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Now is the time to take the next step

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DOI: 10.52057/erj.v1i1.6

received : 2 June 2021

accepted: 17 June 2021

When considering the physiotherapy landscape in France, we can observe the multitude of different colors. Our profession is built and driven by many different forces such as clinicians, scientists, educators, students, syndicates, and policy makers. All these components are essential for the growing and the independence of the profession. In this context, the position and the role of a scientific society might sometimes appear unclear, especially when defending the professional interest. However, the French Physiotherapy Society is driven by using science to serve the best interest of the profession and equally to serve the best interests of those seeking assistance from physiotherapists, patients. However, how can research be conducted in an eminently clinical field of work where vision from the scientific perspective and the clinical one often seems to move in opposite directions? On one hand, the scientist seeks to unravel mechanisms and correlations; searching for a wider context and interpreting facts relying on a population perspective to establish causation and avoid all possible bias in his/her reasoning. On the other hand, the clinician masters the art of managing situations, attaches importance to every detail that might influence a patients' well being in an ecological situation. The clinician's goal is to find personal and adapted solutions when an individual is seeking care and help. He/she applies what was learnt from educational courses and tailors his/her care based on the best available research.

Working in synergy to ensure better standards of care and research, scientists and clinicians could have a tremendous impact on the development of the profession. This is the vision that we share as members of the French Physiotherapy Society. The European Rehabilitation Journal will contribute to answering both scientific questions and to bringing information and context to improve clinical practice. With this new journal, we hope to be able to accompany each professional, so that he/she can continue to develop and thrive, whether he/she has an appetite for clinical practice, research or, both.

Scientific publications serve both scientists and clinicians. The latter is often involved in the generation of clinical questions depending on a specific context while the former identifies ways to evaluate those questions relying on scientific methods. Everyone has the potential to extend his or her reflection based on scientific literature. Some have the desire to go further, to confront their observations and share them with

their peers by submitting their work to a scientific journal to (i) inform the community about what they have observed or discovered, (ii) get the approval and recognition of their peers and (iii) help in the growing process of knowledge in their field. This knowledge dissemination is possible because of the existence of scientific journals who, most of the time, use a peer review process that evaluates and validates (or not) the content to ensure that published scientific evidence respects certain standards and thus, could be used to improve daily practice. Because of the growing scientific corpus regarding physiotherapy and rehabilitation in France, we, the French Physiotherapy Society, have decided to create the *European Rehabilitation Journal* to disseminate the best available evidence in the field of rehabilitation.

As it was previously evoked in an editorial published in this journal by Elkins et al. [1], there are many advantages to the creation of a new scientific journal governed by a scientific/professional society as opposed to a publishing company. In creating the European Rehabilitation Journal, we wish to reconnect scientific publishing with its primary goal which is the production and assessment of new knowledge, avoiding the for-profit journals' influence that increasingly puts pressure on scientists with the so called "publish or perish" constraint and the race to publish in high impact factor (IF) journals [2].

In fact, as Mark Johnston brilliantly explained, the trajectory of science has been influenced by for-profit journals with high IFs because researchers carriers are more and more based on where they publish rather than what they publish [3]. At the same time, for-profit journals sometimes prefer to highlight topics that will increase their visibility rather than focusing on the quality and relevance of the article content.

Community or scientific society-based journals can really benefit authors, the society, and the entire profession by focusing on the following values:

- Peer approved and certified content. Editors of society journals are involved in their field and have high expectations about publications. Because of this involvement, maintaining the integrity of the journal is a top priority.
- Accessible and supportive. Because the editors are scientists, authors, and colleagues, they know how difficult it is to write a story that influences the field. For that reason, reviewers' comments may seem conflicting but aim to provide authors with helpful feedback. Society journals exist to serve authors and the profession.
- Agile and responsive. As editors are deeply involved in their labs,

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departments, clinical practice and institutions we use open software solutions to support and facilitate the publication process with close relationships with authors for easier discussions and modifications.

- Relevant, recognized, and targeted. As a scientific society journal, we aim to publish the most relevant content in the rehabilitation field to be recognized by our community to ensure maximum exposure for authors.

In summary, journals owned by scientific societies and run by practicing scientists represent the goals of academic publishing, focusing on selective content for the publication of research results. The editorial team have a great responsibility and put all its energy into seeking out and helping authors tell and share their stories and experiences. One can argue that it is too soon or too late to engage ourselves in such a project. We would answer that it is the best time ever regarding the professional and scientific situation of Rehabilitation science in France. Facilitating factors are the growing integration into the University system with the creation of the section 91 in the National University Council [4] which will participate in the development of University positions for Physiotherapists, Occupational therapists, Speech therapists, and Psychomotor therapists, among others. All this with the objective to increase the development of scientific reasoning for the care of patients and the community. For all these reasons, I personally encourage you as a reader, educator, scientist, professional expert to help, preserve and support academic publishing by submitting your work to *European Rehabilitation Journal*.

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Registered International Sports Physical Therapist (RISPT): towards excellence in sports physiotherapy for the athlete

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DOI: 10.52057/erj.v1i1.12

received : 2 December 2021

accepted: 19 December 2021

Background ; IFSPT Competencies and RISPT

Physiotherapy, as a profession, is always evolving and developing its knowledge and skill base, and in turn specialist areas of practice have developed. Physiotherapists and particularly Sports and Exercise Physiotherapy specialists require in-depth knowledge, skills and competence specific to this context and area of practice [1]. Sport physiotherapists are typically at the edge of the sport field, close to the injury but also close to the performance, which requires an increasingly high levels of expertise. The International Federation of Sports Physical Therapy (IFSPT) was formed in 2000 in recognition of the need for an international group to bring together national organisations representing sports physiotherapists. IFSPT is a recognised subgroup of World Physiotherapy (www.world.physio).

As part of an EU-funded *Sports Physiotherapy for All project (SPA project)* that was completed in 2007, sports physiotherapy competencies and standards were developed rigorously by a project team, researchers, and a group of international experts in conjunction with the IFSPT. Eleven sports physiotherapy competencies were developed and defined using benchmark statements relating to effective professional behaviours that integrate specific knowledge, skills, and attitudes specific to sports and exercise physiotherapy [2]. Subsequently standards were developed that describe the specific behavioural indicators of the level at which the competencies should be demonstrated, namely a minimum level of capability. Importantly, the minimum threshold is described at Master's level, which promotes individuals having extensive knowledge and skills that demonstrate critical reasoning, flexibility, creativity, independence and leadership [3]. The competencies take a broad stance and refer to athletes of all ability levels and refer to anyone who participates in sports and exercise from recreational through to elite level and those who undertake physical activity.

The IFSPT sports physiotherapy competency document (www.ifspt.org) brings with it many advantages including; a common understanding

and description of the core professional roles and behaviours of sports physiotherapists, the promotion of professional mobility, use in quality assurance of services, clarity of role descriptions for employees, employers and general public, and as a tool for planning and delivering further professional development [1].

The IFSPT uses this document as a benchmarking tool as part of its process for approving member organisations professional development pathways, allowing members to become a Registered International Sports Physical Therapist (RISPT). Currently the IFSPT has 13 member countries with an approved development pathway, the first of these countries were approved in 2009, and currently individuals can only become a RISPT via an approved country's pathway. IFSPT approved pathways require the evidencing of both formal and informal learning, typically an MSc to meet the master's level requirement, sports physiotherapy specific work experience and the use of reflective practice allowing individuals to evidence learning from a variety of events and scenarios. These requirements are consistent with the literature that highlights the need for regular deliberate practice, reflective practice and development of different knowledge types to support professional development and development of expertise [4, 5]. Fundamentally, IFSPT approved professional development pathways promote and support individuals to develop the required knowledge, skills and behaviours to become a specialist sports physiotherapist.

