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Digital technologies for motor rehabilitation in children: protocol for a cross-sectional European survey

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ABSTRACT

Introduction Digital technologies can be used as part of paediatric motor rehabilitation to remediate impairment, promote recovery and improve function. However, the uptake of digital technologies in this clinical field may be limited. The aim of this study is to describe and explain digital technology use for paediatric motor rehabilitation. The specific objectives will be: (1) to describe the access to, acceptance of and use of digital technologies as a function of individual factors related to professionals practicing motor rehabilitation with children, and of environmental factors related to paediatric rehabilitation practice and (2) to explain digital technology use with a causal model based on the 'unified theory of acceptance and use of technology'.

Methods and analysis RehaTech4child (Rehabilitation Technologies For children) is a cross-sectional study involving an online survey, that is sponsored by the European Academy of Childhood Disability (EACD). The survey protocol follows the Strengthening the Reporting of Observational Studies in Epidemiology and CHERRIES (Checklist for Reporting Results of Internet E-Surveys) guidelines. The survey includes 43 questions about (1) respondents' individual and environmental characteristics; (2) the ease of access to digital technologies, and the frequency, type and purpose of use of those technologies and (3) acceptance of technologies and barriers to their use. The survey is intended for professionals involved in paediatric motor rehabilitation. It is disseminated across Europe by the EACD network in 20 languages. Participation is anonymous and voluntary. We aim to include 500 respondents to ensure sufficient precision for the description of study outcomes and to perform stratified analyses by the main determinants.

Ethics and dissemination Ethics approval was waived by the Brest CHRU Institutional Review Board. The study is conducted according to current French legislation (loi Jardé (n°2012-300)) and the survey is GDPR compliant. Study findings will be presented at national and international meetings and submitted for publication in a peer-reviewed journal.

Trial registration number NCT05176522.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ The survey was designed by a multidisciplinary group from several countries and will address the use of digital technologies by professionals with different backgrounds in different practice settings across Europe.

⇒ The study includes several outcomes and will generate data on the use of, access to and acceptance of digital technologies; it covers non-modifiable and modifiable factors that are actionable into recommendations.

⇒ The analysis plan clearly differentiates the descriptive study from the explanatory analysis that will validate a theoretical model of the use of technologies.

⇒ The study is not aimed at surveying a representative sample but at exploring the relationships of both professionals and practice features to the use of technologies.

⇒ The survey responses are self-reported by professionals, and the analysis will include internal validity checks.

INTRODUCTION

Children live multiple experiences at home, at school, during leisure, with family and friends, and through all of their daily activities. This allows them to acquire new skills, become autonomous and prepare their future.[1–3] Compromised motor skill acquisition can have a profound effect on a child's overall development: children and adolescents with motor disabilities have reduced physical exploration and activity, and often impaired learning. They experience activity limitations and participation restrictions as defined within the ICF (International Classification of Functioning) framework.[4] Specialised care and continuous management with individualised rehabilitation programmes reduce the burden of motor disability.[5 6] Rehabilitation is a problem-solving process, which is framed within the holistic biopsychosocial model of illness, delivered in a person-centred way and aims to optimise the individual's self-rated quality of life and degree of social integration by increasing independence in activities.[7] It involves specific interventions that

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are tailored to the child's and family's priorities, which should be enjoyable and motivating for the child and in which parents should be stakeholders.[8] In motor rehabilitation, the principles of motor learning that is, task specificity and repetition, feedback, progressive increase in difficulty, shaping and delivery in a context that is adapted to the child[8 9] are keys for progress. Motor rehabilitation programmes that are tailored to the specific needs of an individual child are personnel intensive and therefore costly. Limited individual and social resources often hinder the achievement of optimal therapy delivery and limit the rehabilitation dose.[10] Multiple appointments with rehabilitation professionals can burden family organisation.[5]

