Some reflections on the past, present, and future of Physical and Rehabilitation Medicine (on the occasion of the 30th SOFMER congress)

In the context of an important national congress and, when colleagues meet to discuss the latest developments in our field of interest, it is of relevance to reflect on the evolution and development of the medical specialty of physical and rehabilitation medicine (PRM). This reflection naturally includes a review of the past, an analysis of the present, and the necessary and inevitable speculation about the future. I had the privilege to share my thoughts on this topic with the 30th Congress of the Société française de médecine physique et de réadaptation held in Montpellier, France on October 8–10, 2015. This article is a summary of that presentation with some additional considerations.

1. Our core values

Disability is a unique human experience that contributes to human diversity and PRM is the only medical specialty whose main purpose is to understand disability in all its dimensions and to ameliorate its consequences by developing interventions to enhance function and improve quality of life.

The roots of modern PRM as a medical specialty can be traced back, at least, to the 19th century. Although we have witnessed many changes in the way PRM is understood and practiced some of the core values remain the same and have been briefly summarized recently by DeLisa [1] as follows:

- enhancing function and independence is as important as finding a cure for a disease;
- physical agents (including exercise) can be as important as chemical agents;
- caregivers include not only the health care team but also the patient, his/her family, and friends;
- patient care is provided by a team;
- PRM professionals are obligated to change the patient’s environment and community;
- the multiple roles of PRM professionals include social advocacy.

By definition, core values are the essence of a profession and determine the course of action we select when given choices. As we plan and work for the future of PRM, it is important to always keep these core values in mind.

2. A profession and a medical specialty

By definition, a profession (and a medical specialty) is a calling or occupation requiring specialized knowledge and long and intensive preparation including instructions in skills and methods as well as in the scientific, historical, or scholarly principles underlying such skills and methods. It is worth considering what is the current status of both, knowledge and science in PRM, and how much progress we have made in both areas.

2.1. Knowledge content in PRM

I strongly believe that the quantity and the quality of our knowledge base have increased significantly in the last few decades. It has been said that when Charles II of England had a mild stroke, the treatment (and rehabilitation) administered by his personal physicians included bleeding, purgatives, enemas, sneezing powder, and antidotes containing extracts of herbs and animals [2]. Needless to say, today's protocols for the treatment and rehabilitation of stroke are vastly different. This is due to the considerable amount of new information and knowledge that has resulted from scientific research in rehabilitation. A quick search of articles registered in PubMed (a database of more than 25 million citations for biomedical literature from MEDLINE, life science journals, and online books) using the term “physical and rehabilitation medicine” shows that the number of published manuscripts in this field increased by a factor of 10 between the years 1975 and 2014. A similar search using the term “stroke rehabilitation” shows a 45 fold increase and a search for the term “exercise” shows an approximate 10-fold increase in the number of manuscripts published in the same time period. It is also interesting to note that not only the amount of also the type and nature of the information included in some of the major textbooks in the specialty has changed dramatically. For example, a textbook published in the United States in 1982 [3] included such topics as pre-vocational evaluation, massage, ultraviolet therapy, diathermy, bed positioning, training in homemaking activities, and footwear and footwear modifications. On the other hand, a recent textbook published in 2010 [4], emphasized topics such as imaging techniques, the application of the ICF in rehabilitation medicine, sports medicine, aging and rehabilitation, injection procedures, transplantation medicine, regenerative medicine, the conduct of clinical trials, and rehabilitation robotics. The topics in the former textbook have not disappeared completely from our field of study but have become less relevant in the modern practice of PRM. This shift in knowledge content and topics of interest is due in part to a more comprehensive approach to the process of rehabilitation and to the dramatic advances in medicine and science in general that have influenced the teaching and scope of practice of PRM.

