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Shaping the future: an Italian survey unveils the unmet need to empower physical medicine and rehabilitation professionals with technological skills

Advanced technological solutions, particularly in robotics, are increasingly integral to rehabilitation services.[1-4] This integration is fueled by the potential of these technologies to enhance the effectiveness, efficiency, and sustainability of care.[5-7] However, this rapid adoption often surpasses existing educational frameworks, presenting significant challenges alongside unique opportunities for growth and innovation in patient care.[8-10]

Scientific societies, such as the Italian Society of Physical Medicine and Rehabilitation (SIMFER), play a vital role in responding to these challenges.[11, 12] The CICERONE Consensus Conference, a pioneering initiative by SIMFER and the Italian Society of Neurological Rehabilitation (SIRN), is one of such response that promotes an evidence-based approach to technologically integrated rehabilitation.[13-15] The Consensus Conference provided informed recommendations on various critical aspects, including treatment classification, reference theories, management models, care service delivery, and legislative factors influencing the use of robotics and electromechanical devices in rehabilitating people with neurological conditions.[13, 14] Additionally, the Italian National Health System (NHS) is trying to include advanced technologies like wearable monitoring devices, robotics for rehabilitation, and telerehabilitation in its list of refundable services under the 2017 Essential Levels of Care.[16] This inclusion marks a significant step towards integrating state-of-the-art technologies into Italy's healthcare system. Thus, Clinicians must develop the necessary skills and knowledge to use these new technologies effectively.

Despite the extensive literature on rehabilitation research by Italian researchers, especially regarding technological devices for neurological disabilities,[2-6, 13-15,] there is a lack of information on the real-world application of these devices across Italy. Understanding their prevalence and practical use in clinical settings is crucial for gauging the current state of rehabilitation practices and the need for deeper integration of these technologies into clinical practice.[8-10, 17] This understanding is vital for advancing the field and enhancing patient care. It also underscores the need for targeted training programs for medical doctors specializing in rehabilitation.

This paper aims to: 1) assess the prevalence of technology use in rehabilitation practice and facilities; and 2) explore clinicians' opinions and overall educational programs regarding technology in healthcare rehabilitation pathways. The Health Technology-Assisted Rehabilitation (HTA) Section of SIMFER conducted a national web-based survey of Physical and Rehabilitation Medicine doctors identified through the SIMFER membership list. We included those clinicians who: 1) owned a valid e-mail account; 2) were enrolled in the Society at the time of the survey; and 3) consented to participate in social and scientific surveys as SIMFER members.

An *ad-hoc* survey was designed adapting existing surveys on technology[10] to the study scope. The survey was developed with iterative steps to previously critically evaluate for face and content validity[18] by a panel expert with rehabilitation, technology, and survey design (Authors). The expert worked independently and then agreed on the final list that included a total of 71 questions. The survey, approved by the SIMFER advisory committee and executed between April 17th and May 21st, 2021, on SurveyMonkey, included four sections focusing on socio-demographic and professional profiles, types and applications of technologies, technology usage processes, and the perceived importance of training in rehabilitation technologies.

Our analysis concentrates on findings from the first and last sections. The survey was emailed to SIMFER-listed clinicians, and follow-up reminders were sent to maximize participation. The data, subject to a thorough accuracy check, were considered incomplete if more than 20% of the information needed to be included. The margin of error based on the rate of respondents was calculated, considering 90% confidence intervals (CI), to study the statistical significance for our population. Of the 1275 clinicians identified, 1032 had valid email addresses, and 186 (18%) provided complete survey responses. Therefore, the survey was barely fit for data analysis, showing a relative standard error of 5.37%. In the literature, the range of responses to surveys conducted among members of scientific societies varies widely, ranging from 2.1%[19] to 78%.[10] It represents a first summary description of the use of new technologies in rehabilitation, in a nation that could be illustrative of other international realities as a starting point for promoting networking to share experiences, expertise, needs, protocols, and guidelines.

Most respondents were from rehabilitation centers in Northern Italy, with Lombardy, Piedmont, and Emilia-Romagna being the most represented regions. Most respondents had over ten years of clinical experience and worked in public hospitals or accredited private centers. Our survey showed that 70% of clinicians use rehabilitation technology, with an average of 2.4 technology-equipped centers per million inhabitants homogeneously in Italy (range 2.1-2.6), while the 55% of referred technology were located in the North, 27% in the Southern Regions and 19% in the center of Italy. The demographic characteristics and expertise of answerers are reported in Table I.