While RISPT status does not license an individual in other countries, it does notify that the individual has achieved the highest level of qualification in his or her country, meeting international IFSPT requirements. Benefits include a recognition of achievement on an international level, increased research and teaching opportunities, a positive effect on consultations and invited presentations, new job opportunities, opportunities for increased job responsibility and an increase in prestige within clinical and academic settings as well as professional associations and the community as a whole.

French-speaking countries; RISPT implementation

The implementation of RISPT in Switzerland

The Swiss Sport Physiotherapy Association (SSPA, www.sportfisio.ch), founded in 2002 as a non-profit organization, is a recognized subgroup

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of PhysioSwiss (the Swiss Association of Physiotherapy) and since 2004 a Member Organization of IFSPT. Currently the SSPA counts about 550 qualified sport physiotherapist members, and strongly recommends its members to keep a record of their continuing professional development (CPD). The SSPA has cooperation contracts with the Swiss Olympic Association (which includes the various Swiss sports federations) and the major national Universities of Applied Sciences offering MSc programs in sports physiotherapy.

In 2019, the SSPA developed national CPD guidelines (based on accreditation levels) for Swiss sports physical therapists, which was officially recognized by the IFSPT in January 2020. To become a SSPA member, any physiotherapist must fulfil the minimum SVSP requirements (according to Article 4 of the statutes) for membership. Each interested SSPA member can then apply for one of the three accreditation levels (A, B, C), which are based on the 11 IFSPT competencies and on defined criteria partially formulated in cooperation with the Swiss Olympic Association. The accreditation level C is required to work as a sports physiotherapist at national and international competitions and to be able to apply for the most important sports events (e.g. Olympic Games, European and World Championships). The accreditation levels B and A are required to be able to apply as a Chief Physiotherapist Officer for national selections as well as for the most important sporting events (e.g. Olympic Games, European and World Championships). The Level A membership, which implies the completion of a MSc Level education mapped to the IFSPT competencies, will entitle those SSPA members to individually apply for RISPT registration.

The SSPA accreditation system aims to enable Swiss sports PTs to provide evidence of CPD throughout their professional careers, and therefore aiming to higher standards of athlete's care in Switzerland. It is also a unique opportunity to enhance the cooperation with the Swiss Olympic Association, the Swiss national federations, and all other related partner societies (sports medicine, sports psychology, sports nutrition, coaching).

The implementation of RISPT in Belgium

The Belgian Federation of Sports Physiotherapy (BFSP, www.bfsp.be/fr) was founded in 2005 at the initiative of Professor Meucsen, a physiotherapist, from the Vrije Universiteit Brussel. The BFSP is recognized by Axxon (the Belgian Association of Physiotherapy) and by the IFSPT since 2019. The missions of the BFSP are to represent sport physiotherapists at national and international level; to promote education, research and development of sport physiotherapy; to promote the place of the sport physiotherapist in society, both in prevention and promotion of a healthy lifestyle based on physical activity and sport.

Since 2019, the BFSP developed a national membership classification according to international IFSPT recommendations and adapted to Belgian legislation. To become a BFSP member, any physiotherapist could apply for one of the three accreditation levels (Gold, Silver, Bronze), which are based on the 11 IFSPT competencies and on specific Belgian criteria. For example, to achieve "Gold" level accreditation, the physiotherapist must have successfully completed an academic certificate program in sport physiotherapy of 45 ECTS, to certify "Long Life Learning" in specific academic education incorporating the IFSPT competencies (continuing education in sport rehabilitation, supervised internship, scientific publications in the field of sport physiotherapy), to attest at least 75% of working time in sport physiotherapy based on the IFSPT competencies, and to attest participation in national or international sport physiotherapy congresses. Moreover, a sport physiotherapist reaching the "Gold" level can become a RISPT and be recognized at international level with IFSPT status.

The implementation of RISPT in France

The national organisation of sports physiotherapy in France is representing by the SFMKS (Société Française des Masseurs Kinésithérapeutes du

Sport, www.kinedusport.com). It is the result of the Société Française des Kinésithérapeutes du Sport born in 1969. Since the second IFSPT world congress in Belfast 2017, the SFMKS had the will to integrate with the IFSPT, and in August 2021 the SFMKS became an official member organisation. The 2022 project of the SFMKS is to develop and propose a CPD pathway for French physiotherapists to be able to gain recognition as a RISPT. In France, there is a complementary diploma in sports physiotherapy, but it does not fulfil all the items required by the IFSPT. Master of Science degrees (in the field of science, technology and health) exist and focus on athlete performance and injury prevention, but again, some items are missing from the curriculums. It is therefore planned to propose a complementary SFMKS CPD pathway that will be IFSPT approved.

Once SFMKS has an IFSPT approved pathway, a group of experts will be set up to oversee the internal application process; validate all the SPA items and the applicant's experience in sports physiotherapy. Mentoring will also be considered, and a portfolio could be envisaged, to ensure the companionship achieved. This mentoring is considered essential and will be a guarantee of quality for the athletes.

Conclusion

In the three projects in Switzerland, Belgium and France, the implementation of the SPA project and IFSPT requirements, leading to RISPT, is done differently according to the legislation of each country and the history of each association. This adaptation is very important, because in each country there are already regional specificities, mainly due to the language spoken, such as French. French-speaking therapists have difficulty reading scientific literature in English, but this gap seems to be closing rapidly. The support of the IFSPT and the inter-associative collaborations are the main actors, being attentive and benevolent to the exchanges and communications of non-English speakers.

In conclusion, the aim of RISPT is to ensure that athletes are cared for by ethical, anti-discriminatory and anti-doping sports physiotherapists who are aware of the latest best practice guidelines for optimal athlete care. Thanks to the IFSPT and the SPA project, these goals for as many athletes as possible will be possible, even for those who speak French!

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A new high-quality scholarly journal will help drive physiotherapy towards being an evidence-based healthcare profession in France

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DOI: 10.52057/erj.vi1i1

received : 11 November 2020

accepted: 3 February 2021

This editorial has several purposes. It reviews the importance of establishing and maintaining a high quality, local, research journal as a forum to both foster and demonstrate a research culture among a nation's physiotherapists. It welcomes *European Rehabilitation Journal* – the journal of the Société Française de Physiothérapie. It also commends the other initiatives and achievements of the Société Française de Physiothérapie towards establishing physiotherapy as an evidence-based healthcare profession in France. Finally, it recognises the profession's need and readiness for the training of physiotherapists in France to progress to a university degree course.

It may surprise some readers to learn that the International Society of Physiotherapy Journal Editors has around 130 member journals, many of which are journals linked to a national physiotherapy member association [1]. However, physiotherapy research is not just published in physiotherapy-specific journals. For example, clinical trials of the effects of physiotherapy interventions have been published in over 4,300 journals as diverse as *Breast Cancer Research and Treatment*, *Critical Care Medicine*, *Spinal Cord*, *World Journal of Urology*, *Obesity Research and Developmental Medicine and Child Neurology*. These many forums for publication of physiotherapy research raise the question: is another journal needed? We strongly contend that it is. Establishing and maintaining a high quality, local, research journal has many advantages for the physiotherapy profession in France. It promotes a culture of research and emphasises the need for evidence-based practice by the profession. It provides a key forum for disseminating research conducted locally and for raising professional issues that have implications for local clinical practice. It provides opportunities to gain experience in conducting, reviewing and editing research. It also allows an international visibility for French physiotherapy research that has often been hidden behind the medical profession. Notably, these advantages all contribute to a form of emancipation for the physiotherapy profession in France.

