ensuring access to highquality rehabilitation interventions" was considered as a priority as a human rights issue 2 in accordance with Articles 25 and 26 of the CRPD relevant to "health" and "habilitation and rehabilitation,", respectively, punctuating "access to rehabilitation" and "organizing, strengthening, and extending comprehensive habilitation and rehabilitation services and programs" for all those in need.7 PRM physicians see WRD 2 as a unique challenge for strengthening rehabilitation.<sup>19, 29</sup> Strengthening rehabilitation imposes an important responsibility and task for rehabilitation professionals and requires the elements of realization in a progressive way and international collaboration, nondiscrimination/ equality, involvement in policy-making and service planning/programming with the features of rehabilitation services, products, or facilities including availability, accessibility, acceptability, quality, privacy/confidentiality, accountability, and shared decision making based on the human rights approach,<sup>30, 31</sup> all being very important to meet the needs of all PwDs.

#### Assistive technology

The use of assistive technology (AT) is important for promoting activity and participation in all PwDs. AT ranges from low technology apparatus such as utensils with handles to high technology equipment or systems such as motorized wheelchairs or computerized systems in rehabilitation practice.<sup>32</sup> Since APwDs may have already had their own assistive devices at the onset of their disability earlier, they may need different AT s to accommodate them at their later life with more functional decline to maintain or improve their HRQoL and to meet their newly arising ageing needs. Smart technologies combining information technology with ATs open a new era to help these people.<sup>33</sup>

#### Secondary conditions

The high incidence of secondary health conditions in APwDs may result in poor health, further functional decline with activity limitations and participation restrictions jeopardizing independence. Two large cohort studies identified pain, chronic medical conditions (hypertension and diabetes mellitus), physical (infection, weakness and speech problems) and psychosocial (fatigue, depression, and sleep problems) secondary health conditions interacting with each other and leading to more physical impairment.<sup>34, 35</sup> While increases in body weight was found associated with a rise in the risk of activities of daily living (ADL) limitations in a graded manner in an MA,<sup>36</sup> another MA revealed that underweight was associated with mortality in the elderly residing in nursing homes.<sup>37</sup> Hence, nutritional guidance by rehabilitation professionals is also important in APwDs.<sup>38</sup> It is important to note that in a retrospective study in a USA population of adults with disabilities punctuated the importance of the number of secondary conditions, poor health being the most important barrier for social participation for both groups with childhood and adult onset disabilities rather than the disability level. 39 Falls represent another important adverse consequence of disability, fall-related injuries being the most common injuries in adults with severe or moderate disability. <sup>40</sup> In summary, it is important for rehabilitation professionals to screen and monitor APwDs for chronic health conditions/secondary conditions or problems which could be detrimental to their optimal functioning. The sine qua nons of the care of older adults with multiple chronic health conditions or multimorbidity are well depicted in a US guideline with five principles consisting of patient preference, interpreting and applying the evidence specific to the elderly with multimorbidity in the literature while also recognizing the limitations of the evidence, making decisions on clinical management considering benefits, risks, burdens, and prognosis, taking into account clinical feasibility of the treatments for the specific old individual, and planning care with the selection of therapies that make the best of benefits, minimize harms, and improve HRQoL.41 It

is important to consider Geriatric Societies "choosing wisely" guidelines regarding diagnostic procedures inthis vulnerable population to prevent unfavorable outcomes (www.choosingwisely.org/clinicianlists /#parentSociety=American\_Geriatrics\_Society).

#### PRM interventions for APwDs

PRM interventions which both address underlying disability and associated secondary conditions mentioned above include exercise including community-based exercise on a continuum, conceptualized as transformative exercise,<sup>42, 43</sup> with following guidelines to ensure safety, self-management, educational and psychological

interventions including nutritional interventions,<sup>38,</sup> <sup>44, 45</sup> virtual reality systems, telerehabilitation, occupational therapy, vestibular rehabilitation,46 cognitive rehabilitation including cognitive stimulation, cognitive training and cognitive recreation, community-based rehabilitation, rehabilitation, interventions vocational for pain management, interventions for falls,47 and interventions for caregivers (other references provided in Supplementary Appendices I, II, online content only). The detailed evidence (being very important as the first step for quality of care and prioritized by UEMS PRM section and Board) 48 of effectiveness of PRM interventions for APwDs, which form the basis for recommendation of these interventions can be found in Supplementary AppendixII and Supplementary Table II, online content only.

#### Vocational rehabilitation and work outcomes

Vocational rehabilitation <sup>14, 17</sup> is an important issue for APwDs if they are at the working age with still present working activities.

#### **Environmental issues and barriers**

Environmental factors as defined in the ICF <sup>16</sup> may play a key role for dependent or independent living of the elderly in a community setting. Environmental factors for the disabled in general include individual factors at the micro level (home as the immediate environment, immediate family/caregiver support, ATs, home modifications, access to information technology), community

factors at the mesa level (natural and built environment, accessibility issues, social networking) and societal factors at the macro level (systems and policies regarding housing, health care and emergency response, legislations, societal attitudes as well analyzed in a qualitative study <sup>49</sup> need further careful attention with innovative approaches for APwDs. Disaster management for PwDs is a challenge for PRM physicians <sup>50</sup> and there is a need for population-specific disaster relief efforts considering biopsychosocial model of care.<sup>51</sup>

#### Assessment

Unquestionably, the ICF <sup>16</sup> provides an excellent means of assessment in PwDs. The ICF-based approach and the role of PRM physicians in identifying rehabilitation needs are well depicted in a UEMS Section of PRM position paper on PRM and persons with longterm disabilities with stroke as an example.<sup>52</sup> Due to the importance of physical activity/performance in APwDs, physical activity level should be measured which can be done by using direct measurements such as energy expenditure or indirect measurements relying on selfreport of physical activity based on a variety of questionnaires.<sup>53</sup>

#### Research

The research gaps in APwDs is comprehensively reported in a series of articles based on the Conference on Aging with a Disability and areas of research on demography, survival, participation, patterns of onset of secondary conditions and their interactions with functioning as well as their prevention and treatment, the role of obesity, different features of APwDs than those having disability due to ageing, and their care needs, the effectiveness of vocational training programs, the accommodation type that best improves their HRQoL, technologies to improve ADL, access to medical care and policies were determined.54,55 At this point, among five distinct scientific fields of human functioning and rehabilitation research, integrative rehabilitation sciences research including the concept of integrated service provides the needed opportunity which could address the unmet needs of this population.<sup>56</sup> Other recommended research areas in APwDs include exercise in specific groups of disabilities as to the dose with elements of type/modality, duration, frequency and intensity with their effectiveneness on the maintenance or improvement in their basic disability to prevent functional decline as well as impact on prevention or reduction of secondary health conditions.<sup>57</sup> More health disparity research is also needed. <sup>28</sup> Last but not the least, research on disaster relief for APwDs is required.<sup>51</sup> Disappointingly, the reality is that current research funding methods/policies do not support research on rehabilitation to the desired extent.58 Finally, it is very important to add that interventions for APwDs can only be achieved successfully by interdisciplinary team working.52, 59 Additional information and further evidence on central issues regarding APwDs (obtained through systematic review of literature) are provided in Supplementary Appendix I, online content only. The results of the Consensus procedure are in Supplementary Tables III, IV, online content only.

#### Recommendations

#### Overall general recommendation.

1. The professional role of PRM physicians in relation to APwDs is extending, expanding and/or improving

health-related rehabilitation services worldwide in various settings (getting beyond the rehabilitation facilities) emphasizing the concept of integrated care with collaboration/cooperation across other sectors/disciplines (e.g. geriatrics, home-care, nursing, and others) to meet the specific needs of APwDs. [SoE: IV;<sup>2, 7-9, 11, 12, 14, 15, 17-19, 22-24, 26, 27, 30, 31</sup>SoR: A]. (SoE: Strength of Evidence; SoR: Strength of Recommendation <sup>20</sup>)

#### *Recommendations on PRM physicians' role in Medical Diagnosis according to ICD*

2. It is recommended that PRM physicians monitor regularly APwDs for the diagnosis/identification of comorbidities and secondary conditions (e.g. pain, spasticity, neuropathic bladder and bowel dysfunction, pressure ulcers, fatigue, depression, sleep problems, infections, musculoskeletal, neurological, cardiovascular, respiratory, metabolic diseases, obesity, frailty, degenerative diseases, overuse syndromes, cognitive dysfunction, and falls) that may lead to additional progressive impairments which may further affect/increase the original level of disability or can be increased by their original disability. [SoE: IV;<sup>10, 34-3</sup>5SoR: A].

3. It is recommended that PRM physicians consider that ageing persons are very often in a vulnerable situation in which complex decisions have to be taken. Invasive and therefore risky diagnostic procedures should always be linked to a functional geriatric assessment and not only to the age/ diagnosis of the patients. This will help to prevent high risk patient groups from negative outcomes (e.g. mortality, complications, length of stay in hospitals) [SoE: IV;41 SoR: A]

Details can be found in American Geriatrics Society Recommendations available at http:// www.choosingwisely.org/clinicianlists/#parent Society=American\_Geriatrics\_Society.

*Recommendations on PRM physicians' role in PRM diagnosis according to ICF* 

4. It is recommended that PRM physicians monitor APwDs for further functional decline to detect additional impairments in body functions, activity limitations and participation restrictions. [SoE: IV;5, 10-12 SoR: A].

*Recommendations on PRM physicians' role in PRM assessment according to ICF* 

5. It is recommended that APwDs are assessed regularly (at least annually) using the ICF/ICF-based instruments including all components of body structures and functions, activities and participation and contextual factors to depict a thorough picture of the individual's health condition in terms of his/her needs to plan and/or revise management decisions. **SoE: IV; 2, 17-19 SoR: A].** 

6. It is recommended that PRM physicians pay particular attention to the assessment of ICF category titles in the environmental factor component (e.g. Products and technology for personal use for ADL, mobility, or communication, those relevant to immediate and larger built environment, to family, neighbours and community members, personal care providers, health and other professionals, support and relationships, attitudes of care providers, health and related professionals, and the society as well as services, systems and policies) (ICF browser. http:// apps.who.int/ [SoE: IV;49 SoR: B].

7. It is recommended that PRM physicians progress the validation of measurement instruments in APwDs. [SoE: IV; SoR: A].

8. It is recommended that PRM physicians evaluate physical activity level of an ageing individual with a disability in more detail using validated instruments. [SoE: IV;53 SoR: A].

Recommendations on PRM management and process

INCLUSION CRITERIA (E.G. WHEN AND WHY TO PRESCRIBE PRM INTERVENTIONS)

9. It is recommended that PRM physicians prescribe PRM interventions whenever needed throughout the continuum of care to maintain and/or improve impairments in body functions, and to reduce activity limitations and participation restrictions in APwDs. [SoE:IV;14, 17 SoR: A].

PROJECT DEFINITION (DEFINITION OF THE OVERALL AIMS AND STRATEGY OF PRM INTERVENTIONS)

10. It is recommended that the overall aim and strategy of PRM interventions is to promote and maintain functional status for full inclusion of

APwDs in society. [SoE: IV; 14, 17, 26, 27 SoR: A].

11. It is recommended that PRM physicians provide advice on policies and programs among and across sectors, stakeholders, public, and decision makers to meet the needs of APwDs. [SoE: IV;14, 17 SoR: A].

TEAM WORK (PROFESSIONALS INVOLVED AND SPECIFIC MODALITIES OF TEAM WORK)

12. An interdisciplinary/multiprofessional team is essential in the management of APwDs. The team can be composed of PRM physicians, other rehabilitation professionals, other medical specialists, other health professionals, vocational rehabilitation specialists, social care providers or community-based workers, gymnasts, and even family members/caregivers. PRM physician can make a unique contribution in the teamwork as the leader, advisor, evaluator, coordinator, or consultant depending on the problem of the person or setting. [SoE: IV;52, 59 SoR: A].

#### PRM INTERVENTIONS

13. It is recommended that PRM physicians prioritize lifelong tailored exercise prescription for APwDs. [SoE: I; SoR: A].

14. It is recommended that PRM physicians may consider exergaming/virtual reality systems for certain elderly people. [SoE: I; SoR: B].

15. It is recommended that assistive devices may play a significant role for independence and technologies including computer-based technologies or smart homes may be considered in certain conditions in ApwDs. [SoE: I to IV; SoR: B].

16. Self-management and educational interventions are very important for APwDs and health promotion programs including nutrition should be advised for eligible elderly with disabilities. **[SoE: I; SoR: A].** 

17. Psychosocial interventions may be considered for the management of pain and depressive symptoms. [SoE: I; SoR: A].

18. Telerehabilitation may be tried. [SoE: IV; SoR: B].

19. Home visits and interventions for home modifications (technical aids, assistive devices and

other tools against barriers) including occupational therapy for 'Activities of Daily Living' training can be considered if needed. [SoE: I; SoR: A].

20. Community-based rehabilitation is very important for APwDs in which PRM physicians are involved in accordance with its redefinition. [SoE: IV; SoR: A].

21. It is recommended that PRM physicians consider vestibular rehabilitation for those with balance problems and dizziness together with other specialists. [SoE: IV; SoR: A].

22. Cognitive rehabilitation including cognitive stimulation, cognitive training and cognitive recreation can be considered for eligible APwDs together with psychologists. [SoE: I; SoR: A].

23. Vocational rehabilitation may be provided for ageing adults with disabilities in relation to the possible working activities still present. [SoE: I; SoR: A].

24. It is recommended that PRM physicians can consider prescribing virtual reality, hypnosis for chronic pain in various chronic neurological conditions and additionally transcranial direct current stimulation (tDCS) for neuropathic pain. **[SoE: I; SoR: B].** 

25. A fall prevention program including exercise needs to be prescribed. **[SoE: I ; SoR: A].** 

26. It is recommended that PRM physicians provide appropriate solutions/recommendations to caregivers to maintain their physical and psychological health. [SoE: I; SoR: B].

OUTCOME CRITERIA

27. It is recommended that PRM physicians decide on the outcome criteria during the assessment and goalsetting processes. [SoE: IV; SoR: A].

LENGTH / DURATION / INTENSITY OF TREATMENT (OVERALL PRACTICAL PRM APPROACH) AND DISCHARGE CRITERIA (E.G. WHEN AND WHY TO END PRM INTERVENTIONS)

28. It is recommended that PRM physicians make treatment decisions and organize plans/programs tai

lored to the specific individual needs in terms of the duration and intensity of a specific treatment. [SoE: IV;<sup>26, 27</sup> SoR: A].

29. It is recommended that PRM physicians continue with their efforts to meet the diverse needs of APwDs with various treatment strategies throughout the lifespan of these persons with a life-long disability. **[SoE:IV;<sup>26, 27</sup> SoR: A].** 

*Recommendations on future research on PRM professional practice* 

30. It is recommended that PRM physicians are involved in research on 'Integrative rehabilitation sciences research' including topics of rehabilitation rehabilitation administration services. and management, integrated care and service, and ICF based case management, health disparities research as well as research on demography, secondary conditions, exercise, new technologies, vocational rehabilitation, and environmental factors including disaster relief to find better solutions and to improve quality of care, to maintain and promote independence and HRQoL of APwDs. [SoE: IV;<sup>28,</sup> <sup>54-57</sup>SoR: A].

### Conclusions

This EBPP covers aspects relevant to APwDs comprehensively ranging from service provision to evidence-based PRM interventions for their conditions/problems and research and provides extensive literature to be evaluated in detail in accordance with its aim of improving PRM physicians' professional practice on this important issue. The expansion of health-related rehabilitation services with the implementation of all its elements addresses functioning needs of this specific population in a variety of settings <sup>26, 27</sup> in the context of which PRM physicians may act as the major health care providers, leaders, collaborators, members, advisors, or consultants in interdisciplinary/ multiprofessional teams 52, 59 contributing uniquely in the maintenance and/or improvement of their body functions and reducing activity limitations and participation restrictions. This EBPP represents the official position of the European Union through the UEMS PRM Section and designates the professional role of PRM physicians in APwDs.

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# SUPPLEMENTARY MATERIALS

**Supplementary Appendix I.**— *The elaborated 'Results' section with the provision of additional information and further evidence on central issues regarding ageing people with disabilities (APwDs) obtained through systematic review of the literature.* 

# Service provision and organization for APwDs and their caregivers

Although service provision and organization for APwDs are essential, the existing literature on the subject is mostly confined to surveys in cohorts and/or practices or qualitative studies. There is lack/paucity of evidence on the identification and effectiveness of types of services to answer the question which type of service should be available for APwDs and which service is better than the other for improving functioning. A model of fully integrated and comprehensive care called PAC E (Program of All-Inclusive Care for the Elderly) in the US was found to have better effectiveness than the less comprehensive 1915(c) disabled and aged waiver programs in reducing nursing home transition in the elderly with cognitive disability.<sup>1</sup> A ten-month community based multicomponent program including home visits, phone calls, assessments of individual needs, and supportive services for the recipients of care and also for the family caregivers was found to improve both physical and mental health of ageing persons with at least two ADL difficulties or mental health problems having a risk for placement in nursing homes.<sup>2</sup> In the WHO Mental Health Gap Action Program, an evidence review indicated inconclusive evidence of effectiveness of community-based strategies of psychosocial rehabilitation in adults with developmental disabilities (DDs) and IDs with some very low quality evidence on the favorable effects of the training of social skills on adaptive behaviors and supported employment programs in persons with autism spectrum disorders.3 An RCT compared an integrated care program for vulnerable communitydwelling old people with usual care and found some reduction in hospitalization and nursing home placement, however, without any difference in health status.<sup>4</sup> While a CR pointed to more beneficial effects of more intense community services than standard services in some countries where available,<sup>5</sup> an SR evaluating the care of ageing persons with IDs underlined that their needs were not sufficiently met with the current care and service provision due to the lack of suitable services, knowledge of the relevant staff, and insufficient access to services after retirement.<sup>6</sup> Unmet needs of ageing people with

DDs and IDs were also highlighted in a qualitative study indicating the requirement for coordination of ageing and disability resource centers in seven states in the US.<sup>7</sup>

#### Access to health care

People with disabilities are known to have been receiving less screening, education on healthpromoting lifestyles including exercise/physical therapy, and suboptimal use of health services 8,9 with an increase in secondary health conditions resulting in poor health status. Significant inequalities were found between persons with physical or IDs when compared to those without disabilities in terms of health risks, health status, and health care utilization to the disadvantage of those with disabilities.<sup>10</sup> Key issues identified as barriers included under- or misdiagnosis, delays in treatment, and accessibility issues to transportation, care facilities, and medical equipment <sup>11</sup> along with financial reasons and social security coverage for health, community exercise options, psychosocial issues and assistance of caregivers as relevant to access to exercise for persons with life-long disabilities.9

### Assistive technology

Assistive technology (AT) device is defined as "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".<sup>12</sup> Smart technologies may be of use for APwDs. Regarding the efficacy of smart home technologies, a CR13 and an SR14 of 2008 pointed to the absence of evidence regarding their impact on outcomes. A more recent SR provided emerging and promising evidence for beneficial effects of smart homes for health promotion, independence, and ageing at home.<sup>15</sup> However, there seems to be a need to study the actual impact of smart home technologies on independence in high quality RCTs. In addition to physical assistance, an SR pointed to emerging evidence on the utility of smart technologies such as web-based support groups, intervention, and contacts in enhancing social connectivity including the elements of social isolation, social support, social
networks, and self-efficacy with also a possible role in improving HRQoL, stress, depression, and selfesteem based on few studies.<sup>16</sup>

#### Secondary conditions

Due to their high incidence and association with further functional decline in APwDs, secondary health conditions need more elaboration. Regarding pain, it was interesting to note that while healthy ageing persons felt an age-related reduction in pain, the level of pain was higher and more severe in APwDs (physical) when compared with the normative population with pain significantly interfering with activities adding to their impairments as they age.<sup>17</sup> Although many persons with spinal cord injury (SCI) were found to maintain participation and HRQoL throughout their lives with variations in distinct HRQoL domains with a potential to improve,<sup>18</sup> the likelihood of increased risk of secondary conditions may result in functional decline while ageing.<sup>19</sup> The association between years after SCI and hypertension and cancer was found significant and significant relationships were demonstrated between mobility status and chronic health conditions such as high cholesterol, hypertension, coronary artery disease, and diabetes mellitus in persons ageing with SCI.<sup>20</sup> An SR pointed to mobility decline in about one fourth of ambulant adult with cerebral palsy (CP).<sup>21</sup> Obesity, early muscle wasting, and increased prevalence of coronary heart disease were also noted among adults with CP<sup>22</sup> which could be helped by PRM in maintaining function to possibly result in health optimization and longevity. As for ageing persons with IDs, a multimorbidity prevalence of 71.2% after the age of 40 years was higher than the prevalence of 58.6% in the general population aged more than 65 years and their problems are more often related to mental health or neurological disease which caused additional disability as they aged.<sup>23</sup> The exponential increase in the prevalence of frailty with age <sup>24</sup> may also affect APwDs. Regarding falls, in a cross-sectional survey, the prevalence of falls as self-reported within the last six months was found highest in persons ageing with muscular dystrophy (70%) followed by ageing persons with postpolio syndrome, multiple sclerosis (MS), and SCI with prevalences of 55%, 54%, and 40%, respectively. The level of mobility, balance problems, the number of comorbidities, gender, the time since diagnosis, and age were noted to be risk factors.<sup>25</sup> In the SCI Ageing Study, 10.4% of the participants reported an injury resulting from a fall, 22.8% of which required hospitalization with an additional 47.6% had ADL limitations for about a week.<sup>26</sup> An SR drew attention to unfavorable effects of acute muscle fatigue on reactive postural control and the importance of endurance training which might be useful for fall risk reduction.<sup>27</sup> Pain (both chronic pain and foot pain) has also been found associated with increased risk of falling in community-dwelling elderly.<sup>28</sup>

#### PRM interventions for APwDs

The detailed evidence of effectiveness of PRM interventions for APwDs is comprehensively presented in Supplementary Appendix II and the summary of evidence is given in Supplementary Table II. Additionally, there are useful guidelines to be followed by PRM physicians when designing/ prescribing PRM programs/interventions as the following: A prescription guideline for resistance exercise draws attention to cautious risk stratification to ensure safety for the elderly with existing comorbidities.<sup>29</sup> A recent report presents physical activity/exercise recommendations for the elderly residing in long-term care facilities.<sup>30</sup>A US guideline recommends that the elderly should be screened for eligibility and advised to attend available nutritional service programs. <sup>31</sup> Basics of nutritional counseling can be found in the age-friendly toolkit provided by the WHO.32 WHO CBR guideline, redefining CBR as "a strategy of organizing rehabilitation within general community for equal opportunities and social inclusion of all persons with disabilities",<sup>33</sup> is an important resource for providing rehabilitation services in a community setting. An evidence-based clinical practice guideline on pain in the elderly in general recommend pharmacological interventions, interventional therapies such as intraarticular injections for those with osteoarthritis, psychological interventions such as CBT, physical activity, assistive devices in the aged in nursing homes considering their preferences.<sup>34</sup> Other guidelines revealing evidence of effectiveness are presented in Supplementary TableII.

# Vocational rehabilitation and work outcomes

Among limited literature on vocational rehabilitation and work outcomes for APwDs, an article investigating the status of vocational rehabilitation (VR) services for APwDs (MS, SCI, post-polio, muscular dystrophy) in the US revealed the underutilization and lack of comprehensiveness of these services not yielding high quality outcomes in beneficiaries, personal and organizational factors affecting the efficacy.<sup>35</sup> A study on adults with CP identified significant predictors for work outcomes as the following: assistance for employment, on-thejob training and support, services for maintenance, and rehabilitation technology.<sup>36</sup>

#### **Environmental issues and barriers**

Research in the area of environmental issues for older adults providing evidence on how the modification of environmental barriers changes the lives of APwDs is limited. A WHO guide on age-friendly cities provides the required features for the inclusion of the aged in society.37 Regarding systems and policies in terms of payment/financial issues that may pose an important barrier for the required "integrated care" for APwDs, as discussed in a doctoral thesis, a "payfor-coordination" system as implemented in some European countries contributed to the success of "coordinated care".<sup>38</sup>

#### Assessment

The ICF is a reference framework for PRM and diagnosis and assessment according to the ICF are of great importance. It should be noted that ICF core sets could be very valuable for the assessment of persons with various disabilities available at www. icf-core-sets.org/. The utility of the ICF Checklist in describing disability in a community- dwelling elderly population has also been shown in a study<sup>39</sup> which needs to be modified and validated for APwDs. Regarding further assessments, for the identification of frailty, the sensitivity of the Program of Research to Integrate Services for the Maintenance of Autonomy (PRISMA) 7 questionnaire, slow gait speed, and the timed get-up-and-go test was found high.<sup>40</sup> For monitoring specifically the elderly at risk of losing independence to identify impairments in body structures and functions and activities and participation and/or environmental factors, a number measurement instruments were developed and recommended (e.g. Short Physical Performance Battery, Continuous Scale Physical Functional Performance).41

#### Research

More on research, in persons ageing with DDs and IDs, reports indicated the need for research on environmental interventions including the effectiveness of technologies in real life context and long-term care systems and policies as well as research on caregivers and family support.<sup>42</sup> In the GOWD Conference /the Toronto declaration particular emphasis was given to the integration of ageing and disability sectors in terms of long-term services and supports and bridging ageing and

disability research was deemed critical for capacity building to meet the needs of APwDs.<sup>43</sup>

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#### Supplementary Appendix II.—

The detailed evidence of effectiveness of PRM interventions for ageing people with disabilities (APwDs) based on papers (41) found with the systematic review which provide evidence.

#### Exercise

A CR evaluating the effects of rehabilitation interventions based on exercises on functioning regarding activities of daily living (ADL) demonstrated improvements in functioning as well as favorable effects on balance, flexibility, strength, and perhaps mood in long-term care residents including those elderly with disabilities such as stroke survivors.1 In an SR, exercise training has been shown to have favorable effects on mobility and function without apparent effects on physical activity and HRQoL in the physically impaired elderly.<sup>2</sup> A more recent MA demonstrated that physical exercise improved executive function relevant to ADL in the elderly with modest effect size.3 An SR and MA demonstrated a small significant effect of yoga exercise on balance and a moderate effect on physical mobility in the elderly with disabilities including those with Parkinson's disease or chronic stroke in aged care facilities.<sup>4</sup> Another SR suggested the implementation of progressive resistance training in the health promotion schedules of the elderly in long term care institutions to maintain independence based on the evidence of significant improvements in function and muscle strength induced by this type of exercise even in the presence of functional disabilities and advanced age.5 An SR provided limited evidence regarding the efficacy of PRM interventions (i.e. strength and neurodevelopmental training, whole body vibration (WBV) training and medications for spasticity) on gait speed in adults with CP.6 An SR demonstrated favorable effects of exercise on ADL, balance and gate in the frail elderly with disability.7 Exercise was found effective in improving both normal and fast gait speed and also physical performance in frail elderly though in small amounts in an SR/MA.8 A very recent RCT provided evidence for the effectiveness of an activity based program on ADL and also on pain in short-term in frail elderly in the community.9 Two SRs and/or MAs pointed to beneficial effects of WBV in the elderly, one showing improvement in single-leg stance and timed up and go test as well as some other mobility or balance measures (though not with consistent results),10 the other demonstrating its efficacy on functional strength mainly in the elderly with severe functional limitations who needed care and unable to participate in conventional exercise suggesting the use of WBV as a skill developing training until

standard exercises can be done.11

#### Virtual reality systems

An SR yielded equal or better effectiveness of exergames or game technologies such as Nintendo Wii in improving physical function mostly related to balance in the elderly with disabilities than conventional exercise. <sup>12</sup> On the other hand, another SR pointed to weak evidence of effectiveness of homebased virtual reality systems on body functions, activity limitations and participation restrictions in healthy elderly and persons with neurological conditions, however, with satisfactory adherence in terms of feasibility.<sup>13</sup> Self-management, educational and psychological interventions In an SR, multidisciplinary health promotion/disease prevention programs aiming to maintain or promote health and HRQoL and to defer decline in functioning and ADL performance were found to be effective in improving 29% of targeted ICF components of body functions and structures, 38% of activities and participation, 32% of environmental and 36% of personal factors in community-dwelling old persons with frailty.<sup>14</sup> An SR also found that the Chronic Disease Self-Management Program aiming to provide skills to favorably manage chronic health conditions produced small to moderate psychological health benefits/healthy behaviors.<sup>15</sup> An SR found some evidence that health promotion programs including nutrition education and exercise were associated with positive dietary and other healthy

behaviors such as exercise and weight reduction and limited improvement in life satisfaction in persons ageing with DDs.<sup>16</sup> Another SR/MA suggested potential utility of suitably designed self-management interventions in reducing depressive symptoms in persons with physical health problems.<sup>17</sup> Cognitive behavioral therapy (CBT) was suggested as an option in the management of depression with significant improvements in mood and disability.<sup>18</sup>

#### Telerehabilitation

An SR indicated the success of 71% of telere habilitation applications with clinical significance in about half of them in studies on neurological or cardiac rehabilitation; however, not with conclusive evidence.<sup>19</sup> An RCT pointed to efficacy of a telephone delivered weight management program in reducing or maintaining weight in persons with physical disabilities.<sup>20</sup>

#### **Occupational therapy**

A CR found no sufficient evidence of efficacy of occupational therapy (OT) in improving, restoring and maintaining independence in ADL or for reducing complications such as depression and low mood based on one study in elderly stroke survivors residing in care homes.<sup>21</sup> In two SRs, moderate to strong evidence was found on education and employment regarding the effectiveness of OT interventions promoting occupational activities and dealing with performance skills and environmental aspects with employment support in adults with serious mental disorders <sup>22</sup> as well as for social skills, life skills, instrumental ADL, and neurocognitive training on performance.<sup>23</sup> An SR/MA drew attention to the potential effectiveness of home visit programs with clinical examination and comprehensive assessment in reducing the burden of disability among the elderly.<sup>24</sup> A guideline recommended OT interventions for home modifications for improving function relevant to ADL for APwDs (physical), however, with weak evidence on the potential to improve outcomes.25

#### Vestibular rehabilitation

While vestibular rehabilitation offers an effective strategy for the management of the elderly with vestibular disorders (i.e. dizziness, imbalance), due to the lack of studies with high methodological quality, evidence regarding its efficacy could not be provided in an SR.<sup>26</sup>

# Cognitive rehabilitation including cognitive stimulation, cognitive training and cognitive recreation

An SR provided substantial evidence of effectiveness of cognitive rehabilitation of diverse types including interventions for executive function, memory, attention, communication and of comprehensiveholistic neuropsychological rehabilitation even many years after the injury for persons with TBI and stroke.27 An SR demonstrated efficacy of cognitive training on memory, attention, and speed processing functions in healthy elderly or those with mild cognitive dysfunction, however, without demonstrable reflection in ADL.<sup>28</sup> A meta-synthesis of qualitative studies revealed that memory rehabilitation was useful in people with long-term neurological conditions with associated effects on acceptance, confidence, improved self-awareness, mood, fatigue, and cognitive deficits leading to beneficial effects on ADL.<sup>29</sup> A CR reported consistent evidence on the effectiveness of cognitive stimulation

on cognitive function and also on HRQoL and wellbeing, but not on mood, ADL, or behavioral and problem solving functions in persons with mild to moderate dementia.<sup>30</sup> Computerbased cognitive stimulation, recreation or training interventions were also noted to be effective in the elderly in an SR <sup>31</sup> and also in those with dementia with better outcomes in cognition, depression, and anxiety than non-computer-based interventions in and SR/MA.<sup>32</sup> Furthermore, long-term effects of computer-based cognitive programs on memory performance were demonstrated in the elderly in an MA.<sup>33</sup>

#### **Community-based rehabilitation**

Rehabilitation services offered in a community setting may provide benefit for APwDs; however, evidence is lacking.

#### Vocational rehabilitation

Moderate evidence for employment was found in an SR for vocational activities including education, counseling, guidance, work organization and schedule modifications, assistance of others, employer support and suitable transportation in persons with physical disabilities.<sup>34</sup>

#### PRM interventions for pain management

A very recent Italian guideline recommends the use of multicomponent treatments for neuropathic pain in SCI including virtual reality protocols and/or hypnosis or transcranial direct current stimulation. For chronic pain in persons with MS, again virtual reality interventions or hypnosis and hypnosis for pain in Parkinson's disease, amyotrophic lateral sclerosis, Guillain-Barré syndrome, and postpolio syndrome are recommended.35 A CR identified small to moderate positive effects of CBT on pain and disability at posttreatment but not in the longterm when compared with waiting list in persons with chronic pain in general.<sup>36</sup> Self-management programs <sup>37</sup> and pain neurophysiology education <sup>38</sup> were found to provide some benefit in the elderly with chronic pain in SRs. PRM interventions for falls In general, identification and modification of risk factors for falls and physical training programs including a variety of modalities are effective strategies with strong evidence to reduce falls in high risk groups of community dwelling elderly.<sup>39</sup> An NGC guideline recommends moderate-intensity aerobic exercise for at least 150 min/wk or vigorousintensity aerobic exercise for at least 75 min/ wk and the addition of muscle-strengthening exercises

2 times/wk along with balance training  $\geq$ 3 days/week for fall prevention in community-dwelling elderly  $\geq$ 65 years with an increased risk for falls with Grade B recommendation level (a moderate net benefithigh certainty).<sup>40</sup>

#### Interventions for caregivers

Family caregivers of APwDs face numerous problems (e.g. depression, poor health, and economic). A recent SR revealed some evidence that support programs for families of ageing persons with DDs produced beneficial effects in terms of well-being, satisfaction, and better service access.<sup>41</sup>

Summary of the evidence for the effectiveness of PRM interventions are given in Supplementary Table II.

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Supplementary Table I.—PICO question used in this EBPP. Population Ageing persons with disabilities

Interventions PRM interventions including assessments, diagnosis,

treatment/management with a holistic approach based on the ICF, service provision, care

Comparison Usual care, usual situation, no intervention Outcomes Functioning, participation, quality of life, quality of care,

systems and policies

Supplementary Figure 1.— Flow chart of papers selection.

SUPPLEMENTARY	TABLE	I	-PICO	question	used	in	this	EBPP.