The survey revealed that 47% used technology solely for clinical purposes, while 53% used it for clinical and research purposes. Of those using technology, 54% followed predefined treatment protocols, including those provided by manufacturers, based on evidence-based medicine, or developed locally. The average score

TABLE I.—*The demographic characteristics and expertise of answerers.*

Region		Answers		Years of work experience (N)			Type of hospital/ clinic (N)			Technological devices availability at the clinical center			
		N.	% out of total responses)	<5	>5;<10	>10	Public center	National system accredited private center	Private, non-accredited center	N of technology YES	% of technology with respect to answers (per region)	% of technology with respect to total technology	Technology for regional population (N. 1,000,000 inhab)*
Nord	Emilia-Romagna	21	11%	2	2	16	12	4	5	14	67%	11%	3.2
	Friuli-Venezia Giulia	4	2%	1	0	3	3	1	0	3	75%	2%	2.5
	Trentino-Alto Adige	3	2%	0	0	3	2	1	0	3	100%	2%	2.7
	Veneto	18	10%	1	5	15	9	7	2	15	83%	12%	3.1
	Liguria	2	1%	0	0	2	1	1	0	2	100%	2%	1.3
	Lombardy	28	15%	2	6	20	7	20	1	19	68%	15%	1.9
	Piedmont	23	12%	2	1	19	16	5	2	14	61%	11%	3.3
Center	Latium	16	9%	0	7	9	10	5	1	13	81%	10%	2.3
	Marche	4	2%	1	1	2	3	1	0	4	100%	3%	2.9
	Tuscany	9	5%	0	2	7	5	1	3	5	56%	4%	1.1
	Umbria	3	2%	0	0	3	2	1	0	2	67%	2%	2.0
South	Basilicata	3	2%	0	0	3	2	1	0	3	100%	2%	6.0
	Calabria	7	4%	2	0	5	4	3	0	5	71%	4%	2.8
	Campania	9	5%	1	4	4	6	3	0	5	56%	4%	0.9
	Apulia	9	5%	1	1	7	4	5	0	5	56%	4%	1.3
	Sardinia	9	5%	1	0	8	6	3	0	2	22%	2%	1.3
	Sicily	14	8%	3	0	10	6	8	0	11	79%	9%	2.3
	Abruzzo	4	2%	0	0	4	3	0	1	3	75%	2%	2.5
North		99	53%	8	14	78	50	39	10	70	79%	55%	2.6
Center		32	17%	1	10	21	20	8	4	24	76%	19%	2.1
South		55	30%	8	5	41	31	23	1	34	65%	27%	2.4
Total		186	100%	17	29	140	101	70	15	128	73%	100%	2.4

N.: number of answers.
*Italian population by region according to ISTAT (National Institute of Statistics) data updated to January 1st, 2021.

for technology integration into rehabilitation programs was 4.5 out of 10, indicating moderate integration. Between centers who use technology also for research, 58% were public and use predefined protocols in 60% of cases, whereas in the 50% of cases the protocols were created ad hoc by researchers with respect the clinicians, who do not perform research, using protocols from the constructor company or validated in the literature in the 66% of cases (χ^2=9.7; P=0.04). 45% of clinical researches received a training with respect the 33% of clinicians who do not performed research (χ^2=4.1; P=0.04). Both groups of respondents report the need for technology-specific training. Clinicians rated their knowledge of rehabilitation technology on average, scoring 4 out of 10. Only 34% had received specific training, highlighting a significant need for more comprehensive education (68% being accredited courses). The duration of these courses varied and in 42% lasted less than 5 hours. Participants strongly desired to learn more about various aspects of rehabilitation technology, including the basics, usage indications, and effectiveness evidence. Figure 1 details results of respondents' experiences and needs about technology and rehabilitation and highlights possible differences between centers where technology were used also for clinical research purpose with respect to those who use technology only for clinical scopes.

The survey results emphasize a crucial need for bespoke educational programs for medical doctors in Physical Medicine and Rehabilitation, tailored to meet Italy's diverse regional needs and experience levels. A significant finding from the survey is the regional disparity in experience with and access to rehabilitation technologies. This disparity highlights the necessity for prioritizing less experienced regions in implementing educational programs. Such initiatives are essential for enhancing familiarity with these technologies and broadening the scope of their usage.