We commend the Société Française de Physiothérapie for establishing *European Rehabilitation Journal* as their official journal. As an online, open-access journal, *European Rehabilitation Journal* will publish one volume per year, with papers added to the volume online as soon as they are accepted for publication. This will permit rapid publication of papers after acceptance because there will be no need to wait for the next available issue. *European Rehabilitation Journal* will follow the quality guidelines recommended by the Committee on Publication Ethics [2] and International Society of Physiotherapy Journal Editors [1]. It will use a double-blind peer-review process, publish full-text English language papers, and have low fees sufficient only to support the technical maintenance of the website and help to finance and promote research projects. All original research in *European Rehabilitation Journal* will be published under a creative commons license, which means that the authors retain ownership of the content and allow the free distribution of it. *European Rehabilitation Journal* is developed using Open Journal System, which is an open-source solution developed by the Public Knowledge Project [3]; it gathers more than 10,000 scientific, open-access journals and focuses on improving the quality and reach of scholarly publishing.

The editorial board that has been recruited consists of international experts from various fields of research including ageing, cardiorespiratory, intensive care, neurology, pain, paediatrics and sport physiotherapy plus research methodology. Papers in *European Rehabilitation Journal* are intended to span the gap between research and daily practice, so both fundamental and clinical research will be accepted. The guidelines for authors on the journal's website provide details about the design and structure of the papers. The editorial board also strongly endorses the use of the reporting guidelines on the EQUATOR network by submitting authors.

One of the goals of *European Rehabilitation Journal* is to be indexed in PubMed within the next few years. This will be achieved by demonstrating high-quality processes and a steady supply of papers with robust methodology and important research findings. While working toward this indexing status, each paper will get a digital object identifier

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(DOI), Crossref will be applied, and ORCID identifiers will be included for authors.

Establishing *European Rehabilitation Journal* is just one of the many valuable initiatives of the Société Française de Physiothérapie. Members of the Société have already published high quality physiotherapy research in many different journals including *Chest*, *BMJ*, *Journal of Physiotherapy*, *Gait & Posture*, *Annals of Physical and Rehabilitation Medicine*, and *Journal of Biomechanics*. Members of the Société are also achieving postgraduate qualifications in all areas of rehabilitation and related disciplines such as neurosciences, health economics and engineering. Every year, the Société is enriched by more members who have Masters and PhD qualifications, further contributing to the evolution of the profession. To further foster research, the Société has instituted academic scholarships and research prizes [4]. In addition, the Société organises scientific conferences every two years to provide opportunities for research dissemination, academic collaboration, and crucial feedback for junior researchers [5] and has collaborated to produce the French section of the Physiotherapy Evidence Database website (PEDro; <https://pedro.org.au/french/>) and French version of the PEDro scale (<https://pedro.org.au/french/resources/pedro-scale/>). The Société is also involved in the recent changes of the status of physiotherapy at the university level. France Mourey, who is an active member of the Société, has been elected President of the Rehabilitation Section (Section 91) in the National University Council (CNU) [6].

World Physiotherapy recommends that training for entry-level physiotherapists should be based on university studies of a minimum of four years, independently validated and accredited as being at a standard that affords graduates full statutory and professional recognition [7]. The Société shares that vision, encouraging its members to take up academic positions. World Physiotherapy provides support and resources to countries where the profession is seeking to establish entry-level physiotherapist education programs at universities [8]. World Physiotherapy's support includes assistance to national physiotherapy associations with the development of appropriate educational standards and with the development of accreditation/recognition processes [9].

We recognise that the initiatives of the Société Française de Physiothérapie are generating excellent conditions for the training of physiotherapists in France to progress to a university degree course, including qualified academic staff with clinical expertise, research skills and publication experience. The 'universitisation' of physiotherapist training will be a crucial step in improving the clinical practice of French physiotherapists and thereby achieve better health outcomes for the French population. And importantly, high-quality clinical research relevant to physiotherapy practice is growing rapidly. At the time of writing, PEDro (<https://pedro.org.au>) contained over 49,000 trials, reviews and guidelines evaluating physiotherapy interventions [10] and the Diagnostic Test Accuracy database (DiTA; <https://dita.org.au>) contained nearly 2,000 primary studies and reviews evaluating the accuracy of diagnostic tests used by physiotherapists [11]. This constitutes enormous content for an evidence-based curriculum in physiotherapy.

Internationally, the high academic standards of physiotherapists are receiving greater recognition. For example, the Cochrane Collaboration has appointed a physiotherapist as the co-chair of the Cochrane governing board and another physiotherapist as the co-author of the Cochrane Handbook of Systematic Reviews. Physiotherapists have been appointed to the Organisation for Economic Co-operation and Development (OECD), the World Health Organization, and the Global Rehabilitation Alliance. Physiotherapy in France can share in this success if it becomes an academic discipline. We encourage all movement towards this goal.

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French translation and validation of the Keele STarT MSK Tool

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DOI: 10.52057/erj.v1i1.5

received: 21 May 2021

accepted: 20 August 2021

ABSTRACT

Background: The Keele STarT MSK Tool is a 10-item questionnaire developed to classify patients suffering from one of the five most common types of musculoskeletal pain into three sub-groups according to their risk of chronic pain (i.e. low risk, medium risk and high risk). **Objectives:** The objective of the present study was to translate the Keele STarT MSK Tool into French and to evaluate its main psychometric properties. **Methods:** The translation and intercultural adaptation of the questionnaire were carried out using a 6-step process. The following psychometric properties were investigated: floor and ceiling effects, construct validity, internal consistency and test-retest reliability including Standard Error of Measurement and Smallest Detectable Change. **Results:** 101 patients suffering from musculoskeletal pain participated in the study. No floor nor ceiling effects were observed. A Cronbach's alpha of 0.65 was found, revealing moderate internal consistency. All items were demonstrated to be significantly correlated with the total score (range of correlations: $r=0.2$ for item 7 to $r=0.78$ for item 1). A significant correlation of $r=0.78$ between the French Keele STarT MSK Tool and the ÖMPSQ-short was found. Nevertheless, a poor agreement between tools was found, highlighted by a Kappa value of 0.57. Test-retest reliability was excellent (Intraclass Correlation Coefficient 0.97). The Standard Error of Measurement and Smallest Detectable Change of ± 1.17 were 0.42 and ± 1.17 , respectively. **Conclusion:** A validated French version of the Keele STarT MSK Tool is now available and can be used by health practitioners to stratify patients as being low, medium or high risk for persistent musculoskeletal pain.

KEYWORDS: Chronic pain, Musculoskeletal pain, Translation, Validation Study.

Introduction

Musculoskeletal (MSK) conditions represent a considerable problem worldwide [1, 2]. MSK pain is prevalent and can place a heavy burden for those affected [3]. Moreover, consultations rates for MSK pain account for around a fifth of all consultations in primary care [4]. MSK conditions therefore have a major impact, not only for the individual but also on the health care system and society.

Patients with MSK pain in different body regions share common prognostic factors, as highlighted in a recent systematic review [5]. Therefore,

prognostic stratification with recommended matched treatments for each subgroup has been suggested as clinically relevant and cost-effective. The Start Back Screening Tool (SBST), developed and validated in 2008 by Hill et al. [6, 7], is a brief questionnaire designed to screen primary care patients with low back pain for prognostic indicators that are relevant to initial decision making. This tool became rapidly very popular. Indeed, with a simple tool, patients are matched to treatment packages appropriate for them, which significantly decrease disability from low back pain, reduce time off work and save money by making better use of health resources.

Recently, a modified, generic version of the SBST, has been developed by Campbell et al. [8] for other musculoskeletal conditions. This new tool, the Keele STarT MSK Tool, allows for the stratification of primary

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care patients suffering from one of the five most common types of musculoskeletal pain (back, neck, shoulder and multi-site pain) into three sub-groups at risk of chronic pain (low-, medium- and high risk). This tool has been designed to assist clinicians in their clinical decision making, by giving information on the likely risk of a poor outcome at the time a patient consults [9, 10]. The Keele STarT MSK Tool is comprised of 10 items assessing individual's function and disability, pain and coping, comorbidity and the impact of pain. The first item is composed of a 0-10 numeric rating scale (NRS) for pain and the remaining nine items consist of yes/no questions. The total score of the Keele STarT MSK Tool ranges therefore from 0 to 12 points. Participants with a score between 0 and 4 points, 5 and 8 points or 9 and 12 points are respectively considered at low, moderate or high risk of chronic pain [11].