Population	Ageing persons with disabilities
Interventions	PRM interventions including assessments, diagnosis,
	treatment/management with a holistic approach based on
	the ICF, service provision, care
Comparison	Usual care, usual situation, no intervention
Outcomes	Functioning, participation, quality of life, quality of care, systems and policies

Supplementary	TABLE	II .—Summary of	the evidenc	e for th	e effectiveness (	of PRM a	approaches,	/interventions in ag	eing peop	le with	disa	bilit	ies
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Population/condi- tion or problem	PRM intervention	Evidence of effectiveness	Source	Author(s), year (ref. n.)	LoE/SoE
Long-term care resi- dents/disability	Physical rehabili- tation interven- tions	Improvement in functioning regarding ADL Favourable effects on balance, flexibility, strength, and perhaps mood (with few adverse events)	CR	Crocker <i>et al.</i> , 2013 <sup>1</sup>	I/Limited I/Good to moderate
Elderly/disabilities	Exercise	Benficial effects on mobility and function; not on HRQoL	SR	de Vries et al., 2012 <sup>2</sup>	I/Moderate
Elderly	Exercise	Beneficial effects on executive function related to ADL	MA	Karr et al., 2014 3	I/Weak
Elderly/disabilities	Yoga exercise	Benficial effects on balance and mobility	SR/MA	Youkhana et al., 2015 <sup>4</sup>	I/Weak
Elderly/disabilities	Exercise (PRT)	Significant improvements in function and muscle strength	SR	Valenzuela et al., 2012 5	I/ Moderate
CP/Adult/disabilities	Exercise	Favourable effects on gait speed	SR	Morgan et al., 2014 6	I/Limited
Frail elderly	Exercise	Favourable effects on ADL, balance and gate	SR	Chou et al., 2012 7	I/Weak
Frail elderly	Exercise	Improves normal and fast gait speed and physical performance	SR/MA	Giné-Garriga et al., 2014 8	I/Weak
Frail elderly	Exercise	Improves ADL and pain	RCT	De Vriendt et al., 2016 9	II/Moderate
Elderly/disabilities	Whole body	Some beneficial effects on mobility or balance measures	SR	Orr, 2015 10	I/Weak
,,	vibration	Beneficial effects on functional strength	SR	Rogan et al., 2015 <sup>11</sup>	I/Moderate
Elderly/disabilities	Virtual reality	Some beneficial effects on balance functions	SR	Skjæret et al., 2015 12	I/Weak
	· · · · · · · · · · · · · · · · · ·	Some benefits for body functions, activities and participation	SR	Miller et al., 2014 13	I/Weak
Elderly/disabilities	Health promotion	Improves targeted ICF components in a range of 29% to 38%	SR	Gustafsson et al., 2009 14	I/Weak
,	programs	Benefits on psychological health and healthy behaviors	SR	Brady et al., 2013 15	I/Weak
Aged/DDs	1.0	Healthy behaviors, some improvement in life satisfaction	SR	Heller & Sorensen, 2013 <sup>16</sup>	I/Weak
Elderly/physical disab.	Self-management	Reduction in depressive symptoms	SR/MA	Matcham et al., 2014 17	I/Weak
Elderly	CBT	Beneficial effects on depressive symptoms (mood)	CR	Simon et al., 2015 18	I/Limited
Physically disabled	Telerehabilitation	Successful in some neurological conditions (inconclusive	SR	Hailev <i>et al.</i> , $2011^{-19}$	I/Limited
		evidence)	~~~		
		Effective in reducing or maintaining weight	RCT	Rimmer et al., 2013 20	II/Moderate
Stroke in care homes	OT	No sufficient evidence of efficacy for improving ADL	CR	Fletcher-Smith <i>et al.</i> , 2013 <sup>21</sup>	I/Limited
Adults with IDs		Effects on education and employment	SR	Arbesman & Logsdon, 2011 <sup>22</sup>	I/Limited
		Effects on social skills, life skills, instrumental ADL	SR	Gibson <i>et al.</i> 2011 $^{23}$	I/Weak
Elderlv/disabilities	Home visits	Reduces the burden of disability	SR/MA	Huss et al., 2008 24	I/Limited
Elderly/disabilities	Home modifica-	Improvement in function relevant to ADL	Guide	Siebert <i>et al.</i> , 2014 <sup>25</sup>	I/Weak
	tions	<b>r</b>			
Elderly	Vestibular reha- bilitation	Lack of evidence of effectiveness due to lack of high quality studies	SR	Martins <i>et al.</i> , 2016 <sup>26</sup>	
Aged/disabilities	Cognitive rehab	Effective on improvement in cognition	SR	Cicerone <i>et al.</i> , 2011 <sup>27</sup>	I/Moderate
Elderly/healthy or cog- nitive dysfunction	-	Beneficial effects on memory, attention, and speed processing functions	SR	Reijnders et al., 2013 <sup>28</sup>	I/Weak
Long-term neurologica condition	l Memory rehab	Beneficial effects on acceptance, confidence, improved self- awareness, mood, fatigue, and cognitive deficits	QSs	das Nair <i>et al.</i> , 2015 <sup>29</sup>	III/Moderate
Elderly/dementia	Cognitive stimula- tion	Beneficial effects on cognitive function and also on HRQoL and wellbeing	CR	Woods <i>et al.</i> , 2012 <sup>30</sup>	I/Limited
Elderly	Computer-based cognitive program	Effective on cognitive dysfunction	SR	Kueider et al., 2012 <sup>31</sup>	I/Weak
Elderly/dementia		Better outcomes in cognition, depression, and anxiety	SR/MA	Garcia-Casal et al., 2016 32	I/Weak
Elderly		Long-term effects on memory performance	MA	Shao et al., 2015 33	I/Weak
Aged/disabilities	Vocational rehab	Favourable effects on employment	SR	Nevala et al., 2015 34	I/Moderate
Neurological disability.	Pain management	Recommended:		-	
Pain/neuropathic	0	Virtual reality and/or hypnosis or tDCS for SCI Virtual reality and/or hypnosis for MS	Guide	Castelnuovo et al., 2016 35	
Chronic		Hypnosis for other serious neurological disorders			
Chronic	CBT	Small to moderate positive effects at post-treatment	CR	Williams et al., 2012 36	I/Moderate
Chronic	Self-management	Provides some benefit	SR	Reid et al., 2008 37	I/Weak
Chronic	Pain education	Provides some benefit	SR/MA	Geneen et al., 2015 38	I/Weak
Elderly/falls	Fall prevention	Favourable effects on fall reduction	SR	Karlsson et al., 2013 39	I/Strong
•	programs			-	÷
Elderly/falls	Exercise	Aerobic exercise and balance training recommended	Guide	Moyer, 2012 40	I/Moderate
Caregivers	Education	Beneficial effects on well-being, satisfaction, and better service access	SR	Heller <i>et al.</i> , 2015 <sup>41</sup>	I/Weak

ADL: activities of daily living; CBT: cognitive behavioral therapy; CP: cerebral palsy; CR: Cochrane review; DD: developmental disability; HRQoL: health-related quality of life; ID: intellectual disability; LoE: level of evidence; MA: meta-analysis; MS: multiple sclerosis; OT: occupational therapy; PRT: progressive resistive training; QS: qualitative study; RCT: randomized controlled trial; SCI: spinal cord injury; SoE: strength of evidence; SR: systematic review; tDCS: transcranial direct current stimulation; tech.: technology. Since the level of evidence was not stated clearly in all SRs/MAs, judgement as to the strength/level of evidence was made considering quality of studies [using Jadad scores (Jadad AR, Moore RA, Carroll D, Jenkinson C, Reynolds DJ, Gavaghan DJ, *et al.* Assessing the quality of reports of randomized clinical trials: is blinding necessary? Control Clin Trials 1996;17:1-12)], consistency of results, and effect sizes, if available.

References relevant to this table are provided on the two previous pages.

SUPPLEMENTARY TABLE III .— *Results of the Consensus procedure*.

Ro	ınd	Number of recommendations	Accept	Accept with suggestions	Reject
1	1 <sup>st</sup> vote	28	60.7%	35.7%	3.6%
	2nd vote	28	89.3%	10.7%	0
2		28 + 2	89.4%	10.6%	0
3		30	91.2%	8.8%	0
4		30	97.8%	0	2.2%
5		30	100%	0	0

SUPPLEMENTARY TABLE IV.—Overall view of recommendations.

Content	Number of recommendations		Streng recommer	th of idations			Stren evic	igth of lence	
	Number	А	В	С	D	Ι	Π	III	IV
Overall recommendation	1	100%	0	0	0	0	0	0	100%
PRM physicians' role in Medical Diagnosis according to ICD	2	93.8%	6.2%	0	0	0	0	0	100%
PRM physicians' role in PRM diagnosis according to ICF	1	100%	0	0	0	0	0	0	100%
PRM physicians' role in PRM assessment according to ICF	4	62.5%	37.5%	0	0	0	0	0	100%
Recommendations on PRM management and process	7	100%	0	0	0	0	0	0	100%
PRM interventions	14	61.6%	35.7%	2.7%	0	78.5%	0	0	11.5%
Recommendations on future research on PRM professional practice	1	87.5%	12.5%	0	0	0	0	0	100%
Total	30	80%	20%	0	0	36.7%	0	0	63.3%

### Evidence Based Position Paper on Physical and Rehabilitation Medicine (PRM) professional practice for persons with obesity and related comorbidities. The European PRM position (UEMS PRM Section)

https://www.ncbi.nlm.nih.gov/pubmed/28681597

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### Evidence Based Position Paper on Physical and Rehabilitation Medicine (PRM) professional practice for persons with obesity and related comorbidities.

### The European PRM position (UEMS PRM Section)

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### ABSTRACT

#### **INTRODUCTION:**

The WHO world health statistics report in 2015 shows that in Europe the overall obesity rate among adults is 21.5% in males and 24.5% in females. Obesity has important consequences for morbidity, disability and quality of life. The aim of the paper was to improve physical and rehabilitation medicine physicians' professional practice for the rehabilitation of patients with obesity and related comorbidities.

#### **EVIDENCE ACQUISITION:**

A systematic review of the literature and a Consensus procedure by means of a Delphi method process has been performed involving the delegates of all European countries represented in the UEMS PRM Section.

**EVIDENCE SYNTHESIS:** The systematic literature review is reported together with the 13 recommendations from the Delphi procedure.

#### **CONCLUSIONS:**

The professional role of PRM physicians in obesity is to propose a complete PRM treatment for the patients considering the comorbidities, impairments, activity limitations and participation restrictions, providing medical care and leadership to the multidisciplinary team, coordinating the individual PRM project developed in team in agreement with the patient and his family/care givers.

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The European PRM position (UEMS PRM Section). Eur J Phys Rehabil Med 2017;53:611-24. DOI: 10.23736/S1973-9087.17.04880-8)

<u>Key words:</u> Obesity Disability evaluation Rehabilitation.

### Introduction

Obesity is a metabolic disease (ICD-10 code E66) that has reached epidemic proportions. The World Health Organization (WHO) has declared obesity as the largest global chronic health problem in adults. Obesity is a gateway to ill health, and it has become one of the leading causes of disability and death, affecting not only adults but also children and adolescents worldwide [1,2,3]. The WHO world health statistics report in 2015 shows that in the European region the overall obesity rate among adults is 21.5% in males and 24.5% in females [4]. An increase to 36.9% and to 38.0% in 2013 in the proportion of men and women, respectively, whose body mass index (BMI) was greater than 25 were noted in the Global Burden of Disease Study <sup>(5)</sup>. Obesity has important consequences for morbidity, disability and health-related quality of life. Obesity entails a higher risk of developing type 2 diabetes, cardiovascular diseases, obstructive sleep apnoea syndrome and obesity hypoventilation syndrome, several common forms of cancer, osteoarthritis and other health problems including musculoskeletal pain and [6,7, 8, 9, 10]. Prevention of obesity is prospectively very important, but the challenge is rather the progression of the disabilities already present posing a significant challenge for Physical and Rehabilitation Medicine (PRM) specialists. The health and economic burden resulting from obesity and its consequences is not only based on mortality and the financial costs of hospital admissions and treatment of comorbidities, but also on significant ensuing disability with limitations in functioning which are well documented in the International Classification of Functioning (ICF) Core Sets for Obesity <sup>(11)</sup>. Disability burden attributable to obesity is substantial, high BMI accounting for 3.8% of world-wide disability adjusted life years in 2010 (12) with 134 million years in 2013 as the leading risk factor almost in all world regions (13).

Today there is no uniformity among different countries across Europe and in the world in the PRM approach. The existing documents in Europe are clinical guidelines for the treatment and management of obesity in the hospital and in the long-term. Physiotherapy interventions are usually not explicitly and specifically included in the existing clinical guide lines about the treatment of obese patients. The availability of evidence of effectiveness of interventions refers only to combined interventions (diet, physical activity, behavioural therapy, pharmacological therapy, bariatric surgery) and not to specific PRM interventions. For these reasons the European Union of Medical Specialists (UEMS) - PRM Section decided to develop one of its evidence based position papers (EBPPs) on obesity and related comorbidities, representing the official position of the European Union. The aim of the paper is to improve PRM specialists' professional practice for patients with obesity and related comorbidities.

### **Evidence** acquisition

Literature search

This paper has been developed according to the Methodology defined by the Professional Practice Committee of the UEMS-PRM Section.<sup>7</sup> The systematic review of the literature has been performed in PubMed the 6th of February, 2016. A library scientist conducted an extensive a priori literature search for articles related to obesity and rehabilitation. The search included articles extracted from the following databases: MEDLINE, EMBASE (Current Contents), SPORTD iscus, SUM, Scopus, CINAHL, AMED,

BIOMED, PubMed, ERIC, the Cochrane Controlled Trials, and PEDro. A hand search of the reference lists of potential case-control studies (CCSs) also was performed. The 4 strings used for the first selection are reported in Appendix I. Two reviewers (CP and BA, in the Acknowledgments) performed the selection at each stage. The subsequent Consensus with Delphi procedure has followed the 4 steps proposed by the Methodology paper.<sup>14</sup>

#### Evidence Synthesis

The criterion for including the studies has been the professional relevance for PRM physicians as judged by the author CP and by BA cited in the Acknowledgements, with the author resolving conflicts. The Strengh of Evidence (SoE) and the Strength of Recommendation (SoR) are given according to the Methodology paper. The PubMed search (string 1 to 3) evidenced the following papers: a total of 462 papers (231 from string 1, 110 from string 2, 121 from string 3), from which we excluded 319 titles not relevant to PRM, and considered 143 titles for abstract review (69 from string 1, 42 from string 2, 32 from string 3) (Figure 1). The Cochrane search (string 4) provided 2 systematic reviews and 110 RCTs (10-year time), from which we selected 32 titles and 8 abstracts. The latter overlapped with the abstracts found in the PubMed search. We then excluded 82 abstracts not relevant to PRM and included for paper review 61 papers.

Twenty-one papers (10 from string 1 and 11 from string 3) out of the 61 plus 8 additional papers (5 European clinical guidelines, 1 American clinical guideline and 3 expert papers) were considered to produce this EBPP (Appendix II).



Figure 1.—Flow chart of papers selection.

The 6 existing clinical guidelines are intended for the treatment and management of obesity in the hospital and in the long term but are not to serve as a standard of care. They are of particular interest to those working in primary care, secondary and tertiary weight management services and those involved in management of services for long term conditions especially diabetes and cardiovascular disease. The 3 key treatments considered in the guidelines (we have excluded bariatric surgery and pharmacological interventions) are: nutrition, physical exercise and behavioral therapy (Table I).

These treatments are complementary and have to be offered to the patient at the same time. The combination of these 3 treatments has been proved to be more effective than single treatment.

The only 2 papers specifically referring to physiotherapy interventions are the Italian Guidelines and the Ottawa Clinical Practice Guidelines (Appendix II). The Italian document provides the following recommendations:

— "the rehabilitation pathway of the obese patient should be characterized by the integration of nutritional, physical/functional rehabilitation (physiotherapy, therapeutic exercise, physical reconditioning, adapted physical activity), psychoeducational (therapeutic education and short focused psychotherapeutic interventions), rehabilitative nursing interventions" (Level: IV; Strength of Recommendation: A).

— "The intensity of the rehabilitative intervention should depend on the level of severity and comorbidities, frailty of the psychic status, degree of disability and quality of life of the patient" (Level: VI; Strength of Recommendation: A).

The Ottawa Panel found evidence to support the use of diet or physical activity/physiotherapy programs for the overall management of osteoarthritis of the knee in obese patients. Results of positive recommendations (grades A and C) from included studies with high methodological quality (Jadad scale score 3) indicate that diet or physical activity programs were promising for:

— short-term (6-month) pain relief (2 grade A recommendations, 6 grade C recommendations);

— long-term follow-up (18-month) pain relief (3 grade C recommendations); — improvement of torque (2 grade C recommendations);

— functional status (2 grade A recommendations, 2 grade C recommendations);

— self-efficacy (2 grade A recommendations, 2 grade C recommendations);

— endurance (2 grade A recommendations);

mobility (1 grade A recommendation, 3 grade C recommendations);

— psychological well-being (2 grade A recommendations, 1 grade C recommendation).

The Ottawa Panel recommends reducing weight prior to the implementation of weight-bearing exercise to maintain joint integrity and to avoid joint disease and dysfunction and the inclusion of diet or physical activity programs in the management of ostheoarthritis among individuals who are obese.

 TABLE I.—Summary of the recommended 3 key-treatments in the existing European Guidelines.

		8 1	
	Nutrition	Behavioral	Physical exercise
NICE (2014)	600 kcal/day deficit low-fat diets, in combination with expert support and intensive follow-up. Low-calorie diets (800-1600 kcal/day) are less likely to be nutritionally complete. Only consider very-low-calorie diets, as part of multi-component program for rapidly losing weight (for example, people who need joint replacement surgery or who are seeking fertility services)	Self-monitoring of behavior and progress stimulus control goal setting slowing rate of eating ensuring social support. Encourage to increase physical activity even if they do not lose weight because of the other health benefits, reduce amount of time spent inactive	At least 30 min moderate intensity physical activity 5 days/week. 1 session or several sessions lasting 10 min or more. To prevent obesity, 45-60 minutes moderate-intensity activity/day. People who have been obese and have lost weight may need 60-90 min activity/day to avoid regaining weight. Activities that can be incorporated into everyday life. Consider person's current physical fitness
Scottish (2010)	600 kcal/day energy deficit, individually tailored	A combination of active support for diet plus behavioral therapy (problem solving, relapse prevention, stimulus control, dealing with problem situations, assertion, and behavior chain analysis) is effective for weight loss at 12 months. Self monitoring stimulus control cognitive restructuring (modifying unhelpful thoughts/thinking patterns) goal setting problem solving assertiveness training slowing the rate of eating reinforcement of changes relapse prevention	Physical activity approximately 1,800- 2,500 kcal/week (225-300 min/week at moderate intensity)
German (2007)	Reduction fat intake only: daily energy deficit about 500 kcal. The fat intake is reduced to about 60 grams per day and the consumption of carbohydrates not limited. Average weight loss of 3.2 -4.3 kg over 6 months. For moderately energy-reduced varied diet, energy deficit 500-800 kcal/ day. Carbohydrates and protein are also reduced. Average of 5.1 kg over12 months can be successfully lost	bolster motivation to comply with the nutrition and exercise recommendations, for long-term weight reduction or stabilization. Self-observation of eating, drinking and exercise habits. Gradual introduction of flexible, controlled eating habits. Learning stimulus control techniques to decrease eating impulses. Use of positive reinforcement in order to strengthen new eating habits and prevent relapse. Social support relapse prophylaxis and management	5 hours additional physical activity per week (additional energy consumption of 2500 kcal/week). To stabilize weight, 3-5 h/ week of increased activity (at least 1500 kcal). Training intensity at 75% of the maximum heart rate if no contraindications. Combination of endurance with muscle building training.
Italian (2010)	Depending on energy consumption, 500 e 1000 kcal caloric restriction.	Behavioral therapy + life style changes more effective than life style changes only. Techniques: therapeutic alliance and adherence, motivation, problem solving, empowerment, narrative medicine.	150-250 min a week induce modest loss (2.3 kg in 6-12 months), 250-400 min a week a 5.0-7.5 kg reduction in 6-12 months. To prevent regain 200 min a week of moderate intensity physical activity.
European (2015)	Balanced hypocaloric diets result in clinically meaningful weight loss. An emphasis on the macronutrient proportion (low fat, low carbohydrate or high protein etc.) has not proved better than a balanced hypocaloric diet, except for low-glycaemic load diets. Beneficial effects on reducing risk factors for cardiovascular disease and type 2 diabetes as well as on promoting adherence. A 15-30% decrease in energy	Reduce sedentary behavior and increase daily activities. Patients should be advised and helped in undertaking (or increasing) physical activity. Exercise advice must be tailored to the patient's ability and health and focus on a gradual increase to levels that are safe. Cognitive-behavioral therapy includes self-monitoring, techniques controlling the process of eating, stimulus control	Additive benefits of combining exercise with caloric restriction on reducing body weight and body fat and preservation of FFM as compared to diet alone. Aerobic training is the optimal mode of exercise for reducing fat mass and body mass while a programme including resistance training is least 150 min/week of moderate aerobic training is the optimal mode of exercise for reducing fat mass and body mass while a

I.—Summary of the recommended 3 key-treatments in the existing European Guidelines (continues).

Nutrition	Behavioral	Physical exercise
(calorie) intake from habitual intake appropriate. Recommended energy deficit of 600 kcal/day will predict a weight loss of about 0.5 kg weekly. Low-calorie diets have an energy content between 800 and 1200 kcal/day. VLCDs usually provide less than 800 kcal/day and may be used only as part of a comprehensive programme under supervision. Unsuitable as a sole source of nutrition for children and adolescents, pregnant or lactating women and the elderly. Meal replacement diets (substitution of one or two daily meal portions by VLCD) may contribute to nutritionally well-balanced diet and weight loss maintenance.	and re-enforcement as well as cognitive and relaxation techniques. CBT can be provided not only by registered psychologists but also by other trained health professionals such as physicians, dieticians, exercise physiologists or psychiatrists. Physicians should recognize where psychological or psychiatric issues interfere with successful obesity management, <i>e.g.</i> depression. Psychological support and/or treatment will then form an integral part of management; in special cases (anxiety, depression and stress), referral to a specialist may be indicated.	program including resistance training is needed for increasing lean mass At least 150 min/week of moderate aerobic exercise with three weekly sessions of resistance exercise.

#### Consensus

#### OVERALL GENERAL RECOMMENDATION

The criterion for including the studies has been the professional relevance for PRM physicians as judged by the author CP and by BA cited in the Acknowledgements, with the author resolving tions includes provision of rehabilitation diagnosis and treatment emphasizing function and quality of life, medical care of the existing comorbidities, prescription of bariatric aids for independence, leadership to the multidisciplinary rehabilitation team bringing a distinctive holistic perspective to the patient care process, developing rehabilitation protocols in different settings in relation to the phases of instability of the condition and taking charge of the return-to-home (avoidance of environmental barriers, prescription of mobility/transferring aids) and return to-work phases.

#### RECOMMENDATIONS ON PRM PHYSICIANS' ROLE IN MEDICAL

#### DIAGNOSIS ACCORDING TO ICD

It is recommended that PRM physicians dealing with obesity and comorbidities gain specific and wide expertise in the specific medical diagnoses and treatment approaches of these patients. They should work in team with other specialties to develop the required PRM treatments. It is also important for PRM physicians to consider obesity risk in people with long-term disabilities already in rehabilitation.

#### RECOMMENDATIONS ON PRM PHYSICIANS' ROLE IN PRM DIAGNOSIS ACCORDING TO ICF

In the diagnostic phase, an assessment of motor function (muscular strength, balance, endurance) and cardiorespiratory capacity, disability, healthrelated quality of life, musculoskeletal pain and other chronic pain conditions and limitations should be performed (Level: III; Strength of Recommendation: A).

#### RECOMMENDATIONS ON PRM PHYSICIANS' ROLE IN PRM ASSESSMENT ACCORDING TO ICF

The rehabilitation plan should be developed according to the ICF model. PRM treatment should be regularly assessed through a complete PRM assessment including evaluation of disease, comorbidity and impairment but also activity limitations and participation restrictions due to health condition and/or treatments, taking into account contextual factors, including environmental and personal factors.

#### RECOMMENDATIONS ON PRM MANAGEMENT AND PROCESS

Inclusion criteria (e.g. when and why to prescribe PRM interventions).—PRM interventions should be proposed when functional capacity and quality of life are reduced due to excessive body mass and presence of disabling comorbidities. Specific PRM interventions are to be prescribed aimed at minimizing joint loads, improve muscle strength, balance, endurance and conditioning, maximizing motor, cardiorespiratory function and independence also with prescription of assistive technologies and ergonomic solutions. Admission to inpatient programs should be granted even in the absence of an acute event, based on severity of disability and clinical appropriateness. (Level: III; Strength of Recommendation: A).

#### RECOMMENDATIONS ON PROJECT DEFINITION (DEFINITION OF THE OVERALL AIMS AND STRATEGY OF PRM INTERVENTIONS)

It is recommended that the PRM programme is proposed in centers where all the team (PRM physician, physiotherapist, occupational therapist, trainer, dietician, psychologist, endocrinologist and other specialties) is present. The integrated individual rehabilitation programme encompasses different areas of intervention and short- and longterm goals:

1) Nutritional intervention finalized to: restore correct eating habits (quality, quantity) in the long term; achieve a weight loss of at least 5% of the initial body weight in the short term and 10% in the long term with significant reduction of the fat mass and maintenance/increase of the lean mass.

2) Motor/functional rehabilitation programme (see "PRM interventions").

3) Therapeutic education and psychotherapeutic interventions targeted to: acknowledge the real needs of the patients; correct the false beliefs on nutrition and physical activity; train self-control and management in eating, physical activity, stress and anxiety (self-monitoring of eating, physical activity and weight, stimulus control, problem solving, cognitive restructuration); improve illness behavior. 4) Rehabilitative nursing, interventions performed by occupational therapists, physiotherapists and nurses and targeted to: improve patients' responses to chronic conditions, disability and pathological life styles; increase the social and environmental supports and compensations; protect and stimulate the functional and relational capacities in order to optimize participation to rehabilitation activities and health care programs (Level: IV; Strength of Recommendation: A).

#### RECOMMENDATIONS ON TEAM WORK (PROFESSIONALS INVOLVED AND SPECIFIC MODALITIES OF TEAM WORK)

An interdisciplinary team is mandatory for effective implementation of rehabilitation for obesityrelated disability. The integration of several medical specialties, including clinical nutrition, endocrinology, psychiatry, physical and rehabilitation medicine, cardiology, pneumology and different health professions, including dietitians, physiotherapists, occupational psychologists, therapists and nurses is required. The PRM physician brings a distinctive holistic perspective to the patient care process, with a particular focus on all dimensions of functioning involving body structures and functions, activities and participation, and contextual factors, whereas members of other disciplines treat particular ICF body structures and functions. The patient and his family are part of the team. For possible surgical options, a bariatric surgeon must be part of the team as well.

#### RECOMMENDATIONS

#### ON PRM INTERVENTIONS

It is recommended that PRM interventions include physical reconditioning with adapted physical activity, motor rehabilitation finalized at improving hypotonic and hypotrophic muscles due to disuse; restore range of motion; improve cardio-circulatory and respiratory capacities; physical modalities or other procedures for pain reduction.

#### RECOMMENDATIONS ON OUTCOME CRITERIA

It is recommended that the following outcome criteria are used:

1) nutritional outcomes (reduce BMI, body weight, LDL cholesterol, improve body composition);

2) motor/functional outcomes (reduce pain, improve physical capacities, function, activities of daily living and tolerance to effort);

3) behavioral and psychological outcomes (improve quality of life, correct nutritional and physical behavior etc.).

#### RECOMMENDATIONS ON LENGTH/DURATION/ INTENSITY OF TREATMENT (OVERALL PRACTICAL PRM APPROACH)

It is recommended that the intensity and duration of the interventions depend on the level of severity and comorbidities, frailty of the psychological status, degree of disability and quality of life of the patient (Level: IV; Strength of Recommendation: A).

Inpatient or specialised extra hospital rehabilitation facilities (up to 1-month stay) admit patients with disabilities susceptible of modifications which require specialized medical rehabilitative and therapeutic care in terms of complexity and/or duration of rehabilitative interventions provided by the health care professionals and the rehabilitation team. Outpatient rehabilitation is characterized by a moderate need for clinical therapeutic care and by high demands of supportive interventions for the patients undergoing treatment.

#### RECOMMENDATIONS ON DISCHARGE CRITERIA (E.G. WHEN AND WHY TO END PRM INTERVENTIONS)

It is recommended that patients stay in rehabilitation until reduction of disability (scales, questionnaires etc.), improvement in functional capacity (scales, functional tests), clinical steady state and reduction of clinical risk factors are reached. Rehabilitation transition settings, including community settings, should be considered after discharge for the delivery of PRM interventions for favourable long-term outcomes.

#### RECOMMENDATIONS ON FOLLOW-UP

A multidisciplinary (dietician, PRM specialist, endocrinologist, psychologist) follow-up at regular intervals based on the individual's specific situation and eventually a prescription of outpatient PRM interventions in different settings are recommended in the long-term phase.

#### RECOMMENDATIONS ON FUTURE RESEARCH ON PRM PROFESSIONAL PRACTICE

The leading role of the PRM specialists in this field should translate into providing new evidences of the effectiveness of specific PRM interventions on functioning and quality of life of obese patients with comorbid conditions. ICF compatible evaluation instruments should be implemented. Evidencebased methods to generate the patient's own activity and self-responsibility (web-based feedback and training) should also be implemented.<sup>15-17</sup>

### Discussion

The environment where the inpatient rehabilitation programmes are held should be structurally and ergonomically adequate and safe for both patients and staff alike, with the adequate presence of bariatric aids and lifting/transferring devices according to the number of obese inpatients.

Not being specifically related to an acute event, the intensity of the interventions should depend on the level of severity and comorbidities, frailty of the psychological status, degree of disability and quality of life of the patient. Using the ICF, it appears that the most impaired functions are included in chapter b2 - sensory functions and pain, and chapter b7 - neuromusculoskeletal and movement-related functions; the most impaired structures are related to chapter s8 - skin and related structures. The most limited activities are included in chapters d2 - general tasks and demands and d4 - mobility. The most extended facilitators are within chapter e1 - products and technology; chapter e2 natural environment and human-made changes to environment, describes the barriers.<sup>18</sup>

A multidimensional approach able to provide front line assessment and preventive strategies, risk stratification, and disease management is needed. For that purpose a team approach and the integration of several medical specialties, including clinical nutrition, endocrinology, psychiatry, psychology, rehabilitation medicine, and different health professions, including dietitians, psychologists, physiotherapists, occupational therapists and nurses is required. It is therefore mandatory to assess quality of life, disability, motor function (muscle strength, balance, tolerance to effort) and musculoskeletal problems (articular pain, limitations of the range of motion). Multidimensional rehabilitation can also be applied to complicated bariatric surgery patients in both the preoperative and postoperative period. Patients with chronic pain who may not have been alleviated after surgery may benefit from PRM interventions with special considerations for this specific group of individuals.<sup>10</sup>

There is a need for multiple settings in relation to the phases of instability of the condition.<sup>19, 20</sup> The model of organisation for long-term PRM depends on the existing traditions of the country. Intensive (inpatient or specialised extra hospital facilities) rehabilitation interventions are directed to the recovery of major disabilities susceptible of modifications which require specialized medical rehabilitative and therapeutic care in terms of complexity.

Outpatient rehabilitation is characterized by a

moderateneed for clinical therapeutic care and by high demandsof supportive interventions for the patients undergoing treatment. PRM physicians should also take into account that higher rates of obesity are observed in persons with disabilities as reported in the World Report on Disability.21 Overweight and obesity prevention programs may also be adapted to persons living with a disability such as spinal cord injury.<sup>22</sup> A systematic review pointed to the effectiveness of physical activity/ exercise including strength training with a duration exceeding 15 minutes in the short-term in children with disabilities.<sup>23</sup>

### Conclusions

The PRM physician is responsible for the functional and social assessment of persons with obesity with related comorbidities and for setting up a comprehensive strategy — a PRM problem-oriented program of care. It should include education of the patients, exercise, physical modalities, occupational therapy, aids and orthoses, pharmacological interventions and proper advice to refer to surgical interventions when the conservative approach is ineffective. PRM physicians, guided by the ICF, are in a position to be helpful to these patients largely. Although there are a number of effective PRM interventions based on scientific evidence for the treatment of patients with obesity with related comorbidities there seems to be a need for more high-quality trials in this field. Especially studies on activities and participation and environmental factors (i.e. work) components of the ICF are required to enable PRM physicians to make evidencebased decisions on treatments to ensure the best care of their patients. The specialty of PRM is well qualified to address the problems of chronicity and obesity in particular.24 For many PRM physicians, however, the prescription of exercise for obese individuals will be venturing into a different realm of practice, beyond their ordinary experience. Some may feel the need to reinforce and further develop their skills in specific areas of exercise and nutrition application for these populations. PRM in general will benefit from widespread education and research efforts in this area.

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Group name.-

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—The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

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#### APPENDIX I.

—The 4 strings used for first selection.

String 1) (obesit[All Fields] OR obesit'a[All Fields] OR obesit'asban[All Fields] OR obesita[All Fields] OR obesita'[All Fields] OR obesita'e[All Fields] OR obesitaksen[All Fields] OR obesitaksessa[All Fields] OR obesitas[All Fields] OR obesitas'[All Fields] OR obesitasban[All Fields] OR obesitasbehandling[All Fields] OR obesitasenheten[All Fields] OR obesitaskirurgi[All Fields] OR obesitaskliniek[All Fields] OR obesitasopererade[All Fields] OR obesitassyndroom[All Fields] OR obesitat[All Fields] OR obesitatii[All Fields] OR obesitax[All Fields] OR obesitax'[All Fields] OR obesite[All Fields] OR obesitehyperglycemie[All Fields] OR obesiteit[All Fields] OR obesites[All Fields] OR obesitet[All Fields] OR obesiti[All Fields] OR obesitic[All Fields] OR obesitics[All Fields] OR obesities[All Fields] OR obesitis[All Fields] OR obesitiv[All Fields] OR obesitogenic[All Fields] OR obesitological[All Fields] OR obesitologists[All Fields] OR obesitology[All Fields] OR obesitv[All Fields] OR 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#### APPENDIX I.

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#### String 2)

**PUBMED:** obesit\* AND rehabilit\* AND ( Guideline[ptyp] OR Meta-Analysis[ptyp] OR Randomized Controlled Trial[ptyp] OR systematic[sb] ) )

#### String 3)

**PUBMED:** "Obesity/rehabilitation" [Mesh] AND (Guideline[ptyp] OR Meta-Analysis[ptyp] OR Randomized Controlled Trial[ptyp] OR Review [ptyp] OR systematic[sb])

#### String 4)

#### Appendix II.—Papers retrieved from the search.

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### Evidence Based Position Paper on Physical and Rehabilitation Medicine (PRM) professional practice for people with cardiovascular conditions. The European PRM position (UEMS PRM Section)

https://www.ncbi.nlm.nih.gov/pubmed/29722511

Alvydas Juocevicius, Aydan Oral, Aet Lukmann, Peter Takáč, Piotr Tederko, Ilze Hāznere, Catarina Aguiar-Branco, Milica Lazovic, Stefano Negrini, Enrique Varela Donoso, Nicolas Christodoulou.

### Evidence Based Position Paper on Physical and Rehabilitation Medicine (PRM) professional practice for people with cardiovascular conditions.

### The European PRM position (UEMS PRM Section)

Alvydas Juocevicius,<sup>1</sup> Aydan Oral, <sup>2</sup> Aet Lukmann,<sup>3</sup> Peter Takáč,<sup>4</sup> Piotr Tederko,<sup>5</sup> Ilze Hāznere,<sup>6</sup> Catarina Aguiar-Branco,<sup>7</sup> Milica Lazovic<sup>8</sup>, Stefano Negrini<sup>9,10</sup>, Enrique Varela Donoso,<sup>11</sup> Nicolas Christodoulou<sup>12,13</sup>

#### ABSTRACT

#### Introduction:

Cardiovascular conditions are significant causes of mortality and morbidity leading to substantial disability.

#### Aim:

The aim of the paper is to improve Physical and Rehabilitation Medicine (PRM) physicians' professional practice for persons with cardiovascular conditions in order to promote their functioning properties and to reduce activity limitations and/or participation restrictions.

#### Material and Methods:

A systematic review of the literature and a Consensus procedure by means of a Delphi process has been performed involving the delegates of all European countries represented in the UEMS PRM Section.

Results: The systematic literature review is reported together with thirty recommendations resulting from the Delphi procedure.

#### **Conclusion:**

The professional role of PRM physicians having expertise in the rehabilitation of cardiovascular conditions is to lead cardiac rehabilitation programmes in multiprofessional teams, working in collaboration with other disciplines in a variety of settings to improve functioning of people with cardiovascular conditions.

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This EBPP represents the official position of the European Union through the UEMS PRM Section and designates the professional role of PRM physicians in persons with cardiovascular conditions.

### Introduction

Cardiovascular diseases are leading causes of mortality, ischaemic heart disease resulting in increased deaths within the last decade by 16.6% globally.1 Substantial disability is also with cardiovascular associated conditions among which ischaemic heart disease ranked the first accounting for more than seven million years lived with disability (YLD). Likewise, heart failure and even atrial fibrillation and flutter impose a great burden of disability on the affected individual and society with YLDs of 6.2 and 2.6 million years, respectively. as calculated in the Global Burden of Disease study for the year 2015.2 Last but not the least, hypertension was found as the leading risk factor in both genders with the largest contribution to death and YLDs.3

The discrepancy between rates of mortality in general and YLDs, the latter decreasing much more slowly (or even increasing) than the former due to the ageing of the population globally leads to a substantial number of chronically ill individuals with cardiovascular conditions who survive which represent a reservoir of disability, requiring health services for secondary prevention and reduction of the disability.4

Disability is an umbrella term describing problems in functioning including impairments in body functions, activity limitations, and restrictions as participation defined the International Classification of Functioning, Disability and Health (ICF).5 The management of any problems in functioning falls within the scope of Physical and Rehabilitation Medicine (PRM), defined as "medicine of functioning".6,7 Significant problems functioning in of individuals with cardiovascular conditions place PRM physicians in a position to carry out successful cardiac rehabilitation with "add-on" specific PRM interventions when necessary.

The aim of this evidence-based position paper (EBPP) is to improve PRM physicians' professional practice for people with cardiovascular conditions in order to promote their functioning properties and to reduce activity limitations and/or participation restrictions.

### Material and Methods

This EBPP is produced according to the methodology proposed by the UEMS-PRM Section.8 The EBPP comprises of two parts: 'Systematic review of the literature' and 'consensus with Delphi procedure among UEMS PRM Section delegates. The details of systematic literature search Pubmed/MEDLINE and the Cochrane Library and paper selection with the main inclusion criterion as the relevance of the article with the PRM profession are given in Supplementary Materials Appendix I (online content only).

Information on the Strength of Evidence (SoE) and Recommendation (SoR) grading as well as how the consensus on recommendations has been reached by the Delphi procedure can be found in the 'Methodology' paper by Negrini et al.8

### Results

Flow chart of paper selection for reviewing the literature is shown in Supplementary Figure 1 in Supplementary materials, Appendix II (online content only). Systematic review of the literature provided us with below listed rehabilitation programmes of care/PRM interventions along with their evidence of effectiveness leading to recommendations in specific cardiovascular conditions.

### Coronary heart disease/ Ischemic heart disease/ Coronary artery disease

Exercise-based cardiac rehabilitation is the cornerstone of management for patients with coronary heart disease (CHD).

A cardiac rehabilitation programme is a multicomponent initiative, core components of which includes assessment of the patient, medical (e.g. cardioprotective treatments) and lifestylerisk factor management involving change of health behaviours and education relevant to physical activity, exercise, diet, smoking cessation, weight control, lipid and blood pressure management exercise prescription, vocational as well as psychosocial management support, and performable by a multiprofessional team in in-patient and/or out-patient settings or at home or in the community requiring lifelong continuation along with audit and evaluation.<sup>9,10</sup> Exercise training is the mainstay and the most studied component of cardiac rehabilitation programmes with varying recommendations guidelines/across countries.<sup>11</sup> in Exercise prescription recommendations in guidelines in different parts of the world and also country specific guidelines in Europe are provided in Supplementary Table II and III, respectively, in Supplementary materials Appendix II (Online content only).