New opportunities for motor rehabilitation delivery have been created by unprecedented technological advances.[11] Technology provides new tools for both assessment and rehabilitation. Digital technologies for motor rehabilitation include mechanical or electronic systems, driven by microprocessors as well as digital hardware and software, that can be prescribed and used by rehabilitation professionals (ie, therapists and physicians), to remediate impairment, promote recovery and improve function.[12 13] Robotic therapy, treadmill with body weight support systems, virtual reality/active gaming systems, and telehealth/phone or tablet apps can be added to, or incorporated within, usual rehabilitation sessions.[14] Such technologies might increase rehabilitation intensity as well as facilitate the implementation of motor learning principles. There is preliminary evidence that interventions involving a combination of traditional therapies and such devices can enhance the outcomes of traditional therapies.[15–18] These interventions appeared to be accepted by children with disabilities involved in the first feasibility studies.[19 20] Several other advantages have been highlighted. Technological devices create opportunities for the delivery of treatments in engaging and multimodal formats that enhance the child's motivation, while providing experiences that are not possible with traditional interventions (eg, virtual reality).[17] Furthermore, technology can expand the scope of an intervention by delivering therapy in the child's environment (eg, home or school) through telehealth. Telehealth delivery does not require face-to-face visits to a provider and facilitates parental involvement.[15] During the COVID-19 pandemic, such interventions were identified as a way to facilitate continuity of care.[21 22] Finally, technology can accurately quantify aspects of therapy that cannot be measured in clinical practice, and thus will enrich the understanding of rehabilitation science and clinician decision-making.[10 23] Therefore, digital technologies for paediatric motor rehabilitation may transform clinical practice through targeted, intensive, enjoyable, more autonomous and potentially cost-effective interventions.[11 24]

Despite the captivating perspectives highlighted by research, the translation of these innovations into clinical practice might be limited in the context of paediatric motor rehabilitation.[10 11 25] Access to technologies may vary depending on environmental factors, such as a country's health policies or financial barriers. Similarly, the type of organisation and care setting may affect access to, and the use of, technologies in paediatric motor rehabilitation.[26] When professionals do have access to technologies, barriers such as insufficient adaptation to children's growth and development and lack of time may limit their implementation in clinical practice.[27 28] Individual factors like academic degrees or professionals' acceptance of, or resistance to, rehabilitation technologies could also influence their use.[11–13] To our knowledge, no information is currently available to characterise the access, use and acceptance of such technologies in paediatric motor rehabilitation practice. Children who require motor rehabilitation are a small and heterogeneous population; furthermore, they grow and their developmental abilities change constantly, which creates specific challenges for the implementation of technologies[25 28] and supports the need for specific studies to be conducted. Further research that involves modelling of the use of paediatric rehabilitation technologies, including acceptance of technologies and barriers to their use in this specific population, is required for the development and implementation of new devices.

The aim of this study is to describe and explain digital technology use for paediatric motor rehabilitation. The specific objectives are (1) to describe the access to, acceptance of and use of digital technologies as a function of individual factors related to professionals practicing motor rehabilitation with children, and of environmental factors related to paediatric rehabilitation practice and (2) to explain digital technology use with a causal model based on the 'unified theory of acceptance and use of technology' model.

The study will address the following research questions:

- How much access do rehabilitation professionals have to digital technologies, what is their level of acceptance and use of technologies, and what are the determinants of access, acceptance and use?
- Can the use of digital rehabilitation technologies be explained by a model of acceptance by rehabilitation professionals?

METHODS AND ANALYSIS

Study partners

The European Academy of Childhood Disability (EACD) is an academic association of professionals who work with people with childhood-onset disabilities throughout Europe. The EACD aims to develop research and disseminate knowledge to improve both healthcare and quality of life for people with childhood-onset disabilities and their families. The EACD has more than 800 members. It has a national coordinator in 32 countries (Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Iceland, Ireland, Israel, Italy, Lithuania, Moldova, The Netherlands, North Macedonia, Norway, Poland, Portugal, Romania, Serbia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine and the UK). One of the key roles of the national coordinators is to represent professionals who work with people with childhood-onset disabilities in each country and to provide a link between the EACD and national organisations.

The EACD is the sponsor for the European survey named 'RehaTech4child' (Rehabilitation Technologies For children) that aims to identify and report on the degree of access to, and use of, paediatric motor rehabilitation technologies by professionals. A multidisciplinary steering committee comprised seven rehabilitation professionals or researchers and a parent of a child with disability from five European countries (France, Spain, Switzerland, Belgium and Romania) was set up.