The Keele STarT MSK Tool has shown good predictive and discriminative ability in development and validation samples [11, 12]. The Keele STarT MSK Tool was initially developed in English and, to our knowledge, has only been translated into Dutch [13]. Despite French being one of the most widespread languages worldwide and the fifth most spoken language, no French version of the Keele STarT MSK Tool is available. The objective of this study was therefore to translate the Keele STarT MSK Tool into French and to investigate its psychometric properties so as to confirm its validity and reliability as an instrument to classify risk of chronic pain for primary care patients suffering from MSK pain.

Methods

The study was developed using two main steps. First, the Keele STarT MSK Tool was translated in French and culturally adapted. Then, the questionnaire was submitted to a sample of individuals suffering from musculoskeletal pain for measuring psychometric properties of the French Keele STarT MSK Tool, respectively its internal consistency, test-retest reliability, construct validity and floor/ceiling effects. The study of the psychometric properties was performed considering the principles of the Consensus-based Standards for the Selection of Health Status Measurement Instruments (COSMIN) recommendations [14]. The full protocol of the study is available under request to the corresponding author. The study protocol was approved by the Ethical Committee of the University of Liège.

French Translation and Adaptation Process

Permission was obtained from the developers of the Keele STarT MSK Tool to translate the questionnaire. The translation of the Keele STarT MSK Tool from English to French was performed according to guidelines of Guillemin et al. [15] and Beaton et al. [16]. This translation consisted of 6 phases: 1) during the first phase, the "forward-translation", two bilingual translators, native French-speakers, independently translated the tool into French; 2) during the second phase, a consensual version was produced by the two native French speakers; 3) during the third phase, the "back translation", two bilingual translators, native English-speakers, independently translated the common version back into English to check its accuracy; 4) during the fourth phase, an expert committee, composed of the four translators and a moderator, reviewed all of the documents, evaluated the conceptual differences between the original questionnaire and the back-translated version and produced a first version of the translated tool; 5) during the fifth phase the translated Keele STarT MSK Tool was subsequently presented to a linguist, to make sure that the translation was appropriate; 6) finally, during the last phase, the tool was submitted to 30 participants for a pre-test.

Study population

Candidates were eligible if they were adults and if they had recently consulted a doctor (either their general practitioner or their specialist)

for knee, cervical, scapular or diffuse musculoskeletal pain. Individuals suffering from cancer, inflammatory arthritis, spondylarthritis, neurological disease or individuals with recent trauma, cognitive impairment, dementia, terminal illness or suffering from pain related to pregnancy were excluded. Participants were recruited at the University Hospital of Liège (Belgium), at the Mont-Falaise Hospital (Belgium) and also by means of social media and flyers distributed in gyms, physical therapy practices and companies/industries. Individual consent to participate was obtained from participants.

At the beginning of the study, socio-demographics characteristics as well as the site of pain of participants were recorded. Once included, participants were asked to complete the French Keele STarT MSK Tool twice, with a 7-day interval between. They were also invited to complete two additional questionnaires. First, they completed the French validated version of the Örebro Musculoskeletal Pain Screening Questionnaire Short-Form (ÖMPSQ-short) [17, 18], which is a 10-item questionnaire that identifies workers at a higher risk of work disability. The total score obtained varies from 1 to 100 points, with a score higher than 50 reflecting a higher estimated risk for future work disability [19]. Second, they completed the French version of the Short-Form 12 (SF-12) questionnaire [20], which is a generic quality of life questionnaire. The SF-12 contains a mental component (MCS) and a physical component (PCS) both are scored out of 100 points.

Participants were categorized as being at low, moderate or high risk of chronic MSK pain according to the results of the French Keele STarT MSK Tool. Differences of sociodemographic and clinical characteristics between these three categories were measured using an ANOVA for continuous variables that followed a normal distribution, a Kruskal-Wallis test for continuous variables that did not follow a normal distribution and with a Chi squared test or Fisher exact test for qualitative variables.

Psychometric evaluations

All analyses were carried out with IBM SPSS for Windows, version 25 (Armonk, NY: IBM Corp.). Normality of distribution of continuous variables was first established on the basis of the distance between mean and median, the histogram, the quantile-quantile plot and the Shapiro-Wilk test. Variables that displayed normal distribution were reported as mean and standard deviation, and non-normal variables as median and interquartile range (P25–P75). Qualitative and binary variables were expressed as absolute and relative frequencies. Moreover, the choice of psychometric statistics used in the analyses was made according to the distribution of variables.

Internal consistency: The estimation of homogeneity across items of the French Keele STarT MSK Tool, or internal consistency, was analysed by calculating the Cronbach's alpha of the total score. The value of alpha varies between 0 and 1, with a good level of internal consistency established when the alpha value ranges from 0.70 to 0.95 [21]. The questionnaire's internal consistency was evaluated as a whole and by deleting a single item one by one. Moreover, to further test internal consistency, we also measured correlations between the total score and each individual item. Significant correlations higher than 0.6 were considered as strong correlations [22].

Construct validity: The construct validity of the French Keele STarT MSK Tool was analysed by correlation with the ÖMPSQ-short. Pearson's correlation coefficient was used for comparison with a high correlation expected between both instruments. Significant correlations higher than 0.6 were considered as strong correlations [22]. Moreover, a Cohen Kappa Coefficient was measured to reflect agreement between the Keele STarT MSK Tool and the ÖMPSQ-short for the categorization of patients at high risk of chronic pain. A Cohen Kappa coefficient higher than 0.6 was considered as acceptable [23].

Floor/ceiling effects: Floor and ceiling effects were considered to be present if more than 15% of the population obtained a maximum score (ceiling effect) or a minimum score (floor effect).

Test-retest reliability: Test-retest reliability shows the extent to which the questionnaire produces the same scores for repeated measurements in participants whose health has not changed [24]. For the one-week test-retest reliability, the Intraclass Correlation Coefficient (ICC – two-way mixed, absolute agreement) was calculated for the total score of the questionnaire. ICC values higher than 0.7 were considered as acceptable [25]. Cohen's Kappa coefficient was calculated for individual binary items, with values higher than 0.6 considered as acceptable [23]. The standard error of measurement (SEM) and the smallest detectable change (SDC) of the questionnaire were also calculated using the following formulas [21]: $SEM = SD \times \text{square root}(1 - ICC)$ $SDC = 1.96 \times SEM \times \text{square root}(2)$ The SEM provides a range around the observed value in which the theoretical “true” value lies. The SDC indicates the amount of change that needs to be measured to be sure that the change measured is real, and not potentially a product of measurement error [24].

Results

French Translation and Adaptation Process

The 10 questions of the Keele STarT MSK Tool were translated without any major difficulties. All differences between translators, both in the phases of translation and back-translation, were resolved by consensus. A prefinal version of the translated questionnaire was pre-tested with 30 participants. The comprehensibility of the questionnaire was excellent, no further change was required during this pilot phase. The final French version of the tool has been validated by the expert committee and is available in Appendix 1.

Psychometric evaluation

Study population: 101 participants took part in this study and completed both the French Keele STarT MSK Tool and the ÖMPSQ-short tools. The sample consisted of 63 women and 38 men with a median age of 25.0 years (interquartile range 21.5–41.0 years). The majority of the sample was composed of active workers (44.6%) or students (34.7%). Respectively 29, 54 and 18 participants were categorized as low, moderate and high risk of chronic pain according to the Keele STarT MSK Tool. Back pain was the most frequently reported symptom by the participants (26.7% of the sample), followed by knee pain (24.8% of the sample). Based on the first item of the Keele STarT MSK Tool, pain was significantly lower for individuals categorized as low risk of chronic pain ($p < 0.001$). Moreover, a better quality of life, both for the mental ($p = 0.01$) and physical component scales ($p < 0.001$) of the SF-12 was observed for individuals at low risk of chronic pain (Table 1).