Before prescribing an exercise-based cardiac rehabilitation programme, assessment with a focus on functioning is the major step which can be done using the brief ICF Core Sets for cardiopulmonary conditions for acute and post-acute care (www.icf-research-branch.org/ download/category/12-cardiovascularandrespi ratoryconditions) as well as ICF Core Sets for chronic ischemic heart disease.<sup>12</sup> Rehabilitation goal setting follows the assessment process. PRM physicians may refer to clinical algorithms for the prescription of exercise for patients with CHD as demonstrated in the paper by Achttien et al.<sup>13</sup> There is also a strong need for the assessment and inclusion of psychosocial risk factor (such as stress, anxiety, depression, type-D personality, social isolation) management strategies to be accomplished by relevant team members in cardiac rehabilitation programmes due to their unfavourable effects on required lifestyle modifications, HRQoL, programme adherence, and ultimately prognosis. These strategies can be found in the position paper by ESC/EACPR/ Cardiac Rehabilitation Section.<sup>14</sup> Attention is needed particularly for depression which is very common in cardiovascular diseases, affecting nearly half (~40%) of those with CHD15 and even those with peripheral arterial disease with a prevalence ranging from 3 to 48% depending on study type.<sup>16</sup> Depression is not only associated with mortality in CHD or heart failure, but also

with worse HRQoL, more frequent use of health services and costs/economical burden.<sup>15</sup> Another aspect is its negative influence on exercise capacity, walking capabilities, and physical functioning which can ultimately lead to worse prognosis with further increase mortality risk.<sup>17</sup> Patient education for the modification of CHD risk factors for secondary prevention (certainly also for primary prevention) should be prioritized in cardiac rehabilitation programmes with the objectives of promoting a healthy lifestyle including cessation of smoking, regular physical activity/exercise, a healthy diet, stress management along with adherence to treatment/ programmes, health-care system use, and returnto-work.<sup>18</sup> Exercise-based cardiac rehabilitation programmes may additionally include sexual counselling.<sup>19</sup>Cardiac rehabilitation programmes may be delivered in a variety of ways. In addition to conventional hospital/centre-, home- or community-based cardiac rehabilitation programmes, tele-cardiac rehabilitation programmes/telehealth interventions tailored to the needs of the individual patient are available as alternative models.<sup>20</sup> Guidelines for cardiac rehabilitation in low-resource settings are also available.21

Possible basic/intracellular mechanisms of beneficial cardioprotective effects of exercise may relate to favourable outcomes in the production of nitric oxide and heat shock proteins, improvements in potassium channel function (ATP-dependent), opioid system and cardiac antioxidant capacity.<sup>22</sup>

Risk stratification for each individual to be admitted to cardiac rehabilitation programmes, tailored exercise, monitoring, and ensuring safety are of paramount importance, the measures for which can be found in guidelines [Supplementary Table II and III, respectively, in Supplementary materials Appendix II (Online content only)].

As summarized in the 2014 overview of six Cochrane reviews, exercise-based cardiac rehabilitation leads to reductions in hospitalizations in clinically stable patients with low-risk after myocardial infarction, percutaneous coronary intervention, or heart failure with improvements in health-related quality of life (HRQoL) and with similar effects and costs of centre- or home-based programmes when compared with usual care.<sup>23</sup> Additionally favourable effects on mortality have been evidenced in recent CRs/SRs [Supplementary Table IV in Supplementary materials Appendix II (Online content only)], mortality benefits of exercise being similar to those of drug interventions in CHD or heart failure.<sup>24</sup>

Despite well established efficacy of exercisebased cardiac rehabilitation programmes on function and HRQoL as well as on mortality based on good evidence,<sup>23,24</sup> availability of cardiac rehabilitation programmes globally is low with only 38.8% of countries globally having cardiac rehabilitation programmes, 68.0%, 28.2%, and 8.3% of which in high-income, middle-income, and low-income countries, respectively.25 Even at the availability of programmes, participation in and adherence to those programmes are problematic issues resulting from either patientor programme-related factors which include existence of co morbidities, unemployment, low income, lack of a spouse, less education, living away from facilities, not being able to drive or use transportation, showing similarities at different parts of the world.<sup>26</sup> Even in outpatient/ home/community settings, participation in exercise training is associated with problems albeit less when referred and/or recommended by a physician.<sup>27</sup> Therefore, it is very important for physicians to motivate patients with CHD to exercise in different settings.

It is important to note that cardiac rehabilitation programmes require multiprofessional a team, working in collaboration with other disciplines. The authors of this EBPP on behalf of the UEMS PRM Section recommend more involvement of PRM physicians in cardiac rehabilitation programmes as leaders in inpatient and outpatient settings (centre-based) in collaboration with other health professionals trained in cardiac rehabilitation and as joint leaders, coordinators, advisors, evaluators, or consultants at home and/or community settings. The reasons for this recommendation include the

following: First of all, PRM is the primary medical specialty concerned with the improvement of physical and cognitive functioning including behaviour as well as promotion of participation (including quality of life) and modification of personal and environmental factors with responsibility of rehabilitation management of persons with disabling health conditions and their co-morbidities across all ages in addition to the prevention, medical diagnosis and treatment of health conditions. 7,28,29 This definition of PRM covers the aspects to fulfil the components rehabilitation programmes. of cardiac Collaboration with cardiologists is certainly required regarding the basic cardiovascular examination and assessment, planning cardiac rehabilitation tailored to the individual patient, regulating cardiovascular medications, and possible adverse events.<sup>30</sup> It should also be noted that effective team working is fundamental in PRM.<sup>31</sup>

Additionally, in in-patient/hospital settings, it may be more feasible to use the facilities already available in PRM departments in hospitals (exercise equipment, physical therapists, and other rehabilitation professionals) in circumstances where there is no common physical therapy units or competent rehabilitation professionals serving to all medical specialties, which might be the case for some countries, particularly in university hospitals. In centre-based cardiac rehabilitation programmes which are more common in European countries,<sup>32</sup> or at home or community settings, PRM physicians may contribute significantly to cardiac rehabilitation programmes by virtue of their competence and rehabilitation as their health strategy.<sup>6,7,28</sup>

### Hypertension

Hypertension is the globally ranking first and the the most important risk factor for death responsible for 49% of CHD and for 62% of cerebrovascular disease.<sup>3</sup> Each augmentation of 20/10 mm Hg in suboptimal systolic blood pressure (SBP) (SBP > 115 mmHg) was noted to double the risk of cardiovascular disease by the World Health Organization.<sup>33</sup> Exercise training is considered as a significant non-pharmacological intervention in the management of hypertension with cardiovascular risk and pharmacological intervention related cost and adverse event reducing effects. Potential acute or chronic mechanisms by which exercise training reduces/ improves blood pressure include decreased peripheral vascular resistance, reduced cardiac output, stroke volume, and left ventricular enddiastolic volume, improvement in myocardial contractility and coronary perfusion, arterial compliance and endothelial function, increased nitric oxide production and reduced rate of atherosclerosis.<sup>34,35</sup>

Exercise recommendations on hypertension by several guidelines are shown in Supplementary Table II in Supplementary Materials Appendix II (Online content only). Recommendations may vary in guidelines in terms of frequency, intensity, time, and type (FITT).<sup>36</sup> It should also be noted that hypertension may complicate the health condition when concomitantly exists with CHD and/or heart failure. Also in this case, exercise training with close and careful supervision and monitoring (mostly with ECG for arrhythmias) as well as CHD risk factors management are suggested based on C level of evidence and class I recommendation in a guideline.<sup>37</sup>

Safety concerns should be prioritized by all of the exercise prescribing and supervising professionals. Cautious evaluation, health pharmacological treatment, if required, exercise testing for men aged  $\geq 45$  years and for women  $\geq$  55 years, and risk stratification and close monitoring are major issues regarding safety before and during tailored exercise training of individuals with hypertension. The association between strenuous exercise and increased thrombocyte activation and adhesion should be well known in order to prevent the risk of sudden death, particularly important for those who are not used to exercising. It is also important to know that cardiovascular event and mortality risk may increase by 4% for each augmentation of 10 mm Hg in SBP when exercising at moderate intensity.38

Gradual increase in exercise intensity could be a good safety measure. Medications the patient is using should also be evaluated since  $\beta$ -blockers and diuretics may adversely affect thermoregulation and may be reasons for hypoglycaemia. Gradual cessation of exercise and control of room

temperature are recommended for individuals taking  $\beta$ -blockers, calcium channel blockers, and vasodilators due to their possible post-exercise hypotensive effects.<sup>39,40</sup> It is important to follow exercise testing and prescription guidelines.<sup>40</sup>

### Heart failure

The details of exercise training can be found in HFA/EACPR consensus document.<sup>41</sup> In addition to exercising, heart failure disease management programmes supporting self-management/care (management of medications and behaviours) are the backbone of rehabilitation in heart failure. Attention should be given to components of these programmes such as those which provide better patient understanding and self-care of the health condition, improved self-efficacy, more involvement of family members/caregivers in selfcare, improvement in psychosocial well-being and health-care professionals support for the use of technology.<sup>42</sup> Supported self-management strategies may contribute to greater self-efficacy and facilitate understanding/learning as well as adapting and applying health professionals' advices into daily living.43 Self-efficacy strategies are also important for exercise programmes with beneficial effects on initiation and maintenance of exercise and confidence.44 Patient-centeredness involving the concepts of collaboration between the patient and health professionals, joint efforts in goal-setting, identifying and respecting the preferences of the patient, and 'shared decision making' with active role of the patient on care has been found associated with better outcomes symptom reduction, decreased including rehospitalisation rates and improvement in HRQoL.45

Exercise adherence,<sup>46</sup> patient centeredness to be measurable with appropriate tools not yet existing,<sup>47</sup> and transitional care<sup>48</sup> are other issues to be considered adequately in the rehabilitation of patients with heart failure.

### Peripheral artery disease/ Intermittent claudication

Individuals with lower extremity peripheral artery disease (PAD) are now considered as a target population for cardiac rehabilitation which forms the first-line intervention with the goal of improving functioning, particularly mobility (walking) as well as reducing the risk of cardiac events through lifestyle modifications.49 An Australian guideline presents exercise training with supervision and appropriate monitoring as the most effective intervention for improving exercise tolerance as well as daily physical activity and HRQoL, and reducing the risk of cardiovascular disease. Tailored exercise prescription and progression appropriate for the specific individual may include 'walking', 'cycling' or 'arm-crank ergometer', 3 sessions/ week for 40 minutes at a moderate intensity till the threshold of severe claudication pain. Dynamic resistance exercises can be added 2 sessions/week at least. Safety measures are very important due to commonality of comorbidities including hypertension, DM and peripheral neuropathy and also for high cardiovascular risk in these patients.<sup>50</sup>

### Venous insufficiency / Venous ulcers

Individuals with venous insufficiency and/or venous ulcers may benefit from compression garments and physical activity/exercise at a moderate level (e.g. walking).<sup>51</sup>

# Coronary artery bypass graft surgery (CABGS)

Cardiac rehabilitation after CABGS involves the same principles as for CHD.<sup>10</sup>

### Heart valve surgery

Cardiac rehabilitation following heart valve surgery may offer benefits to the individual and health-care cost reduction.<sup>52</sup>

### Heart transplantation

It is well known that exercise training results in improvements in cardiopulmonary functional variables, exercise capacity, body composition, and HRQoL in heart transplant recipients.<sup>53</sup> It has recently been shown in a retrospective study that early participation in a cardiac rehabilitation programme following heart transplantation is associated with long-term survival.54

# Implantable cardioverter defibrillators (ICD)

Exercise combined with psychoeducational interventions may induce extra benefits of approximately 14% to 25% in improving exercise capacity, HRQoL, and general physical and mental well-being in patients with an implanted ICD in a safe manner.<sup>55</sup> PRM physicians should observe attentively any shoulder disability which may be associated with implanted ICDs due to avoidance of shoulder movements in fear of dislodgement of the leads.<sup>56</sup> Also, some concerns and fear of unfavourable interactions with the use of some physical modalities in individuals with cardiac rhythm devices such as pacemakers and/or implantable ICDs exist. Despite lacking guidelines and/or robust research on this issue, the avoidance of electrical currents such as TENS and interferential current and also diathermy is suggested.<sup>57</sup> However, a recent SR based on four trials (3 of which being safety studies and one being a case report) on the safety of the use of neuromuscular electrical stimulation (NMES) for increasing exercise capacity and strength of lower extremity (thighs) in individuals with ICDs did not reveal any interference with electromagnetism which could jeopardise ICD function when used for the tighs; however, the opposite was observed when used for abdominal muscles.<sup>58</sup> It is apparent that utmost caution is required, the recommendations for which can be found in this SR.

The evidence for the effectiveness of nonpharmacological/conservative interventions which may fall within the scope of PRM for patients with cardiovascular conditions can be found in Supplementary Table IV in Supplementary materials, Appendix II (online content only).

### Final Recommendations for Physical and Rehabilitation MedicineProfessionalPractice in Europe

#### Overall general recommendation

It is recommended that rehabilitation 1. programmes for patients with cardiovascular conditions involve PRM physicians. Their role is, according to their expertise, to lead exercise-based cardiac rehabilitation programmes in collaboration with cardiologists and/or with other medical specialists trained in cardiac rehabilitation (e.g. sports medicine physicians or others) and with a competent team in in-patient, out-patient settings, home, and in the community to reduce impairments in function, activity limitations, and participation restrictions associated with these conditions. It is recommended that PRM physicians make every effort to promote participation in and adherence to exercise-based cardiac rehabilitation. It is recommended that PRM physicians follow available guidelines and evidencebased interventions when performing cardiac rehabilitation [SoE: IV; 7,13,28-31 SoR: A]

# Recommendations on PRM physicians' role in Medical Diagnosis according to ICD

2. It is recommended that PRM physicians make a thorough consideration of the assessments and diagnoses made by the cardiologists and/or other medical specialists relevant to the individual with cardiovascular conditions which represent an absolute indication for exercise-based cardiac rehabilitation (i.e. coronary heart disease, coronary artery bypass graft surgery, heart valve surgery, chronic stable heart failure) and also those with high likelihood of benefiting from exercise (i.e. hypertension, atrial fibrillation, cardiac rhythm device users, heart transplantation, peripheral artery disease/Intermittent claudication [**SoE: IV;<sup>30</sup>SoR:A**]

# Recommendations on PRM physicians' role in PRM diagnosis according to ICF

3. It is recommended that PRM physicians perform a complete bio-psycho-social evaluation

of the patients with cardiovascular conditions considering the diagnosis/identification of emotional functions and social functions such as psychological conditions (i.e. stress, anxiety, depression, type-D personality, social isolation) that are associated both with reworsening of the health condition and also with poor adherence to the rehabilitation programme. [SoE: IV;SoR:A]

4. It is recommended that PRM physicians examine elderly patients with chronic cardiac conditions with regard to the diagnosis of muscle weakness, sarcopenia, frailty or other comorbidities in order to target appropriate interventions [SoE: IV;6,7, 28-30SoR:A]

5. It is recommended that PRM physicians pay particular attention to lifestyles of cardiovascular patients with regard to healthy living in order to identify/diagnose unfavourable conditions such as obesity, metabolic syndrome, diabetes mellitus or nutritional deficits or any other unfavourable life habits such as smoking or a sedentary lifestyle [SoE:IV; <sup>6,7, 28-30</sup> SoR:A

### Recommendations on PRM physicians' role in PRM assessment according to ICF

6. It is recommended that PRM physicians focus on the diagnosis of impairments in body functions, activity limitations, and participation restrictions of patients with cardiovascular conditions, which is of primary importance for cardiac rehabilitation goal setting [SoE:IV; <sup>6,7, 28-30</sup> SoR:A]

It is recommended that PRM physicians 7. carefully consider the assessment of ICF category titles in the environmental factor component such as products and technology, family, personal care providers, health professionals, other professionals, support and relationships, attitudes of care providers, health and related professionals as well as services, systems and policies category titles in relation to supported self-management, use of information technology for health promotion/lifestyle changes, caregivers, well-being of family improved coordination among health professionals to enhance motivation, exercise adherence and quality of cardiac rehabilitation programmes, and better organization of PRM projects of cardiac rehabilitation [SoE:IV; 6,7,28,29 SoR:B]

8. It is recommended that PRM physicians use the ICF for the assessment of functioning properties of the patient with a cardiovascular condition to target PRM interventions [SoE:IV;<sup>5,6,7,28</sup>SoR:B]

9. It is recommended that PRM physicians use

the comprehensive and/or brief ICF Core Sets for cardiopulmonary conditions for acute and postacute care as well as ICF Core Sets for chronic ischaemic heart disease that are available for this purpose (www.icf-research-branch.org/download/ category/12-cardiovascularandrespiratoryconditio ns) [SoE:IV;SoR:A]

# Recommendations on PRM management and process

## Inclusion criteria (e.g. when and why to prescribe PRM interventions)

10. It is recommended that PRM physicians prescribe exercise-based cardiac rehabilitation within the multiprofessional team as early as possible following the diagnosis or accomplishment of a procedure (e.g. surgery) for a cardiovascular condition with absolute consideration of the individual's specific health status and his/her preference [SoE:IV;SoR:A]

11. Cardiac rehabilitation is prescribed to patients with cardiovascular conditions to improve body functions impairments (particularly those relevant to cardiovascular system and mainly exercise capacity), to modify cardiovascular risk factors favourably for secondary prevention, to reduce activity limitations and participation restrictions, to improve HRQoL, and to reduce cardiovascular morbidity and mortality as well as to reduce health-care costs [SoE:IV;SoR:A]

#### Project definition (definition of the overall aims and strategy of PRM interventions)

12. It is recommended that PRM treatment or programmes are offered in acute hospitals (intensive care units), in post-acute settings, in centres specialised in cardiac rehabilitation, at home or in the community or with the use of information and communication technologies in the form of telemedicine or telerehabilitation interventions with the aim of improving body functions and reducing activity limitations, and participation restrictions [SoE:IV;<sup>20</sup>SoR:B]

13. It is recommended that PRM treatment or programmes are designed absolutely tailored to the specific patient considering his/her medical condition, risk stratification, and needs [SoE:IV;SoR:A]

Team work (professionals involved and specific modalities of team work)

It is recommended that cardiac rehabilitation 14. is performed by a multiprofessional expert team working in interdisciplinary way. The team can be composed of physicians (expert PRM physicians by virtue of their competence, cardiologists, sports medicine physicians and others (e.g. internal medicine physicians, occupational physicians with expertise and training in cardiac rehabilitation and psychiatrists for psychological problems), other rehabilitation professionals(physiotherapists, exercise physiologists, occupational therapists, rehabilitation nurses, social workers, vocational counsellors, horticultural therapists, and others), other health professionals including clinical psychologists, dieticians, human movement scientists, health informaticians) social care providers or community-based workers, and also family members/caregivers. PRM physician can make a unique contribution in the teamwork as a leader or joint leader with cardiologists, and/ or as a coordinator, advisor, evaluator, or consultant depending on the functioning properties of the patient or setting [SoE:IV;<sup>31</sup>SoR:A]

#### **PRM interventions**

15. It is recommended that PRM physicians prescribe exercise training, tailored to the individual and compatible with the diagnosis of and in cooperation with cardiologists and/or other relevant physicians, in the context of cardiac rehabilitation programmes after a thorough review of the patient's medical condition with recognition of the risks (by risk stratification) and paying utmost attention to safety issues [SoE:IV; SoR:A]

16. It is recommended that PRM physicians refer to guidelines/consensus documents/position papers for conducting cardiac rehabilitation programmes including exercise training prescription for coronary heart disease patients (Please see guidelines presented in Supplementary Table II **[SoE:IV;SoR:A]** 

17. It is recommended that PRM physicians provide guideline-based exercise prescription for individuals with hypertension (with or without diabetes mellitus and other risk factors) (Please see guidelines in Supplementary Table III [SoE:IV;SoR:A]

18. It is recommended that PRM physicians use in general Heart Failure Association and the European Association for Cardiovascular Prevention and Rehabilitation guideline41 or certainly other local guidelines pertinent to their countries, if available, for exercise prescription [SoE: IV; SoR:A]

19. It is recommended that PRM physicians consider suitable exercise prescription in cooperation with relevant physicians for other cardiovascular conditions/patients such as atrial fibrillation, coronary artery bypass surgery, heart walve surgery, heart transplantation, peripheral artery disease/ intermittent claudication, venous insufficiency, and individuals with pacemakers or cardioverter defibrillators [SoE:IV; SoR:A]

20. It is recommended that PRM physicians motivate cardiovascular patients for starting, maintaining, and adhering to exercise at different settings [SoE:IV;SoR:A]

21. It is recommended that PRM physicians consider tele-cardiac rehabilitation [SoE:IV;SoR:B]

22. It is recommended that PRM physicians get involved in self-management education to favourably modify coronary heart disease risk factors and to improve self-efficacy [**SoE:IV;SoR:A**]

23. It is recommended that a PRM programme of care involve psychological/psychosocial interventions supported by clinical psychologists and/or social workers to improve psychological conditions and/or social support [SoE:IV;SoR:B]

#### Outcome criteria

24. It is recommended that PRM physicians determine patient-centred outcome criteria in relation to the individual patient's functional impairments, activity limitations, and participation restrictions [SoE:IV;SoR:A]

25. It is recommended that PRM physicians use main outcome criteria including aerobic endurance parameters/ exercise capacity (as measured using VO2max, 6-Minute Walk Test, or others), coronary heart disease risk factor modification, health related quality of life (as measured using generic or disease specific assessment tools), reoccurrence of cardiac events, rehospitalisation rates, hospital days, and even survival in cardiac patients, blood pressure as the main outcome in addition to the others in patients with hypertension, and cardiac function/ haemodynamic parameters (e.g. ejection fraction) as an additional main outcome in patients with heart failure [SoE:IV;SoR:A]

26. It is recommended that PRM physicians use secondary outcome criteria such as improvement in depressive symptoms or anxiety, body composition (e.g. BMI, muscle strength, body fat), ADL ability, return-to-work or autonomic function (particularly in patients with heart failure) or heart rate control in patients with atrial fibrillation or glycemic control in patients with diabetes mellitus [SoE:IV;SoR:A] Length/duration/intensity of treatment (overall practical PRM approach)

27. It is recommended that PRM physicians follow guidelines/consensus documents/position papers (please see Supplementary Tables II and III) for the length, duration, and intensity of PRM approaches with an absolute adaptation to the medical condition and needs of the specific patients [SoE:IV;SoR:A]

Discharge criteria (e.g. when and why to end PRM interventions)

28. It is recommended that patients with cardiovascular conditions are followed up and monitored closely throughout their lifespan with regard to progression of impairments in body functions, activity limitations, and participation restrictions as well as adherence to requirements of cardiac rehabilitation programmes including exercise and favourable lifestyle changes [SoE:IV;SoR:B]

## Recommendations on future research on PRM professional practice

29. It is recommended that PRM physicians are involved in research on 'Integrative rehabilitation sciences research' associated with rehabilitation services, rehabilitation administration and management59 in order to provide suitable cardiac rehabilitation services in hospitals, rehabilitation centres or at home or community settings to meet the needs of cardiovascular patients [SoE:IV;SoR:A] It is recommended that PRM physicians are 30. also involved in research to identify effectiveness of the individual components of cardiac rehabilitation (i.e. lifestyle modifications, self-management, exercise, psychological interventions [SoE:IV;SoR:B] Results of the Consensus procedure during the Delphi process for producing the recommendations and overall view of recommendations are presented in Supplementary Table IV and V, respectively, in Supplementary materials, Appendix II-online content only.

### Conclusion

Rehabilitation in cardiovascular conditions not only improves functioning, but also has significant effects on mortality as well as reduction in costs. The professional role of PRM physicians having expertise in the rehabilitation of cardiovascular conditions is to lead cardiac rehabilitation programmes within the context of multiprofessional teams, working in
collaboration with other disciplines in a variety of settings to reduce impairments in function, activity limitations, and participation restrictions associated with these conditions. PRM physicians are expected to make every effort to promote participation in and adherence to cardiac rehabilitation programmes. It is recommended that PRM physicians follow available guidelines and evidence-based interventions when performing cardiac rehabilitation with careful attention to patient safety issues.

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### SUPPLEMENTARY MATERIALS

#### Supplementary Appendix I.— Systematic Literature Search

For the systematic review of the literature, the main inclusion criterion was the relevance of the article with the PRM profession according to the judgment of two authors (A.O. & P.Te). The literature search for the identification of studies relevant to 'persons with cardiovascular conditions' was conducted using the search terms/strings in the databases including Pubmed/MEDLINE and the Cochrane library. The search was run between the dates January 31 2016 and January 31 2017. Language was restricted to English and some other European languages covered by the searched databases. Cochrane reviews (CRs), systematic reviews (SRs) and/ or meta-analyses (MAs), randomized controlled trials (RCTs), and guidelines were our priority in the systematic literature search. Search in the cited references for articles relevant to the topic in the retrieved articles was also made. General statements/reports/position papers on the subject by major relevant international bodies (the UEMS PRM Section and others) were also considered.

#### Search strings PUBMED/MEDLINE:

Pubmed: ("Cardio\*" OR "cardiac" OR "vascular") AND rehabilit\* ( ( Guideline[ptyp] OR Meta-Analysis[ptyp] OR Randomized Controlled Trial[ptyp] OR systematic[sb])) (String 1) and PubMed Clinical Queries/Systematic reviews: Cardiovascular rehabilitation AND (coronary heart disease OR heart failure OR hypertension OR Peripheral artery disease OR Venous insufficiency OR atrial fibrillation OR Heart valve surgery OR Heart transplantation OR Implantable cardioverter defibrillators) (String 2)

#### **Cochrane Library:**

http://onlinelibrary.wiley.com/cochranelibrary/search/mesh?searchRow.searchCriteria. meshTerm=Heart+Diseases&searchMesh=Lookup&searchRow.ordinal=0&hiddenFields.strategySortBy=lastmodified-date%3Bdesc&hiddenFields.showStrategies=false&hiddenFields.containerId= &hidden Fields. etag=&hiddenFields.originalContainerId= (String 1),

http://onlinelibrary.wiley.com/cochranelibrary/search/mesh?searchRow.searchCriteria. meshTerm=Hypertension&searchMesh=Lookup&searchRow.ordinal=0&hiddenFields.strategySortBy=lastmodified-date%3Bdesc&hiddenFields.showStrategies=false&hiddenFields.containerId=&hidden etag=&hiddenFields.originalContainerId= (String 2)

http://onlinelibrary.wiley.com/cochranelibrary/search/mesh?searchRow.searchOptions. conceptId=D001157&searchRow.searchCriteria.meshTerm=Arterial%20Occlusive%20 Diseases&metshTreeSelect=true&searchRow.ordinal=0&hiddenFields.strategySortBy=last-modifieddate;desc&hiddenFields.showStrategies= (String 3)

http://onlinelibrary.wiley.com/cochranelibrary/search/mesh?searchRow. searchOptions.conceptId=D014689&searchRow.searchCriteria.meshTerm=Venous%20 Insufficiency&meshTreeSelect=true&searchRow.ordinal=0&hiddenFields.strategySortBy=last-modifieddate;desc&hiddenFields.show Strategies= (String 4)

Due to the tremendous number of CRs or SRs/MAs corresponding to the importance and very wide scope of the topic addressed in this EBPP, review selection for presenting evidence of effectiveness of PRM interventions for secondary prevention was as follows: For each specific subject a most recent CR and additionally a most recent SR/MA was selected considering the nature of CRs being updated regularly with the addition of published appropriate articles since the last search date of the initial/previous CR and other SRs comprising of generally the same/similar articles depending on the methodology of the SR which vary. However, CRs or SRs providing evidence on different outcomes of the same subject were also included in the SR part. Evidence from RCTs was included if a CR or SR was lacking on a specific subject, if a good quality RCT was not included among evaluated studies in CRs or SRs already cited in this EBPP, or if a subsequent RCT (published after the last search date for CRs or SRs) provided a differing evidence rather than adding to the previous evidence.

#### Supplementary Appendix II.— Tables and figures Suplementary Figure 1. ---- Flow chart of paper selection



## SUPPLEMENTARY TABLE I. Cardiac rehabilitation exercise recommendations based on guidelines for people with coronary heart disease

Cardiac rehabilitation exercise recommendations based on guidelines for people with coronary heart disease

Guide- lines/FITT	EACPR, 2014 <sup>1</sup>	AACVPR, 2013 <sup>2</sup>	ACRA, 2014 <sup>3</sup>	JCS , 2012⁴
Exercise type	Aerobic endurance (AET) + Dynamic resistance training (DRT)	AET + DRT + Flexibility training (FT)	AET+DRT	AET
Frequency	3 sessions/week (6–7 better) for AET; 2 sessions/ week for DRT	3–5 sessions /week for AET; 2–3 sessions/ week for DRT and FT (not consecutively)	1-2sessions/week for AET; not speci- fied for DRT	1–3 sessions/ week
Intensity	50–80% VO <sub>2</sub> max; 50–80% HR peak;40–60% HRR; 10–14 of RPE	40–80% VO <sub>2</sub> peak or HR <sub>max</sub> (as deter- mined by max. exercise test);11–16 of RPE for AET; To moderate fatigue (11–13 of RPE); From 50% 1RM and increasing to 60–70% 1RM for DRT; To a mild discomfort level for FT	Low- to moderate intensity for AET; as appropriate for DRT	40–60% VO <sub>2</sub> peak; 40–60% HRR; 12–13 of RPE
Time/ Duration	≥ 20–30 minutes/ session for AET; 10–15repi- titions/ set for DRT for 2–16 weeks	20–60 min./session for AET; 1–3 sets of 10–15 repetitions of 8–10 varying exer- cises for DRT; 3–5 repetitions/exercise of 30–90 sec. for FT with the duration ≤36 sessions	30–60 minutes/ Session for 3–12 weeks	15–60 minutes/ Sessions for 5 months

AACPR: American Association of Cardiovascular and Pulmonary Rehabilitation; ACRA : Australian Cardiovascular Health and Rehabilitation Association; Aerobic endurance training (AET) may include walking, jogging, treadmill, cycling, bicycle ergometer, stair climbing, stepping, swimming, dancing, rowing, elliptical trainer); CACR: Canadian Association of Cardiac Rehabilitation; Dynamic resistance training (DRT) may include circuit training with light weights and pulley exercises for upper extremities, machine weights, calisthenics); EACPR: European Association of Cardiovascular Prevention and Rehabilitation; FITT: Frequency, Intensity, Time, Type; Flexibility training (FT) may include static stretches, gymnastics exercises); HR: Heart rate; HRR: heart rate reserve; JCS: Japanese Circulation Society; RM: Repetition maximum; RPE: Rating of perceived exertion (Borg scale); Please see the ref. n. 11 in the main text, a paper comparing these guidelines in detail.

#### SUPPLEMENTARY TABLE II. Some country specific guidelines for cardiac rehabilitation

Country	Guideline	Author , year, (ref. n.)
Austria	Austrian model of outpatient cardiac rehabilitation	Niebauer et al.,2013⁵
Belgium	Position paper of the Belgian Working Group on Cardiovascular Preven- tion and Rehabilitation: cardiovascular rehabilitation	Dendale et al., 2008 <sup>6</sup>
France	French Society of Cardiology guidelines for cardiac rehabilitation in adults	Pavy et al., 2012 <sup>7</sup>
Germany	Cardiac rehabilitation in Germany	Karoff et al., 2007 <sup>8</sup>
	Recommendations for resistance exercise in cardiac rehabilitation. Rec- ommendations of the German Federation for Cardiovascular Prevention and Rehabilitation	Bjarnason-Wehrens et al., 2004 <sup>9</sup>
Ireland	Cardiac Rehabilitation Guidelines 2013. Dublin: Irish Association of Cardiac Rehabilitation	McCreery et al., 2013 <sup>10</sup>
The Netherlands	Exercise-based cardiac rehabilitation in patients with coronary heart disease: a practice guideline	Achttien et al., 2013 <sup>11</sup>
UK	The BACPR Standards and Core Components for Cardiovascular Disease Prevention and Rehabilitation 2012	BACPR, 2012 <sup>12</sup>

BACPR: British Association for Cardiovascular Prevention and Rehabilitation

SUPPLEMENTARY TABLE III. Exercise recommendations based on guidelines for people with hypertension

Guidelines/FITT	ESH/ESC, 2013 <sup>13</sup>	AHA, 2013 <sup>14</sup>	CHEP, 2014 <sup>15</sup>	JNC 8, 2014 <sup>16</sup>
Exercise type	Aerobic exercise + Dynamic resistance training	Aerobic exercise + Dynamic resistance training	Aerobic exercise +Dy- namic, Isometric, or Handgrip resistance training	Aerobic exercise
Frequency	5-7 days/week	Most days/week	4-7 days/week	3-4 sessions/ w for ≥12 weeks
Intensity	Moderate	Moderate to high, >40%-60% of maximum	Moderate	Moderate to Vigorous
Time/Duration	≥30 min/day; Dynamic RT 2-3 days/week	150 minutes/ week +Dynamic RT	30-60 min/d + Dynam- ic, Isometric, or Handgrip RT	40 min/session
Outcome/ reductions	2-3 mmHg; 5-7 mmHg in hypertensives			1-5 mmHg

AHA: American Heart Association; CHEP: Canadian Hypertension Education Program; ESC: European Society of Cardiology; ESH: European Society of Hypertension; FITT: Frequency, Intensity, Time, Type; JNC 8: Eighth Joint National Committee; Aerobic exercise training protocols including walking, jogging, calisthenics, bicycle ergometer, treadmill, stair climbing, swimming....;Dynamic resistance training protocols including weights, resistance training machines, dynabands; Isometric exercise training protocols including 4 sets of 2-min handgrip, leg contractions sustained at 20–50 % of maximal voluntary contraction with a rest period of 1–4 min between each set. Please also see ref. n. 36 in the main text, a paper which compares these guidelines in detail.