Study design

RehaTech4child is a cross-sectional study based on an online survey. The survey protocol follows the Strengthening the Reporting of Observational Studies in Epidemiology and CHERRIES (Checklist for Reporting Results of Internet E-Surveys). It has been enriched with the recommendations by Wardropper and Bennett about survey research. [29] [30]

The survey is intended for professionals practicing paediatric motor rehabilitation (physiotherapist, occupational therapist, psychomotor therapist, adapted physical activity teacher, physician, etc) at the time of survey completion.

Questionnaire creation

First version

An initial version of the questionnaire was created by two authors and discussed with the steering committee. Previous research about the implementation of new technologies in rehabilitation practice was used to create the questionnaire.[12 13 27 31] Specific attention was paid by the steering committee to include the specificity of paediatric practice[10 25 28]: this was not considered in previous studies.

Survey piloting

The survey was pilot tested by 17 EACD national coordinators or rehabilitation professionals and 3 early career researchers with different professional backgrounds who came from 18 countries (Austria, Belgium, Croatia, Finland, France, Georgia, Germany, Moldova, The Netherlands, Norway, Portugal, Romania, Serbia, Spain, Sweden, Switzerland, Turkey and the UK) to improve clarity, ensure objectivity and ensure that the content fitted with local contexts. This group was not involved in the design of the study. Pilot testers were asked (1) to complete the survey and send it back; (2) to record survey completion time and (3) to provide qualitative feedback to improve the quality of the survey. The survey was considered clear and easy to follow. Some minor adjustments in the wording were made to improve clarity and correct typos. The survey took more than 15 min to complete for 12 of the pilot testers. Since we targeted a shorter time of completion of the survey (maximum 15 min) in order to make it easier to fulfil, some parts of the survey about individual rehabilitation devices were removed. Questions regarding acceptance of technologies and barriers to their use were formulated to fit with the categories of digital technologies (robotic devices, treadmill with body weight support systems; virtual reality/ gaming systems, and telehealth and phone/tablet apps) and not with the individual devices. Finally, using the qualitative feedback, we enriched the questionnaire with specific questions regarding child and family participation seen from the professional perspective (eg, 'Do you think that digital technologies provide an opportunity for family members to participate in the rehabilitation process?'). Changes were discussed within the steering committee until consensus was reached.

Description of the questionnaire

RehaTech4child is a voluntary survey. It is introduced to potential respondents by a paragraph that presents the aims and the context of the survey and provides a definition of digital technologies. It specifically states that the subject is the use of technologies in paediatric motor rehabilitation. It also informs respondents that the results will be used for research purposes.

The 10-page survey consists of 6 parts with a total of 43 questions (table 1). The questionnaire is available online https://www.surveymonkey.com/r/Rehatech4childTEST.

Part 1 includes questions about respondents' sociodemographic characteristics (job title, gender, age, academic degrees and duration of professional experience) and their professional practice (practice of motor rehabilitation with children, country, type and size of the employing organisation and care setting). Respondents stating that they do not practice motor rehabilitation with children cannot continue completing the survey. Part 1 also includes questions about the characteristics of their patients (clients) (age and diseases according to the International Classification of Diseases and related health problems[32]).

Part 2 evaluates the use of digital technologies by respondents. It includes the definition of digital technologies and presents the three categories of digital technologies investigated in the RehaTech4Child survey (figure 1).

Parts 3, 4 and 5 follow the same design: they respectively focus on the following groups of technologies: (1) robotic devices, treadmill with body weight support systems, (2) virtual reality/gaming systems and (3) telehealth and phone/tablet apps. Each one includes two sections.

The first section includes questions about the ease of access to digital technologies, the frequency of use of those technologies and the characteristics of their use (type of device(s) used and purpose of their use according to the ICF).