Internal consistency: A Cronbach's alpha of 0.65 was found revealing moderate internal consistency. When one item was removed from the analysis, the lowest Cronbach's alpha obtained was 0.55 (when removing item 1). Removing other items did not affect the internal consistency of the French Keele STarT MSK Tool (Table 2). All items also demonstrated significant correlations with the total score (highest correlation for item 1 with $r = 0.78$, $p < 0.001$, lowest correlation for item 7 with $r = 0.2$, $p = 0.04$).

Construct validity: The French Keele STarT MSK Tool had good construct validity highlighted by a strong and significant correlation with the ÖMPSQ-short ($r = 0.78$, $p < 0.001$). The ÖMPSQ-short score was significantly lower for participants at low risk of chronic pain, as diagnosed with the Keele STarT MSK Tool (28 ± 10.8 points vs 42.1 ± 11.5 points vs 65 ± 11.9 points for individuals at low, moderate and high risk of chronic pain, $p < 0.001$, respectively) (Table 1). Using the Keele STarT MSK Tool, 18 (18%) of the participants were categorized as “high risk”, using the

ÖMPSQ-short, 30 (30%) were categorized as “high risk”. Agreement between both tools was not optimal, however, with a kappa coefficient of 0.57, (95% CI 0.39 ; 0.75, $p < 0.001$).

Floor and Ceiling effects: No floor, nor ceiling effect was observed for the French Keele STarT MSK Tool.

Test-retest reliability Among the 101 participants, 51 participants did not report any modification of pain during the 7-day interval and could therefore be invited to complete the French Keele STarT MSK Tool a second time. Test-retest reliability for those 51 participants for the total score was excellent with an ICC of 0.97 (95% CI 0.95–0.98). Kappa Coefficient values for individual items were excellent and ranged from 0.79–0.95 (Table 3). Using this sample of 51 participants included in reliability analyses, a SEM of 0.42 and a SDC of 1.17 were obtained.

Discussion

Evidence shows that chronic MSK pain represents a considerable burden for the individual and society. It is essential to have tools to categorize individuals into subgroups to offer matched and appropriate treatments with regards to the clinical conditions of patients and avoid pain becoming chronic. Our study has established a French version of the Keele STarT MSK Tool with acceptable internal consistency, excellent test-retest reliability and absence of floor/ceiling effects. Although we found a good correlation between the total scores of the French Keele STarT MSK Tool and the French ÖMPSQ-short tool, there was poor agreement between both tools in identifying patients at high risk of chronic pain, highlighted by a Kappa coefficient of 0.57.

To provide equivalence between the English and the new French version of the Keele STarT MSK Tool, a rigorous translation and cross-cultural adaptation process was followed. Input from the 30 participants of the pre-test and from a linguistic expert during the expert committee review confirmed that the French Keele STarT MSK Tool has the same content as the original English Keele STarT MSK Tool, while also being comprehensible to its target audience.

The sample of participants included in the validity study consisted of 101 individuals suffering from one of the five most common types of musculoskeletal pain. In accordance with the literature, highlighting a higher proportion of women in medical consultations for MSK pain [26], we also included a higher proportion of women in the study (62.4%). In our sample, the Keele STarT MSK Tool classified 18% of the population as high risk for chronic pain, which is in between the prevalence found in the study by Dunn et al. [11] who validated the original Keele STarT MSK Tool (i.e. 33% of the population was categorized as “high risk”) and the prevalence found in the study of van den Broek [3] et al. who validated the Dutch translation of the Keele STarT MSK Tool (i.e. 2.8% of the population was categorized “high risk”). In the Dutch validation study [3], authors raised some hypotheses to explain the low prevalence found. Among the hypotheses, they explained that they included only patients that consulted their physiotherapist and not their general practitioners, in contrast with the Dunn et al. [11] study. In our study, we included participants consulting their general practitioners or addressed to a physiotherapist by a specialist physician which might explain that our prevalence was higher than in Van den Broek et al. [3] study.

Psychometric analyses revealed that the French Keele STarT MSK Tool has a moderate but acceptable internal consistency (Cronbach's alpha of 0.65). With this value, the internal consistency of the Keele STarT MSK Tool could not be considered as excellent. However, all items appear to be significantly and positively correlated with the total score of the questionnaire, revealing that, even if homogeneity of the tool is not perfect, it is nevertheless acceptable for its purpose. Only item 7 demonstrated a relatively low correlation with the total score. Neither the validation of the

Table 1 Socio-demographic and clinical characteristics of the population

	Total sample n=101	Low KSMT (0-4 points) n=29	Moderate KSMT (5-8 points) n=54	High KSMT (9-12 points) n=18	p-values*
Sex					
Women	63 (62.4)	15 (51.7)	37 (68.5)	11 (61.1)	0.32
Age (years)	25.0 (21.5-41.0)	24.5 (21.0-27.1)	27.0 (22.7-41.7)	24.5 (20.7-41.2)	0.29
Professional status					
Active	45 (44.6)	9 (31.0)	28 (51.9)	8 (44.4)	0.48
Student	35 (34.7)	12 (41.4)	16 (29.6)	7 (38.9)	
Incapacity	8 (7.9)	2 (6.8)	4 (7.4)	2 (11.1)	
Retired	6 (5.9)	2 (6.9)	3 (5.6)	1 (5.6)	
Unemployed	7 (6.9)	4 (13.8)	3 (5.6)	0 (0.0)	
BMI (kg/m²)	24.1 (20.9-26.4)	24.5 (21.0-27.1)	24.0 (20.7-26.2)	23.9 (20.6-27.1)	0.95
Site of pain					
Neck	15 (14.9)	4 (13.8)	8 (14.8)	3 (16.7)	0.14
Back	27 (26.7)	6 (20.7)	16 (29.6)	5 (27.8)	
Shoulder	18 (17.8)	5 (17.2)	12 (22.2)	1 (5.6)	
Knee	25 (24.8)	12 (41.4)	10 (18.5)	3 (16.7)	
Multi-site	16 (15.8)	2 (6.9)	8 (14.8)	6 (33.3)	
Pain (NRS)	5.64 ± 2.05	3.59 ± 1.35	5.96 ± 1.47	8.00 ± 1.24	<0.001
SF-12					
PCS (/100)	50.0 ± 9.52	56.5 ± 7.52	50.0 ± 7.55	39.4 ± 8.44	<0.001
MCS (/100)	50.0 ± 10.3	51.1 ± 10.9	51.3 ± 9.94	44.2 ± 9.03	0.01
ÖMPSQ-short	42.1 ± 16.7	28.0 ± 10.8	42.1 ± 11.5	65.0 ± 11.9	<0.001
KSMT (0/12)	5.74 ± 2.56	2.6 ± 1.18	6.2 ± 0.99	9.5 ± 0.71	<0.001

KSMT: Keele STarT MSK tool ; BMI: Body Mass Index ; ÖMPSQ-short: Örebro Musculoskeletal Pain Screening Questionnaire Short-Form; NRS: Numeric Rating Scale *p-values for continuous variables obtained from an ANOVA test for continuous variables with a normal distribution (ÖMPSQ-short, Pain(NRS), SF-12 and KSMT) and from a Kruskal-Wallis test for continuous variables without a normal distribution (age and BMI) ; p-values for qualitative variables obtained from a Chi² test or a Fisher exact test.