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Health Condition/ PRM approach Evidence of effectiveness problem		Source	Author(s), year, (ref. n.)	LOE/	
·					SoE
CHD	Exercise-based cardiac rehab	Reduction in cardiovascular mortality and hospitalization risk as well as improvements in HRQoL.	CR	Anderson et al., 2016 <sup>1</sup>	I/low-mod.
CHD, Heart failure, or revascularization	Home-based vs. centre-based cardiac rehab	Similar favourable outcomes regarding mortality, cardiac events, exercise capacity, modi- fiable risk factors such as total cholesterol, LDL, smoking status, SBP, and HRQoL outcomes with home- and centre-based cardiac rehab following low risk MI, heart failure, or revascu- larization in a period of follow-up of up to a year. Small differences between the two (with similar care costs) regarding HDL, triglycerides, and DBP in favour of centre-based cardiac rehab.	CR	Taylor et al., 2015 <sup>2</sup>	1/
CHD	Home-based ex- ercise/long term effects	Significant difference (albeit small) in exercise capacity favouring home-based rehab when compared with centre-based rehab (by a SMD of 0.25) in the long-term (over a year).	SR/MA	Claes et al., 2016 <sup>3</sup>	I/Limited
CHD, Heart failure	Exercise-based cardiac rehab	Higher exercise capacity (VO <sub>2</sub> max by 3.3 ml/kg.min) following exercise, higher intensity exercise accounting for the largest improvements in VO <sub>2</sub> max.	MA	Uddin et al., 2016 <sup>4</sup>	I/
CHD, CABGS	Sexual counsel- ling	Conflicting evidence of efficacy, two reporting favourable effects and one reporting no differ- ence when compared with controls based on 3 trials.	CR	Byrne et al., 2016⁵	I/very low
CHD	High intensity in- terval vs. moderate intensity continu- ous training	Ability of high intensity interval training to improve exercise capacity (VO <sub>2</sub> max) significantly better (+1.78 mL/kg/min) than that of moderate intensity continuous training; the latter with better efficacy on decreasing resting heart rate (-1.8/min) and body weight (-0.48 kg). No significant differences between the two types regarding blood triglyceride, glucose, and HDL levels.	SR	Liou et al., 2016 <sup>6</sup>	I/ Limited
СНD	Interval training vs. continuous exercise	Significantly more beneficial effects on VO <sub>2</sub> max (by a WMD of 1.53 ml/kg/min) when compared with continuous exc. as well as on anaerobic threshold without any effect on SBP. No studies with very long-term follow-ups to assess mortality and/or morbidity.	MA	Elliott et al., 2015 <sup>7</sup>	1/
CHD/Heart failure/ COPD	Eccentric exer- cise	Similar effects in increasing mobility (walking) and muscle strength with lesser consumption of $O_2$ and greater power when compared with concentric exercise	SR	Ellis et al., 2015 <sup>8</sup>	I/Limited
СНD	Resistance train- ing	Significantly more favourable effects in improving VO <sub>2</sub> max (by a WMD of 0.92 mL/kg/ min in the middle-aged; 0.70 mL/kg/ min in the old) and strength of muscles (by a SMD of 0.73 in middle-aged, 1.18 in the old for upper ext.; 0.65 in the middle-aged, 0,63 in the old for lower ext.) and also mobility (by a SMD of 0.61) compared with controls.	MA	Yamamoto et al., 2016 <sup>9</sup>	1/
CHD	Resistance train- ing	Significant Improvements in VO <sub>2</sub> max (by a WMD of 0.61), max. work capacity (by a SMD of 0.38), and strength of muscles (by a SMD of 0.65) when combined with aerobic training in comparison to the latter alone. No difference in effectivenes as a single treatment when compared with aerobic training. Combined treatments of shorter duration with more beneficial effects on exercise capacity and strength; those with long duration with effects on only strength.	SR/MA	Xanthos et al., 2017 <sup>10</sup>	I/moderate

CHD	Aerobic+ resis- tance training	Aaerobic + resistance training with more beneficial effects in terms of body (by a WMD of 2.3%) and trunk fat (by a SMD of 0.56) decrease, fat free mass increase (by a WMD of 0.9kg), lower (SMD: 0.77) and upper body strength (SMD: 1.07) increase, and work capacity improvement and also with a trend of increase in VO <sub>2</sub> (by a WMD of 0.41ml/ kg/min) compared with aerobic training alone without any reported serious adverse events	MA	Marzolini et al., 2012 <sup>11</sup>	I/
CHD	Tele-cardiac re- hab	Significant increase on physical activity level when compared with usual care and cen- tre-based CR; also more effective on adherence to exercise, LDL and DBP compared with centre-based rehab. Similar effects of both on exercise capacity and other CHD risk factors.	SR/MA	Rawstorn et al., 2016 <sup>12</sup>	I/
CHD	Patient educa- tion	Potential favourable effects on HRQoL and costs of healthcare ; weak evidence on reducing mortality (all-cause), cardiac morbidity, and admissions to hospital.	SR/MA	Brown et al., $2013^{13}$	I/weak-Limited
CHD	Internet-based interventions	Potential (inconclusive) favourable effects on physical activity, nutrition, and HRQoL; no apparent evidence on CHD risk factors, cardiac events, or cost-efficacy (with promotion of a healthy life style and physical activity).	CR	Devi etal., 2015 <sup>14</sup>	I/weak-limited
CVD/Type D person- ality	Cardiac rehab	Significant improvements in depression and anxiety, physical functioning, and HRQoL as preliminary evidence.	SR	Cao et al., 2016 <sup>15</sup>	I/Weak
СНD	Psychological in- terventions	Potential effectiveness on treatment of psychological conditions: depression (by a SMD of -0.21-small/moderate), anxiety (by a SMD of -0.25); moderate favourable effect on cardiac mortality (RR:0.80).	CR	Whalley et al., 2011 <sup>16</sup>	I/Weak
CHD/Depression	Psychological in- terventions	Clinically significant (albeit small) favourable effects on depression (by SMDs ranging fron -0.81 to 0.12) when compared with usual care. No favourable effects on cardiac events, hospital admissions, HRQoL (apart from psychosocial dimension, and mortality based on one study for each outcome; no differences between different psychological interventions regarding outcomes.	CR	Baumeister et al., 2011 <sup>17</sup>	I/ limited
CHD/depression	Psychosocial in- terventions	Significant modest reduction in symptoms of depression (by a SMD of 0.15) and improve- ment in social support (by a SMD of 0.17); without any difference regarding anxiety, HRQoL, MI, revascularisation, or mortality.	SR/MA	Ski et al., 2016 <sup>18</sup>	I/weak
CHD/anxiety	Music therapy	A small but consistent favourable effect on psychological distress with listening to music; a moderate but inconsistent efficacy on anxiety more apparent in those with MI and in those who selected music themselves; reduction in heart (by a MD of -3.40) and respiratory (by a MD of -2.50) rate , and SBP (by a MD of -5.52 mmHg);potetial pain-reducing (with $\geq$ 2 sessions) and sleep quality improving effects.	CR	Bradt et al., 2013 <sup>19</sup>	I/weak
Hypertension	Aerobic exercise	Significant effects on SBP (by a WMD of -4.06mmHg) and DBP (by a WMD of /-2.77 mmHg) (24h), more prominent in those with BP $\geq$ 130/85 mmHg.	MA	Sosner et al., 2016 <sup>20</sup>	I/fair
Hypertension	Walking	Favourable effects with walking at moderate-high intensity (intensity is important)	SR	Lee et al., 2010 <sup>21</sup>	l/poor
Hypertension (various chronic dis.)	Nordic walking	Favourable effects on exercise capacity, VO <sub>2</sub> max, BP, resting heart rate, , and HRQoL; superior to walking.	SR	Tschentscher et al., 2013 <sup>22</sup>	I/
Hypertension	Resistance exer- cise	Decrease in SBP by -3.03mmHg and in DBP by -2.10mmHg	MA	MacDonald et al., 2016 <sup>23</sup>	I/fair to mod.
Hypertension	Isometric exer- cise	Reductions (as MD) SBP – 5.20 mmHg, DBP – 3.91 mmHg, MAP – 3.33 mmHg. More reduction in MAP in males (– 4.13 mmHg) than in females, in persons ≥ 45 years (– 5.51mmHg), in those with ≥8 weeks of isometric exercise (–4.22mmHg), in hypertensives (– 5.91 mmHg). Effects on other CHD risk factors unexplored.	SR/MA	Inder et al., 2016 <sup>24</sup>	I/good to moderate

Hypertension	High-intensity inter- val vs. moderate-in- tensity continuous training	Significant beneficial effects on vascular function (by a MD of 2.26%) (as measured by brachial artery flow-mediated dilation) when compared with moderate-intensity continuous training. Potential favourable effects also on CHD risk factors, aerobic capacity, inflammation, oxidative stress, and insulin sensitivity.	SR/MA	Ramos et al., 2015 <sup>25</sup>	I/Limited
	Yoga	Very low–quality evidence for effects of yoga on SBP (-9.65 mmHg) and DBP (-7.22 mmHg) compared with usual care, with more prominent effects in hypertensives; Exercise is superior; More adverse events with yoga	SR/MA	Cramer et al., 2014 <sup>26</sup>	I/Limited
	Tai chi	Reductions in SBP ranging from -22.0 mmHg to -11.5 mmHg in 6 RCTs. No difference in 2 RCTs; an increase in SBP (5.2 mmHg) in 1 RCT; Limited/inconclusive evidence.	CR	Hartley et al., 2014 <sup>27</sup>	I/Limited
	Qigong	Significant reductions in SBP (-17.40mm) and DBP (-10.15mm Hg) when compared with controls; Exercise is superior; Non-significant reduction in SBP when compared with antihypertensives. More reduction with Qigong + antihypertensives in SBP (-11.99mmHg) and DBP (-5.28mm Hg).	SR	Xiong et al., 2015 <sup>28</sup>	I/weak
	Baduanjin	Significant reductions in SBP (-13.00 mmHg) - DBP (-6.13 mmHg). No significant difference between antihypertensives. More reduction with Baduanjin + antihypertensives in SBP (-7.49 mmHg)-DBP (-3.55 mmHg).	SR/MA	Xiong et al., 2015 <sup>29</sup>	I/weak
Hypertension/diabet- ics	Exercise	A change in SBP of 2.42 mmHg, DBP of 2.23 mmHg, HDL of 0.04 mmol/L, and LDL of 0.16 mmol/L.	MA	Hayashino et al., 2012 <sup>30</sup>	I/
Hypertension	Relaxation ther- apies	Significant (albeit small) reductions in SBP (by a MD of -5.5 mmHg) and DBP (by a MD of -3.5 mmHg) when compared with controls. Not a significant SBP reducing effect in single-blinded (by a MD of -3.2 mmHg) or sham-controlled (by a MD of -3.5 mmHg) trials; conflicting evidence	CR	Dickinson et al., 2008 <sup>31</sup>	I/weak
Heart failure	Exercise-based cardiac rehab	A tendency towards reduced mortality in exercise-based cardiac rehab studies with a fol- low-up exceeding a year (long-term). Reduced overall and disease specific hospitalization rates. Improvements in HRQoL. Potential cost-effectiveness of exercise-based cardiac rehab in relation to quality-adjusted life years and saved life-years, however, with additional costs for exercise training.	CR	Taylor et al., 2014 <sup>32</sup>	1/
Heart failure	Home- vs. cen- tre-based cardiac rehab	Improvement in VO <sub>2</sub> max (by a MD of 1.6 ml/kg/min) and HRQoL (MLHFQ) (by a MD of $-3.3$ ) with home-based cardiac rehab when compared with usual care. Similar outcomes with home-based and centre-based rehab regarding hospitalisation, mortality, or costs.	SR/MA	Zwisler et al., 2016 <sup>33</sup>	1/
Heart failure/normal ejection fraction	Exercise	Significant increase in VO2max (by a MD of 2.08 mL/ kg/min- 17% from baseline), heart rate max. (by a MD of 3.46 bpm), 6MWT (by a MD of 32.1m) and HRQoL (by an MD of 11.38 in SF-36) when compared with controls.	SR/MA	Chan et al.,2016 <sup>34</sup>	1/
Heart failure	Exercise + inspi- ra- tory muscle train- ing	Improvements in maximal inspiratory pressure (by a WMD of 20.89 cm $H_2O$ ) and HRQoL without any significant difference in $VO_2$ max when compared to exercise alone.	SR/MA	Neto et al., 2016 <sup>35</sup>	I/fair
Heart failure	Comparison-ex- ercise modalities	A significant improvement in HRQoL with continuous endurance +strength training. Signif- icant improvement in left ventricular end-diastolic diameter and left ventricular ejection fraction in favour of Interval training when compared with continuous training. Favourable effects of any kind of exercise training on cardiac function, HRQoL, and prognosis.	SR/MA	Cornelis et al., 2016 <sup>36</sup>	I/
Heart failure	Aquatic exercise	Similar beneficial effects when compared with land-based exercise in terms of muscle strength, exercise capacity (VO <sub>2</sub> peak), and HRQoL	SR/MA	Adsett et al., 2015 37	I/fair-good

Heart failure	Hydrotherapy	Improvements in exercise capacity when compared with sedentary controls	SR	Neto et al., 2015 38	1/
Heart failure	E x e r c i s e / high-vigorous vs. moderate inten- sity	Significant improvements in total and physical scores of MLHFQ (by a MD of -8.24, and -2.89, respectively) at moderate to high/vigorous intensity. Significant reductions in MLWHF total score at high- (by a MD of -13.74) and vigorous-intensity (by a MD of -8.56), but not at moderate-intensity exercise. Significant improvements of -3.87 after aerobic and -9.82 after combination of aerobic and resistance exercise in total MLWHF score, but not after resistance exercise only. The higher the intensity, the greater the improvement.	SR/MA	Ostman et al., 2016 <sup>39</sup>	1/
Heart failure/elderly	Exercise	Significant improvements in 6MWT (by 50.05 m) and generic HRQoL with no difference in VO2max, disease-specific HRQoL , hospital admission, or mortality when compared with controls .	SR/MA	Chen et al., 2013 <sup>40</sup>	1/
Heart failure	Resistance train- ing	Significant improvement in VO <sub>2</sub> max (by a MD of 1.43 ml/kg/min), HRQoL (by a MD of -8.31), 6MWT (by a MD of 13.49 m) with the combined and with resistance exc. alone VO <sub>2</sub> max (by a MD of 3.99 ml/kg/min) and 6MWT (by a MD of 41.77 m) compared with controls, with unchanged outcomes in terms of left ventricular ejection fraction, resting BP, hospitalization, or mortality for both.	SR/MA	Jewiss et al., 2016 <sup>41</sup>	1/
Heart failure	Comparison: ex- ercise vs. drug	Improvements with exercise in exercise capacity (VO <sub>2</sub> max) (by a WMD of 2.283 ml/min/kg), 6MWT (by 30.275m), and MLHFQ (HRQoL) total score (by 8.974) when compared with usual care, but not with medications (VO2max by a WMD of $-0.393$ ml/min/kg), 6MWT (by _9.463m), or MLHFQ (1.042) when compared with no medications/placebo.	MA	Fukuta et al., 2016 <sup>42</sup>	1/
Heart failure	Exercise/auto- nomic function	Favourable effects on cardiac autonomic function with improvements in heart rate recovery at 2 min. following moderate intensity aerobic exercise and also on heart rate variability.	SR	Hsu et al., 2015 <sup>43</sup>	I/fair to good
Heart failure	Self-manage- ment	Favorable effects on time to and hospitalization alone related to disease, disease specific HRQoL(by a SMD of 0.15), hospital days in the elderly, and mortality of all causes. No effect on survival in those without depression; reduction in survival in those with depression and requires caution.	MA	Jonkman et al., 2016 <sup>44</sup>	I/
Heart failure	Tai Chi	Significant improvements in HRQoL (by a WMD of $-14.54$ ), but not on SBP DBP, or VO <sub>2</sub> max.	MA	Pan et al., 2013 <sup>45</sup>	l/Insufficient
Heart failure	NMES	Improvement in VO <sub>2</sub> max (by a SMD of 4.86 ml/kg/min),6MWT (by a SMD of 63.54 m), strength of muscles (by a SMD of 30.74 N), endothelial function (by a SMD of 2.67%), symptoms of depression (by a SMD of – 3.86) and HRQoL when compared with those without exercise; No significant differences in VO <sub>2</sub> max, 6MWT, or HRQoL when compared to those with exercise.	SR/MA	Gomes Neto et al., 2016 <sup>46</sup>	1/
Heart failure (also chronic respiratory disease and some other chronic diseas- es)	NMES	Significant quadriceps muscle strength improving effect (by a SMD of 0.53; ~1.1 kg)(based on low evidence) and muscle mass increase; improvements in 6MWT (by a MD of 35 m) when compared with the controls (based on very low to low evidence) without any serious adverse events, but with some muscle soreness (based on moderate evidence.	CR	Jones et al.,2016 <sup>47</sup>	I/very low-low-mod- erate
Heart failure	Acupuncture	Varying, inconsistent, conflicting results in studies: improvement in left ventricular ejection fraction by 9.95%; improvement in heart rate variability, exercise capacity, HRQoL; reduction in stay in intensive care and rehospitalisation risk; Inconclusive evidence.	SR	Lee et al., 2016 <sup>48</sup>	I/Limited
Heart failure/on ECMO	Physiotherapy	Early mobilization and ambulation safe and leading to autonomy at an acceptable level as preliminary evidence	SR	Polastri et al., 2016 <sup>49</sup>	I/Limited

Atrial fibrillation	Exercise	Improvement in exercise capacity, ADL abilities and HRQoL with moderate-intensity physical activity; high-intensity physical activity may be risky	SR	Giacomantonio et al., 2013 <sup>50</sup>	I/Limited
Atrial fibrillation	Exercise	Significant improvements in exercise capacity, strength of muscles, heart rate control, ADL, and/or HRQoL based on conflicting evidence.	SR	Reed et al., 2013 <sup>51</sup>	I/Conflicting
Pacemakers	Exercise	More favourable effects on exercise capacity and HRQoL added to those of the pacemaker.	RCT	Patwala et al., 2009 <sup>52</sup>	11/
Cardioverter defibril- lators	Exercise-based cardiac rehab	Improvement in aerobic capacity safely, without increasing the risk of shocks; insufficient data of effects on HRQoL, or anxiety/depression.	SR	Isaksen et al., 2012 <sup>53</sup>	l/weak
CABG surgery	Exercise-based cardiac rehab	Reduction in mortality	SR/MA	Rauch et al., 2016 <sup>54</sup>	I/Limited
Heart valve surgery	Exercise-based cardiac rehab	Potential exercise capacity improving effects (by a SMD of -0.47) when compared with no exercise based on moderate quality evidence based on two trials. Insufficient evidence on the effects on serious adverse events, mortality, or return-to-work; Lack of evidence on HRQoL, haemodinamic parameters, or cost.	CR	Sibilitz et al., 2016 <sup>55</sup>	I/insufficient to mod- erate
Cardiac surgery/pre- operative	Preoperative physical therapy	Significant reductions in the risk of pulmonary complications (atelectasis, pneumonia) and duration of hospitalization after surgery with preoperative incentive spirometry, breathing and/or coughing exercises;respiratory muscle and/or;cardiorespiratory exercise training); no effects on pneumothorax, duration of mechanical ventilation, or mortality (all-cause); Possible beneficial effects on 6MWT or HRQoL.	CR	Hulzebos et al., 2012 <sup>56</sup>	I/Limited
Heart transplantation	Exercise	Significant improvements in VO <sub>2</sub> max (by a MD of 2.34 ml/kg/min)and muscle strength (as measured by chest pres 1RM (by a SMD of 23.3 kg).	MA	Hsieh et al., 2011 <sup>57</sup>	١/
Heart transplantation	Exercise	Significant improvement in $VO_2$ max (by a SMD of 0.77); no difference as to BP, lipids, or blood glucose control compared with usual care.	SR/MA	Didsbury et al., 2013 <sup>58</sup>	I/Limited
Peripheral artery dis- ease/intermittent claudication	E x e r c i s e / home-vs. hospi- tal-based	Home-based exercise inferior to centre-based exercise regarding walking distance (max. and pain free), superior regarding walking capacity in daily life based on low quality of evidence. Similar HRQoL between the two.	SR	Bäck et al., 2015 <sup>59</sup>	I/Low
Venous insufficiency	Exercise	Some evidence of symptom reducing efficacy, increases in half venous refilling time (by a MD of 4.20 sec) and total venous refilling time (by a MD of 9.40 sec.), however, insufficient evidence based on very low quality of evidence due to the high risk of bias of the studies.	CR	Araujo et al., 2016 <sup>60</sup>	I/weak
Venous ulcers	Compression treatments	Unclear evidence on self-management programmes or education on healing or adherence	CR	Weller et al., $2016^{61}$	I/Low

---: strength of evidence not indicated or not clear in the review; CHD: Coronary heart disease; CABGS: Coronary artery bypass surgery; COPD: Chronic obstructive pulmonary disease; CR: Cochrane review; DBP: Diastolic blood pressure; ECMO: Extracorporeal membrane oxygenation; HRQoL: Health-related quality of life MA: Meta-analysis; MD: Mean difference; MLHFQ:Minnesota Living with Heart Failure Questionnaire;6MWT: Six-Minute Walk Test; mod.: moderate; NMES: neuromuscular electrical stimulation; SBP: Systolic blood pressure; SMD: Standardized mean difference; SR: Systematic review; SGRQ: St. George's Respiratory Questionnaire; WMD: Weighted mean difference

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#### SUPPLEMENTARY TABLE IV. Results of the Consensus procedure

Rou	ind	Number of recom- mendations	Accept as it is	Accept with suggestions	Reject
1	1 <sup>st</sup> vote	29	93.4%	6.3%	0.3%
	2 <sup>nd</sup> vote	29+1=30	93.6%	6.1%	0.3%
2		30	99.4%	0.6%	0
3		30	100%	0	0
4		30	99.4%	0	0.6%
5		30			

SUPPLEMENTARY TABLE V. Overall view of the recommendations

Content	Number of recom- men-dations	Strength of recommendations					Strength of evidence				
	Number	A	В	С	D	I	II		IV		
Overall recommendation	1	100%	0	0	0	0	0	0	100%		
PRM physicians' role in Medical Diagnosis according to ICD	1	100%	0	0	0	0	0	0	100%		
PRM physicians' role in PRM diagnosis according to ICF	3	90.91%	9.09%	0	0	0	0	0	100%		
PRM physicians' role in PRM assessment according to ICF	4	59.09%	40.91%	0	0	0	0	0	100%		
Recommendations on PRM management and process	19	77.51%	22.01%	0.48%	0	0	0	0	100%		
Recommendations on future research on PRM professional practice	2	54.55%	45.45%	0	0	0	0	0	100%		
TOTAL	30	76.37%	23.33%	0.30%	0	0	0	0	100%		

## Evidence Based Position Paper on Physical and Rehabilitation Medicine (PRM) professional practice for people with respiratory conditions. The European PRM position (UEMS PRM Section)

https://www.ncbi.nlm.nih.gov/pubmed/29722510

Aydan Oral, Alvydas Juocevicius, Aet Lukmann, Peter Takáč, Piotr Tederko, Ilze Hāznere, Catarina Aguiar-Branco, Milica Lazovic, Stefano Negrini, Enrique Varela Donoso, Nicolas Christodoulou.

## EEvidence Based Position Paper on Physical and Rehabilitation Medicine (PRM) professional practice for people with respiratory conditions

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### The European position Produced by the UEMS-PRM Section

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#### ABSTRACT Introduction:

Chronic respiratory conditions are among the top causes of death and disability.

#### Aim:

The aim of the paper is to improve Physical and Rehabilitation Medicine (PRM) physicians' professional practice for persons with chronic respiratory conditions in order to promote their functioning properties and to reduce activity limitations and/or participation restrictions.

#### Method:

A systematic review of the literature and a Consensus procedure by means of a Delphi process has been performed involving the delegates of all European countries represented in the UEMS PRM Section.

**Results:** The systematic literature review is reported together with twenty-three recommendations resulting from the Delphi procedure.

#### **Conclusion:**

The professional role of PRM physicians having expertise in the rehabilitation of chronic respiratory conditions is to lead pulmonary rehabilitation programmes in multiprofessional teams, working in collaboration with other disciplines in a variety of settings to improve functioning of people with chronic respiratory conditions.

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This EBPP represents the official position of the European Union through the UEMS PRM Section and designates the professional role of PRM physicians for people with respiratory conditions.

## Introduction

Global Burden of Disease study reported that respiratory conditions such as chronic obstructive pulmonary disease (COPD) and asthma were among significant causes of total deaths with ranks 10 and 37 in 2015, respectively. The ageing of the world's population led to increased mortality due to COPD by 24.2%.<sup>1</sup> Respiratory conditions were also found significantly incapacitating with asthma and COPD being among the top causes of years lived with disability (YLDs) with ranks of 11 and 14, responsible for approximately 16 million and 12 million YLDs, respectively.<sup>2</sup>

It is clear that chronic respiratory conditions, particularly COPD, are not just a matter of decline in lung function parameters of airflow obstruction as mostly expressed using forced expiratory volume (FEV1). COPD and related comorbidities associated with significant problems in are functioning parameters outside the lungs such as impaired exercise capacity and difficulty in activities of daily living (ADL) leading to poor health-related quality of life (HRQoL), which are the most important concerns for the patients.<sup>3</sup> Furthermore, some functioning parameters in COPD have been found significantly associated with mortality and HRQoL.4 Therefore, the management of chronic respiratory conditions requires a biopsychosocial approach as defined in the International Classification of Functioning, Disability and Health (ICF)<sup>5</sup> to improve functioning and HRQoL. ICF Core Sets for obstructive pulmonary diseases well demonstrates potential problems in functioning properties of an individual with COPD both for assessment and also for targeting treatments in order to improve impairments in body functions, activity limitations and participation The approach of Physical and restrictions.<sup>6</sup> Rehabilitation Medicine (PRM) based on "the WHO's integrative model of functioning, disability and health and rehabilitation as its core health strategy"7 and its conceptual definition as "medicine of functioning"<sup>8</sup> pose a significant challenge for PRM physicians to be more involved in pulmonary rehabilitation programmes.

The aim of this evidence-based position paper (EBPP) is to improve PRM physicians' professional practice for persons with chronic respiratory conditions in order to promote their functioning properties and to reduce activity limitations and/or participation restrictions.

## Material and Methods

The methodology proposed by the UEMS-PRM Section for producing this EBPP is described in the paper by Negrini et al.<sup>9</sup> Details of inclusion criteria of the articles for the systematic review of the literature, paper selection, the dates of search, language restriction, priorities in the systematic literature search, and selection of Cochrane reviews, systematic reviews, and randomized controlled trials (RCTs) are described in the online version of a previous paper.<sup>10</sup> The grading of the Strength of Evidence (SoE) and Strength of Recommendation (SoR) as well as reaching consensus on recommendations by the Delphi procedure are described in the 'Methodology' paper.9

### Results

Flow chart of paper selection for reviewing the literature is shown in Supplementary Figure 1 in Supplementary materials Appendix II (online content only). Reviewing the literature systematically with the main inclusion criterion as the relevance of the article with the PRM physicians' profession to improve PRM professional practice for people with respiratory conditions in order to promote their functioning properties resulted in the below listed subjects of discussion and arguments as well as evidence of effectiveness of rehabilitative interventions for people with chronic respiratory conditions (Summary of evidence of effectiveness of interventions are given in Supplementary Table I in Supplementary materials, Appendix II-online content only) which led to recommendations for PRM physicians for the successful management of people with chronic respiratory conditions.

## Pulmonary rehabilitation and why PRM physicians need to be more involved in pulmonary rehabilitation programmes

Pulmonary rehabilitation is an essential for the management of people with chronic respiratory conditions. The previous definition (2006) of pulmonary rehabilitation as "an evidencebased, multidisciplinary, and comprehensive intervention for patients with chronic respiratory diseases who are symptomatic and often have decreased daily life activities. Integrated into the individualized treatment of the patient, pulmonary rehabilitation is designed to reduce symptoms, optimize functional status, increase participation, and reduce health care costs through stabilizing or reversing systemic manifestations of the disease"11 (Quote. Nici et al., 2006. p.1391) is revised in 2013 as "a comprehensive intervention based on a thorough patient assessment followed by patient tailored therapies that include, but are not limited to, exercise training, education, and behaviour change, designed to improve the physical and psychological condition of people with chronic respiratory disease and to promote the long-term adherence to health-enhancing behaviors".12 (Quote. Spruit et al., 2013. p.e14). Indeed, both definitions of pulmonary rehabilitation approach patients with chronic respiratory conditions in the context of a biopsychosocial model similar to that defined in the ICF 5 with implications taking into consideration the dimensions of body functions and structures and activities and participation. The recent definition is broader in the sense that it urges more active involvement of people with chronic respiratory conditions in the management of their health condition and provides more flexibility regarding varying delivery of pulmonary rehabilitation services to succeed in accomplishing the desired patientcentred outcomes.<sup>13</sup> The main point is "integrated care" generally defined as "a continuum of patient-centred services organized for patients with chronic conditions with the goal of achieving their optimal daily functioning and health

status and maintaining their independence and functioning in the community".<sup>14</sup> (Quote. Nici et al., 2012. p. 9). Since chronic respiratory conditions, considering COPD as the prototype, are complex diseases associated with manifold clinical presentations and comorbidities, integrated care is warranted for their optimal management of which pulmonary rehabilitation is the central/cardinal component.<sup>13,14,15</sup> The holistic approach required for the management of COPD urges the involvement of a competent and dedicated multiprofessional team working in an interdisciplinary way who will combine patient-management skills into joint activities for the common goal of treatment of the individuals taking into consideration all aspects of the complex disease in a life-long continuum with a patient-centred approach to achieve favourable clinical and functional outcomes.12,14

According to the American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR) statement, core clinical competencies for health professionals conducting pulmonary rehabilitation programmes cover the assessment and management of the patient along with the assessment and/or management of the manifestations (such as dyspnoea) and possible requirements (such as oxygen, medications, techniques including therapeutic and а variety of breathing techniques) of the health condition as well as self-management, exercise testing and training (taking into consideration functioning and ADL), cessation of smoking, knowledge on other respiratory conditions other than COPD, psychosocial management (taking into consideration the influence of the health condition on emotional and cognitive functioning as well as activities and participation such as work, education and environmental factors such as social relationships) adherence to life-style changes such as physical activity, exercise, nutrition), emergency responses to deteriorating patients' signs and symptoms, adverse events, unexpected events such as falls and fractures and precautions such as hygiene and immunization.<sup>16</sup> The proper strengths of PRM physicians in the context of these competencies include, firstly and very importantly, a through biopsychosocial assessment of the patient revealing problems in functioning in all dimensions of the ICF including impairments in body functions, activity limitations and participation restrictions as well as environmental factors (which may act as barriers) to target relevant rehabilitative interventions. A unique aspect of PRM is that it is a medical specialty/profession with training for diagnosing and treating health conditions using a broad scope of biomedical and technological interventions and at the same time for applying rehabilitation as its core health strategy to improve functioning which enable an appropriate response to the needs of people with chronic conditions with multimorbidity with increasing disability both and the individual and also at the societal level for reducing activity limitations and participation restrictions7,8,17,18,19 in disabling health conditions among which chronic respiratory conditions present a significant example. It is actually the epidemiological shift, in terms of greater prevalence, from communicable to noncommunicable diseases (e.g. COPD) leading to limitations in functioning due to the ageing of the population, which makes rehabilitation the health strategy of the twenty-first century.<sup>20</sup> Given major indications for referral to pulmonary rehabilitation programmes include impaired HRQoL, reduced functioning, decreased work performance and difficulties in performing ADL,12 PRM physicians' focus on functioning and disability based on the ICF framework<sup>7,8,17</sup> may provide unique contributions in pulmonary rehabilitation including add-on specific PRM interventions for certain comorbidities to be in pulmonary rehabilitation implemented programmes. Regarding ongoing support needed, as an element of integrated care for people with chronic respiratory conditions <sup>14,15</sup> in a lifelong continuum, PRM physicians may have an important role in delivering pulmonary rehabilitation services in the community.<sup>21</sup>

The main content of pulmonary rehabilitation includes exercise training and an educational component relevant to self-management and positive adaptive change as well as interventions relevant to body composition abnormalities including nutritional counselling.<sup>12</sup> However, the content of pulmonary rehabilitation programmes may vary across countries.<sup>22</sup>

Regarding exercise prescription, ATS/ ERS guideline for pulmonary rehabilitation recommends endurance/aerobic exercises as the mainstay in the form of walking on the ground or on treadmill or cycling for 3 to 5 days a week with a duration of 20 to 60 minutes for every session at an intensity of greater than 60% maximum work rate obtained in an incremental test or between 12 and 14 (somewhat hard) on a 6-20 Borg Rating of Perceived Exertion scale with the progression according to symptoms. For those with unendurable symptoms, continuous exercise may be replaced by interval training. Resistance/strength training is recommended in the form of lifting relatively heavy loads repetitively for 2 to 3 days a week, 1 to 3 sets of 8 to 12 repetitions with an intensity of 60%-70% of 1 repetition maximum to progress with increasing weight, adding more repetitions to every set, increasing number of sets in every session or reducing rest periods in case the patient is able to exceed the solicited number of 6 to 12 repeatedly on two sessions one after the other by 1 or 2 repetitions. Upper limb exercises, aerobic exercises in the form of arm ergometry and/or resistance exercises in the form of lifting free weights or using elastic bands are also suggested along with flexibility exercises in the form of stretching of upper and lower limb muscles such as biceps, quadriceps, hamstrings and calf muscles and range of motion exercises for the trunk, neck and shoulder for 2 to 3 days a week. Neuromuscular electrical stimulation (NMES) is proposed as a passive exercise modality for those patients severely deconditioned with poor exercise tolerance and/or hospitalized patients due to acute exacerbations of their chronic condition. Inspiratory respiratory muscle training may be added to exercise training for those patients whose inspiratory muscles are weak. In pulmonary rehabilitation programmes, 8 to 12 weeks of exercise training was noted to be required for clinically significant benefits in exercise capacity and HRQoL. Supplemental oxygen may be used for some patients during exercise training.<sup>12</sup> Exercise prescription options in some other guidelines can be found in the review by Garvey et al.<sup>23</sup> The updated ATS/ ERS statement regarding muscle dysfunction in upper and lower extremities provides thorough information on pathophysiological mechanisms, assessment, and treatment options for this significant consequence of COPD.<sup>24</sup>

Pulmonary rehabilitation programmes may be delivered in diverse ways including acute hospital, intensive care units, in-patient as well as in outpatient settings, at home or in the community.<sup>12,22</sup>

Regarding assessment, ICF Core Sets for obstructive pulmonary diseases6 as well as ICF Core Set for patients with cardiopulmonary conditions in acute<sup>25</sup> and in early post-acute rehabilitation facilities<sup>26</sup> allow a thorough biopsychosocial assessment of these patients, also considering environmental factors, in a variety of settings and foster patient-centred favourable outcomes. Numerous outcome measures/tests may be used to measure diverse aspects, particularly those relevant to exercise tolerance/capacity, functioning, and HRQoL, in patients with chronic respiratory conditions.<sup>12</sup> Once 'what to measure' has been defined using the ICF as an excellent means, the following question relates to 'how to measure' for which appropriate data collection tools may be selected from the perspective of lived health/limitations in activities and participation.<sup>27</sup>

The effectiveness of pulmonary rehabilitation in COPD is well-established in the way that the editorial board of the Cochrane Airways decided the closure and the lack of need on updating the most recent Cochrane Review on pulmonary rehabilitation due to the meaningful beneficial outcomes achieved so far not warranting further evidence.<sup>28</sup> (Please see the most recent and other Cochrane Reviews in Supplementary Table I-online content only).

Despite profound evidence on the effectiveness of pulmonary rehabilitation, its utilization all around the world is low. The ATS/ERS policy statement calls to action all relevant stakeholders including all relevant health professionals to have training on pulmonary rehabilitation and to improve delivery of pulmonary rehabilitation to those patients who are in need as well as to promote access to pulmonary rehabilitation programmes.<sup>29</sup> This call poses a responsibility for PRM physicians to be more involved in and lead pulmonary rehabilitation programmes for chronic respiratory conditions which they frequently encounter.<sup>7,30</sup>

Notwithstanding the complexity of the problems in patients with chronic respiratory conditions, particularly in COPD, requiring a comprehensive and holistic approach with a focus on disabling aspects and functioning, the involvement of PRM physicians (physiatrists) in pulmonary rehabilitation programmes is low as reported in a survey in 2013.<sup>22</sup> We strongly recommend that pulmonary rehabilitation programmes involve PRM physicians and more PRM physicians gain expertise and lead appropriate programmes or jointly with other relevant physicians in the context of a competent multiprofessional team working in collaboration with other disciplines.<sup>31</sup> The leadership of PRM of physicians adds much, by virtue of the definition of PRM as the "medicine of functioning"<sup>8</sup> to successfully carrying out rehabilitation programmes pulmonary to achieve desired outcomes relevant to functioning as the mainstay and to meet the complex needs of this population including add-on specific PRM interventions with their already available competencies.

## Specific considerations in a variety of respiratory conditions

Although there is a long list of respiratory conditions that may benefit from pulmonary rehabilitation with an indication for referral,<sup>12</sup> rehabilitative aspects and the use of PRM interventions for obstructive respiratory conditions and some examples from restrictive pulmonary diseases and from other respiratory conditions will be covered in this paper. The general principles of pulmonary rehabilitation may be adapted to a variety of respiratory conditions with special considerations for the specific disease.<sup>32</sup>

## Chronic obstructive pulmonary disease (COPD)

PRM physicians may refer to generally used12 or country specific guidelines, if available, for the details of pulmonary rehabilitation.

Hospitalized patients with acute exacerbations of COPD may benefit from PRM interventions including airway clearance techniques, training with incentive spirometer, electrical stimulation (e.g. electro-acupuncture) for reducing dyspnoea, high frequency chest wall oscillation, relaxation massage, exercises and lower extremity muscle strengthening as a preventive measure for immobilization related muscle weakness.<sup>33</sup>

Common problems in COPD such as muscle dysfunction, autonomic dysfunction presenting with impairments in sympathetic activity in muscles, baroreceptor sensitivity, and variability of heart rate, <sup>34</sup> impairments in postural control resulting from lack of physical activity, mobility limitations, decreased strength of muscles, and the old age,<sup>35</sup> chronic neck pain affecting chest expansion and leading to lung function impairments,36 and oropharyngeal dysphagia resulting from impairments in breathing and swallowing coordination<sup>37</sup> also need to be dealt with a PRM programme. Aerobic exercise training with Grade 1A recommendation for the treatment of muscle dysfunction<sup>38</sup> balance training,<sup>35</sup> management of chronic neck pain, if available, based on beneficial effects of respiratory training on lung function,<sup>36</sup> spinal manipulative therapy (based on potential favourable effects on chest wall flexibility/thoracic excursion),39 can be included in pulmonary rehabilitation programmes based on the needs of the individual patient. Whole body vibration can also be considered based on the evidence of beneficial effects in improving lower extremity exercise capacity and HRQoL.<sup>40</sup> Additionally and most importantly, patients with COPD are exposed to the risk of cardiovascular diseases (e.g. hypertension, CHD, heart failure, PAD) and many of them may suffer from these health conditions. Other comorbidities beyond the respiratory system and systemic manifestations of COPD such as diabetes mellitus, metabolic

syndrome, osteoporosis, osteoarthritis, gastrooesophagealreflux, changes in body composition/ weight (e.g. cachexia or overweight/obesity) as well as psychological manifestations (anxiety/ depression)<sup>41</sup> require special attention. The identification/diagnosis of these comorbidities is important and each demands specific individualized management strategies including PRM interventions.