An urgent requirement for medical professionals to be more informed about these devices' technological aspects and applications has been identified. This encompasses a comprehensive understanding of these technologies' operational aspects, clinical applications, potential benefits, and evidence-based practices. Essential areas of focus include ensuring all clinicians, irrespective of their region, possess foundational knowledge of the available rehabilitation technologies; training on integrating these technologies within existing treatment protocols and individual patient plans; educating on the latest research and best practices in technology-assisted rehabilitation; and providing hands-on experience, especially for clinicians in underrepresented regions, to gain practical experience with these technologies, drawing on the expertise of more experienced areas.[8, 13, 17]

Strengthening collaboration and resource sharing with engi-

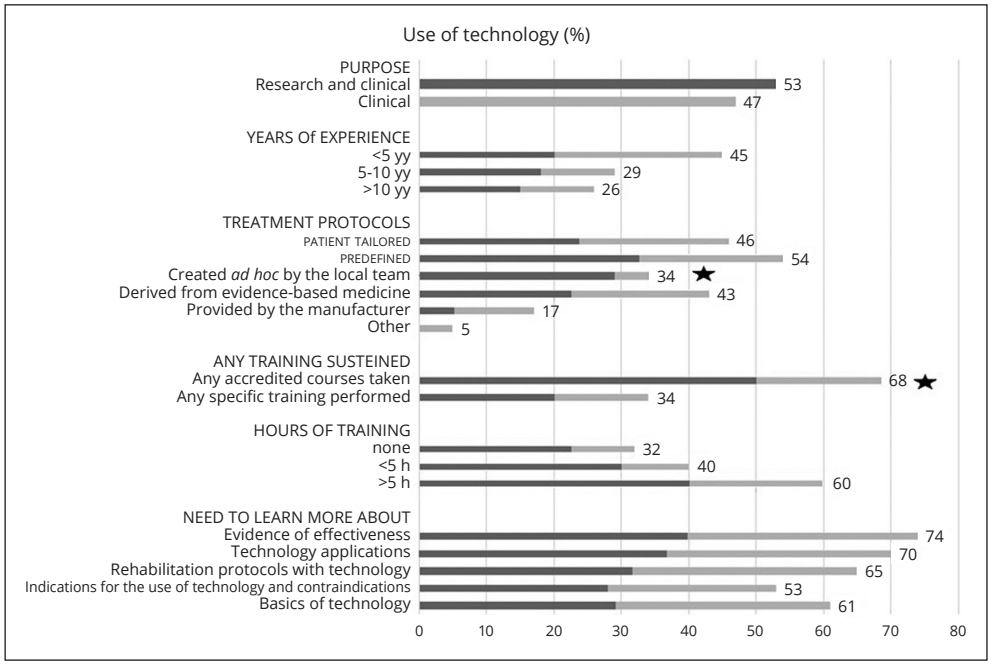

Figure 1.—Respondents' use and need for technology, distinguishing between those who use it for clinical research versus exclusively clinical purposes (Stars indicate statistical differences between group).

neering sectors, technology manufacturers, research institutions, universities (*i.e.*, PM&R specialization schools and bioengineers or bachelor in physiotherapy), and healthcare authorities is pivotal to achieving these objectives. Such collaborations are expected to facilitate the provision of the necessary technologies and the practical training required to use them.[8, 17] Promoting the introduction of university credits on technology-aided medicine and rehabilitation for both residency and medical and surgical undergraduates, should be the starting point of a training process that will continue organizing interdisciplinary courses in which PRM clinicians, computer scientists and engineers can discuss each other on the basis of evidence-based medicine.

The international literature shows the same strong interest on the implementation of technology in rehabilitation.[1] Although we did not find surveys, to date, the literature is indicative of a considerable number and variety of technologies[10, 17] and robotic devices[1] in the field of clinical rehabilitation, some of which are commercially available. A number of important issues have emerged, related to the integration of rehabilitation technology into real-world clinical practice and few data are available on the distribution and sustainability of technology-aided rehabilitation in the world clinical.[17] Moreover, while technology is believed to be excellent also for quantitative assessment of sensorimotor ability, it is rarely used. To understand this apparent contradiction, Shirota *et al.*[17] sought to gather different stakeholders' points of view, finding that clinicians' top factors are lack of knowledge, cost, and time. Research engineers, on the other hand, indicated device-dependent factors and a lack of standardization. At the end, reimbursement and standardization of technology-aided assessments were rated as tow of the top activities to pursue in the coming years to promote the field of technology-aided sensorimotor assessments. Notwithstanding, geo-economic factors may influence also the distribution of technology in the world.

To conclude, the survey underlines the need for comprehensive, tailored educational programs. These programs should address the disparities in technology access and experience in different areas while catering to the broader need for enhanced knowledge and skills in applying these technologies in Physical Medicine and Rehabilitation. Moreover, it would be useful to broaden this investigation to an international setting, to verify technology distribution, issues about use and knowledge opening to widespread and unified action.

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

Authors' contributions
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