Table 2 Values of internal consistency

	Cronbach's alpha when item removed	Correlation with the total score of the KSMT	P-value for correlation
Item 1	0.55	0.79	<0.001
Item 2	0.61	0.53	<0.001
Item 3	0.61	0.54	<0.001
Item 4	0.66	0.28	0.005
Item 5	0.63	0.44	<0.001
Item 6	0.62	0.47	<0.001
Item 7	0.66	0.20	0.04
Item 8	0.58	0.64	<0.001
Item 9	0.63	0.44	<0.001
Item 10	0.63	0.44	<0.001

KSMT: Keele STarT MSK tool

Table 3 Kappa Coefficient values for each individual items

Item	Kappa	95%CI
Item 1	0.81	0.70 ; 0.94
Item 2	0.89	0.74 ; 1.04
Item 3	0.95	0.85 ; 1.05
Item 4	0.89	0.74 ; 1.04
Item 5	0.79	0.56 ; 1.01
Item 6	0.95	0.84 ; 1.05
Item 7	0.93	0.81 ; 1.06
Item 8	0.91	0.79 ; 1.03
Item 9	0.91	0.78 ; 1.03
Item 10	0.95	0.86 ; 1.04

original tool [11] nor the validation of the Dutch translation of the Keele STarT MSK Tool [13], provided a measure of internal consistency of the tool, which prevents us from comparison. During the French translation and validation of the SBST, the authors found a Cronbach's alpha of 0.74 for the psychological subscale of the tool, which is close, but nevertheless better than the internal reliability of the Keele STarT MSK Tool. However, the Keele STarT MSK Tool does not have a psychological subscale, which does not allow for optimal comparison between the tools.

Construct validity of the French Keele STarT MSK Tool has been demonstrated by a strong, positive and significant correlation with the ÖMPSQ-short questionnaire [27]. Nevertheless, when measuring agreement between tools to classify individuals as "high risk" of chronic pain, we found poor concordance, with a Kappa coefficient of 0.57, which is below the acceptable threshold of 0.6. This apparently opposite result simply reflects that both tools seem to evolve in the same direction and are therefore correlated but, unfortunately, they do not classify the same individuals as high risk.

We also demonstrated excellent test-retest reliability over a one-week period, both for individual items and for the total score of the French Keele STarT MSK Tool. For this analysis, only half of the participants

completed the French Keele STarT MSK Tool twice. Even if the sample was restricted compared to the full sample of participants, the sample size is acceptable from a methodological point of view [16]. The validation of the original Keele STarT MSK tool did not provide a reliability analysis. However, in the Dutch translation and validation study, authors found a quadratic-weighted kappa coefficient for the total score of 0.71. Because of the continuous format of the total score of the questionnaire, we decided to measure an ICC for the total score and measure Kappa Coefficients for all items separately. We found high values of reliability with an ICC of 0.97 for the total score and Kappa values higher than 0.79 for individual items, which confirmed high reliability of the questionnaire. In our study, we were also able to calculate the standard error of measurement and minimal detectable change of the questionnaire, which was not computed in prior studies. The MDC for the French Keele STarT MSK Tool is 1.17 points (on a scale from 0 to 12 points), which means that a individuals would have to change by at least this amount before we can be sure that he/she has actually improved or deteriorated.

Finally, no floor nor ceiling effects were identified. This psychometric property is important for the capacity of the tool to detect changes. When floor/ceiling effects are identified, tools are less sensitive to change and less able to discriminate between patients.

Limitations

Because of the cross-sectional design of our study, we were unable measure the responsiveness, the minimal clinical important difference nor the predictive validity of the French Keele STarT MSK Tool. During their Dutch translation process, van de Broek et al. [13] measured the ability of the Dutch Keele STarT MSK Tool to predict persisting disability at 3 months. They found relative risk ratios for persisting disability of 2.2 for the medium risk group and 7.3 for the high-risk group. However, even if they were the first ones to provide longitudinal psychometric properties of this questionnaire, their sample size for high-risk patients only included 4 patients, which limits generalisability of findings in this group. Still because of the cross-sectional design of the study, we measured the validity of the French Keele STarT MSK tool only through construct validity and not using criterion validity, which is also questionable. Indeed, it would have been very informative to obtain longitudinal data on the incidence of chronic pain in our population and the possible association between this incidence and the results obtained from the Keele STarT MSK tool. Another possible limitation of our study is that almost 80% of our sample was comprised of active workers and students. A selection bias may have occurred because we mainly recruited via social networks and flyers in companies/industries. Therefore, our sample is represented by a high proportion of active workers, and a lower proportion of unemployed or retired participants, or people with work incapacities.

Perspective

Results of our study encourages clinicians to use the French Keele STarT MSK tool to help identify French-speaking patients at risk of chronicity and to identify the presence of psychosocial factors to be taken into account in the clinical management of the patient. Because the responsiveness, the minimal clinical important difference, and the criterion validity of the questionnaire have never been measured, further longitudinal studies using the Keele STarT MSK tool should be encouraged.

Conclusion

The French version of the Keele STarT MSK Tool is now available and shows good validity and reliability values. This tool can be used with confidence to obtain a classification of individuals suffering from MSK conditions at low, moderate or high risk of chronic pain. Before this study, the Keele STarT MSK Tool had been only validated in one unique

population study. With this study, we validated it in a second cohort from a different country.

Disclosure of interest

The authors report no conflict of interest

Ethics

The study was approved by the Ethical Committee of the University of Liège

Data availability

All data are available under request to the corresponding author

Authors' contribution

J-F. Kaux, and C. Demoulin designed the study. L. Criscenzo recruited participants and collected the data. S. Bornheim and J. van Beveren were translators and participated in the interpretation of results. L. Criscenzo and C. Beaudart run the analyses. C. Beaudart, J-F. Kaux and C. Demoulin interpreted the data. C. Beaudart drafted the manuscript. All authors reviewed the manuscript and approved it.

Acknowledgments

We would like to thank all the participants of this study. We would also like to thanks the Fondation Léon Frédéricq, Fonds CNRF for its support.

Fundings

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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Physiotherapy management in patients with Covid-19

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DOI: 10.52057/erj.v1i1.2

received: 8 March 2021

accepted: 14 April 2021

ABSTRACT: The coronavirus disease 2019 (COVID-19) is caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) which is responsible for the current pandemic and results in a large number of hospitalizations. This highly contagious disease causes severe acute respiratory infection; thus, many patients require management in intensive care. At a time when there is a high influx of patients with COVID-19 in Intensive Care Units all over the world, there is little literature concerning the physiotherapy management of these patients. This article provides information based on the latest evidence to help physiotherapists optimize care, to protect patients and care providers in the Intensive Care Units, and for follow-up care.

KEYWORDS: Covid-19; critically ill; intensive care unit; physiotherapy; rehabilitation

Background

The number of cases of SARS-CoV-2, responsible for the coronavirus disease 2019 (COVID-19), rose at an exponential rate and rapidly reached the status of a pandemic. In a cohort from China, the COVID-19 was associated with severe disease requiring intensive care in approximately 5% of cases and the overall fatality rate was 2.3%. The death rate for all infected patients may be in the range of 0.5% to 5.6% [1, 2]. Among patients requiring hospitalization, the proportion of case-fatality is between 5% and 15%. However, in patients who become critically ill, it ranges from 22% to 62% [3, 4]. From ICU to the recovery period, the interventions of physiotherapists are essential to prevent potential acquired muscle weakness and to improve the functional recovery of patients. The objective of this article is to recall the main functional consequences of hospitalization and to synthesize the possible actions (Figure 1). A section is also devoted to post-hospital care.