### Asthma

Conservative management of asthma is similar to that of COPD, requiring comprehensive chronic disease management programmes with multicomponent interventions taking into consideration environmental factors including health services, systems, and policies.<sup>42</sup> Patients with asthma may benefit from public health interventions/community based asthma control programmes.<sup>43</sup>

## Bronchiectasis

Non-pharmacological management options for the management of bronchiectasis include respiratoryphysiotherapyforbronchopulmonary secretion expectoration using airway clearance techniques and improvement of understanding the disease, ventilation efficiency, and exercise tolerance. Pulmonary rehabilitation and exercise should be provided for patients when needed.<sup>44</sup> An overview of CRs pointed to potential improvements in HRQoL with airway clearance techniques.<sup>45</sup>

## **Cystic fibrosis**

A pulmonary rehabilitation programme for patients with cystic fibrosis includes airway clearance techniques, inhalation therapies, and exercise training. A variety of musculoskeletal conditions as well as pain frequently present in these patients may require specific PRM interventions. Pelvic floor exercises can be recommended to those with stress urinary incontinence.<sup>46</sup>

## Interstitial lung disease

Individuals with interstitial lung disease may benefit from a pulmonary rehabilitation programme with endurance/aerobic exercise training as the main component Resistance exercises may be added with caution. It is important to modify exercise prescription for these patients due to severe dyspnoea during exercising and oxygen supplementation is usually required.<sup>47</sup>

### **Obstructive sleep apnoea**

Continuous positive airway pressure, behaviour management, specific exercises (e.g. myofunctional therapy), and oral appliances may be beneficial in individuals with obstructive sleep apnoea.<sup>48</sup>

### Lung transplantation

Lung transplant recipients may also benefit from exercise training.<sup>49</sup>

Last but not the least, safety, exercise tolerance issues, and careful consideration of comorbidities in patients with chronic respiratory conditions before admission to and during an exercisebased pulmonary rehabilitation programme need utmost attention.<sup>12,32</sup>

## Final Recommendations for Physical and Rehabilitation Medicine Professional Practice in Europe

#### Overall general recommendation

It is recommended that rehabilitation 1. programmes for patients with respiratory conditions involve PRM physicians having expertise on such problems and PRM physicians lead appropriate pulmonary rehabilitation programmes close collaboration in with respiratory physicians/pulmonologists and /or with other medical specialists trained in pulmonary rehabilitation (e.g. sports medicine physicians or others) in the context of a competent team in inpatient, out-patient settings and in the community to reduce impairments in function, activity limitations, and participation restrictions associated with respiratory conditions. It is recommended that PRM physicians make every effort to promote participation in and adherence to pulmonary rehabilitation programmes. It is recommended that PRM physicians follow available guidelines and evidence-based interventions when performing pulmonary rehabilitation [SoE:IV;7,8,17-21 SoR:A]

Recommendations on PRM physicians' role in Medical Diagnosis according to ICD

2. It is recommended that PRM physicians make a thorough consideration of the assessments and diagnoses made by the respiratory physicians/ pulmonologists or other physicians relevant to the individual with respiratory conditions which represent an indication for pulmonary rehabilitation (e.g. Chronic obstructive pulmonary disease (COPD), asthma, bronchiectasis, cystic fibrosis, interstitial lung disease and other diagnoses). It is also recommended that PRM physicians gain expertise in performing and interpretation of pulmonary function tests to identify abnormalities and to assess pulmonary function gains after pulmonary rehabilitation [**SoE: IV; SoR:A**].

3. It is recommended that PRM physicians take into account/ consider the diagnoses of other comorbidities beyond the respiratory system and systemic manifestations of COPD such as diabetes metabolic syndrome, mellitus, osteoporosis, gastro-oesophageal osteoarthritis, reflux, and changes in body composition/weight (e.g. cachexia or overweight/obesity) as well as psychological manifestations (anxiety/depression) [SoE:IV;3,12 SoR:A]

## Recommendations on PRM physicians' role in PRM diagnosis according to ICF

4. It is recommended that PRM physicians perform a complete bio-psycho-social evaluation of the patients paying particular attention to the identification of functional impairments such as muscle dysfunction, muscle strength, respiratory pattern, chest deformities, autonomic dysfunction, postural control/balance function, sensations of pain (e.g. chronic neck pain affecting chest expansion function), and swallowing functions (e.g. oropharyngeal dysphagia resulting from impairments in breathing and swallowing coordination) in patientswith respiratory conditions

#### [SoE:IV;35-39 SoR:A]

programmes in close collaboration with respiratory physicians/pulmonologists and /or with other medical specialists trained in pulmonary rehabilitation (e.g. sports medicine physicians or others) in the context of a competent team in inpatient, out-patient settings and in the community to reduce impairments in function, activity limitations, and participation restrictions associated with respiratory conditions. It is recommended that PRM physicians make every effort to promote participation in and adherence to pulmonary rehabilitation programmes. It is recommended that PRM physicians follow available guidelines and evidence-based interventions when performing pulmonary rehabilitation [SoE:IV;7,8,17-21 SoR:A]

## Recommendations on PRM physicians' role in PRM assessment according to ICF

5. It is recommended that PRM physicians focus on the assessment of impairments in body functions, activity limitations, and participation restrictions of patients with respiratory conditions, which is of primary importance for rehabilitation goal setting **[SoE:IV;SoR:A]** 

6. It is recommended that PRM physicians use ICF Core Sets for obstructive pulmonary diseases for patients with COPD or asthma to target PRM interventions [SoE:IV;6,25,27 SoR:A]

It is recommended that PRM physicians 7. carefully consider the assessment of ICF category titles in the environmental factor component such as products and technology, natural environment (e.g. climate, air quality), day/night cycles, family, personal care providers, health professionals, other professionals, support and relationships, attitudes of care providers, health and related professionals as well as services, systems and policies category titles in relation to supported self-management, use of information technology (telemedicine or telerehabilitation) for health promotion/lifestyle changes as well as use of ventilatory assistive devices, climate and air quality with adverse effects on pulmonary function, well-being of family caregivers, improved coordination among health professionals to enhance motivation, adherence quality of pulmonary rehabilitation and programmes, and better organization of PRM projects of pulmonary rehabilitation [SoE:IV; 6,25,27 SoR:A]

## Recommendations on PRM management and process

## Inclusion criteria (e.g. when and why to prescribe PRM interventions)

8. It is recommended that PRM physicians prescribe pulmonary rehabilitation in close collaboration/cooperation with a respiratory physician/pulmonologist or other physicians, if needed, within the multiprofessional team as early as possible following the diagnosis of a respiratory condition with absolute consideration of the individual's specific health status and his/ her preference [SoE:IV;SoR:A]

9. It is recommended that pulmonary rehabilitation is prescribed to patients with respiratory conditions to improve body functions impairments, to reduce activity limitations and participation restrictions, to improve HRQoL, to reduce exacerbations, to reduce emergency visits and rehospitalisations, and even to reduce respiratory morbidity and mortality as well as to reduce health-care costs [SoE:IV; SoR:A]

## Project definition (definition of the overall aims and strategy of PRM interventions)

10. It is recommended that PRM projects are offered in acute (even in intensive care units) and post-acute settings, in centres specialised in cardiopulmonary rehabilitation, at home or in the communicy or with the use of information and communication technologies in the form of telerehabilitation with the aim of improving body functions and reducing activity limitations, and participation restrictions [SoE;IV;SoR:A]

11. It is recommended that PRM projects are designed absolutely tailored to the specific patient considering his/her medical condition, risk stratification, and needs [SoE:IV; SoR:A]

## Team work (professionals involved and specific modalities of team work)

12. It is recommended that pulmonary rehabilitation is performed by a multiprofessional expert team, under the leadership of a PRM physician in close collaboration with other

disciplines. The team can be composed of physicians (expert PRM physicians by virtue of their competence, respiratory physicians/ pulmonologists, sports medicine physicians and others with expertise and training in pulmonary rehabilitation), other rehabilitation professionals (such as physiotherapists), other health professionals, social care providers or community-based workers, and also family members/caregivers. PRM physician can make a unique contribution in the teamwork as leader, joint leader, coordinator, advisor, evaluator, or consultant depending on the functioning properties of the patient or setting [SoE:IV;<sup>30,31</sup> SoR:A]

#### **PRM interventions**

13. It is recommended that PRM physicians use American Thoracic Society/European RespiratorySocietyPolicyStatement/Guideline<sup>12</sup> or certainly other local guidelines pertinent to their countries or region when performing pulmonary rehabilitation [SoE:IV;SoR:A]

It is recommended that PRM physicians 14. consider "add-on" PRM interventions such as respiratory physical therapy including breathing exercises, airway clearance techniques, electroacupuncture for dyspnoea, neuromuscular electrical stimulation (NMES) and/or strengthening/endurance exercises for muscle weakness. postural control interventions including whole body vibration, interventions for the management of chronic neck pain which may interfere with respiratory function, spinal manipulative therapy for improving thoracic excursion, interventions for dysphagia, and interventions for the non-pharmacological management of depressive symptoms as well as interventions for other possible comorbidities osteoarthritis and osteoporosis such as programmes pulmonary rehabilitation in [SoE:IV;SoR:A]

15. It is recommended that PRM physicians get involved in chronic pulmonary disease management programmes for improving selfcare/self-management, behaviour change, and self efficacy. **[SoE: IV; SoR:A]** 

16. It is recommended that PRM physicians apply telerehabilitation for patients with

respiratory conditions [SoE:IV;SoR:B]

#### Outcome criteria

17. It is recommended that PRM physicians determine patient-centred outcome criteria in relation to the individual patient's functional impairments, activity limitations, and participation restrictions [SoE:IV;SoR:A]

18. It is recommended that PRM physicians use main outcome criteria including aerobic endurance parameters/ exercise capacity (as measured using VO2max, 6-Minute Walk Test, incremental shuttle walk test, or others), health related quality of life (as measured using generic or disease specific assessment tools), dyspnoea, fatigue, rehospitalisation rates, hospital days, survival and pulmonary function variables (e.g. FEV1) in patients with respiratory conditions and specifically expectoration of the sputum in patients with bronchiectasis/ cystic fibrosis and apnea-hypopnea index in individuals with obstructive sleep apnea [SoE:IV;SoR:A]

It is recommended that PRM physicians 19. use secondary outcome criteria such as improvement in mastery of disease control, balance, emotional functions (e.g. depressive symptoms, anxiety), muscle strength, body composition or related conditions (e.g. BMI, sarcopenia, cachexia, frailty), ADL ability, returnto-work or autonomic function (particularly in patients with chronic obstructive pulmonary disease ) or duration of ventilatory assistance in patients with acute exacerbations of chronic obstructive pulmonary disease or number of acute exacerbations, emergency visits, and inspiratory muscle strength in patients with asthma [SoE:IV;SoR:A]

#### Length/duration/intensity of treatment (overall practical PRM approach)

20. It is recommended that PRM physicians follow guidelines/consensus documents/position papers for the length, duration, and intensity of PRM approaches in pulmonary rehabilitation with an absolute adaptation to the medical condition and needs of the specific patients **[SoE:IV;SoR:A]** 

Discharge criteria (e.g. when and why to end

#### **PRM interventions)**

21. It is recommended that patients with respiratory conditions are followed up and monitored by PRM physicians closely throughout their lifespan with regard to progression of impairments in body functions, activity limitations, and participation restrictions as well as adherence to requirements of pulmonary rehabilitation programmes including exercise, favourable lifestyle changes, self-management, self efficacy, and disease mastery

#### [SoE:IV; SoR:A]

## Recommendations on future research on PRM professional practice

22. It is recommended that PRM physicians get involved in research on 'Integrative rehabilitation sciences research' associated with rehabilitation services, rehabilitation administration and management50 in order to provide suitable pulmonary rehabilitation services in hospitals, rehabilitation centres or at home or community settings to meet the needs of respiratory patients as well as the effects of organizational components within specific healthcare systems [SoE:IV;SoR:B]

23. It is recommended that PRM physicians are also involved in research to identify effectiveness of the individual components of pulmonary rehabilitation (i.e. lifestyle modifications, self-management, self-efficacy exercise, psychological interventions and others [SoE:IV;SoR:B]

Results of the Consensus procedure during the creation of the recommendations using a Delphi process and overall view of recommendations are provided in Supplementary Table II and III, respectively, in Supplementary materials, Appendix II-online content only.

#### Conclusion

Chronic respiratory conditions, COPD as the prototype, are complex diseases with comorbidities in a wide range. While the favourable effects of pulmonary rehabilitation are well-established, its uptake is low by those in need. The professional role of PRM physicians having expertise in the rehabilitation of chronic respiratory conditions is to lead pulmonary rehabilitation programmes in multiprofessional teams, working in collaboration with other disciplines in a variety of settings to improve quality of life of people with chronic respiratory conditions with a focus on functioning and addressing impairments in function, activity limitations, and participation restrictions. PRM physicians, by virtue of the definition of PRM, their competencies, and their focus on functioning may make unique contributions when leading pulmonary rehabilitation programmes.

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#### SUPPLEMENTARY MATERIALS

#### Supplementary Appendix I.— Literature search

Specifically, the literature search for the identification of papers relevant to the PRM profession regarding persons with respiratory conditions as judged by two authors (AO and PT) was performed using the below search strings in Pubmed/ MEDLINE as follows:

("Respiratory\*" OR "pulmonary" OR "lung") AND rehabilit\* ((Guideline[ptyp] OR Meta-Analysis[ptyp] OR Randomized Controlled Trial[ptyp] OR systematic[sb] )) with the activated filters of publication date from 2007/01/31 to 2017/01/31, Humans. (String 1)

and

Pubmed Clinical Queries: Pulmonary rehabilitation AND (Chronic obstructive pulmonary disease OR Asthma OR Bronchiectasis OR Cystic fibrosis OR Interstitial lung disease OR Obstructive sleep apnoea OR Lung transplantation) Filters activated: Review, Publication date from 2007/01/31 to 2017/01/31. (String 2)

The search for Cochrane reviews from the Cochrane library was performed using the two string as follows:

http://onlinelibrary.wiley.com/cochranelibrary/search/mesh?searchRow.searchCriteria. meshTerm=%22Respiration+Disorders%22&searchMesh=Lookup&searchRow.ordinal=0&hiddenFields. strategySortBy=last-modified-date%3Bdesc&hiddenFields.showStrategies=false&hiddenFields.containerId= &hiddenFields.etag=&hiddenFields.originalContainerId (**String 1**)

and

http://onlinelibrary.wiley.com/cochranelibrary/search/mesh?searchRow.searchCriteria. meshTerm=Lung+Diseases&searchRow.searchOptions.qualifiers=Q000534&searchMesh=Lookup&searchRow. ordinal=0&hiddenFields.strategySortBy=last-modified-date%3Bdesc&hiddenFields.showStrategies= false&hiddenFields.containerId=&hiddenFields.etag=&hiddenFields.originalContainerId (**String 2**).

We also searched from cited references for relevant literature in the retrieved papers as well as position papers by the UEMS PRM Section.

Supplementary Figure 1. Flow Chart of papers selection



Health Condition /problem	PRM approach	Evidence of effectiveness S		Author(s), year, (ref. n.)	LoE/
					SOE
COPD/Acute exac- erbations	Airway clear- ance tech- niques	Significant (albeit small) reductions in the requirement and duration of ventilatory assistance (by a MD of -2.05 days) and hospital days (by a MD of -0.75 days) in short-term, but not on HRQoL. However, significant benefits in HRQoL (by a MD of -6.10), reduction in disease-related hospitalisation in short-term in stable patients.	CR	Osadnik et al., 2012 <sup>1</sup>	II/ Weak
COPD	Upper limb exercise	Improvements in dyspnoea (by a MD of 0.37) and upper limb exercise capacity (by a SMD of 0.66), but not in HRQoL when compared with no training.	CR	McKeough et al., 2016 <sup>2</sup>	I/Low –mod.
COPD	Pulmonary rehabilitation	Moderately large and clinically significant reductions in fatigue (by a MD of 0.68) based on low-quality evidence) and dyspnoea (by a MD of 0.79) (based on moderate-quality evidence), improvements in emo- tional function (by a MD of 0.56) and mastery of control of the health condition (by a MD of 0.71)(both based on low-quality evidence); beneficial effects on exercise capacity (by a MD of 6.77), all dimensions of SGRQ with better total scores (by an MD of -5.15)(based on low quality evidence) and HRQoL when compared with usual care to a degree non necessitating further trials. Hospital-based being superior to community-based programmes in terms of all domains of the CRQ, but not for SGRQ. Similar significant improvements in 6MWT (by a MD of 43.93m) with functional and maximal exercise. No significant difference of efficacy between 'only exercise' and 'complex pulmonary rehabilitation programmes'.	CR	McCarthy et al., 2015 <sup>3</sup>	I/ High qua-lity
COPD/exacer- bations	Pulmonary rehabilitation	Significant reductions in hospitalizations and mortality as well as beneficial effects on HRQoL above the minimally important difference (by a MD of -7.80 for SGRQ) based on high quality evidence and reductions in activity limitations, exercise capacity and walking (6MWT improving by 62m) based on high quality evidence; no significant effects for symptoms; No effect on readmissions to hospital or mortality; Caution needed for adverse events.	CR	Puhan et al., 2011⁴	I / h i g h qua-lity
COPD/mild symp- toms	Pulmonary rehabilitation	Significant improvement (albeit small) in HRQoL in the short-term based on moderate quality evidence and nonsignificant improvement in the distance of walking.	SA/MA	Rugbjerg et al., 2015⁵	I/mod.
COPD	Pulmonary rehabilitation	Significant favourable outcomes regarding hospitalization and rehospitalisation rates when compared with control groups in RCTs; The opposite finding for rehospitalisations in cohort studies (in real world).	SR/MA	Moore et al., 2016 <sup>6</sup>	I/
COPD	Pulmonary rehabilitation	Inconsistent beneficial effects on balance (inconsistent limited evidence); the same for survival.	SR	Hakamy et al., 2016 <sup>7</sup>	I/Limited
COPD	Home/commu- nity- vs. centre- based pulm. rehab	Improvement in exercise capacity (6MWT, incremental shuttle walk test), dyspnoea, and HRQoL (SGRQ, CRDQ) when compared with controls. Similar beneficial effects on exercise capacity and HRQoL when compared with centre-based pulmonary rehabilitation.	SR/MA	Neves et al., 2016 <sup>8</sup>	I/mod.
COPD	Exercise + psychological interventions	Consistent improvement with combined exercise and psychological interventions in exercise capacity (SMD from 0.22 to 1.23), HRQoL (SMD from 0.09 to 1.16), dyspnoea (SMD from $-1.63$ to $-0.25$ ), depression SMD from $-0.46$ to $-0.18$ ), and anxiety (SMD from $-0.50$ to $-0.20$ ) compared with controls. Consistent improvement with combination in exercise capacity (SMD from 0.64 to 0.71), dyspnoea (SMD from $-0.35$ to $-0.97$ ), and anxiety (SMD from $-0.13$ to $-1.00$ ) when compared with other active interventions. and but not for depression or HRQoL.	SR	Wiles et al., 2015 <sup>9</sup>	I/

COPD	Resistance training	Significant improvements in CRDQ dyspnoea score (by a WMD of 0.59), strength of muscles, and FEV1 (by a WMD of 6.88%) when compared with no exercise with DRT; significant improvements in SGRQ total (by a WMD of -7.44) and each dimension score, and strength of muscles with the combination of DRT and AET. No significant difference in VO <sub>2</sub> max, 6MWT, and peak work load between the intervention and control groups.	SR/MA	Liao et al., 2015 <sup>10</sup>	I/low to mod.
COPD	Resistance + endurance exc.	Similar efficacy with aerobic & resistance exc. in exercise capacity, distance walked, HRQoL. Significant improvement in lower ext. muscle strength (by a SMD of 0.69) when combined.	SR/MA	lepsen et al., 2015 <sup>11</sup>	I/ Mod.
COPD	Patient educa- tion	Improvement (albeit small) in SGRQ (HRQoL) (by a MD of -2.8) compared with usual care at a year (mod- erate-quality evidence). No effect on psychological morbidity (low-quality evidence). Supported education likely to reduce hospitalizations; unlikely to affect mortality.	CR	Howcroft et al., 2016 <sup>12</sup>	I/Mod.
COPD	Self-manage- ment	Improvement in HRQoL (by a SMD 0.08) at 12 months, duration to be hospitalized related to COPD or for any reason, particularly in men, those with more impaired lung function, those with moderate self-efficacy and high BMI, however inconsistently; no effects on mortality.	MA	Jonkman et al., 2016 <sup>13</sup>	I/
COPD	Supported self- manag.	Favourable effects of multicomponent interventions (by a MD of2.40 in SGRQ at 6 months) on HRQoL and of exercise (by a MD of 4.87 in SGRQ at 3 months), but minimal effect on hospitalizations.	SR	Jordan et al., 2015 <sup>14</sup>	I/limited
COPD	Whole body vibration	Significant improvements in exercise capacity (6MWT); some benefits for HRQoL; no clear effects on lung function variables.	SR	Yang et al., 2016 <sup>15</sup>	I/ mod.
COPD/acute exac- erbations/ multimorbidities	Exercise (aero- bic, resistance,- balance,and/ or functional training)	Significant improvements in aerobic endurance parameters in patients with COPD and most of the mor- bidities with the exception of OA, OP, and depression; improvements in strength in those with COPD and old age, CHD, heart failure, and DM; improvements in HRQoL, function, and disease control; reduction in mortality risk in those with old age, COPD and/or CHD. Significant favourable effects of varying modalities of exercise in patients with acute exacerbations of COPD, and multiple associated comorbidities.	SR	Reid et al., 2012 <sup>16</sup>	l/mod,- good
COPD	Whole body vibration	Significantly superior to controls without exercise, sham WBV, or only exercise groups in terms of beneficial effects on 6MWT (exercise capacity) as preliminary evidence.	SR	Gloeckl et al., 2015 <sup>17</sup>	١/
COPD	Tai Chi	Benefits for exercise capacity, i.e. 6MWT (short term: by an MD of 16.02m in short-, 30.90m in mid-, and 24.63m in long-term), lung function variables, and HRQoL outcomes, i.e. CRDQ dyspnoea (by a MD of 0.90), fatigue (by a MD of 0.75), and total score (by an MD of 1.92) in short-term when compared with controls.	SR/MA	Guo et al., 2016 <sup>18</sup>	1/
COPD	Telehealth care	Telehealthcare provided via websites or phones and/or combined with exercise and/or education with favourable effects on the level of physical activity (by a MD of 64.7 min), dyspnoea (by a SMD of 0.088), and physical capacity (by a MD of 1.3m) when compared with usual care, education and/or exercise.	SR/MA	Lundell et al., 2015 <sup>19</sup>	l/weak
COPD	Spinal manipu- lation	Preliminary evidence of beneficial effects on lung function and exercise capacity when added to exercise	SR	Wearing et al., 2016 <sup>20</sup>	l/high
COPD	NMES	Significant improvements in leg extensor strength (by a SMD of 1.12) and exercise capacity-increase in distance (by a WMD of 51.53m), and endurance (by a SMD of 1.11).	MA	Chen et al., 2016 <sup>21</sup>	I/Weak
COPD	Nutritional support	Improvements in inspiratory/expiratory muscle strength, handgrip strength, weight gain and HRQoL, par- ticularly in those with improper/insufficient nutrition.	CR	Ferreira et al.,2012 <sup>22</sup>	I/low-mod.

COPD	Oxygen ther- apy	Reduction in breathlessness during exercising and performing ADL in patients with mild or no hypoxemia. No effect on HRQoL.	CR	Ekström et al., 2016 <sup>23</sup>	I/limit-mod.
Asthma	Physical train- ing	Considerable improvement in exercise capacity (VO <sub>2</sub> max) (by a MD of 4.92 mL/kg/min); no effects on lung function parameters; significant increase in heart rate max. (by a MD of 3.67 bpm); potential favourable effects on HRQoL.	CR	Carson et al., 2013 <sup>24</sup>	I/moderate
Asthma	Breathing exercises	Improvement in HRQoL (consistently), symptoms of asthma, decrease in the number of acute exacerba- tions, lung function with inconsistent findings in studies when compared with inactive controls or those with only education	CR	Freitas et al., 2013 <sup>25</sup>	I/Limited
Asthma	Inspiratory muscle train.	Significant improvements in inspiratory muscle strength (by a MD of $13.34 \text{ cmH}_2\text{O}$ ) (low quality evidence) and some inconsistent/ inconclusive evidence on lung function variables and dyspnoea	CR	Silva et al., 2013 <sup>26</sup>	I/Limited
Asthma	Water-based exercise	Due to high risk of bias in evaluated studies of very low quality, clear differences between water-based exercise in comparison with other approaches indeterminable	CR	Grande et al., 2014 <sup>27</sup>	I/very low
Asthma	Yoga	Subtle improvements in symptoms and in HRQoL	CR	Yang et al., 2016 <sup>28</sup>	l/ mod.
Asthma	Telemonitoring	No clear evidence of efficacy on exacerbation rate, emergency visits, or hospital stay with recording and symptom sharing with healthcare professional via phone calls, text or web messages when compared with usual care; possible benefits for HRQoL and lung function.	CR	Kew et al., 2016 <sup>29</sup>	I/weak
Asthma	Self-manag. support/digital interventions	Promising evidence revealing significant (albeit small) improvement in asthma control (by a SMD of 0.54) and asthma-specific HRQoL (by a SMD of 0.45).	SR/MA	McLean et al., 2016 <sup>30</sup>	l/ weak
Asthma	Supported self-manage- ment	Varying results depending on the target, those targeting patients for their active engagement in regularly reviewed educational programmes, professionals for skill training, and organisational factors with commitment to the health system and assessment of the efficacy of implementation at the same time with the most consistent favourable results relevant to clinical outcomes and process measures.	SR	Pinnock et al., 2015 <sup>31</sup>	I/strong
Asthma	Chronic dis- ease manag. Prog.	Potential favourable effects on HRQoL (by a SMD 0.22), severity of the health condition (by a SMD of 0.18), and tests of lung function (by a SMD 0.19) when compared with usual care in adults	CR	Peytremann et al., 2015 <sup>32</sup>	l/low -mod.
Obstructive Sleep Apnoea	Myofunctional therapy	Significant decrease in apnoea-hypopnoea index (by a MD of -14.26; ~50%); improvement in oxygen saturation (by a MD of 4.19%) and sleepiness; significant decrease in polysomnography snoring.	SR/MA	Camacho et al., 2015 <sup>33</sup>	١/
Obstructive Sleep Apnoea	Hypoglossal Nerve Stimu- lation	Significant reductions in apnoea-hypopnoea index by 50% and 57% and oxygen desaturation index by 48% and 52% at one year and similarly at 3 and 6 months. To be used if medical treatment fails.	SR/MA	Certal et al., 2014 <sup>34</sup>	IV/
Bronchiectasis	Airway clear- ance tech- niques	Possible improvements in some symptoms and lung function parameters, expectoration of the sputum, and HRQoL in persons in a stable condition; effects unknown in exacerbation or in the long-term.	CR	Lee et al., 2015 <sup>35</sup>	I/Limited

## "Evidence Based Position Paper on Physical and Rehabilitation Medicine (PRM) professional practice for persons with spinal cord injury. The European PRM position (UEMS PRM Section)"

https://www.ncbi.nlm.nih.gov/pubmed/29952157

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## Evidence Based Position Paper on Physical and Rehabilitation Medicine (PRM) professional practice for persons with spinal cord injury.

### The European PRM position (UEMS PRM Section)

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#### ABSTRACT

#### Introduction:

Spinal cord injury (SCI) is a devastating condition and a challenge for every health system and every society.

#### Aim:

The aim of the paper is to improve Physical and Rehabilitation Medicine (PRM) physicians' professional practice for persons with SCI in order to improve their functionality, social and community reintegration, and to reduce activity limitations and/or participation restrictions.

#### **Material and Methods:**

A systematic review of the literature and a consensus procedure by means of a Delphi process have been performed involving the delegates of all European countries represented in the UEMS PRM Section.

#### **Conclusion:**

The professional role of PRM physicians having expertise in the rehabilitation of SCI is to lead rehabilitation programmes in multi-professional teams, working in interdisciplinary way in a variety of settings to improve functioning of people with SCI. This EBPP represents the official position of the European Union through the UEMS PRM Section and designates the professional role of PRM physicians for people with SCI.

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## Introduction

According to World Health Organization (WHO) whereas 15% of the population is affected by disability, less than 0.1% of the population suffer spinal cord injury (SCI). The small number of people with SCI does not reflect the importance of this special group of patients for health systems globally and for disability. The management of these persons challenges almost every aspect of the health system and almost every aspect of Physical and Rehabilitation Medicine (PRM). A health system with adequate PRM programmes and facilities for people with SCI in particular will inevitably be more inclusive of disability in general. Improved accessibility and greater availability of assistive devices will help millions of the world's disabled among them the increasing number of older people<sup>1</sup>.

The epidemiological data for incidence and prevalence of SCI are lacking globally. In many countries there are not official epidemiological data for SCI. Few countries in the world have SCI registries<sup>1</sup>. Fitzharris, et al in 2011 estimated that globally in 2007, there would have been between 133 and 226 thousand incident cases of traumatic SCI from accidents and self- harm/violence. The global incidence of traumatic SCI was estimated to be 23 cases per 1,000,000 persons (179,312 cases per year)<sup>2</sup>. DeVivo in 2012 reported: "Incidence and prevalence of SCI in the US are higher than in the rest of the world. Average age at injury is increasing in accordance with an aging general population at risk. The proportion of cervical injuries is increasing, while the proportion of neurologically complete injuries is decreasing. Injuries due to falls are increasing. Recent gains in general population life expectancy are not reflected in the SCI population<sup>3</sup>. Lee, et al in 2014 wrote that global prevalence of traumatic SCI was between 236 to 4187 per million. He also reported the missing prevalence data for major populations that persisted<sup>4</sup>. Non-traumatic SCI prevalence data are lacking. Some information is available only for Australia (367 per million population) and Canada (1227 per million population)<sup>5,6</sup>. To a large extent non-traumatic SCI are underestimated even in countries with good statistical services in relation to traumatic SCI<sup>6</sup>.

PRM physicians during their training in PRM specialty are adequately trained and qualified to treat patients with SCI during acute, post-acute and chronic phase<sup>7,8,9,10,11</sup>.

Clinical examination, use of specialized scales and classifications [International Standards for Neurological Classification of SCI (ISNCSCI), ASIA Impairment Scale (AIS), Spinal Cord Independence Measure (SCIM), International SCI core data sets by ISCoS, classification of neuropathic bladder dysfunction according to the terminology of International Continence Society (ICS)] are very important in the everyday clinical practice of PRM physician.

Collaboration of ISPRM, WHO and ISCoS12 has been made under the special need for high-quality rehabilitation services and social and community reintegration for persons with SCI. PRM physicians in different settings of rehabilitation services<sup>13</sup> and from the first few days to life-long specialized follow-up care of patients with SCI, are responsible for the prognosis, prevention, early diagnosis and management of secondary conditions, and complications<sup>14</sup>. Main goals of PRM physician and rehabilitation team is the fully reintegration and high quality of life of the person with SCI in family, community, society taking into consideration body structure and function, activities and participation, personal and environmental factors according to ICF. (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/).

Why PRM physicians are involved in SCI rehabilitation programmes: In the origin of Physical and Rehabilitation Medicine, spinal cord injuries were one of the main subjects of this medical specialty in dealing with the victims of the Second World War and to give official standing to rehabilitation medicine in the military and the Veterans Administration after Second World War<sup>15</sup>. The disability model for people with spinal cord injuries is a fundamental professional practice topic for Physical and Rehabilitation Medicine physicians. A health system with adequate PRM programmes and facilities for people with SCI in particular, will inevitably be more inclusive of disability in general. Improved accessibility and greater availability of assistive devices will help millions of the world's disabled among them the increasing number of older people<sup>1</sup>.

SCI leads to multisystem impairments<sup>16</sup>: sensory and motor, autonomic nervous system (bladder, bowel, cardiovascular system, thermoregulation, sweating, sexual function), skin and underlying tissues fragility, digestive system, respiratory system, muscle tone, pain nociceptive and neuropathic, bone demineralization.

Rehabilitation pathway in healthcare system and society is described in Chapter 8 of the White Book of PRM for every person with disability needing rehabilitation<sup>17</sup>.

## Material and Methods

This EBPP is produced according to the methodology proposed by the UEMS-PRM Section in the 'Methodology' paper by Negrini et al<sup>18</sup>. The EBPP comprises of two parts: 'Systematic review of the literature' and 'consensus with Delphi procedure among UEMS PRM Section delegates. The grading of the Strength of Evidence (SoE) and the Strength of Recommendation (SoR) and consensus on recommendations by the Delphi procedure are described in the 'Methodology' paper.

A comprehensive literature search of electronic databases was undertaken. The electronic search included MEDLINE/PubMed and the Cochrane library (1/1/2000 to 9/2016). All titles and abstracts retrieved were then assessed against inclusion criteria by two reviewers and agreement was achieved through discussion of the results of the full text articles phase. A log was maintained of all articles with reasons provided for any exclusion. This review considered guidelines, meta-analyses and systematic reviews. All studies must have been published in the English language. Study participants of any age or gender, with any level or completeness of SCI were included, or if an equivalent population was part of the analysis. No restrictions were placed on time elapsed since injury. PRM interventions were required to be applicable in the acute phase, during rehabilitation of SCI or in the chronic phase. Studies were excluded if: 1) a SCI population was not included 2) PRM interventions were not studied 3) the level of evidence was lower than that of a systematic review 4) results prior to 1/1/2000. Two categories of search terms were used to form the population and the intervention part as follows:

## Results

Through initial assessment of 8430 titles, the articles that were chosen for further analysis were 177 as is shown in the flow chart of papers' selection (Figure 1). Subsequently, data from each of the studies were extracted and a table was formed (Appendix 1); investigations involving similar interventions were grouped. Data extracted included the type of study, study results and methodological quality (strength of evidence grading, I, II, III or IV).

# Literature search revealed the following special issues: The importance of SCI team in post-acute SCI management.

SCI management includes overall treatment of medical, physiological, functional, psychological, and social consequences of the injury, from early moments on. Therefore, rehabilitation services must include a highly specialized multi-professional team lead by PRM physicians to assess levels and completeness of injury, to recognize the unique needs of SCI patients, to anticipate potentials for recovery and functional outcomes, to implement interventions to maximize patients' outcomes, and to prevent and treat both common and unusual medical complications. Postacute SCI management includes care of the wide array of multisystem dysfunctions, spinal and neurogenic shock, autonomic dysfunctions with simultaneous onset of myriad of symptoms of neurogenic bladder and bowel, and dysfunction in other systems<sup>19</sup>. The frequency of medical complications in SCI is inversely proportional to the quality of care available. Therefore, it is critical that the physicians directing care for the newly injured persons, and their teams possess expertise in post-acute management, in identifying of associated injuries, developing treatment plans to prevent medical complications, promptly diagnosing them if they occur and treating them expeditiously, alongside individually tailored, goal-oriented rehabilitation protocols.

Population	(spinal cord injuries[mh] OR spinal injuries[tiab] OR spinal cord injur*[tiab] OR spine injur*[tiab] OR spinal injur*[tiab] OR spinal cord trauma*[tiab] OR spinal fracture*[tiab] OR spinal cord lesion[All Fields] OR paraple- gia[mh] OR quadriplegia[mh] OR parapleg*[All Fields] OR quadripleg*[All Fields] OR tetrapleg*[All Fields] OR SCI[tiab])	
Interventions	(Rehabilitation[mh] OR physical medicine[tiab] OR conservative treatment[tiab] OR conservative management[tiab] OR Physical and Rehabilitation Medicine [All Fields] OR Rehabilitation Research [All Fields] OR Neurological Rehabilitation [All Fields])	
### Health related participation issues and long-term prevention of secondary complications in SCI, and the need for long-term PRM follow-up.

With greater life expectancies, the focus of rehabilitation and interventions for people with SCI has shifted from medical management to issues that affect quality of life, community participation<sup>20</sup> and overcoming environmental and societal barriers<sup>21</sup>. People with a chronic disability resulting from SCI develop complex rubrics for navigating their personal health care systems, while higher use of health care resources relates to older age, having substantial complications, and living in a longterm care facility. The care is provided by PRM specialists in outpatient departments or sometimes as an outreach from an institutional rehabilitation setting, home visiting programmes, or by telephone consultations. The most consistently mentioned issues are bowel and bladder problems and pain, adaptive equipment, prescription medications, spasticity and other issues. There is a need for annual comprehensive health evaluation and follow-up by specialized multi-professional teams, including awareness of areas in which there are often unmet needs, such as psychological concerns, sexual and reproductive health, and lifestyle issues. Patients undergo annual re-evaluations for the first 3-5 years until they establish a consistent record of healthy routines and participation in the community. As patients age with spinal cord injury, especially into their 2nd and 3rd decade of injury, their medical and functional conditions can change dramatically, and may require a resumption of annual evaluations.

### Assistive technology for people with SCI aims to increase their capacity to perform activities of daily living, enable participation and improve quality of life.

Using assistive technology (AT) has been associated with a higher participation in social life<sup>22</sup>, increasing employment rates, enabling learning and education, inclusion in the society and better quality of life<sup>23</sup>. AT can reduce the burden of care for society and families and the costs with services<sup>23,24</sup>. The type of assistive technology depends on the level of lesion and environmental factors. The main type of AT, related to the functional need of person with SCI, are mobility devices, communication devices, selfcare and home-care aids and environmental control units. Among these, mobility aids, mainly wheelchair is one of the most important pieces of AT for the individual with SCI<sup>25,26,27</sup>.

With the development of materials and technology, the diversity of assistive devices has increased dramatically, from the basic wheelchair to the smart devices like wearable robotic orthosis or braincomputer interface, making the process of choosing the appropriate device a real challenge for the clinicians. There is a growing body of evidence to guide clinical decision making in choosing the most appropriate equipment that is highly needed in order to improve functioning and is available at a price the community can afford. PRM physicians have to be aware of the existence of affordable assistive products that can be cost-effective in order to reduce disability burden<sup>28</sup>.

### Final Recommendations for Physical and Rehabilitation Medicine Professional Practice in Europe.

The results of the consensus procedure are displaced in tables 1,2,3,4 & 5.