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2.2. Scientific research in PRM

Research that uses the scientific method is one of the best strategies available to humans who want to understand nature and the world. In the context of clinical medicine, scientific research is based on the use of sound study designs and the systematic search for evidence that could change the practice of a medical specialty and the treatments available for patients. In this regard, success will depend on the development of research capacity and a research agenda that is responsive to the needs of persons with disabilities [5]. Capacity building is a process of individual and institutional development that leads to a higher level of skill and a greater ability to perform research [6]. The elements of research capacity are briefly presented in Table 1. Although few precise data on the current situation of research capacity in various countries have been published, an increase in both the number of scientific journals and publications in the field of PRM suggest that some of the elements of research capacity have been significantly enhanced in recent decades.

On the other hand, a research agenda represents an outline or list of questions and areas of scientific inquiry relevant to the specialty. This agenda should incorporate all levels of the clinical and translational research continuum including basic, human clinical, practice-based, and global health research. A quick overview of recent publications in PRM show that researchers are targeting all four levels of the continuum including basic research questions using animal and in vitro models, human clinical trials, practice-based research including outcomes and health services research, and population health studies. This comprehensive approach is required in PRM because of the broad spectrum of health conditions that require and could benefit from rehabilitative interventions.

2.3. Clinical trials in PRM

One of the most widely accepted research study design for the generation of new knowledge for use in human populations is the randomized controlled trial (RCT). A clinical trial is defined as “any research study that prospectively assigns human participants or groups of humans to one or more health-related interventions to evaluate the effects on health outcomes.” (http://www.who.int/ictrp/en). The total number of randomized controlled trials (> 200,000 in December, 2015) in all categories in 191 countries of the world officially registered in one database (http://www.clinicaltrials.gov/) has increased significantly in the last 5 years (Fig. 1). More relevant to this commentary, in the “rehabilitation” category, the number of trials has increased from 1445 in 2010 to 4412 active registered trials in the month of December, 2015. This volume of RCT’s is very similar to the number of RCT’s in closely related specialties such as neurosurgery, neurology, and orthopedics. Because many considered RCT’s the gold standard by which the quality of scientific evidence should be judged, this increase in RCT’s in PRM has to be considered a very positive development.

Several PRM journals have published a larger number of RCT’s in the last few years including a recent special issue of the American Journal of Physical and Rehabilitation Medicine dedicated to RCT’s published in October 2015.

Not only the quantity but also the quality of research in PRM has been improving in the last 15 years. For example, the number of studies describing sample size calculations, defining a primary outcome, reporting blinding procedures, and asking the correct question has increased significantly [7–10] in the last 20 years. These are all elements of a well-conceived and conducted research study and can be considered proxies for the quality of the study design, performance, and reporting.

3. Science and scientific discoveries

Another reason to have an optimistic view of the future of PRM is the dramatic increase in the number of scientific discoveries and technological developments in the last two decades that could impact our understanding of impairment and disability and the development of innovative rehabilitation strategies. For example, advances in genetics and genomics have resulted in a more comprehensive understanding of the contribution of our DNA to human behavior, health, and several chronic illnesses. These advances can find applications in PRM. For example, several dozen genes have been identified [11] that influence a person’s response to exercise training as well as an individual’s habitual level of physical activity. This may explain why some of our patients do not respond (so called non-responders) to therapeutic exercise as expected and suggest that the identification of genes that influence this response may help us better match patients with appropriate exercise-based rehabilitation interventions. The concept of genetic testing prior to pharmacological intervention is already being implemented in clinical practice. Will this strategy be used in rehabilitation in the near future?

Table 1
Elements of research capacity.