Factors associated with admission to intensive care

According to the latest available data, patients who require intensive care are older than patients who do not require intensive care (median age,

66[57-78] years vs 51[37-62] years), and 72.2% have underlying comorbidities, commonly diabetes, respiratory and cardiac disease [1, 4]. In a cohort study [5], death was associated with older age, a higher Sequential Organ Failure Assessment (SOFA) score, and d-dimer levels above 1.0 µg/L on admission. In this study, the median duration of viral shedding was 20 [17.0–24.0] days in survivors, but continued until death in fatal cases [5]. The most common symptoms on hospital admission were fever (94%) and cough (79%), followed by sputum production (23%) and fatigue (23%), which is concordant with the study by Yang et al. published early on [3].

Given the severe acute respiratory infection the disease causes, intensive care is a key component of the management. The median time between symptom onset and admission to the Intensive Care Unit (ICU) has been reported to be 9.5[7–12.5] days, suggesting a gradual deterioration in the majority of cases [3]. Two observational ICU studies showed that between 47% and 71% of patients admitted required invasive ventilation [3, 4]. Non-survivors were more likely to develop Acute Respiratory Distress Syndrome (ARDS) compared to survivors and were more likely to need mechanical ventilation [3]. The most documented reason for requiring intensive care was for respiratory support, of which two-thirds of patients met the criteria for ARDS [4]. In addition to respiratory failure, sepsis and heart failure are also reported to be common reasons for admission to intensive care and subsequent intubation [5, 6].

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Hygiene procedures for COVID-19 transmission control

What is the risk of SARS-Cov-2 contamination for healthcare providers?

The risk of nosocomial transmission of SARS-Cov-2 is high. One of the largest cohort reported revealed that a total of 1716 healthcare providers were contaminated out of 44672 confirmed cases of COVID-19. Around 15% of these cases were classified as severe or critical and five deaths occurred [1]. All care providers (including physiotherapists) that manage individuals with COVID-19 should therefore be thorough with their own protective measures, especially when providing aerosol-generating procedures. Moreover, contaminated care providers may also contaminate other patients. Another important point to consider is that the mean incubation period for SARS-Cov-2 infection is 5.2 days, but it can be up to 14 days [7]. If available, physiotherapists should wear surgical masks when taking care of other patients, or at least the most vulnerable ones, even if they have no signs of COVID-19 infection.

What are the recommendations for the prevention and control of infection in care providers?

One of the key components of infection prevention for the management of individuals with COVID-19 infection is staff education [8]. These measures involve taking precautions during all procedures that can generate aerosolization, droplets and contact. Personal Protective equipment (PPE) such as a surgical cap, a well-fitted high filtration mask (N95/FFP-2 masks), goggles or a face shield, a non-sterile, waterproof, long-sleeve gown and non-sterile gloves should be worn and at all times within the patient's room. A complete alcohol-based hand rub should be performed before, during and after dressing and undressing. All this equipment should be removed in the antechamber and treated as infectious waste (except for face shields and goggles). Comprehensive guidelines for dressing and undressing procedures have been published [8]. Protective measures for non-aerosol generating procedures can be limited to surgical masks, the use of gloves, gowns and goggles [9]. No personal belongings should be brought into the patient's room. Finally, all non-essential care procedures should be avoided to decrease the risk of viral transmission.

All therapists who are involved in aerosol-generating procedures and caring for patients on ventilatory support (Continuous positive airway pressure, Non-invasive Ventilation, High Flow Nasal Canula etc.) must use high levels of protection.

In the acute phase of a COVID-19 infection, caregivers should only enter the patient's room if their presence is essential, and they should be equipped with the appropriate level of PPE [10]. Aerosol procedures should be applied with an awareness of the potential risks of contamination, and the aim of each intervention should be determined before entering the room (Figure 1). The Surviving Sepsis Campaign guidelines on the management of critically ill patients with COVID-19 suggested using a surgical/medical mask rather than a high filtration mask in addition to contact and eye protection during non-aerosol-generating procedures such as the prevention or treatment of complications relating to bed rest. This recommendation is applicable for both non-ventilated patients and those under invasive mechanical ventilation (closed circuit) [11].

Clinical Management in the ICU and Outcomes

The management of severe cases of COVID-19 is very close from the management of other types of viral pneumonia that cause respiratory failure. The principal feature of patients with severe disease is the development of ARDS that is characterized by a serious deterioration in gas exchange driven by alveolar and interstitial infiltrates [12]. Therefore, evidence-based treatment guidelines for ARDS should be followed, including conservative fluid strategies, antibiotic-therapy for potential bacterial co-infection, lung protective ventilation and prone positioning [13].

Physiotherapy for patients on invasive mechanical ventilation

What are the consequences of mechanical ventilation?

Approximately 50% of patients admitted to ICU develop ICU-acquired weakness, which may increase the duration of mechanical ventilation [14]. ICU-acquired weakness may also persist for up to 5 years after hospital discharge, with a significant loss of functional capacity [15]. The main contributors to ICU-acquired weakness are inflammation, metabolic disorders, and muscle rest during sedation or neuromuscular blockers, particularly in patients with sepsis and prolonged invasive mechanical ventilation [16, 17]. A high proportion of COVID-19 patients are on invasive ventilation (71% of required mechanical ventilation in the cohort by Yang et al. [3]). It is therefore to be expected that the vast majority of these patients will develop ICU-acquired weakness. In addition to physical weakness, stays in ICU often result in cognitive and psychological impairments, which are collectively named post intensive care syndrome (PICS). There is a large body of evidence showing that muscle weakness is an independent factor associated with a higher rate of long-term mortality and a decrease in functional capacity [18, 19]. A similar association has been found for PICS syndrome [20].

How should muscle function be assessed in patients with COVID-19?

Overall strength can be measured using the Medical Research Council sum-score (MRC-SS). ICU-acquired weakness is characterized by symmetrical impairment in the left and right limbs that is most prominent in proximal muscles [18]. A score below 48/60 on the MRC scale indicates significant muscle weakness and is associated with an increase in the risk of ICU and hospital death [21].

As the diaphragm can be severely affected during controlled ventilation, the switch to spontaneous ventilation should be done as soon as possible [22]. In addition, switching to spontaneous ventilation is essential for accurate assessment of respiratory muscle function. Maximum inspiratory pressure (MIP) is a simple measure of all the inspiratory muscles together. This measurement is often available on ventilators: a value below 30 cmH₂O is defined as indicative of respiratory muscle weakness and predictive of difficult weaning from mechanical ventilation [23]. MIP measurements can be repeated daily to monitor progress and are considered valid in patients who respond to simple orders. The assessment of voluntary muscle strength (MRC-SS and MIP) is limited to patients who are both awake and cooperative. In non-cooperative patients, ultrasound is a reliable, sensitive, and valid tool to assess diaphragm [24, 25, 26] and quadriceps strength [27].

Once sedation has been stopped or after weaning from mechanical ventilation, it is important to assess the patient's functional capacity in order to guide further physical rehabilitation. Scales such as the 5-meter walk test or the 5 times sit-to-stand test may be useful [28, 29].

Could airways clearance techniques help the patients?

In patients on mechanical ventilation, chest physiotherapy does not lead to further improvements in ventilatory function or gas exchange [30], therefore it is of no interest for patients with COVID-19.

How to preserve functional capacity in patients in ICU?

Neuromuscular Electrical Stimulation (NMES) is a non-invasive and easy to perform technique that does not require prolonged exposure of the physiotherapist to the patient. Several systematic reviews have suggested that NMES preserves muscle strength, mass and architecture [31, 32, 33]. However, the results of the studies included in those systematic reviews are not always clinically relevant and need to be considered with caution [34].

Early rehabilitation including passive mobilization exercises do not decrease the duration of hospitalization and mechanical ventilation in

patients with acute respiratory failure [35]. Interestingly, Griffiths et al. showed a modest benefit of passive mobilization on muscle trophicity when it was performed for three hours at a time, three times a day [36], which is not feasible in clinical practice. Thus, in view of the absence of benefits described in the literature, passive range of motion exercises are not a priority intervention for patients on mechanical ventilation and should not be performed [37].