## A. Overall general recommendation

1. The professional role of PRM physicians for persons with SCI, is to improve specialized rehabilitation services worldwide in different settings (acute, post-acute and long-term) and to organize a comprehensive PRM treatment for the patients considering all comorbidities and complications, impairments, activity limitations and participation restrictions. (<sup>29,23,1</sup>) [SoE: IV; SoR: A]

Level of agreement (LoA) per group of recommendations: Unanimous (U)

# **B.** Recommendations on PRM physicians' role in Medical Diagnosis according to ICD

2. It is recommended that PRM physicians monitor closely and regularly (with a frequency dictated by the phase post-SCI) persons with SCI for the neurological level and severity of injury, using at a minimum the International Standards for Neurological Classification of SCI (ISNCSCI) (<sup>30,31,32</sup>). [SoE: IV; SoR: A]

3. It is recommended that PRM physicians classify patients for complete or incomplete paraplegia or tetraplegia according to AIS (American Spinal Injury Association Impairment Scale) (<sup>30,32,31</sup>). Regular reassessment is recommended to identify changes of AIS (e.g. from AIS B to AIS C). [SoE: IV ; SoR: A]

4. It is recommended that PRM physicians proceed to further imaging and neurophysiology tests (e.g. radiography, CT, MRI or electrodiagnostics) in the event of deterioration of the neurological level, and/or completeness of injury, and/or functional level, either in the acute, post-acute, or chronic phase of injury (<sup>33,34</sup>). [SoE: IV; SoR: A]

It is recommended that during the acute 5. and post-acute phase, PRM physicians monitor closely and regularly persons with SCI for the early diagnosis and treatment of secondary conditions such as neurogenic bladder(35,36,37,38,39,40,41,42) and dysfunction $(^{43,44})$ , dysfunction, bowel sexual spasticity(<sup>50,51,52,53</sup>), pain(45,46,47,48,49), pressure ulcers(<sup>54-61</sup>), infections (urinary tract, respiratory, etc), osteoporosis(62,63), sarcopenia, spinal deformity, deep vein thrombosis(64), respiratory dysfunction(65,66), cardiovascular dysfunction including autonomic dysreflexia (67-72), depression(73-78), sleep problems, falls, etc. [SoE: IV; SoR: A]

6. It is recommended that during the chronic phase, PRM physicians monitor closely for complications and at a minimum annually review person with SCI for neurogenic bladder dysfunction and their overall health status (<sup>79,80,36</sup>). [**SoE: IV; SoR: A**]

7. It is recommended that PRM physicians monitor persons with SCI for neurogenic bladder dysfunction at least once with urodynamics. Urodynamics may be repeated in the following situations: to verify the efficacy of the bladder management, if bladder emptying is not balanced and safe for the upper urinary tract, and if complications (recurrent urinary tract infections, vesico-ureteric reflex, etc.) occur (<sup>81</sup>). [SoE: IV; SoR: B]

8. It is recommended that for neurogenic bladder follow-up PRM physicians, routinely, consider existing guidelines of well recognized scientific societies in this field (e.g. International Spinal Cord Society, International Continence Society, European Urology Association, etc.) and/or local/national guidelines, if available. Accordingly, the existing PRM guidelines are considered in every PRM intervention (<sup>81</sup>). [**SoE: IV; SoR: A**]

*Level of agreement (LoA) per group of recommendations: Good (G)* 

# C. Recommendations on PRM physicians' role in PRM diagnosis and assessment according to ICF

9. It is recommended that PRM physicians plan individualized rehabilitation programmes and medical management for persons with SCI according to her/his specific needs identified through periodic assessment using the ICF/ICF-based instruments, goals setting, targeting body structures and functions, activities, participation, personal and environmental factors (<sup>82,83,84,85</sup>). [SoE: IV; SoR: A]

10. It is recommended that PRM physicians pay attention to the assessment of at a minimum the following ICF categories of Brief ICF Core Sets for SCI in the post-acute and long-term context (Table 6 & 7):

<sup>(85)</sup> (ICF browser. http://apps.who.int/ classifications/ icfbrowser/) [**SoE:IV, SoR: A**]

Brief ICF Core Sets for SCI in the post-acute context

p.6:

https://www.icf-research-branch.org/download/ send/8-neurologicalconditions/79-comprehensiveand-brief-icf-core-set-for-sci-in-the-post-acutecontext

and Brief ICF Core Sets for SCI in the long-term context

p.13-4:

https://www.icf-research-branch.org/download/ send/8-neurologicalconditions/80-comprehensiveand-brief-core-sets-for-sci-in-the-long-termcontext

11. It is recommended that PRM physicians further evaluate the physical activity level of an individual with SCI in depth using validated instruments (86,87,88) [SoE: IV; SoR: A]

Level of agreement (LoA) per group of recommendations: High (H)

### D. Recommendations on PRM management and process - Inclusion criteria (e.g. when and why to prescribe PRM interventions)

12. It is recommended that PRM physicians prescribe PRM interventions whenever needed throughout the pathway of care for persons with SCI, to decrease impairments in body functions, to

prevent or manage complications, to treat secondary conditions, and to improve and maintain functioning properties including activities and participation. <sup>(29,1)</sup> [SoE: IV ; SoR: A]

# Project definition (definition of the overall aims and strategy of PRM interventions)

13. It is recommended that the overall aims and strategy of PRM interventions are defined by a multi-professional team. An important role of PRM physician is to lead and coordinate the rehabilitation team in an interdisciplinary way and to plan the individualized PRM programs developed in team with other health professionals and medical specialists, in agreement with the patient, family and/ or caregivers, and according to the specific medical diagnoses and goals setting. (<sup>1,29</sup>) [SoE: IV; SoR: A]

14. It is recommended that PRM physicians to provide advice on policies and programmes among and across sectors, stakeholders, public, and decision makers to meet the needs of persons with SCI (<sup>1,29</sup>) [SoE: IV; SoR: A]

15. It is recommended that the PRM interventions can take place in different PRM settings, according to the phase post-SCI (acute, post-acute, chronic phase): PRM departments in general or university hospitals, PRM departments/centres, specialized SCI centres, community based PRM facilities including home-rehabilitation, where the rehabilitation team is specialised in SCI. <sup>(1,29,89)</sup> [SoE: IV ; SoR: A]

16. It is recommended that the rehabilitation programme for persons with SCI is planned on an individualised basis in a patient-centred approach. <sup>(1)</sup> [SoE: IV; SoR: A]

# Team work (professionals involved and specific modalities of team work)

17. It is recommended that the PRM physician is the coordinator of the multi-professional team, which is essential in the management of persons with SCI along all the phases post-SCI (acute, post-acute, chronic phase) <sup>(1)</sup>. [SoE: IV; SoR: A]

18. It is recommended that the multi-professional rehabilitation team, consisting of PRM physician, rehabilitation nurse, physiotherapist, occupational therapist, nutritionist, adapted physical activity and sports therapist, speech and language therapist

(for high tetraplegia with cannulas/ventilation), recreational therapist, orthotist, psychologist, social worker, vocational counsellor, liaison person (case manager) and community-based workers, peer counsellors, other medical specialists, and other health professionals participate in the specialized rehabilitation programme for patients with SCI in the acute, post-acute and chronic phase of rehabilitation. The multi-professional team working in an interdisciplinary way is patient-centred focusing on patient as well as on family members, significant others, and caregivers taking into account the patients' preferences. <sup>(1)</sup> [SoE: IV; SoR: A]

### **PRM** interventions

19. It is recommended that the rehabilitation programme for persons with SCI is planned within the ICF framework, and goals setting is done with the cooperation and the consent of the patient/family-caregivers through the multi-professional team and interdisciplinary approach. <sup>(1,29,89)</sup> [SoE: IV ; SoR: A]

20. It is recommended that appropriate physical agents <sup>(90-94)</sup> (NMES, FES modalities, etc.) and advanced technology <sup>(95-100)</sup> (virtual reality, robotic rehabilitation, etc.) are incorporated in the SCI healthcare provision through every stage of recovery, whenever recommended and available [SoE: IV; SoR: B]

21. It is recommended that a therapeutic exercises programme in SCI is prescribed and adapted to SCI persons' needs, according to the neurological level of injury, age, and comorbidity (87). [SoE: IV; SoR: A]

22. It is recommended that PRM physicians prescribe assistive products to increase independence including computer-based technologies or smart homes, that should be considered in certain conditions in persons with SCI to provide and/or increase independence <sup>(101,102)</sup> [SoE: IV; SoR: A]

recommended that educational 23. It is interventions and helpful resources, credible websites, organisations, and targeting selfmanagement are provided to persons with SCI improving independence, promoting a healthy lifestyle, as well as reducing the impact of secondary complications <sup>(103,104)</sup>. [SoE: I; SoR: A]

24. It is recommended that healthy life-style promotion programmes including healthy nutrition,

regular therapeutic exercises and effort training, and participation in athletic activities, are incorporated in the rehabilitation programme of persons with SCI <sup>(67,72,105,106,107,108,88)</sup>. **[SoE: I; SoR: A]** 

25. It is recommended that psychosocial interventions are considered for the management of pain, depressive symptoms, anxiety, and delayed adjustment to disability of persons with SCI <sup>(73,75,76,77)</sup>. **[SoE: I; SoR: A]** 

26. It is recommended that PRM physicians organize tele-health interventions and tele-rehabilitation to improve health care provision and continuing rehabilitation in the chronic phase post-SCI, particularly for people with SCI in remote areas <sup>(1,73)</sup>. **[SoE: IV; SoR: A]** 

27. It is recommended that home visits and occupational therapy interventions for home adaptations are offered before discharge to home, where feasible <sup>(1)</sup>. [SoE: IV; SoR: A]

28. It is recommended that vocational rehabilitation is systematically and adequately offered to improve employment rates and decrease the high rates of unemployment of persons with SCI during their working life. <sup>(83,109,110111)</sup>.

[SoE: IV; SoR: A]

## Outcome criteria

29. It is recommended that PRM physicians decide on the outcome criteria during the assessment and goal-setting processes within the ICF framework. Spinal Cord Independence Measure (SCIM III) is adequately validated and must be used to assess components of functioning during rehabilitation <sup>(112,113,32,31)</sup>. Walking Index for SCI (WISCI II) should be used to assess ambulation of persons with SCI <sup>(114)</sup>. **[SoE: IV; SoR: A]** 

# Length/duration/intensity of treatment (overall practical PRM approach)

30. It is recommended that PRM physicians as coordinator of the multi-professional team, establish objectives of treatment decisions/plans/programs according to the specific needs of individuals with SCI in terms of duration and intensity of a specific treatment, in agreement with team and patient/family-caregivers. [SoE: IV; SoR: A]

Discharge criteria (e.g. when and why to end PRM interventions)

31. It is recommended that PRM physicians decide the discharge criteria from inpatient rehabilitation facilities and liaise to outpatient facilities taking into consideration the individual needs for each person with SCI such as medical stability, nursing and medical requirements, rehabilitation goal attainment, home and caregiver situation and possibility of transportation. [SoE: IV; SoR: A]

### Follow up criteria and agenda

32. It is recommended that PRM physicians should provide life-long monitoring for persons with SCI to look for further functional decline, to detect additional impairments in body functions, activity limitations and participation restrictions <sup>(115,116)</sup> [SoE: **III ; SoR: A**]

33. It is recommended that during longterm follow-up, prevention & management of secondary complications (including pressure (35,36,37,38,39,40,41,42) ulcers<sup>(54-61)</sup>, neurogenic bladder spasticity<sup>(50,51,52,53)</sup>. dysfunction<sup>(43,44)</sup>, & bowel pain<sup>(45,46,47,48,49)</sup>, and neuropathic nociceptive heterotopic ossifications(117,118), osteoporosis<sup>(62,63)</sup>, sarcopenia, low energy fractures, orthostatic hypotension(70,71,119), cardiovascular and respiratory function including autonomic dysreflexia, sexuality-reproductive issues<sup>(120-123</sup>) is dealt with the PRM physician and the multiprofessional rehabilitation team. [SoE: IV; SoR: A]

34. It is recommended that a robust system of primary healthcare and/or community based rehabilitation, accessible to people with SCI, is offered, under the supervision of PRM physician, including annual comprehensive examination and appropriate specialized services by the multiprofessional rehabilitation team as part of the long-term follow up and provision of care for persons with SCI <sup>(80,79,89)</sup>. **[SoE: IV; SoR: A]** 

35. It is recommended that PRM physicians continue long-term follow-up of persons with SCI, also when ageing, aiming to meet the individualized needs of the person using diverse treatment strategies along the lifespan of these persons with a life-long disability <sup>(115,116)</sup> (see also EBPP for ageing persons with disabilities<sup>124</sup>) [**SoE: IV; SoR: A**]

36. It is recommended that PRM physician develop and/or join a network of specialists involved in SCI care, in order to share knowledge and expertise **[SoE: IV; SoR: A]** 

*Level of agreement (LoA) per group of recommendations: Good (G)* 

## **Conclusion:**

The professional role of PRM physicians having expertise in the rehabilitation of SCI is to lead rehabilitation programmes in multi-professional teams, working in an interdisciplinary way in a variety of settings to improve the functioning of people with SCI. This EBPP represents the official position of the European Union through the UEMS PRM Section and designates the professional role of PRM physicians for people with SCI.

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## Figure 1. Flow Chart of papers selection



#### Table 1. Results of the Consensus procedure

Round	Number of recommendations	Accept	Accept with suggestions	Reject
1	40	10.0%	90.0%	7,5%
2	37	46%	54%	0
3	40	97,5%	2,5%	0
4	40	95%		5%
5	38			

#### Table 2. Level of Agreement grading.

Level of agreement	Abbreviation	Meaning
Unanimous	U	100%
Very High	VH	95-99.9%
High	Н	90-94.9%
Good	G	80-89.9%

streng	th of	recom	nendation	as
6				

A: It must be normally applied;

#### or B: It is important, but can be applied not in all situations;

#### or C: Less important, it can be applied on a voluntary basis;

or D: Very low importance

#### Table 4. Level of agreement grading

Level of agreement (LoA)	Abbreviation	Meaning
Unanimous	U	100%
Very High	VH	95-99.9%
High	Н	90-94.9%
Good	G	80-89.9%

#### Table 5. Overall view of the recommendations

Content	Number of Red mendations	com-	Strength of recommendations			Strength of evidence				Level of Agreement	
	Number	%	A	В	C	D	Ι	II	III	IV	
Overall recommen- dation	1		100%	0	0	0	0	0	0	100%	U (100%)
PRM physicians' role in Medical Diagnosis according to ICD	7		85.71%	14.29%	0	0	0	0	0	100%	G (83,9%)
PRM physicians' role in PRM diagno- sis and assessment according to ICF	3		91.67%	8.33%	0	0	0	0	0	100%	Н (91,6%)
Recommendations on PRM manage- ment and process	25		80.0%	17.5%	2.5%	0	12%	0	4%	84%	G ( 80%)
Recommendations on future research on PRM profession- al practice	2		87.5%	6.25%	6.25%	0	0	0	0	100%	G (87,5%)
TOTAL	38		82.9%	15.13%	1.97%	0	7,9%	2,6%	0	89,5%	G (85,53%)

#### Table 6: Brief ICF Core Sets for SCI in the post-acute context

	ICF code Title	Early post-acute SCI	
Body Functions	b152	Emotional functions	
	b280	Sensation of pain	
	b440	Respiration functions	
	b525 Defecation fund		
	b620	Urination functions	
	b730	Muscle power functions	
	b735	Muscle tone functions	
	b810	Protective functions of the skin	
Activity & Participation	d410	Changing basic body position	
	d420	Transferring oneself	
	d445	Hand and arm use	

	d450	Walking
	d510	Washing oneself
	d530	Toileting
	d540	Dressing
	d550	Eating
	d560	Drinking
Environmental Factors	e115	Products and technology for personal use in daily living
	e120	Products and technology for personal indoor and outdoor mobility and transportation
	e310	Immediate family
	e340	Personal care providers and personal assistants
	e355	Health professionals
Body Structure	s120	Spinal cord and related struc- tures
	s430	Structure of respiratory sys- tem
	s610	Structure of urinary system

## Table 7: Brief ICF Core Sets for SCI in the long-term context

	ICF code Title	chronic SCI			
Body Structure	b152	Emotional functions			
	b280	Sensation of pain			
	b525	Defecation functions			
	b620	Urination functions			
	b640	Sexual functions			
	b710	Mobility of joint functions			
	b730	Muscle power functions			
	b735	Muscle tone functions			
	b810	Protective functions of the skin			
Activity & Participation	d230	Carrying out daily routine			
	d240	Handling stress and other psychological demands			
	d410	Changing basic body position			
	d420	Transferring oneself			
	d445	Hand and arm use			
	d455	Moving around			
	d465	Moving around using equip- ment			
	d470	Using transportation			
	d520	Caring for body parts			
	d530 Toileting				

	d550	Eating
Environmental Factors	e110	Products or substances for personal consumption
	e115	Products and technology for personal use in daily living
	e120	Products and technology for personal indoor and outdoor mobility and transportation
	e150	Design, construction and building products and tech- nology of buildings for public use
	e155	Design, construction and building products and tech- nology of buildings for private use
	e310	Immediate family
	e340	Personal care providers and personal assistants
	e355	Health professionals
	e580	Health services, systems and policies
Body Structure	s120	Spinal cord and related struc- tures
	s430	Structure of respiratory sys- tem
	s610	Structure of urinary system
	s810	Structure of areas of skin

Bronchiectasis	Oscillating PEPP	Significant improvement in expectoration of the sputum compared with no intervention with similar effects as those of other airway clearance techniques on lung functional tests and dyspnoea; significant improvement in disease-specific and cough-related QoL compared to no intervention; no reduction in exacerbation rate.	SR	Lee et al., 2015 <sup>36</sup>	1/
Bronchiectasis	Pulmonary rehabilitation	Post-treatment improvement in incremental shuttle walk distance (by a WMD of 67m) and disease-spe- cific HRQoL (by a WMD of -4.65 units), but not at 6 months; no benefit on psychological symptoms or cough-related HRQoL (by a WMD of 1.3). No benefit on exercise capacity or HRQoL if started during an acute exacerbation. Exacerbation frequency reducing effect over a year for only exercise.	SR	Lee et al., 2016 <sup>37</sup>	I/mixed
Cystic fibrosis	Exercise	Beneficial effects (inconsistent) on pulmonary function, exercise capacity, and HRQoL with aerobic or anaerobic exercise or their combination in the short- or long-term compared with no exercise based on limited evidence.	CR	Radtke et al., 2015 <sup>38</sup>	I/Limited
Cystic fibrosis	PEPP	Significant exacerbation reducing effects when compared with other airway clearance techniques	CR	McIlwaine et al., 2015 <sup>39</sup>	l/ weak
Cystic fibrosis	Chest physio- therapy	Increases in transport of the mucus in the short-term	CR	Warnock et al., 2015 <sup>40</sup>	I/Weak
Interstitial lung disease	Pulmonary rehabilitation	Immediate improvement in 6MWT (by a WMD of 44.34 m), VO2max (by a WMD of 1.24 ml/kg/min;re- duction in dyspnoea (by a SMD of -0.66); improvement in HRQoL also in subgroups with idiopathic fibrosis	CR	Dowman et al., 2014 <sup>41</sup>	I/low to mod.
Dust-related respi- ratory dis.	Exercise	Short and longer term beneficial effects on exercise capacity and HRQoL based on very low quality evi- dence	CR	Dale et al., 2015 <sup>42</sup>	l/weak
Lung transplan- tation	Exercise	Significant improvements in muscle function, exercise capacity, and spinal BMD based on limited evidence.	SR	Wickerson et al., 2010 43	I/fair –mod.
Lung transplan- tation	Whole body vibration	Significant improvement in 6MWT, work rate when compared with the control group only with exercise	RCT	Gloeckl et al., 2015 <sup>44</sup>	/

BMD: Bone mineral density; COPD: Chronic obstructive pulmonary disease; CR: Cochrane review; CRDQ: Chronic Respiratory Disease Questionnaire; Guide: Guideline/ position paper; HRQoL: Health-related quality of life; MA: Meta-analysis; MD: Mean difference; 6MWT: Six-Minute Walk Test; mod.: moderate; NMES: neuromuscular electrical stimulation; PEPP: Positive expiratory pressure physiotherapy; RCT: Randomised controlled trial; SMD: Standardized mean difference; SR: Systematic review; SGRQ: St. George's Respiratory Questionnaire; WBV: Whole body vibration; WMD: Weighted mean difference

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Round		Number of recom- mendations	Accept	Accept with suggestions	Reject
1	1 <sup>st</sup> vote	23	92.9%	7.1%	0
	2 <sup>nd</sup> vote	23	92.9%	7.1%	0
2		23	99.5%	0.5%	0
3		23	100%	0	0
4		23	99.9%	0	0.1%
5		23			

SUPPLEMENTARY TABLE II.—Results of the Consensus procedure.

#### SUPPLEMENTARY TABLE III. — Overall view of recommendations

Content	Recom- men-dations	Strength of recommendations				Strength of evidence			
	Number	А	В	С	D	I	П	Ш	IV
Overall recommendation	1	100%	0	0	0	0	0	0	100%
PRM physicians' role in Medical Diagnosis according to ICD	2	86.36%	13.64%	0	0	0	0	0	100%
PRM physicians' role in PRM diagnosis according to ICF	1	90.91%	9.09%	0	0	0	0	0	100%
PRM physicians' role in PRM assessment according to ICF	3	81.81%	18.19%	0	0	0	0	0	100%
Recommendations on PRM management and process	14	85.71%	14.29%	0	0	0	0	0	100%
Recommendations on future research on PRM professional practice	2	27.27%	72.73%	0	0	0	0	0	100%
TOTAL	23	81.03%	18.97%	0	0	0	0	0	100%

## Evidence Based Position Paper on Physical and Rehabilitation Medicine (PRM) professional practice for persons with acute and chronic pain. The European PRM position (UEMS PRM Section)

https://www.ncbi.nlm.nih.gov/pubmed/29984569

Gabor Fazekas, Filipe Antunes, Stefano Negrini, Nikolaos Barotsis, Susanne R. Schwarzkopf, Andreas Winkelmann, Enrique Varela-Donoso, Nicolas Christodoulou

## Evidence Based Position Paper on Physical and Rehabilitation Medicine (PRM) professional practice for persons with acute and chronic pain.

## The European position Produced by the UEMS-PRM Section

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#### ABSTRACT Introduction:

Pain is a frequent complaint from patients undergoing rehabilitation. It can be a major problem and can lead to several activity limitations and participation restrictions. For this reason, when the Professional Practice Committee (PPC) of the Physical and Rehabilitation Medicine (PRM) Section of the European Union of Medical Specialists (UEMS) decided to prepare evidence-based practice position papers (EBPPs) on the most relevant fields of PRM, a paper on the role of the PRM specialist on pain conditions was also included.

#### Aim:

The goals of this paper are to provide recommendations on the PRM physician's role in pain management; how to address this major problem and what is the best evidencebased approach for the PRM physician in acute and chronic pain conditions.

#### Method:

This paper follows the methodology defined by the Professional Practice Committee of the UEMS-PRM Section1. A systematic literature search in PubMed was carried out and the results obtained from filtered papers were subjected to four Delphi rounds.

**Results:** Through the literature selection process, thirty-one reccomendations are presented in the paper.

#### Results

Fifteen recommendations were obtained from the Consensus Process and systematic review and were approved by all of the

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delegates of the UEMS-PRM Section. It is recommended that PRM physicians focus on pain as a primary aim of their interventions, in whatever field they are applying their competencies. It is also recommended that the approach to pain focuses either on reducing the symptoms and improving functioning / reducing disability or recurrences and improving the health condition in the long term avoiding chronicity.

#### Conclusions

Every PRM specialist encounters the problem of pain and some specialise in this field and their role is greater than that of the regular PRM doctor. Based on the evidence available, it is reasonable to determine the role of the physiatrist in managing pain.

## Introduction

Pain is a very frequent complaint of patients undergoing rehabilitation. In the United States 25,3 million adults (11,2%) reported daily pain; persons with severe pain are likely to suffer from more severe disability than those who have less pain1. Of the eight most common rehabilitation diagnoses, musculoskeletal conditions, including low back pain, proved to have the highest load on the health care system because of their high prevalence and impact on disability<sup>2</sup>. All PRM physicians encounter this problem and have to manage it. In some cases the PRM doctors work in specialised pain clinics treating persons whose main problem is a pain syndrome. PRM physicians working in PRM departments have a unique advantage in dealing with pain, because the bio-psycho-social model approach of PRM is similar to the present approach to pain. Also PRM settings have most of the specialists and equipment, which are necessary for the comprehensive treatment of patients with pain. For this reason, when the Professional Practice Committee of the UEMS-PRM Section decided to prepare evidence-based practice position papers on the most relevant fields of PRM, it was decided that a paper on the role of the PRM specialist in pain management should also be included. The goal of this work is to provide recommendations on the role of the PRM specialist in managing the major problem of acute and chronic pain using the best evidence based approach.

The focus was on the role of the PRM specialist and not on the evaluation of specific interventions.

## Material and Methods

TThis paper has been developed according to the methodology defined by the Professional Practice Committee of the UEMS-PRM Section3. The systematic review of the literature was performed in PubMed, 3 July 2016. The string used for the first selection was "(("Pain"[MeSH Terms] AND Guideline[ptyp])OR("Pain"[MeSH Terms] AND "Cochrane Database Syst Rev"[Jour])) AND ("2011/07/04"[PDAT] : "2016/07/03"[PDAT])".

The selection process is reported in Figure 1. The only criterion for including the studies was the professional relevance for PRM physicians as judged by at least two of the authors, with the main author resolving conflicts. The Strength of Evidence (SoE) and the Strength of Recommendation (SoR) are given according to the Methodology paper. The consensus with the Delphi procedure has followed the 4 steps proposed by the Methodology paper.<sup>3</sup> The final recommendations were approved by at least ninety percent of the members of the PPC, or all delegates in the relevant Delphi rounds.

## Results

## Systematic review

Initially 477 papers were found, but only 11 were finally accepted according to the inclusion criteria of the Evidence Based Position Papers. The reason for the high rate of excluded papers is that in spite of the numerous publications on pain only very few concerned the role of the PRM physician. Several others dealt with certain interventions, which are not primarily designated to a PRM physician and have no special PRM relevance. The included papers contain commitments to the approach and tasks of the PRM specialist or pain management relevant to PRM. No paper was found that describes the role of the PRM specialist in pain conditions in general. The selected papers deal with certain pain conditions (mainly low back pain, but also adhesive capsulitis and osteoarthritis) or focus on interventions used in pain release (Transcutaneous electrical nerve stimulation -TENS, pilates etc). All of the included papers are Cochrane reviews, thus they represent a larger number of studies.

During the first Delphi Round, 15 recommendations were set up in eight categories. In the later phases the wording of some recommendations were changed. Instead of recommending that the PRM physician should apply pain treatment only in the presence of "a complete diagnosis" the phrasing in the presence of "a diagnosis as complete as possible" was approved, because it emphasizes both the importance of diagnosing the cause of the pain and also the relevance of pain relief as soon as possible. There was a suggestion to use the term "bio-psycho-social rehabilitation" as often mentioned by pain specialists. However, the phrase "comprehensive rehabilitation" was approved as it is used in PRM. There were no new recommendations added or deleted after the first round of the Delphi process.

### Recommendations

#### Overall general recommendation

#### **Recommendation 1**

It is recommended that PRM physicians focus on pain as a primary aim of their interventions, in whatever field they are applying their competencies. It is recommended that the approach to pain focuses either on reducing the symptoms and improving functioning / reducing disability or recurrences and improving the health condition in the long term and to avoid chronicity. **[SoE: IV; SoR: A]** 

Recommendations on PRM physicians' role in Medical Diagnosis according to ICD

#### **Recommendation 2**

It is recommended that PRM physicians apply pain treatments only in the presence of a diagnosis that is as complete as possible, based on the underlying pathology, resulting in nociceptive, neuropathic or mixed pain. [SoE: IV ;SoR: A]

Recommendations on PRM physicians' role in PRM diagnosis according to ICF

#### **Recommendation 3**

Since diagnosis of patients' functioning in relation to pain (either nociceptive, neuropathic or mixed) is the fundamental condition of clinical pain assessment, it is recommended that PRM physicians obtain a complete history and clinical examination, including functional assessment, and focus on the patients' individual needs and preferences<sup>4,5</sup>. [SoE IV ;SoR: A]

### **Recommendation 4**

It is recommended that PRM physicians perform a complete functional assessment of pain syndromes from acute to chronic settings<sup>6,7</sup>. [SoE: IV; SoR: A]

Recommendations on PRM management and process

#### **Recommendation 5**

It is recommended that PRM physicians carefully follow the current evidence-based Clinical Guidelines on the different pain syndromes (references of current Guidelines) [SoE: IV ; SoR: A]

#### **Recommendation 6**

It is recommended that PRM physicians use a uniform terminology to manage all pain conditions related to nociceptive and neuropathic pain<sup>8</sup>. [SoE: IV ; SoR: A]

Project definition (definition of the overall aims and strategy of PRM interventions)

#### **Recommendation** 7

It is recommended that PRM physicians define the treatment and rehabilitation plan and manage the team in the multi-professional comprehensive rehabilitation of pain syndromes. [SoE: IV ;SoR: A]

Team work (professionals involved and specific modalities of team work)

#### **Recommendation 8**

It is recommended to provide multi-professional comprehensive rehabilitation by a rehabilitation team, co-ordinated by PRM physicians for management of patients with chronic pain syndromes. [SoE: IV; SoR: A]

#### **Recommendation 9**

It is recommended that multi-professional comprehensive rehabilitation in a team managed by PRM physicians, is delivered in the different PRM settings, including multidisciplinary pain clinics, rehabilitation centres or outpatient settings<sup>9</sup>. [SoE: IV ; SoR: A]

### **Recommendation 10**

It is recommended that the PRM programme for chronic pain syndromes are delivered by clinicians from different disciplines, one specialised for specific pain treatment and with a minimum of two healthcare professionals from different professional backgrounds, who would be involved in the intervention delivery. The different components of the intervention must be offered as an integrated PRM programme, involving team management by a PRM physician<sup>10</sup>. [**SoE: IV**; **SoR: A**]

## **PRM** interventions

## **Recommendation 11**

It is recommended that PRM physicians prescribe an individual therapeutic plan with symptomatic and functional conditions based on multi-modal interventions according to individual needs and to the actual evidence<sup>10,11</sup>. [**SoE: IV ; SoR: A**]

#### **Recommendation 12**

It is recommended that the PRM treatment and rehabilitation plan includes all analgesic possibilities, from pharmacological to nonpharmacological therapeutic modalities according to the actual evidence<sup>12,13,14</sup>. [SoE: I; SoR: A]

## **Recommendation 13**

Physical exercises and mainly, individual exercises, seems to be appropriate in many pain conditions according to the actual evidence. Since PRM physicians are specialized in prescribing specially designed, individualized exercises, it is recommended that PRM physicians include this analgesic approach whenever possible in the therapeutic plan<sup>6,8,15,16,17,18,19</sup>. **[SoE: I ; SoR: A]** 

## **Recommendation 14**

It is recommended that PRM physicians encourage physical conditioning in all pain conditions, since it is a major issue in pain treatment and a part of return to work<sup>20</sup>. [SoE: IV; SoR: B]

## Outcome criteria

### Recommendation 15

It is recommended that PRM physicians use in the approach to pain syndromes, together with the classical physical examination, quality of life, pain and disability scales as outcome criteria according to the specific clinical situation. [SoE: IV; SoR: B]

### **Discussion and conclusions**

On the basis of the Methodology paper of the PPC, there were 15 recommendations approved concerning the role of the PRM specialist in the field of pain. The recommendations cover eight categories. As an overall general rule, it was accepted that PRM specialists should focus on pain as a primary aim of their work and not only as a side activity. As regards the medical diagnosis, it is necessary to treat the pain in the presence of a diagnosis as complete as possible (it is not always possible to have a complete diagnosis, but pain relief should be administered.) Function is a principle of PRM. For this reason when treating patients with pain, PRM physicians should not only obtain a general medical history, but also include functional conditions and perform a complete functional assessment. Rehabilitation of patients with pain can be provided in all kinds of PRM settings and should be carried out by a multi-professional team, co-ordinated by a PRM specialist. It was not the task of this paper to evaluate specific interventions used for pain relief. These are used not only in PRM settings, but also by other medical specialists. However, if a PRM specialist is providing these interventions, they should be part of an individual therapeutic plan, integrated in the PRM programme, provided by a multi-professional team led by a PRM specialist. The plan should be multi-modal, involving a wide range of therapeutic modalities, both non-pharmacologic and pharmacologic.

The last recommendation concerns the outcome criteria. It was approved that the PRM physician should include, with the classical physical examination, quality of life, pain and disability scales as outcome criteria.

## **Conclusion:**

In conclusion, it may be strongly emphasized that pain release is a primary role for a PRM physician in a PRM setting. Persons with complex pain in PRM should be benefiting from the professionalism of a multi-disciplinary team led by a PRM specialist. The individual's rehabilitation plan should be based upon medical and functional assessment and involve a wide range of pharmacologic and non-pharmacologic interventions. Outcome criteria should measure the person's quality of life and level of disability.

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20 Physical conditioning as part of a return to work strategy to reduce sickness absence for workers with back pain (Review) Copyright © 2013 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd. Pag 4.



## Evidence Based Position Paper on Physical and Rehabilitation Medicine (PRM) professional practice for Adults with Acquired Brain Injury (ABI). The European PRM position (UEMS PRM Section)

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## Evidence Based Position Paper on Physical and Rehabilitation Medicine (PRM) professional practice for Adults with Acquired Brain Injury (ABI). The European PRM position (UEMS PRM Section): The European position Produced by the UEMS-PRM Section

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### ABSTRACT Introduction:

Acquired brain injury (ABI) is damage to the brain that occurs after birth caused either by a traumatic or by a nontraumatic injury. The rehabilitation process following ABI should be performed by the multi-professional team, working in an interdisciplinary way, with the aim of organizing a comprehensive and holistic approach to persons with every severity of ABI. The Evidence based position paper on the rehabilitation of the persons with ABI was prepared by the working group consisted of the UEMS – PRM section Proffessional Practice committee members and other highly specialised experts from the field.

#### Aim:

The aim of the working group was to collect recommendations on PRM physician role in the process of rehabilitation, reccomendations on the management and procedures used in the rehabilitation process and future research and approach to the problem of ABI rehabilitation.

#### Method:

This paper has been developed according to the methodology defined by the Professional Practice Committee of the UEMS-PRM Section: a systematic literature search has been performed in PubMed and Core Clinical Journals. On the basis of the filtered papers, recommendations have been made as a result of five Delphi rounds.

**Results:** Through the literature selection process, thirty-one reccomendations are presented in the paper.

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#### **Conclusion:**

The expert consensus is that structured, comprehensive and holistic rehabilitation programme delivered by the multiprofessional team, working in an interdisciplinary way, with the leadership and coordination of the PRM physician, is likely to be effective, especially for those with severe disability after brain injury.

## Introduction

Acquired brain injury (ABI) is damage to the brain that occurs after birth caused either by a traumatic or by a nontraumatic injury <sup>1</sup>. For the purposes of this paper, the definition of acquired brain injury used is: Acquired brain injury describes insults to the brain that are not congenital or perinatal, but usually applied to single event pathology and not to progressive degenerative disease <sup>2</sup>. The most frequent causes of ABI are: trauma, oxygen supply cessation (e.g. after cardio-respiratory arrest), infections, (e.g. meningitis) and tumours <sup>3</sup>. The paper is focused mainly on the management of traumatic brain injury (TBI), although the general principles can be adapted to ABI from other causes. Transport accidents, sport accidents, assaults and falls are the primary causes of TBI. Incidence ranges from 200 to 300 cases of TBI per 100.000 inhabitants per year; peak risk of injury occurs between 16 to 25 years, rising again around 65 years <sup>4</sup>.

Few data are available on the long term physical consequences of moderate to severe TBI. People who have suffered a brain injury have a higher risk of death than people hospitalised for equal durations due to other injuries or people from the general population <sup>5</sup> and there is a high prevalence of residual disability arising from brain injury <sup>6</sup>. It has been reported that 90% of people with TBI admitted for rehabilitation will experience one or more problems in the areas of physical functioning and community integration <sup>7</sup>. The proffessional role of the PRM physician is to lead and coordinate the multi-professional team, working in an interdisciplinary way, with the aim of organizing a comprehensive and holistic approach to persons with every severity of ABI (severe, moderate and mild) in every stage of rehabilitation - from intensive care, acute and post-acute hospital care, as well as throughout their long-term care<sup>8</sup>

## Material and Methods

This paper has been developed according to the methodology defined by the Professional Practice Committee of the UEMS-PRM Section <sup>9</sup>. The systematic review of the literature has been performed in »MEDLINE PubMed« and »Core Clinical Journals« on February 2016. The search terms used in titles and abstracts for the first selection has been: traumatic brain injury AND rehabilitation as well acquired brain injury AND rehabilitation. Exclusion terms in titles were child/infant/adolescent/newborn AND mild/ minor traumatic brain injury. Filters used in search methodology were: Last 10 years, English, Controlled Clinical Trial / Systematic Review / Meta-Analysis / Guideline. MeSH thesaurus: rehabilitation. The «Mendeley Reference Management Software» was used for titles and abstracts management and reviewing.