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<th>Element</th>
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<tr>
<td>Researchers</td>
<td>A pool of well-qualified researchers with the appropriate training and mentoring, a strong commitment to inquiry, and desire to collaborate with others</td>
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<tr>
<td>Research culture, environment, and infrastructure</td>
<td>Recognition of research and scientific discovery as an institutional, organizational, and professional core value; needed human and physical resources</td>
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<tr>
<td>Partnerships</td>
<td>Partnerships with scientists in other disciplines, academic departments, institutions and with patient advocacy groups are vital to enhancing the capacity for conducting interdisciplinary, high-quality, meaningful research</td>
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<td>Funding</td>
<td>Generous budgets dedicated to scientific research with an emphasis on rehabilitation medicine; funding for different stages of a scientific career</td>
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<td>Metrics</td>
<td>Indicators of success</td>
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Fig. 1. Number of clinical trials by category registered in the last six years in http://www.clinicaltrials.gov/.
Another example of a scientific area that has resulted in impressive advances is research into the biology of stem cells. Again, we should take advantage of these advances and explore their potential applications in PRM. Pre-clinical and limited clinical data suggest that, in the future, it may be possible to replace tissue that has been damaged or lost as a result of injury or disease with cells that have been reprogrammed to become tissue-specific (i.e., neurons, muscle fibers) mature cells. The potential to change the rehabilitation process with this type of intervention should be evident to the reader! Similarly, the field of tissue engineering is demonstrating that it is possible to grow specific tissues in a laboratory setting that may be used to replace damaged or dysfunctional organs in humans. Although these strategies are not ready to become the standard of care in the very near future, the science and early clinical studies show great promise. In my view, the field of PRM should anticipate these changes and proactively develop rehabilitation interventions that may be more appropriate for patients undergoing these advanced treatments.

Finally, we should consider advances in another related field outside of PRM that have changed our present and will alter our future. The progress we have made in rehabilitation engineering in general and the development of rehabilitation robotics in

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**Fig. 2.** National Societies active in the International Society of Physical and Rehabilitation Medicine as of the end of 2015.
particular could impact directly the level of activity and participation of persons with permanent impairments. Considerable technological advances have resulted in the design and fabrication of various types of robotic devices with the potential to impact even early rehabilitation interventions closer to the acute episode of trauma or illness. Several robots have been designed to deliver therapy and others to enhance mobility in patients, particularly stroke survivors and those with injuries to the spinal cord. Some of these devices are still in experimental stages but others are being used in clinical settings and in various age groups. Although clinical evidence is not at the same level as our enthusiasm for these devices, we should be optimistic about the potential for rehabilitation engineering to alter our rehabilitation paradigm.

It is reasonable to speculate that, in the future, when treating a patient with an impairment, we will have several choices starting with the replacement of the tissue damaged by injury or illness, the selection of an optimal rehabilitation intervention based on the genetics of the person interacting with his/her environment, the use of technology to enhance the training of the healthy and/or the new tissue, the use of devices that will replace the function that has been lost, and combinations of these and other strategies.

4. The relevance of the International Society of Physical and Rehabilitation Medicine

Many national organizations have promoted PRM in the past and a number of societies are presently active at the national level. To promote and advance PRM around the world, and in the context of a “globalized economy” it is important to have an international organization that is dedicated to the field. That organization is the International Society of Physical and Rehabilitation Medicine (ISPRM). ISPRM was founded in 1999 and includes national societies (Fig. 2) as well as individual members. It is the largest organization in the world dedicated to PRM and should serve as a catalyst for future developments in PRM.

One of the main goals of ISPRM is the dissemination and exchange of information. This is accomplished using various mechanisms such as a website (http://www.isprm.org/), world congresses, and a web of journals that includes seven journals (Fig. 3). This effort could result in the adoption of educational and clinical practice standards in all regions of the world for the benefit of persons with disabilities.

5. Conclusion

In conclusion, an analysis of the past and present of the medical specialty of PRM should make us feel optimistic about the future of our field. The knowledge base and the scientific activity needed to support the practice of rehabilitation has significantly improve. In my opinion, young professionals in PRM have entered a dynamic field and should welcome the opportunity to make a contribution for the benefit of persons with disabilities around the world.

Disclosure of interest

The author declares that he has no competing interest.

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