A recent study showed that a comprehensive rehabilitation program including the addition of an in-bed cycle ergometer with quadriceps electrostimulation did not improve muscle strength more than standard rehabilitation alone with patients exercising out of bed [38]. These results suggest that when patients can perform exercise out of bed, the use of an in-bed cycle-ergometer does not provide any additional benefit. However, in-bed cycle-ergometry could be considered for patients who cannot perform exercise out of bed because it may provide some benefit above no exercise. Functional electrical stimulation cycling could also be considered, because it provides more intense exercise than in-bed cycle-ergometry alone [39].

In view of the lack of effectiveness of in-bed techniques, it is important to get the patient out of bed as soon as possible. A comprehensive physiotherapy program with out-of-bed exercises can increase muscle strength and recovery of functional capacity and reduce ICU delirium [40]. Active exercises can be initiated once sedation has been stopped and when the patient can respond to simple orders. Patients who tolerate this can be actively positioned using different types of supportive devices (stretcher chairs, standing frames etc.). Passive verticalization on a tilt table does not affect muscle strength [41] and active verticalization should mostly be considered. Several studies have shown no benefits of intensive early rehabilitation over standard rehabilitation including exercise out of bed [42, 43]. Therefore, in the context of COVID-19, intensive early rehabilitation should not be carried out.

The reduction in gas exchange associated with lung infection can cause severe hypoxemia during rehabilitation sessions. In patients with unstable SpO₂ levels it is advisable to adjust their oxygen intake in order to maintain an SpO₂ of 94% during the training sessions [44]. In order to limit desaturation, in the cases where oxygen intake cannot be adjusted, exercise intensity can also be decreased [45].

Finally, considering the risk of transmission and the evidences, inspiratory muscles training using valve does not seem appropriate [46, 47]. In case of inspiratory muscle weakness, we recommend establishing a protocol in order to gradually decrease the levels of ventilatory support and monitor the evolution of inspiratory muscle strength.

Physiotherapy for non-ventilated patients

In view of the exceptional nature of the current health situation, a dedicated physiotherapist should be in charge of patients with COVID-19 whenever possible. If this is not possible, isolation procedures should be followed and physiotherapists in contact with patients with COVID-19 should not also treat vulnerable, non-infected patients. A meticulous organization of the care schedule and staff must be put in place to minimize the risk of transmission. Finally, the potential benefits of any intervention must constantly be weighed against any possible risk of cross-contamination. In patients who are less severely affected physiotherapists can limit their interventions to the provision of advice and instructions regarding exercises that the patient can perform independently (eg. standing up regularly, walking in the room every hour, use of elastic bands for strengthening; depending on the patient's tolerance and ability). Patients should be encouraged to sit out of bed as much as possible and to carry out their own activities of daily living [44].

Are airway clearance techniques useful?

Two published cohort studies reported that between 20 and 30% of patients with COVID-19 produce sputum [5, 48]. Nevertheless, it is not-

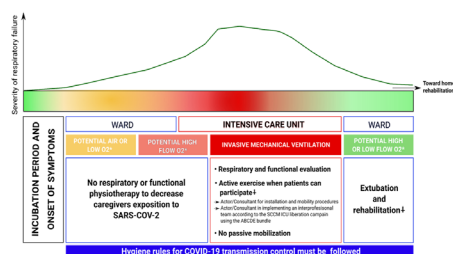


Figure 1 Clinical course and outcomes in critical care patients and management strategies for physiotherapists. Based on data from Wang et al., Yang et al., Wu et al and Bouadma et al. [1, 4, 11, 21]. ABCDE: Awakening and Breathing Coordination, Delirium, and Early exercise/mobility; NEMS: Neuromuscular Electrical Stimulation; O₂: oxygen

worthy to mention that if the patient has an effective cough and does not retain secretions, the literature does not support the use of airways clearance techniques [49]: chest physiotherapy is not recommended as routine treatment for pneumonia in adults [50]. In addition, airway clearance techniques can tremendously increase the risk of contamination because of droplet dispersion in the environment. This is also the case for instrumental techniques (incentive spirometry, positive expiratory pressure masks, etc.) that can cause aerosolization and are therefore not advised [51]. However, chest physiotherapy may be indicated for patients with underlying secretion clearing issues (such as bronchiectasis or cystic fibrosis) [52].

Physiotherapy following discharge from intensive care

Evidence regarding the potential long-term consequences of viral infections causing acute severe respiratory diseases is scarce. Data from the influenza A epidemics showed that survivors had substantial alterations in their lung function up to 2 years after being discharged from hospital [53, 54]. In addition to impaired lung function, exercise capacity is markedly reduced in survivors [55, 56]. In the COVID-19 epidemic, a large number of patients admitted to the ICU develop ARDS [4]. This condition is strongly correlated with a decrease in long-term functional capacity [57], in particular muscle strength and walking distance [58]. Ong et al. showed that 41% of subjects had a loss of maximum aerobic capacity compared to normal values 3 months after hospital discharge [55]. Exercise capacity is an important determinant of quality of life. Data from 110 SARS survivors showed they had a significantly reduced quality of life compared to the general population [56]. Finally, the long-term consequences of ARDS on mental health should not be overlooked. Depression and anxiety are also very common in survivors of ARDS, with a prevalence above 26% and 28% respectively [58].

How to continue physiotherapy after discharge?

Patients who have been ventilated for more than seven days and who have a significant loss of functional capacity are likely to respond the best to an inpatient or day-care rehabilitation program. This group of patients is at higher risk of hospital readmission should be closely monitored [59]. Those patients, and their rehabilitation needs, can be identified by physiotherapists through simple functional tests such as the sit to stand test (30 seconds or one minute), the time up and go test (TUG) or the physical function in ICU test (PFIT test). In order to prevent cross-transmission of the virus, it is not useful to provide

supervised rehabilitation to patients who are independent, have no muscle weakness or who have a low risk of deconditioning [60]. In this case tele-rehabilitation could be discussed.

For patients who do not have access to a rehabilitation center, treatment at home or in an out-patient physiotherapy practice should be considered. The provision of a booklet containing a six-week program of home exercises has been shown to optimize functional recovery [61]. The exercises should be simple with minimal need for equipment (e.g. standing up from a chair, climbing stairs, walking 30 minutes a day, strengthening exercises using bottles of water etc.). The intensity of physical activity should be low (3 on the modified Borg scale) for the first 6 to 8 weeks after discharge from hospital [60]. The proportion of patients with COVID-19 and severe residual hypoxemia during exercise is currently unknown. Physiotherapists should monitor SpO₂ during exercise to measure the severity of hypoxemia. If the patient uses oxygen, titration is recommended in order to maintain 90%SpO₂ [45]. For patients who are not on oxygen, supplementation should be discussed with their physician and the intensity of the exercise should be reduced.

To increase patient adherence to a home exercise program, the patient can be instructed to keep a log-book of daily activities and to identify any barriers that prevent him/her from carrying out any activities. Simple tools such as a pedometer can be useful to motivate patients. A weekly follow-up telephone call or a home visit may be necessary to supervise the exercise program, answer the patient's questions and provide motivational coaching [62]. Tele-rehabilitation can also be useful [63] and could be particularly appropriate in the context of the COVID-19 epidemic.

Conclusion

The COVID-19 pandemic is one of the largest that the world has faced in the last fifty years, resulting in a high number of hospitalizations and saturating intensive care units. In this context, physiotherapists have an important role to play in helping patients return to their highest level of function, in the ICU or following discharge from the hospital. Finally, in view of the very high proportion of patients who are likely to have persistent loss of functional capacity following discharge, clinical research should aim to rapidly evaluate new management strategies and tools such as tele-rehabilitation and unsupervised rehabilitation in order to help patients to regain physical and cognitive function.

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