The only criterion for including the studies has been the professional relevance for PRM physicians as judged by at least two of the authors, with the main author resolving conflicts. The Strength of Evidence (SoE) and the Strength of Recommendation (SoR) are given according to the Methodology paper. The consensus with Delphi procedure has followed the 5 steps proposed by the Methodology paper<sup>9</sup>. The final recommendations were approved by at least ninety percent of the members of Proffessional Practice Committee or all delegates in the relevant Delphi rounds.

## Results

## Systematic review

241 titles were initially found, from which 132 abstracts were selected by the at least two members of the working group and finally 88 articles were used for the final result of 31 reccomendations.

Reccomendations were prepared according to the chapters proposed in the Methodology paper (h) as defined by the Professional Practice Committee of the UEMS-PRM Section:

A. Overall general recommendation

**B.** Recommendations on PRM physicians' role in Medical Diagnosis according to ICD

**C.** Recommendations on PRM physicians' role in PRM diagnosis and assessment according to ICF

**D.** Recommendations on PRM management

and process

E. Recommendations on future research on PRM professional practice Project definition The special attention was oriented to the subchapter «PRM Interventions» in Chapter D. where the reccomended management of the specific problems of brain injured population is emphasized:

Respiratory problems
Swallowing problems
Nutritional and dietary problems
Spasticity treatment
Disorders of consciousness assesment and management
Cognitive problems
Functional problems and Activity of Daily Living (ADL) problems
The use of Virtual Reality (VR)
Problems of cardiorespiratory capacity
Return to work problems

### Recommendations

### A. Overall general recommendation

**1.** The professional role of the PRM physician is to lead and coordinate the multi-professional team, working in an interdisciplinary way, with the aim of organizing a comprehensive and holistic approach to persons with every severity of ABI (severe, moderate and mild) in every stage of rehabilitation – from intensive care, acute and post-acute hospital care, as well as throughout their long-term care <sup>(8, 10, 11)</sup>. **[SoR: A; SoE: IV]** 

## **B. Recommendations on PRM physicians' role** in Medical Diagnosis according to ICD

**2.** It is recommended that the PRM physician is accurately and without delay conversant with all clinical information regarding the up-to-date Medical Diagnoses, including results of relevant diagnostic procedures <sup>(12)</sup>. This recommendation has no time limit through the treatment process and has a special relevance for those with an unstable clinical status including current complications and comorbidities. **[SoR: A; SoE: IV]** 

**3.** The PRM physician should monitor the level of cognitive responsiveness of the person after ABI in intensive and acute care settings with behavioral observations as well one or more appropriate assessment tools (eg. Westmead Post-Traumatic Amnesia scale, Galvestone Orientation and Amnesia Test, Mini Mental State Examination (MMSE) <sup>(13)</sup>, Montreal Cognitive Assessment (MoCA) <sup>(14)</sup>, Rancho Los Amigos Level of Cognitive Functioning Scale (RLA LCFS) <sup>(15, 16)</sup> and Glasgow Outcome Scale - Extended (GOS-E) <sup>(17)</sup>.

The PRM physician should adapt the therapeutic multidisciplinary approach perform appropriate diagnostic and and procedures clinical (clinical examination, US examination, CT scan, MR imaging, etc.) whenever there is a reduction in responsiveness. [SoR: A; SoE: IV]

4. It is recommended that the PRM physician, together with a multi-professional team, performs a thorough assessment of cognitive responses for patients in a Disorder of Consciousness. It is recommended, that term "Vegetative state" is replaced by a term "Unresponsive wakefulness syndrome" in all communications (18, 19). The definitive diagnosis of the state of consciousness should not be concluded after a single examination but after repeat assessments and after obtaining information on the patients past life, to avoid misdiagnosis. (20 - 22). It is recommended that the definition of the awareness state should follow the Royal College of Physicians National Clinical Guidelines for the Prolonged Disorders of Consciousness 2013 (23) or American Academy of Neurology<sup>(24)</sup>. [SoR: A; SoE: III]

**5.** It is recommended that the PRM physician thoroughly and closely observes, detects and starts treatment for any medical complications in ABI person in intensive, acute and post-acute phase of treatment, since complications strongly negatively interfere with rehabilitation process as well prolong the acute stage of treatment <sup>(25)</sup>. The life threatening clinical conditions which are most frequent after severe and moderate ABI and should be clinically diagnosed without delay are <sup>(26)</sup>

1. Paroxysmal sympathetic activity

2. Respiratory complications

a) Respiratory impaired physiology (hypoxia...)

*b) Pulmonary tract obstruction* 

*c) Tracheostomy problems* 

*3. Post Traumatic epilepsy* 

4. Post Traumatic behavior-emotional disturbances, aggression, agitation.

 Post Traumatic hydrocephalus (due to intracranial bleeding, intracranial pressure...)
 Infections (respiratory, urinary tract or central nervous system infections)

7. Pressure sores

8. Coagulations disorders (DVT prevention...)

9. Gastrointestinal complications (PEG tube problems, transit problems, malabsorption syndrome...)

10.Endocrinologicalproblems:PostTraumatichypopituitarism,hyperprolactinemia (due to the seizures orpituitary injury or due to pharmacologicalagents)

11. Bone disorders: osteoporosis, heterotopic ossifications

12. Post Intensive Care Syndrome (PICS)[SoR: A; SoE: IV]

6. It is recommended that the PRM physician recognizes and clearly defines medical conditions which can interfere with transition of ABI person from acute setting to post-acute specialized comprehensive care. Those medical conditions should be recognized and resolved before transition to specialized institutions, especially if the post-acute care institution has limited facilities for the required clinical diagnostic procedures (12) [SoR: A; SoE: IV]

C. Recommendations on PRM physicians' role in PRM diagnosis and functional

assessment according to ICF

7. It is recommended that the PRM physician and the rehabilitation team uses the International Classification of Functioning, Disability and Health (ICF) taxonomy as a basic tool to collect information about the ABI person's limitations and personal needs as well as to assist planning, implementing and coordinating the rehabilitation process <sup>(27-29)</sup>. **[SoR: A; SoE: III]** 

**8.** It is recommended that the PRM physician uses the ICF core set for Traumatic Brain Injury (30) to detect and follow up changes functional status of person with ABI. It is recommended, that a brief ICF core set for Traumatic Brain injury <sup>(31)</sup> is used to detect changes before and after every completed comprehensive rehabilitation process (inpatient or outpatient) and for periodical follow up during the comprehensive rehabilitation process and at regular outpatient visits. **[SoR: A; SoE: III]** 

D. Recommendations on PRM management and process

Inclusion criteria (e.g. when and why to prescribe PRM interventions)

9. It is recommended that the PMR physician evaluates persons who sustain a mild, moderate and/or severe ABI. Any short or long-term cognitive, consequences on behavioural or physical functioning not necessarily limited to injury itself, should be included in rehabilitation process. It is recommended that the rehabilitation process begins as early as possible after acute ABI preferably in the intensive care unit or as soon as the clinical status allows acute rehabilitation, <sup>(12, 25, 32, 33)</sup>. It is recommended that the rehabilitation process continues until the patient achieves the ceiling of his/her functional status. It is recommended that recovery should be objectively proven through functional assessment scales. The pathway of treatment during the acute and post-acute phases should follow available national or European guidelines, since the use of standardized pathways achieves a better long term outcome <sup>(34 - 41)</sup>. After completing the comprehensive rehabilitation process, persons with ABI should be monitored by periodic rehabilitation interventions to identify and manage any decline of functional status. [SoR: A; SoE: I]

## Project definition (definition of the overall aims and strategy of PRM interventions)

**10.** Due to the fact, that ABI can be a chronic and lifelong condition, which demands continuous interventions after the hospital treatment has concluded, it is recommended, that the model of care for the persons with ABI is based on a bio – psycho – social model. The ultimate goal for a rehabilitation team is to involve the person with ABI in the domestic or institutional environment that will promote optimal participation in society, as well provide maximal quality of life, wellbeing and dignity <sup>(42)</sup>. [SoR: A; SoE: IV]

**11.** It is recommended that the PRM physician plans the rehabilitation interventions and agrees realistic goals with the person with ABI and/or his next of kin or caregivers. The rehabilitation team, working in an interdisciplinary form, under the supervision of the PRM physician should adapt the goals to achieve maximal functioning that is meaningful for an ABI person and/or the caregiver which maximizes the ABI person's opportunity for independent living and functioning ideally in the home environment after the conclusion of rehabilitation process <sup>(43</sup>). **[SoR: A; SoE: I]** 

**12.** It is recommended that the PRM physician plans the post-rehabilitation period of the person with ABI in a domestic or institutional environment in cooperation with those who can assist and coordinate with the person with ABI in organising his/her activities and participation in the environment when required (50). This person can be a relative or spouse of the person with ABI, but preferably, from the outset, be a professional, who is appropriately trained in managing the ABI effects on functioning in society (40). This professional may have a professional background as a social worker, care manager, community coordinator, be a trained representative of a recognised Brain Injury Society or any formally educated adult person (32)

# Team work (professionals involved and specific modalities of team work)

**13.** It is recommended that the PRM physician is the leader and coordinator of the multi-professional team which works in an interdisciplinary way and treats the consequences of ABI involving a broad spectrum of impairments on the clinical level, including the neuropsychological, emotional, behavioural, perceptional, linguistic, vocational and social levels. The composition of the multi-professional team may differ at different stages of the recovery progresses. <sup>(11, 51)</sup>.

[SoR: A; SoE: IV]

**14.** It is recommended, that the goal setting process is derived with the reference to the patient and family own life goals and priorities. <sup>(39)</sup>. There is evidence that goal setting may improve some outcomes for adults receiving rehabilitation for acquired disability. The best of this evidence appears to favor positive effects for psychosocial outcomes (i.e. health-related quality of life, emotional status, and self-efficacy) rather than physical ones <sup>(49, 52).</sup> **[SoR: A; SoE: III]** 

## **PRM** interventions

15. It is recommended that the PRM physician together with the multi-professional team have adequate theoretical knowledge, clinical skills and therapeutic equipment for clinical and functional assessment to provide a base for planning and performing PRM interventions through all stages of rehabilitation <sup>(8, 11)</sup>. **[SoR: A; SoE: IV]** 

16. It is recommended, that all persons with moderate or severe ABI trauma are supported by a respiratory team, which provides adequate chest mobilization, maintains proper positioning, oxygenation and manual respiratory techniques during the acute phase of rehabilitation <sup>(32, 33)</sup>. **[SoR: A; SoE: I]** 

## [SoR: A; SoE: III]

17. It is recommended to asses swallowing safety in all patients who had a moderate or severe Acquired Brain Injury. PRM physicians should be trained in the clinical assessment to determine the existence of dysphagia in particular where there is a suspicion of a "silent" aspiration. Complementary tests should be done such a Videofluoroscopy or a fibroscopy (FEES - Fiberoptic Endoscopic Evaluation of Swallowing). When artificial nutrition is likely to be required for more than one month, Percutaneous Gastrostomy (PEG) should be considered in those patients with swallowing problems requiring a nasogastric tube.<sup>(32, 33, 53, 54)</sup>. [SoR: A; SoE: I]

**18.** It is recommended that all persons with ABI have a dietary and nutritional analysis performed in cooperation with a clinical dietitian not later than 48 hours after transition from intensive to an acute setting <sup>(55, 56)</sup>. **[SoR: B; SoE: III]** 

**19.** It is recommended that for all persons with ABI who develop spasticity and/or muscle shortening, the following protocol represents the minimal interventional standard <sup>(57 - 64)</sup>:

- Elimination of triggering factors (pain, infection, constipation)

- Use of the custom or individual orthoses / serial casting for joint position maintaining

- Use of drug therapy – including injection of botulinum toxin and intrathecal drug delivery - for spasticity in combination with serial casting and positioning.

[SoR: A; SoE: II]

**20.** It is recommended that for all persons after ABI with disorders of consciousness a detailed evaluation of cognitive responsiveness should be performed by a multi-professional team with knowledge of diagnostic criteria of Minimally Conscious State and Unresponsive Wakefulness Syndrome, using standardized assessment tools with adequate psychometric and diagnostic properties. There is low evidence that a structured neurostimulation program adapted to the persons level of responsiveness – in young adults - is potentially effective in

raising the level of consciousness. <sup>(65 - 68)</sup>. [SoR: A; SoE: III]

**21.**It is recommended that a cognitive evaluation is performed on all persons after ABI who regain consciousness and awareness, followed by a cognitive neurorehabilitation/training which involves a systematic, functionally oriented service of the rapeutic activities based on assessment and understanding of the patient's behavioural deficits <sup>(23, 32, 69)</sup>. [SoR: A; SoE: III]

**22.** It is recommended that occupational therapy interventions are performed in realistic and where possible the patient's domestic environment. Such interventions can achieve meaningful functional training as they are oriented to foster the maximal functional independence in activities of daily living after discharge from institutional care. When medical devices, including devices for mobility are necessary for performing daily activities, the ABI person should be equipped with those devices and trained how to use them before being discharged to home<sup>(70, 71)</sup>. [SoR: A; **SoE: IV**]

**23.** It is recommended that the PRM physician implements Virtual reality (VR) based therapy and Computer based cognitive training, as well strategy-oriented approaches for persons after ABI to improve cognitive functioning and balance deficits <sup>(72 - 75)</sup>. **[SoR: A; SoE: III]** 

**24.** It is recommended that the PRM physician prescribes a physical activity program which consists of aerobic exercises that can be performed in various ways <sup>(76-83)</sup> in the chronic phase after ABI, to improve cardio-respiratory capacities, mood and self-esteem in persons after ABI. **[SoR: A; SoE: III]** 

25. It is recommended that the PRM physician adapts a vocational rehabilitation (VR) program for the person after ABI, in order to enhance patient's return to work <sup>(84-89)</sup>.
[SoR: A; SoE: III]

## Outcome criteria

**26.** It is recommended that the PRM physician decides on the outcome criteria during the assessment and goal-setting processes using the functional scales which suit the ICF framework (10, 29).

## 1.) Global outcome:

\*GOS-E, \*MPAI-4, \*DRS \*SF-36

## 2) ICF domain of function

\* Recovery of consciousness: CRS-R, SMART

\* PostTraumatic Amnesia (PostTraumatic Confusional State): Confusion Assessment Protocol

- CAP, GOAT, Westmead.

\* Agitation: ABS

\* Neuropsychological assessment: RAVLT, TMT, Processing Speeding index form, WAIS-III or WAIS-IV, SASNOS

\* Physical function: FIM motor subscale, Barthel \* Balance: BERG

\* Spasticity: Ashworth Scale, Modified Ashworth Scale

\* Hand Upper Limb function: Fugl Meyer motor subscale

\* Gait: FAC 10 m test, 6 minute walking test

**3)** ICF domain of Activity and participation \* FIM/FAM subscale

\* CIQ \* CHART

[SoR: A; SoE: IV]

## Length/duration/intensity of treatment (overall practical PRM approach)

**27.** It is recommended that the PRM physician prepares and evaluates treatment decisions/plans/ programs according to the specific needs of person with ABI to prescribe the duration and intensity of a specific treatment in agreement with rehabilitation team and patient  $^{(90-93)}$ . **[SoR: A; SoE: III]** 

# Discharge criteria (e.g. when and why to end PRM interventions)

**28.** It is recommended that a person with an ABI should concludes the rehabilitation programme and is transferred to a domestic environment after reaching the long-term goals set at the beginning of the rehabilitation programme, or when there has not been been any further progress in his/ her functional capacity recorded for defined time period, or when he or she is not able to participate in the rehabilitation program due to deterioration in his/her health or the onset of a significant co-morbidity <sup>(10, 93)</sup>. **[SoR: A; SoE: III]** 

## Follow up criteria and agenda

**29.** It is recommended that the PRM physician plans the follow up visits for the person with ABI on a regular time basis. The schedule for reviews should be consistent with the clinical and functional status of the person with ABI. Where further rehabilitation is indicated for patients with brain injury after discharge from inpatient care, this may be offered by tele-medicine solutions or face-to-face engagement to alleviate long term burdens due to depression, behavioural and cognitive consequence <sup>(32, 94)</sup>. **[SoR: A; SoE: I]** 

# E. Recommendations on future research on PRM professional practice Project definition

**30.** It is recommended that the PRM physician participates in future research on PRM professional practice projects that are targeting effective treatments and interventions to address the multitude of physical, behavioral and cognitive problems caused by ABI, including the research on drug therapy. Research on epidemiology, survival rates and prognostic factors of ABI could contribute to better utilization of rehabilitation resources and long term management planning. It is recommended that focus is also on the field of post ABI-life: caregiver's burden, socialization of ABI families and interpersonal relationship problems of persons after ABI (95). [SoR: A; SoE: III]

**31.** It is recommended that future research projects in the field of ABI rehabilitation

concur to improve evidence based practice and undergo rigorous peer reviewed evaluation. This review process is intended to reduce the likelihood of new interventions being introduced which have little or no scientific evidence base <sup>(96)</sup>. **[SoR: A; SoE: IV]** 

### **Discussion and conclusions**

This paper includes 31 reccomendations on rehabilitation of persons with acquired brain injury. It was produced in aim to strenghten and emphasize the role of the PRM physician in the process of rehabilitation of patients with Acquired Brain Injury. The decision to expand the topic from traumatic brain injury to acquired brain injury was accepted after a thorough discussion inside the Proffessional Practice Comittee, with aim to cover the greater population of subjects with injuries and diseases of brain. This paper however does not include reccomendations for rehabilitation after stroke, since this topic is covered in a special paper.

This Evidence based position paper does not include the evidence based management of cerebrovascular insults (ie stroke) since it is described in a separate article. This paper is not intended to be construed or to serve as a standard of care. Standards of care are determined on the basis of all clinical data available for an individual case and are subject to change as scientific knowledge and technology advance and patterns of care evolve. Adherence to recommendations will not ensure a successful outcome in every case, nor should they be construed as including all proper methods of care aimed at the same results.

Acquired brain injury is a complex condition that can have unpredictable long-term effects on a person depending on the nature of the injury, the medical history of that person and their exposure to other wider economic and social factors.

The expert consensus is that structured, comprehensive and holistic rehabilitation programme delivered by the multi-professional team, working in an interdisciplinary way, with the leadership and coordination of the PRM physician, is likely to be effective, especially for those with severe disability after brain injury.

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## Evidence Based Position Paper on Physical and Rehabilitation Medicine (PRM) professional practice for persons with stroke. The European PRM position (UEMS PRM Section)

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### Evidence Based Position Paper on Physical and Rehabilitation Medicine (PRM) professional practice for persons with stroke.

### The European PRM position (UEMS PRM Section)

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#### ABSTRACT

#### Introduction:

Stroke is a major cause of disability worldwide, with an expected rise of global burden in the next twenty years throughout Europe. This EBPP represents the official position of the European Union through the UEMS Physical and Rehabilitation Medicine (PRM) Section and designates the professional role of PRM physicians for people with stroke.

#### Aim:

The aim of this study is to improve PRM physicians' professional practice for persons with stroke in order to promote their functioning and enhance quality of life.

#### Methods:

A systematic review of the literature including a tenyear period and a consensus procedure by means of a Delphi process was been performed involving the delegates of all European countries represented in the UEMS PRM Section.

#### **Results:**

The systematic literature review is reported together with seventy-eight recommendations resulting from the Delphi procedure.

#### **Conclusion:**

The professional role of PRM physicians for persons with stroke, is to improve specialized rehabilitation services worldwide in different settings and to organise and manage the comprehensive rehabilitation programme for stroke survivors considering all impairments, comorbidities and complications, activity limitations and participation restrictions as well as personal and environmental factors.

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#### Key words:

Stroke, physical and rehabilitation medicine, rehabilitation

### Introduction

Stroke is the second most common cause of deaths and third most common cause of disability worldwide.1 Every two seconds someone across the globe suffers a symptomatic stroke.<sup>2</sup> Stroke systems of care, integrated approaches to stroke care delivery, and the availability of resources for stroke care vary considerably across geographic regions, creating a risk for suboptimal care.<sup>2</sup> Although age-standardised rates of stroke mortality have decreased worldwide in the past two decades, the absolute number of people who have stroke every year, stroke survivors, related deaths, and overall global burden of stroke (Disability-Adjusted Life-Years lost) are great and increasing.<sup>3</sup> This is also the case in Europe where both the incidence of stroke and deaths due to stroke are declining because of the developments in the prevention and treatment of cerebrovascular diseases. However, the absolute number of strokes continues to increase because of the ageing population, and the strong association between the stroke risk and age.<sup>4</sup> It is estimated that there will be a 34% increase in total number of stroke events in Europe between 2015 and 2035.<sup>5</sup> Decrease in death rates will lead to more people surviving their strokes and living with the consequences. Therefore, both the cost and the global burden of stroke is estimated to rise in Europe.<sup>4,5</sup>

Despite improvements in mortality and morbidity, stroke survivors need access to effective rehabilitation services. Over 30% of stroke survivors have persistent disability and might require long-term rehabilitation.6 Almost one third of stroke survivors report unmet rehabilitation needs.<sup>7</sup> Stroke care process throughout Europe varies considerably from one country to another and even in the same country. For example only 30% of people who have stroke in Europe get treated in specialized stroke units, which have been shown to be associated with less mortality and better outcomes.<sup>5,8</sup> Organisation and provision of stroke rehabilitation and follow-up services after inpatient rehabilitation also shows variation across countries in terms of admission criteria, therapy time and contents of therapy.<sup>9,10,11</sup> It is reported that many stroke survivors in Europe have to wait long to get an

assessment of their rehabilitation needs and to actually receive therapy.<sup>5</sup> Outpatient therapy services, ongoing long-term support and followup is inadequate in many parts of Europe. Specialist rehabilitation may only be available in large urban areas. Occupational and speech therapy and psychological support are either very limited or not available in several countries.<sup>5</sup> Thus considering both the current situation of stroke care as well as the expected rise of stroke burden, it is clear that rehabilitation services for persons with stroke need to be improved throughout Europe.

Stroke rehabilitation is one of the main practice areas of the Physical and Rehabilitation Medicine (PRM) physicians.<sup>12</sup> PRM is the primary medical specialty that focuses on the improvement of functioning based on the WHO's integrative model of functioning, disability and health, and rehabilitation as its core health strategy.<sup>13,14</sup> PRM physicians are adequately trained and qualified to organise and manage the comprehensive rehabilitation programme for stroke survivors within a holistic teamwork approach in acute, post-acute and long-term settings.12 The aim of this evidence-based position paper (EBPP) is to improve PRM physicians' professional practice for persons with stroke in order to promote their functioning and enhance quality of life.

### Materials and methods

This EBPP is produced according to the methodology proposed by the Union of European Medical Specialists (UEMS) PRM Section,<sup>15</sup> comprising of two parts:

1) a systematic review of the literature including a ten-year period,

2) a consensus procedure by means of a Delphi method process involving the delegates of all European countries represented in the UEMS PRM Section.

An electronic literature search was done in PubMed/MEDLINE including the search terms of "stroke" AND "rehabilitation". Search filters used were: i) Publication types: guidelines, metaanalyses, systematic reviews and randomized controlled trials, ii) Humans, iii) Adults 19+, iv) Published in the last 10 years between 31 August 2007 and 30 August 2017, then extended until 30 November 2017, v) Language: English. Search string used was: ("stroke" [MeSH Terms] OR "stroke" [All Fields]) AND ("rehabilitation" [Subheading] OR "rehabilitation" [All Fields] OR "rehabilitation" [MeSH Terms]) AND ((Randomized Controlled Trial[ptyp] OR Guideline[ptyp] OR Meta-Analysis[ptyp] systematic[sb]) OR AND ("2007/08/31"[PDAT] : "2017/11/30"[PDAT]) "humans" [MeSH AND Terms] AND English[lang] AND "adult"[MeSH Terms])

The only criterion for including the studies was the professional relevance for PRM physicians as judged by the two authors (AKK, KSS), with the main author resolving the conflicts. The grading of Strength of Evidence (SoE) and the Strength of Recommendation (SoR) were given as described in the original 'Methodology paper'.<sup>15</sup> The consensus with Delphi procedure followed the 4 steps proposed in the same paper.<sup>15</sup>

### Results

#### Systematic review and consensus

The electronic literature search identified 2145 papers and 185 of them were considered for the preparation of this EBPP. Flow chart of papers selection is presented at Figure 1. After a thorough review of the relevant papers, 78 recommendations were prepared and sent for Delphi round 1. Two recommendations were combined and one extra recommendation was suggested and included at this first round. None of the recommendations were rejected at any of the Delphi rounds. However some recommendations were accepted with minor changes. Results of the consensus procedure is presented at Table 1. The consensus procedure ended up with 78 final recommendations. The number of recommendations were high mainly because of the comprehensive and diverse nature of the PRM interventions for persons with stroke. Therefore recommendations regarding PRM interventions were systematically reported in 6 categories: Dysphagia management and nutritional support, upper limb rehabilitation,

lower limb rehabilitation, rehabilitation of communication and cognitive disorders, prevention and management of complications / secondary conditions, and managing transitions of care. For each recommendation, SoE and SoR gradings were performed and overall view of the recommendations is shown at Table 2.

Recommendations stated in this EBPP included and summarized the role of PRM physician in each and every scope of stroke rehabilitation. However before reporting the recommendations, it has been felt necessary to make a brief emphasis on the following issues which emanated from the literature review:

- Importance of teamwork: Evidence shows that improved functional outcomes and even better survival can be achieved with interdisciplinary team-working in stroke care and rehabilitation.<sup>16,17,18</sup> Therefore three recommendations (nr 17-19) pointing out the composition and the work style of the PRM team have been made.

- Commencement of rehabilitation: Early commencement of rehabilition after stroke is recommended in many clinical practice guidelines.<sup>19,20,21</sup> However, the optimal time to begin rehabilitation remains still unsettled.<sup>22,23,24</sup> The evidence shows that early initiation of rehabilitation interventions within the first two weeks for some deficits such as upper limb dysfunction, mobility and gait problems, dysphagia, aphasia and neglect is beneficial.<sup>23,25</sup> Nevertheless, very early mobilization and intense therapy within the first 24 hours following stroke may be harmful.<sup>24,26</sup> Timing of commencement of rehabilitation has been carefully worded in our relevant recommendations (nr 10 and 39).

- Awareness of the risk of recurrent stroke: It is well-documented that risk of recurrent stroke is high after a previous stroke.<sup>27</sup> This should be kept in mind both during the inpatient rehabilitation phase to monitor patient's neurological status closely and also in long-term after hospital discharge to manage secondary prevention.<sup>28,29,30</sup> This issue has been reflected in our relevant recommendations (nr 3,4 and 58).

- Management of transitions: Transitions of care are defined as the movements of patients among providers, different goals of care and across various settings where healthcare services are received.<sup>31</sup> PRM physician has important roles in managing the transitions of care for the stroke survivor, including education, training and support for the patient/ family/ caregiver as well as discharge planning activities for home adaptation and community reintegration.<sup>31-34</sup> These aspects are well pointed out in the relevant sub-section of the recommendations (nr 66-72).

#### Recommendations

#### **OVERALL GENERAL RECOMMENDATION**

1. The professional role of PRM physicians with persons with stroke, is to improve specialized rehabilitation services worldwide in different settings (acute, post-acute and long-term) and to organise and manage the comprehensive rehabilitation programme for stroke survivors considering all impairments, comorbidities and complications, activity limitations and participation restrictions as well as personal and environmental factors.<sup>20,22,35</sup> [SoE: IV; SoR: A]

#### RECOMMENDATIONS ON PRM PHYSICIANS' ROLE IN MEDICAL DIAGNOSIS ACCORDING TO ICD

2. It is recommended that PRM physicians monitor closely and regularly persons with stroke for the diagnosis/identification of complications and secondary conditions such as malnutrition, pressure ulcers, deep venous thrombosis, bladder and bowel dysfunction, infections (especially urinary tract and chest), post-stroke depression, hemiplegic shoulder pain, central pain, complex regional pain syndrome, spasticity, contractures, fatigue, falls, post-stroke osteoporosis and seizures that may lead to additional progressive impairments which may further affect/ increase the original level of disability or can be increased by their original disability. <sup>20,21,36-50</sup> [SoE: IV; SoR: A]

3. It is recommended that PRM physicians should consider that the risk of recurrent stroke is high after a previous stroke and monitor the stroke survivor's neurological status closely during the rehabilitation process. <sup>20,27-29</sup>

[SoE: IV; SoR: A]

4. It is recommended that PRM physicians proceed to further investigation (imaging, laboratory etc) and neurological consultation in the event of deterioration of the neurological status of the stroke survivor. <sup>20,23</sup> [SoE: IV; SoR: A]

#### RECOMMENDATIONS ON PRM PHYSICIANS' ROLE IN PRM DIAGNOSIS AND ASSESSMENT ACCORDING TO ICF

5. It is recommended that PRM physicians, depending on the setting of the stroke continuum of care, personally assess and/or organize, coordinate and conduct the multi-professional interdisciplinary assessment of the stroke survivors' functioning based on the ICF framework, including impairments of body functions and structures, activity limitations, participation restrictions, environmental barriers and facilitators, as well as individuals' perceptions and expectations.<sup>13,20,21</sup> [SoE: IV; SoR: A]

6. It is recommended that assessment of functioning based on the ICF should be the base of a specific rehabilitation project defined with an iterative problem-solving rehabilitation process which comprises 4 stages: i) assessment, to identify the patient's problems and needs, ii) goal-setting, to define and assign goals for the rehabilitation plan, iii) intervention, to perform all educational, medical, therapeutic and supportive applications for the achievement of goals, and iv) re-assessment, to evaluate the effects of interventions against goals set. <sup>20,21,52-54</sup> [SoE: IV; SoR: A]

7. It is recommended that PRM physicians assess a minimum of the following ICF categories for persons with stroke:

i) Body Functions: b110- Consciousness functions, b114- Orientation functions, b730- Muscle power functions, b167- mental functions of language, b140- Attention functions, b144- Memory functions
ii) Body Structures: s110- Structure of brain, s730- Structure of the upper extremity

iii) Activities and participation: d450- Walking, d330- Speaking, d530- Toileting, d550- Eating, d510- Washing oneself, d540- Dressing, d310-Communicating with -receiving -spoken messages iv) Environmental factors: e310- Immediate family, e355- Health professionals, e580- Health services, systems and policies.<sup>52,55-57</sup> [SoE: IV; SoR: A] 8. It is recommended that assessment of body functions and structures, activities and participation, and environmental factors be conducted using standardised methods and valid assessment or outcome measurement tools linked to the ICF.<sup>20,21,52,54,58-67</sup>

#### [SoE: IV; SoR: A]

#### **RECOMMENDATIONS ON PRM MANAGEMENT AND PROCESS**

*Inclusion criteria (e.g. when and why to prescribe PRM interventions)* 

9. It is recommended that PRM physicians prescribe PRM interventions whenever rehabilitation is needed throughout the continuum of stroke care, in order to improve stroke survivor's impairments of body functions and structures, and reduce activity limitations and participation restrictions.<sup>13,20,21</sup> [SoE: IV; SoR: A]

10. It is recommended that all persons with stroke should receive rehabilitation health care as early as possible once they are determined to be ready for and able to participate in rehabilitation.<sup>21,23,25</sup> [SoE: IV; SoR: A]

### *Project definition (definition of the overall aims and strategy of PRM interventions)*

11. It is recommended that the overall aims and strategy of PRM interventions are to improve or restore impaired body functions and structures, to prevent further impairments and complications, to optimise activities and participation, and to enhance quality of life.<sup>13,18,20-22,68,69</sup>

[SoE: IV; SoR: A]

12. It is recommended that the rehabilitation programme including PRM interventions is determined by the multi-professional rehabilitation team, led by the PRM physician, in cooperation with other disciplines.<sup>13,20,21</sup>

[SoE: IV; SoR: A]

13. It is recommended that the rehabilitation programme including PRM interventions is determined according to the assessment and goal-setting stages in the rehabilitation process, taking into account the premorbid physical, cognitive, psychological, social and vocational condition of the stroke survivor.<sup>14,20,21,70</sup>

[SoE: IV; SoR: A]

14. It is recommended that the rehabilitation programme for the stroke survivor is patient-centred, based on shared decision-making, culturally appropriate, and incorporates the agreed-upon goals and preferences of the patient, family, caregivers and the rehabilitation team.<sup>13,20,21</sup>

#### [SoE: IV; SoR: A]

15. It is recommended that PRM interventions can be administered in different settings depending on the phase after stroke (acute, post-acute, long-term) as well as the status of the stroke survivor in terms of rehabilitation needs: inpatient settings such as specialised stroke units, post-acute PRM departments in general/university hospitals, acute wards in general/university hospitals, post-acute general PRM units; outpatient settings such as facility-based outpatient clinics or day hospitals; communitybased rehabilitation facilities such as early supported discharge teams for home rehabilitation or therapybased rehabilitation at home.<sup>20-22,52,70</sup> [SoE: IV; SoR: A]

16. It is recommended that PRM physicians provide advice on policies and programmes among and across sectors, stakeholders, public, and decision-makers to meet the needs of stroke survivors for functioning.<sup>13,20,21</sup>

#### [SoE: IV; SoR: B]

*Team work (professionals involved and specific modalities of team work)* 

17. It is recommended that rehabilitation to stroke survivors is delivered by a multi-professional rehabilitation team, led and coordinated by the PRM physician, working in a collaborative way, as well as with other disciplines. The core team, experienced in stroke rehabilitation, comprises PRM physician, rehabilitation nurse, physiotherapist, occupational therapist, speech and language therapist, clinical psychologist and social worker. However, not every patient will need each of these professions. Other health professionals such as dietitian, orthotist, sports and recreational therapist, vocational counsellor, rehabilitation assistant, or rehabilitation engineer, and other physicians such as neurologist, orthopaedic surgeon, neurosurgeon or psychiatrist can also be included in the team if needed.<sup>14,17,20,21,70,71</sup> [SoE: IV; SoR: A]

18. It is recommended that throughout the continuum of stroke care, the roles and responsibilities of the core multi-professional rehabilitation team should be clearly documented and communicated to the stroke survivor, his/her family and caregiver.<sup>70</sup> [SoE: IV; SoR: A]

19. It is recommended that the multi-professional rehabilitation team, led and coordinated by the PRM physician, working in a holistic, interdisciplinary collaboration, conduct regular meetings to discuss and update the individualised rehabilitation plan, including the stroke survivor, his/her family and caregiver in the decision-making process.<sup>12,20,21,70</sup> [SoE: IV; SoR: A]

#### PRM interventions

20. It is recommended that PRM interventions for the stroke survivor mainly include pharmacological treatments (systemic / local medications, injections, nerve blocks etc.), physical modalities, physiotherapy, occupational therapy, speech and language management, dysphagia nutritional therapy, therapy, cognitive interventions, psychological interventions (including counselling of patients, families, and caregivers), bladder, bowel and sexuality management, use of assistive/adaptive technology and orthotics, adapted physical activity and sports, vocational rehabilitation, and provision of education, training and support for the patient/ family/caregiver.<sup>20-22,70</sup>

[SoE: IV; SoR: A]

#### *i)* Dysphagia management and nutritional support

21. Swallowing assessment (firstly clinical bedside assessment, if necessary further assessment with videofluoroscopy or fiberoptic endoscopic examination) is recommended after stroke to identify dysphagia which can lead to aspiration pneumonia, malnutrition, dehydration or other complications.<sup>21,72,73</sup> [SoE: IV; SoR: A]

22. Restorative swallowing exe

22. Restorative swallowing exercises and compensatory techniques to optimise the efficiency and safety of swallowing (e.g. positioning, dietary modifications, oral hygiene) should be administered for the management of dysphagia.<sup>20,21,70,74</sup> [SoE:IV; SoR: A]

23. Neuromuscular electrical stimulation, repetitive transcranial magnetic stimulation and acupuncture may be considered as adjunctive therapies for post-stroke dysphagia.<sup>74-76</sup> [SoE: I; SoR: B]

24. It is recommended that persons with stroke should be screened for nutritional status after hospital admission and nutritional support is provided for patients with malnutrition or for those at risk of malnutrition.<sup>20,21,36,70,73</sup> [SoE: IV; SoR: A]

25. Enteral feeding preferably via nasogastric tube should be initiated within the first week after stroke for persons who cannot swallow safely. Percutaneous

gastrostomy tube is considered in patients with dysphagia lasting more than 2-3 weeks.<sup>73,74,77</sup> [SoE: IV; SoR: A]

#### *ii) Upper limb rehabilitation*

26. It is recommended that persons with stroke should engage in repetitive, progressively adapted, task-specific and goal-oriented upper-extremity and trunk training to enhance motor control and restore sensorimotor function of the affected upper limb.<sup>78-81</sup> [SoE: I; SoR: A]

27. It is recommended that exercises such as stretching, mobilisation, sensory stimulation and neurodevelopmental techniques should be administered to improve upper limb functioning after stroke.<sup>21,82-84</sup> [SoE: IV; SoR: A]

28. It is recommended that constraint-induced movement therapy (conventional or modified), mental practice, mirror therapy, interventions for sensory impairment, and virtual reality are beneficial to improve upper limb functioning and be considered for eligible stroke survivors.<sup>20,21,78,85-87</sup> [SoE: IV; SoR: A]

29. It is recommended that electrical stimulation to wrist, forearm and shoulder muscles be considered to improve strength and improve upper limb function.<sup>20,21,78,82,88,89</sup>

[SoE: IV; SoR: B]

30. Strength training to improve upper extremity function should be considered for stroke survivors with mild and moderate motor impairment. Strength training, performed appropriately, should not aggravate spasticity or pain.<sup>90</sup>

#### [SoE: I; SoR: A]

31. It is recommended that persons with stroke should receive occupational therapy, individualised for the needs of the person, to improve activities and instrumental activities of daily living.<sup>91</sup> [SoE: I; SoR: A]

32. Robot-assistive therapy for the upper limb may be used to enhance motor recovery in addition to conventional rehabilitation interventions.<sup>92-94</sup> [SoE: I; SoR: B]

33. Wrist and hand splints may be useful for stroke survivors who have immobile hands due to weakness or spasticity, in order to prevent contracture, maintain joint range of motion, position in antispastic pattern, facilitate function, and aid care or hygiene, with supervision by the PRM physician/team to prevent local side effects.<sup>21,70</sup>

[SoE: IV; SoR: A]

34. Adaptive and assistive equipment may be used to improve safety and activities in daily life if other methods of performing task/activity are not available or cannot be learned.<sup>20,21,91</sup> [SoE: IV; SoR: A]

35. Botulinum toxin injection into targeted upper limb muscles is recommended to reduce focal upper limb spasticity, to increase range of motion, and to improve activities such as dressing and hygiene.<sup>95-98</sup> [SoE: I; SoR: A]

36. Oral antispastic medication, such as tizanidine or baclofen can be prescribed for generalised disabling spasticity.<sup>20,21</sup>

#### [SoE: IV; SoR: A]

37. It is recommended that joint protection strategies such as proper positioning, supporting and correctly handling the arm should be applied during the early and flaccid stage of recovery to prevent or minimise shoulder pain and subluxation.<sup>20,21,70</sup> [SoE: IV; SoR: A]

38. It is recommended that management of hemiplegic shoulder pain, after a thorough examination/ assessment for the underlying etiological factors, can include glenohumeral and/or subacromial corticosteroid injections, suprascapular nerve block, electrical stimulation to shoulder muscles, botulinum toxin injections into subscapularis and/ or pectoralis muscles, shoulder orthoses, systemic anti-inflammatory medication, massage and gentle mobilisation techniques for the shoulder musculature, and acupuncture.<sup>20,21,44,99-102</sup>

[SoE: IV; SoR: A]

#### iii) Lower limb rehabilitation: Mobility, balance, gait

39. It is recommended that persons with stroke should start to be mobilised as early as possible, which might be beyond the first 24 hours after stroke, unless there are contraindications.<sup>20,21,24-26</sup> [SoE: IV; SoR: A]

40. Progressively adaptive, intensive, goal-oriented and repetitive task training is recommended for stroke survivors to improve transfers and mobility.<sup>79,81</sup> [SoE: I; SoR: A]

41. It is recommended that overground and treadmillbased gait training (with or without body weight support), resistance training, cycling, rhythmic auditory stimulation and cuing, cardiovascular conditioning, biofeedback, circuit class therapy, virtual reality training, and electromechanical (robotic) gait training can be used to improve mobility and walking.<sup>85,103-113</sup> [SoE: III; SoR: A]

42. Stroke survivors with poor balance and at the risk of falls should receive balance training interventions such as trunk retraining, sit-to-stand exercises, force platform biofeedback, virtual reality training or aquatic therapy.<sup>113-117</sup>

#### [SoE: III; SoR: A]

43. It is recommended that ankle-foot orthoses and functional electrical stimulation are used to improve gait for stroke survivors with foot drop.<sup>118-119</sup> [SoE: I; SoR: A]

44. It is recommended that the need for ambulatory assistive devices such as cane, walker or wheelchair should be evaluated on an individual basis and prescribed accordingly to help mobility efficiency and safety of the stroke survivor.<sup>20,21</sup>

#### [SoE: IV; SoR: A]

45. It is recommended that after screening for aerobic exercise, individually tailored aerobic training is incorporated into the rehabilitation programme to enhance cardiopulmonary fitness and other health outcomes as well as to reduce the risk of a new recurrent stroke.<sup>20,21,120-121</sup>

#### [SoE: IV; SoR: A]

46. It is recommended that antispastic pattern positioning, resting ankle splints at night and during assisted standing (with supervision to prevent local side effects), range-of-motion exercises, and stretching can be considered to prevent contracture and help to decrease spasticity.<sup>20,21</sup>

#### [SoE: IV; SoR: A]

47. It is recommended that targeted botulinum toxin injections into lower limb muscles, oral antispastic drugs such as tizanidine or baclofen, and intrathecal baclofen administration can be useful for lower limb spasticity after stroke.<sup>20,21,122-124</sup>

#### [SoE: IV; SoR: A]

## *iv) Rehabilitation of communication and cognitive disorders*

48. It is recommended that all persons with stroke should be screened for communication disorders, which include aphasia, dysarthria and speech apraxia.<sup>20,21,70</sup> [SoE: IV; SoR: A]

49. It is recommended that the rehabilitation team and all other health-care providers should receive information, education and training to enable them to support and communicate effectively with stroke survivors having communication difficulties and their family/caregiver.<sup>21,70</sup>

#### [SoE: IV; SoR: A]

50. It is recommended that all stroke survivors with communication disorders should receive speech and language therapy, individually tailored according to their needs.<sup>125-129</sup> [SoE: I; SoR: A] 51. It is recommended that computer-based therapies, constraint-induced therapy, group language therapies, communication partner training, repetitive transcranial magnetic stimulation and pharmacotherapy (donepezil, memantine) can be useful for stroke survivors with aphasia to improve speech and communication skills in addition to conventional speech and language therapy.<sup>129-134</sup>

#### [SoE: IV; SoR: A]

52. It is recommended that augmentative and alternative communication devices and environmental modifications can be considered to enhance functional communication.<sup>20-135</sup>

#### [SoE: IV; SoR: A]

53. It is recommended that all persons with stroke should be screened for cognitive deficits including hemi-inattention (or unilateral neglect), and the impact of deficits on daily activities should also be assessed.<sup>20,21,70,136</sup>

#### [SoE: IV; SoR: A]

54. It is recommended that rehabilitation interventions for unilateral neglect can include visual scanning training, phasic alerting, cueing, limb activation, trunk rotation, mirror therapy, virtual reality, optokinetic stimulation, neck muscle vibration, eye patching, prism adaptation, and repetitive transcranial magnetic stimulation.<sup>20,21,134,137-141</sup>

#### [SoE: IV; SoR: A]

55. It is recommended that the use of cognitive skill training strategies can be considered to improve attention, memory and executive functioning, as well as internal (e.g. encoding and retrieval strategies, self-efficacy training) and external (assistive technologies such as paging systems, computers, prompting devices) compensatory strategies to improve memory functions after stroke.<sup>20,70,134,136,142-145</sup> [SoE: IV; SoR: A]

56. Specific gestural or strategy training is recommended for apraxia following stroke.<sup>20,134,146</sup> [SoE: IV; SoR: A]

57. It is recommended that physical exercise can be considered as adjunctive therapy to improve cognitive functioning after stroke.<sup>20,136,147,148</sup> [SoE: IV; SoR: A] *v) Prevention and management of complications/ secondary conditions* 

58. It is recommended that the PRM physician evaluates the stroke survivor regarding his/her risk factors for recurrence of stroke and should provide education, treatment and guidance in order to manage secondary prevention.<sup>20,29,30</sup>

#### [SoE: IV; SoR: A]

59. It is recommended that persons with stroke are screened for post-stroke depression and other mood disorders, and consultation by a psychiatrist and treatment of depression by anti-depressive medication (preferably by SSRIs) as well as adjunctive non-pharmacological methods such as patient education, counselling, social support, psychotherapy and physical exercise can be considered.<sup>20,136,149-151</sup> [SoE: IV; SoR: A]

60. It is recommended that persons with poststroke urinary incontinence should be assessed for the type and severity of bladder dysfunction, and an individually tailored, structured management strategy, including bladder retraining, timed/ prompted voiding, pelvic floor exercises, intermittent catheterisation, anticholinergic medication and/or environmental and lifestyle modifications should be employed.<sup>20,152-154</sup>

#### [SoE: IV; SoR: A]

61. It is recommended that persons with post-stroke faecal incontinence are offered a bowel management programme including a balanced diet with good fluid intake, physical exercise and a regular planned bowel routine. A bowel routine may include use of oral laxative medication, suppositories or enemas; abdominal massage; digital rectal stimulation and digital evacuation of stool.<sup>20,155</sup>

[SoE: IV; SoR: A]

62. It is recommended that during acute hospitalization and inpatient rehabilitation of persons with stroke, all measures to prevent skin breakdown and pressure ulcers should be applied. These include minimizing skin friction and pressure, providing appropriate support surfaces, avoiding excessive moisture, maintaining adequate nutrition and hydration, positioning and turning regularly, good skin hygiene, and use of special mattresses and wheelchair cushions.<sup>20</sup> [SoE: IV; SoR: A] 63. It is recommended that an interdisciplinary pain management programme including pharmacotherapy, exercise and psychosocial support can be considered, and motor cortex stimulation may be tried for persons with post-stroke central pain.<sup>20,21,156,157</sup> [SoE: IV; SoR: A]

64. It is recommended that persons with stroke should be screened for fall risk, taking into account medical, functional, cognitive and environmental factors, and an individually tailored falls prevention and training programme should be implemented for the patient and the family/caregiver.<sup>20,21,158-160</sup> [SoE: IV; SoR: A]

65. It is recommended that persons with stroke are assessed for osteoporosis, as bone loss is common early after stroke. Physical activity, calcium and vitamin D supplementation, as well as bisphosphonates and denosumab can be considered for the prevention or management of post-stroke osteoporosis.<sup>20,161-164</sup> [SoE: IV; SoR: A]

#### vi) Managing transitions of care

66. It is recommended that stroke survivors and their families/caregivers should be prepared for transitions between care stages/settings by information sharing, provision of education, skills training, psychosocial support, and awareness of community services.<sup>20,31,32,165-170</sup> [SoE: IV; SoR: A]

67. It is recommended that self-management interventions including information provision, goal setting, problem solving, and the promotion of self-efficacy are offered to stroke survivors to support their adjustment and coping with their stroke-related disability.<sup>171</sup>

#### [SoE: I; SoR: A]

68. It is recommended that the use of telemedicine technology modalities such as video, web-based support and tele-rehabilitation are considered to increase access to ongoing support and healthcare services and rehabilitation therapies following transitions from inpatient rehabilitation to community, particularly for patients in remote areas.<sup>20,31,167,170,172</sup>

[SoE: IV; SoR: B]

69. It is recommended that pre-discharge home visits and occupational therapy interventions for home adaptations can be offered to establish a safe and enabling home environment for the stroke survivor.<sup>33,34,70,173</sup>

#### [SoE: IV; SoR: A]

70. It is recommended that a thorough vocational assessment and vocational rehabilitation services are offered to stroke survivors who may be able to return to work.<sup>20,21,70,174</sup>

#### [SoE: IV; SoR: A]

71. It is recommended that sexual issues are discussed with stroke survivors (and their partners) during (post-acute) rehabilitation before discharge home and again after transition to community. Education, counselling, and if appropriate, treatment addressing sexual concerns should be offered.<sup>20,21,175</sup>

#### [SoE: IV; SoR: A]

72. It is recommended that stroke survivors are encouraged to participate in recreation and leisure activities by provision of information regarding such activities in the community as well as education and self-management skill development to engage in those activities.<sup>20,21</sup>

[SoE: IV; SoR: A]

#### Outcome criteria

73. It is recommended that PRM physicians decide on the outcome criteria which will be used during the rehabilitation process. Usually standardised outcome scales assessing activities or instrumental activities of daily living (e.g, Barthel index, FIM) are used as the main outcome criteria in the postacute rehabilitation phase. However other secondary outcome measures assessing specific areas (e.g. cognitive impairments, aphasia, mobility, dexterity) can also be used. In the long-term phase, assessment of participation and quality of life by patient-reported outcome measures may be preferred.<sup>20,54,66,67,70,176,177</sup> [SoE: IV; SoR: A]

## *Length/duration/intensity of treatment (overall practical PRM approach)*

74. It is recommended that the length, duration and intensity of the treatment, defined with the special rehabilitation project, is determined by the multiprofessional rehabilitation team led and coordinated

by the PRM physician, according to the specific needs and goals, and the condition of the stroke survivor in agreement with him/her and the family/ caregiver.<sup>20-22,70</sup>

#### [SoE: IV; SoR: A]

75. It is recommended that PRM physicians must be aware that greater duration and intensity of total inpatient rehabilitation therapy may result in better functional outcomes.<sup>178-180</sup> [SoE: IV; SoR: A]

## *Discharge criteria (e.g. when and why to end PRM interventions)*

76. It is recommended that discharge criteria and discharge setting from inpatient rehabilitation (e.g. home, nursing facility, community rehabilitation facility, outpatient rehabilitation facility) are determined by the multi-professional rehabilitation team led and coordinated by the PRM physician, according to the individual needs and condition of the stroke survivor in agreement with the patient/family/caregiver.<sup>20,31,181,182</sup> [SoE: IV; SoR: A]

77. It is recommended that PRM physicians should organise the post-discharge follow-up plan to ensure the continuity of care of the stroke survivor.<sup>20,31</sup> [SoE: IV; SoR: A]

#### **RECOMMENDATIONS ON FUTURE RESEARCH ON PRM PROFESSIONAL PRACTICE**

78. It is recommended that PRM physicians are involved and perform research in the field of stroke rehabilitation to investigate the effectiveness of various novel therapies such as repetitive transcranial magnetic stimulation, transcranial direct current stimulation, electrical stimulation, robotic therapy, as well as pharmacological agents, to explore multimodal interventions (e.g. drug plus exercise therapy, brain stimulation plus exercise therapy), new technologies (e.g. virtual reality, body-worn sensors, communication systems, tele-rehabilitation) and effective models of stroke care, and to develop standardised outcome assessment methods such as computer adaptive testing.<sup>20,78,89,133,183-189</sup> [SoE: IV; SoR: A]

### Conclusions

Stroke rehabilitation is one of the main practice ares of PRM physicians. The professional role of PRM physicians for persons with stroke is to improve specialized rehabilitation services worldwide in different settings and to organise and manage the comprehensive rehabilitation programme for stroke survivors considering all impairments, comorbidities and complications, activity limitations and participation restrictions as well as personal and environmental factors. This EBPP represents the official position of the European Union through the UEMS PRM Section and designates the professional role of PRM physicians for persons with stroke.

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Figure 1. Flow Chart of papers selection

# Table 1. Results of the Consensus procedure \*2 combined, 1 added after 1<sup>st</sup> Round

Delphi Round	Number of	Accept	Accept with suggestions	Reject
	recommendations			
1	78	69.2%	30.8%	0
Among authors				
2	78*	79.5%	20.5%	0
Among all delegates				
3	78	79.5%	20.5%	0
Among all delegates				
4	78	92.3%	7.7%	0
Among authors				

#### Table 2. Overall view of the recommendations

Content	Number of	Strength of recommendations			Strength of evidence				
	Recommendations								
	Ν	Α	В	С	D	Ι	II	III	IV
Overall general	1	100%	0	0	0	0	0	0	100%
recommendation									
PRM physicians' role in	3	92.6%	7.4%	0	0	0	0	0	100%
medical diagnosis according									
to ICD									
PRM physicians' role in PRM	4	91.7%	8.3%	0	0	0	0	0	100%
diagnosis and assessment									
according to ICF									
Recommendations on PRM	69	83.3%	15.4%	1.1%	0.2%	14.5	0	2.9%	82.6%
management and process						%			
Recommendations on future	1	77.8%	22.2%	0	0	0	0	0	100%
research on PRM professional									
practice									
TOTAL	78	84.20%	14.66%	1.0%	0.14	7.9%	2.6%	0	89.5%
					%				

### 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

https://www.ncbi.nlm.nih.gov/pubmed/27882907

Gerold Stucki , Mauro Zampolini, Alvydas Juoc Evicius , Stefano Negrini, Nicolas Christodoulou 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

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#### ABSTRACT

Since its launch in 2001, relevant international, regional and national PRM bodies have aimed to implement the International Classification of Functioning, Disability and Health (ICF) in Physical and Rehabilitation Medicine (PR M), whereby contributing to the development of suitable practical tools. These tools are available for implementing the ICF in day-to-day clinical practice, standardized reporting functioning outcomes quality of in management and research, and guiding Educational evidence-informed policy. efforts have reinforced PR M physicians' and other rehabilitation professionals' ICF knowledge, and numerous implementation projects have explored how the ICF is applied in clinical practice, research and policy. Largely lacking though is the systemwide implementation of ICF in day-to-day practice across all rehabilitation services of national health systems. In Europe, systemwide implementation of ICF requires the interaction between practice, science and governance. Considering its mandate, the UEMS PR M Section and Board have decided to lead a European effort towards system-wide ICF implementation in PRM, rehabilitation and health care at large, in interaction with governments, non-governmental actors and the private sector, and aligned with ISPR M's collaboration plan with WHO. In this paper we present the current PRM internal and external policy agenda towards system-wide ICF implementation and the corresponding implementation action plan, while highlighting priority action steps - promotion of ICF -based standardized reporting in national quality management

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and assurance programs, development of unambiguous rehabilitation service descriptions using the International Classification System for Service Organization in Healthrelated Rehabilitation, development of Clinical Assessment Schedules, qualitative linkage and quantitative mapping of data to the ICF, and the cultural adaptation of the ICF Clinical Data Collection Tool in European languages.

**Key words:** Physical and rehabilitation medicine - International Classification of Functioning, Disability and Health - Physicians.

In 2001, the World Health Assembly (WHA) endorsed the International Classification of Functioning, Disability and Health (ICF).<sup>1</sup> The launch of the ICF was a landmark event for rehabilitation.<sup>2,</sup> <sup>3</sup> This is because for rehabilitation "the ICF serves as a practical lens through which we can observe the lived experience of health in a way that 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 persons' functioning needs, and researchers who aim to explain and influence functioning.<sup>3</sup>

Consequently, since the launch of ICF, relevant Physical and Rehabilitation Medicine (PR M) bodies at the international, regional and national level have aimed to implement the ICF in PR M. First and foremost is the application of the ICF in the definition of the PRM specialty. Thus, in 2011 the umbrella organization of PRM physicians worldwide, the International Society of Physical and Rehabilitation Medicine (ISPR M), endorsed an ICF -based conceptual description of PRM, understood as the "Medicine of Functioning",<sup>4</sup> as well as an ICF -based conceptual description of rehabilitation, understood as a health strategy in conjunction with prevention and cure.<sup>5</sup> Both conceptual descriptions were developed based on the responses to two discussion papers published in 2007 on behalf of the Professional Practice Committee of the European Union of Medical Specialists (UEMS) PR M Section.<sup>6, 7</sup> The conceptual descriptions endorsed by ISPR M have served as the basis for other conceptual descriptions e.g. for specific applications like vocational rehabilitation.8 Based on these ICF -based conceptual descriptions, rehabilitation aims to optimize peoples' functioning and to minimize the experience of disability.

ISPRM has also been instrumental in the development of practical tools necessary for the application of the ICF in rehabilitation practice, research and policy. Based on a decision taken by the ISPRM Assembly of Delegates during its first congress in 2001 in Amsterdam 9 ISPRM spearheaded the application of the ICF by leading the effort to develop ICF Core Sets, standards for the application of the ICF in rehabilitation and health care at large.<sup>10-13</sup> Collaborating with the World Health Organization (WHO ), ISPR M also contributed to the development of the so-called 'functioning properties' that will be introduced into the 11th revision of the International Classification of Diseases (ICD-11) to describe the potential impact of a specific disease/disorder on a person's

functioning, and hence will allow for the coding of functioning e.g. in the context of diagnosis-related groups (DR Gs).<sup>14-16</sup> Responding to an initiative by the Chinese Association for PRM (CAR M) <sup>17</sup> to develop a simple ICF Clinical Data Collection Tool as a "default assessment tool" for rehabilitation and health care at large, ISPR M, supported by the Italian Society of PRM (SIMFER), is now collaborating with the Asian-Oceanian Society of PRM, the UEMS PRM Section and Board, and national PRM societies in its cultural adaptation worldwide. Those practical tools allow for the implementation of the ICF in day-today clinical practice, the standardized reporting of functioning outcomes in both quality management and research, and for guiding evidence-informed policy.

Parallel to the developments of practical tools major educational initiatives <sup>18-21</sup> have reinforced the ICF knowledge of PRM physicians and other rehabilitation professionals, and numerous implementation projects have explored how to apply the ICF in clinical practice, research and policy.<sup>22, 23</sup> What is still largely lacking, however, is the full and systematic integration of the ICF in day-to-day practice across all rehabilitation services of national health systems, that is, its system-wide implementation.

In Europe, the system-wide implementation of the ICF in day-to-day rehabilitation practice requires a concerted effort and interaction between practice, science and governance. Considering its mandate in the field of competence of PRM specialists, the UEMS PRM Section and Board has decided to lead a European effort towards the 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 ISPR M's work plan with WHO

In this paper we present the leadership role of the UEMS PRM Section and Board, the emerging internal and external policy agenda and the implementation action plan towards the system-wide implementation of the ICF in PRM, rehabilitation and health care at large.

## The leadership role of the UEMS PRM Section and Board

Recognizing the opportunities and overcoming the challenges arising from the system-wide implementation of the ICF is primarily a matter of governance. Governance in this context relates to the role of a non-governmental actor such as the UEMS PRM Section and Board in the specification of norms within its field of competence and in cooperation with other medical specialties, governments, other non-governmental actors, and the private sector.

Figure 1 shows how the UEMS with its Sections, including the PRM Section, provides advice to the European Commission for primary legislation and participates in committees for the implementation of directives. It is in contact with members of the European Parliament, and through its national member associations, UEMS cooperates with national governments and provides advice to the European Council. Through these policy channels the UEMS PRM Section and Board has the capacity to advocate for the system-wide implementation of the ICF not only in PRM, but also in other areas of rehabilitation and health care at large. Thus, the UEMS PRM Section and Board is ideally positioned to lead the 301efforts in the 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.

Against this backdrop, the assembly of the UEMS PR M Section and Board decided at its meeting in St. Petersburg (3-5 September 2015) to initiate a European effort with the goal of the "system wide implementation of the ICF in PRM, envisioning its implementation in rehabilitation and health care at large". The effort is being led by the Presidents of the UEMS Section and Board (NC, AJ) and coordinated by its Secretary General (MZ) and its Expert for the ICF (GS), and involves the Clinical Affairs and the Professional Practice Committee as well as the entire UEMS PR M Board. To develop an implementation action plan a workshop was held in Nottwil, Switzerland, from 22-23 January 2016, and hosted by the Swiss Society of PR M (SGPMR) and the Swiss Paraplegic Foundation. The implementation action plan was presented, reviewed and updated in the meeting of the UEMS PR M Section and Board in Athens from 25-27 February 2016.

To strengthen its effort, the UEMS PR M also collaborates with its national member organizations and ISPR M according to their mutual recognition agreement.<sup>24</sup> The basis for the current collaboration is the ISPR M-WHO collaboration plan 2015-2017 <sup>25</sup> with a focus on the implementation of WHO 's Global Disability Action Plan 2014-2021.<sup>26, 27</sup> Item 3 of the ISPR M-WHO collaboration plan calls for national models for ICF -based routine data collection and national rehabilitation quality

management programs that aim to strengthen the disability component in national health information systems.<sup>26</sup> These two concrete goals provide the concrete reference point for the European effort towards the system-wide implementation of the ICF.

## Internal policy agenda within the field of competence of PRM specialists

#### Promoting the use of ICF by PRM specialists

Two related barriers towards the system-wide implementation of ICF in daily PRM practice are misconceptions and its perceived complexity. One misconception to be corrected is the view that the ICF is just another outcome measure. What needs to be promoted is the understanding and use of the ICF as a health information reference. The ICF is not a measure but a reference classification and standard.3 To overcome the perception that the ICF is too complex to implement in day-to-day practice, we need to foster the view that the ICF is a powerful lens through which we can observe, understand and influence people's lived experience. In turn it can guide clinical decision-making and outcome evaluation and most importantly, its use, facilitated by the now available range of suitable tools, such as the ICF Core Sets, is fundamental for rehabilitation practice and not an additional time-consuming activity. For example, the ICF is ideally suited for the standardized reporting of rehabilitation goals. With respect to assessment, the Chinese slogan "simple is best" may provide an important lesson - the ICF Clinical Data Collection Tool developed by CAR M and tested for the European cultural context by the SI MFER may be the most promising tool for assessing functioning across rehabilitation and health services of the health care system.<sup>28</sup>

## *Entrenching the ICF in the field of competeof PRM specialists*

The most important document in defining the field of competence of PR M specialists is the White book on Physical and Rehabilitation Medicine in Europe developed in a collaborative effort of the UEMS PR M Section and Board with the European Society of PR M and the European Academy of PRM.<sup>29</sup> The currently planned revision of the White book provides the unique opportunity to embed information about the ICF implementation in the White book chapters where appropriate, thus entrenching ICF implementation in the field of competence of PRM specialists.

*ICF-based outcome evaluation in quality management and accreditation of rehabilitation services* 

In the future the application of the ICF in rehabilitation service provision may become an essential aspect of rehabilitation service accreditation. More concretely, the accreditation process may examine whether and how an ICF -based measurement-for-improvement system has been integrated in rehabilitation quality management of a service is used for clinical decision-making, and has contributed to continuous improvement of service outcome.

The concrete steps necessary to integrate the ICF in rehabilitation service provision are discussed further in the section "Implementation governance challenges at the level of service and care provision" since this is as much an external as well as a PRM internal policy agenda item.

#### Beyond PRM: external policy agenda in interaction with the health care system

## *Implementation governance challenges at the European and national policy level*

The first implementation governance challenge faced is at the macro-level of European and national policy. Here the goal is to advocate for the inclusion of the ICF and ICF -based standards for data collection and reporting in the six components of national health systems including health information, service delivery, financing and work force.<sup>30</sup>

To reach this goal the UEMS PR M Section and Board could elicit the support of other UEMS Sections representing medical specialties with an interest in functioning and rehabilitation. This is highly relevant since the success of system-wide ICF implementation not only depends on the leadership of PRM, but ultimately relies on the support of other medical specialties and health professions involved in rehabilitation and disability management.One may even argue that the successful implementation of the ICF in PRM can only be achieved with the successful implementation of the ICF in national health systems at large. This insight is reflected in the European effort goal that explicitly extends ICF implementation beyond PRM, envisioning its implementation in rehabilitation and health care at large.

Implementation governance challenges at the National

#### Quality Management level

The second implementation governance challenge is at the meso-level of national rehabilitation quality management against the backdrop of macrolevel policies. To address this challenge we first have to develop an approach on how to design and implement a national rehabilitation quality management system in alignment with the microlevel ICF -based rehabilitation quality management approach described below. Moreover, strategies for aligning ICF -based national rehabilitation quality management systems with existing quality management and quality assurance systems in the rehabilitation sector and health care at large must be developed. In the context of the European effort toward system-wide implementation of the ICF first steps to develop a model for a national rehabilitation quality management, including a data collection architecture, criteria for IT solutions and solutions for data protection, have been taken. In this effort, the UEMS PR M Section and Board has initiated a collaboration with the Japanese Association of PR M (JAR M), who has embarked on a project to develop a national rehabilitation quality management system based on an existing registry.<sup>31</sup>

## *Implementation Governance Challenges at the care provision level*

The third implementation governance challenge is at the level of care provision. Clinical leaders are faced with the challenge of implementing the ICF in day-to-day clinical practice at the micro-level, while also ensuring continuous quality improvement at the meso-level of rehabilitation services and adhering to the requirements at the national level. The construction of an ICF -based clinical quality management program that is useful for both the management of individual patients as well as improvement of rehabilitation service quality, is driven by several action steps. First, it requires the unambiguous description of a service. To ensure recognition by patients, payers and policy makers, a description of a service should include a short narrative description in lay language. To minimize ambiguity and ensure comparability of rehabilitation services a description should include a systematic, classification-based description e.g. by applying the International Classification System for Service Organization in Health-related Rehabilitation (ICSO -R).<sup>32</sup> Methods for developing such narrative and classification-based descriptions were explored in the aforementioned Nottwil workshop for 6 exemplary rehabilitation services and are reported in Kiekens et al.<sup>33</sup> Based on the deliberations at the Feb. 2016 Athens meeting, developing descriptions for at least 10 rehabilitation services that represent the innovative spectrum of rehabilitation services throughout Europe is envisioned. The second action step is the specification of a so-called Clinical Assessment Schedule. A Clinical Assessment Schedule specifies what ICF domains to document (compulsory and optional). Methods for developing a clinical assessment schedule was also explored in the Nottwil workshop using the aforementioned 6 rehabilitation services. The results are presented in Prodinger et al.<sup>34</sup> As with the rehabilitation services descriptions, there is a plan to develop clinical assessment schedules for at least 10 reference rehabilitation services throughout Europe. The third action step is the ICF -based standardized documentation of functioning with data collected in clinical routine. This entails the qualitative linking and quantitative mapping of data collected with the a range of currently available data collection tools to the ICF . Qualitative linking involves linking concepts contained in the data collected to the ICF following established linking rules.<sup>35</sup> To determine the metric equivalence of items or sub-scales of the data collection tools, the items/sub-scales that cover the domain defined by the linked ICF categories are then quantitatively mapped using the Rasch methodology. The resulting Rasch scores can then be compared on a common metric. This methodology was presented at the Nottwil workshop as well.36,37

A universal alternative to the use of current data collection tools is the use of the newly developed ICF Clinical Data Collection Tool which is based on simple intuitive descriptions and uses a Numerical Rating Scale.<sup>38</sup> This tool has been developed in an international cooperation under the auspices of ISPR M and in cooperation with the ICF Research Branch, a cooperation partner within the WHO Collaborating Center for Family of International Classifications in Germany. The first version was developed by CAR M.17, <sup>39</sup> A second version, including its process for the cultural adaptation of the tool in European languages, was developed by SI MFER in collaboration with the ICF Research Branch.<sup>40, 41</sup> As part of the European effort for the system-wide implementation of the ICF, European language-specific versions will be developed and published. At the Nottwil workshop there was also agreement to develop scoring algorithms for the ICF Clinical Data Collection Tool that would allow the use of scores for clinical follow-up and outcome evaluation.

#### ICF implementation action plan

The ICF implementation action plan that resulted from discussions of the internal and external policy agenda items clearly shows that the system-wide implementation of the ICF in PR M requires a multi-faceted effort. Currently envisioned activities and deliverables are summarized in Table I.<sup>28,</sup> 32-34, 37, 42-44 They are not set in stone but must be adjusted along the way as we learn what works and what does not work. At this stage the number of services ultimately needed to adequately describe the innovative spectrum of rehabilitation services across Europe still needs to be determined. Similarly, the data collection tools that are currently used and considered both useful and valid will only be identified once the action plan has progressed. The action plan will have important consequences with respect to the human and time resources needed for qualitative and quantitative cross-mappings.

#### Conclusions

At its core the system-wide implementation of the ICF in PR M, rehabilitation and the health care system at large requires the introduction of ICF -based standardized reporting of data collected with various data collection tools and the integrative use of these data for clinical practice, clinical and national quality management as well as outcomes and epidemiological research. This represents important changes to current practice at all levels. Thus, for system-wide implementation of the ICF to be successful an unprecedented interaction between practice, science and governance is crucial. From the so-called "theory of change" 45-48 we can learn that to succeed we need "champions" and "knowledge brokers". Champions are highly credible and convincing advocates of the cause at the European, national and local level. Champions we find in delegates of national PR M societies, their network of PR M specialists and patient advocates. Knowledge brokers are those who have unique expertise that they are willing to share. The knowledge brokers in our European effort are the colleagues who spearheaded the work on developing the conceptual description of rehabilitation services, including the specification of a Clinical Assessment Schedule and the construction and application of a measurement-for-improvement system for continuous quality improvement. Finally, the UEMS PR M Section and Board's endeavor to bring together practice, science and governance would be empowered if other European PR M organizations, including the European Society of PR M and the European Academy of PR M, would join the effort. Indeed, the European effort towards the system wide implementation of the ICF in PR M, rehabilitation and the health care system at large provides the three European organizations with a unique opportunity to collectively strengthen rehabilitation and the specialty of PRM in national health systems.

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Topic	Activity	Deliverable	Comment
ICF in Data Collect	ion		
ICF Clinical Data Collection Tool	National consensus conferences to develop language-specific versions following a protocol established by SIMFER in collaboration with the ICF Research Branch <sup>28</sup> Cooperation across national societies for the development of a language- specific versions spoken in several European countries ( <i>e.g.</i> French, Dutch)	Publication of the language-specific versions in a joint publication	Hosting of the language versions of the ICF Clinical Data Collection Tool on the webpages of the relevant national societies, the UEMS PRM Section and Board (www.euro-prm. org) and the ICF Research Branch (www.icf- research-branch.org)
	Development of scoring algorithms using Rasch analysis based on a European-wide data collection effort applying the language-specific versions of the ICF Clinical Data Collection Tool	Scoring algorithms for the ICF components body functions & structures and activity & participation	
ICF in Rehabilitatio	n Services		
	Development of unambiguous narrative and classification-based descriptions of specific rehabilitation services by applying ICSO-R <sup>32, 33</sup>	List of descriptions of specific rehabilitation services in Europe	
	Identification of comparable rehabilitation services across Europe	List of similar rehabilitation services that are used across Europe along the continuum of care (acute, post-acute, long-term)	<ul> <li>Development of a European portfolio of model rehabilitation services (prototypical descriptions) and reference rehabilitation services (real life examples)</li> <li>Designation of a reference rehabilitation service based on defined criteria (established measurement-for-improvement system; leaders of the service willing to take on the role of "knowledge brokers" by sharing their expertise with colleagues and providing advice to policymakers from different European countries)</li> </ul>
	Specification of Clinical Assessment Schedules for specific rehabilitation services using a protocol currently in development <sup>34</sup>	Implemented Clinical Assessment Schedules for specific rehabilitation services	Clinical Assessment Schedules for services along the continuum of care can be combined meaningfully in national reference models for rehabilitation quality management
	Development of measurement-for- improvement systems for clinical decision- making in individual patients (micro-level) and continuous improvement of a rehabilitation service (meso-level)	Implementation of measurement- for-improvement systems in rehabilitation services across Europe	Potential for integrating a measurement-for- improvement system with a "measurement- for-research" system <i>e.g.</i> cohort studies, clinical registries and clinical trials
ICF in Data Reporti	ng		
Existing data collection tools	Identification of data collection tools that cover the ICF domains included in the Clinical Assessment Schedules of specific rehabilitation services	List of data collection tools that cover the ICF domains included in the Clinical Assessment Schedule of specific rehabilitation services	The list of data collection tools will grow with the number of Clinical Assessment Schedules
	Review of data collection tools identified in a European- wide project called "European Standardization of Outcome Measurement in Rehabilitation" (Pro-ESOR) <sup>42, 43</sup>	List of data collection tools described in Pro-ESOR that are well-known, considered valid and are currently used in clinical practice	This list will enrich the list of data collection tools that cover the Clinical Assessment Schedule domains

 TABLE
 I.—ICF Implementation Action Plan (continues).

Торіс	Activity	Deliverable	Comment
ICF-based reporting of data	Qualitative linking and quantitative mapping of data collected with the tools identified above to the ICF using the methodology developed in the ICF INFO project <sup>37, 44</sup>	Tables displaying ICF domains resulting from the qualitative linking of data collection tools Transformation tables using a 0-100 interval reference scale that resulted from the quantitative mapping of data collected with the data collection tools to the ICF	Only data collection tools that fulfill three criteria should be considered for quantitative mapping: 1) extensively used in daily practice; 2) well-known and considered valid by experts; 3) available and validated in various European languages Hosting of the qualitatively linked and quantitatively mapped data collection tools on the webpages of the relevant national societies, the UEMS PRM Section and Board (www.euro-prm.org) and the ICF Research Branch (www.icf-research-branch.org)
ICF in National Reha	bilitation Quality Management		
	Promotion of ICF-based standardized reporting of functioning outcomes to national quality agencies responsible for quality management in rehabilitation and health care at large	Implementation of ICF-based standardized reporting of functioning outcomes within national quality management agency programs	This is an opportunity for PRM to promote the ICF as a health information reference in national health systems
	Cooperation with the International Society of Physical and Rehabilitation Medicine (ISPRM) and the Japanese Association of PRM (JARM) in the development of a model data architecture for national rehabilitation registries	Availability of a model data architecture for the development of national rehabilitation registries	
	Development of IT and data protection solutions	Exemplary IT and data protection solutions	
ICF in the Accreditati	on of Rehabilitation Services		
	Development of criteria for the accreditation of ICF-based measurement-for-improvement systems that complement the current UEMS criteria for quality assurance	Document outlining the criteria for ICF-based measurement-for- improvement systems	The development of criteria for ICF-based measurement-for-improvement systems may lead to an update of the UEMS Section criteria for rehabilitation services
ICF in the Health Car	e System at Large		
	Cooperation between the UEMS PRM Section and Board with the whole UEMS in using the policy channels described in Figure 1	The UEMS supports the UEMS PRM Section and Board in its effort to implement the ICF and ICF based standards, specifically the health information component, in medicine and the health care system at large	In implementing the ICF in health systems throughout Europe the leadership of the UEMS PRM Section and Board may inspire other medical specialties to use the ICF as a health information reference for the standardized reporting of health outcomes