The second section evaluates the acceptance of technologies and barriers to their use. The items included in this

Table 1 : Description of the survey

Item	Questions	Answer-option	Description of options/logic applied
Part 1			
Sociodemographic characteristics (RC)			
Job title	1. What is your profession?	1. Physiotherapist 2. Occupational therapist 3. Orthopaedic technician 4. Psychomotor therapist 5. Adapted physical activity teacher 6. Physician 7. Other	Multiple choice
Gender	2. You identify as	1. Female 2. Male 3. Other	Multiple choice
Age group	3. What is your age? (in years)	1. Under 18 2. 18–24 3. 25–34 4. 35–44 5. 45–54 6. 55–64 7. 65+	Drop down menu
	4. Do you practice motor rehabilitation with children in a professional setting?	1. Yes 2. No	Multiple choice *In the case of a negative response, respondents skip to part 6*
Experience	5. How many years have you been practicing motor rehabilitation with children?		Slider Scale range labels: Left side 0 Right side 60
Academic degree/diploma	6. What is /are your academic degree(s) or diploma(s)?	1. Bachelor's degree (eg, BSc) 2. Research masters (eg, MSc) 3. Clinical masters (eg, MOT, MPT, MRSC) 4. MD 5. PhD 6. Other	Multiple checkboxes
Professional practice			
Country	7. In which country are you currently practicing?	1. Albania 2. Austria 3. Belarus 4. Belgium 5. Bosnia and Herzegovina 6. Bulgaria 7. Croatia 8. Cyprus 9. Czech Republic 10. Denmark 11. Estonia 12. Finland 13. France 14. Georgia 15. Germany 16. Greece 17. Hungary 18. Iceland 19. Ireland 20. Israel 21. Italy 22. Latvia 23. Lithuania 24. Luxembourg 25. Malta 26. Moldova 27. Montenegro 28. Netherlands 29. North Macedonia 30. Norway 31. Poland 32. Portugal 33. Romania 34. Russian Federation 35. Serbia	Drop-down menu

Continued

Table 1 Continued

Item	Questions	Answer-option	Description of options/logic applied
Country	7. In which country are you currently practicing?	36. Slovakia 37. Slovenia 38. Spain 39. Sweden 40. Switzerland 41. Turkey 42. Ukraine 43. UK 44. Other (please specify)	Drop-down menu
Type of organisation	8. Do you work in a?	1. Public institution 2. Private organisation 3. Private practice 4. Other	Multiple checkboxes
Number of children attending the institution per week	9. How many children attend your institution each week?	1. Less than 100 2. More than 100	Multiple choice If the respondent chooses 'more than 100' Then the following open-ended question will appear 'What is the postal code of your institution?'
Type of practice	10. Do you work in?	1. Acute services 2. Rehabilitation centre 3. Specialised services, at home, at school or in institutions 4. Self-employed (/own business) 5. Academic research 6. Research and development 7. Other	Multiple checkboxes
Patient characteristics			
Age category	11. What is the age category of your patients?	1. (0–6) years 2. (7–11) years 3. (12–17) years	Multiple checkboxes
Type of health problem	12. What type of childhood health problems do you primarily work with?	1. Cerebral palsy 2. Neoplasms of the nervous system 3. Intracranial injuries (eg, traumatic brain injury) 4. Autism spectrum disorders 5. Disorders of intellectual development 6. Nerve, nerve root and plexus disorders (eg, brachial plexus disorder) 7. Polyneuropathies (eg, Charcot Marie Tooth) 8. Diseases of myoneural junction and muscle (eg, muscular dystrophy, Steinert dystrophia, congenital myopathies) 9. Diseases of the musculoskeletal system and connective tissue (eg, arthropathies, osteopathies and chondropathies) 10. Congenital malformations and deformations of the musculoskeletal system (eg, arthrogryposis, Ehler Danlos, congenital malformations of the limb(s) or of the spine, osteochondroplasia)	
Type of health problem	12. What type of childhood health problems do you primarily work with?	11. Spinal dysraphism/spinal cord malformations 12. Diseases of the respiratory system 13. Diseases of the circulatory system (eg, heart and vascular diseases) 14. Chromosomal abnormalities (eg, Down syndrome) 15. Injuries to the upper and lower limbs, injuries to the spine (eg, contusion, fracture, dislocation, sprain, etc) 16. Other	Multiple checkboxes
Part 2†			
Use	13. Do you use (or have you used) any of the categories of rehabilitation technologies presented in the list above?	1. Yes 2. No 3. In the past but not now	Multiple choice
Part 3‡			
Access to, and use of, robotic devices and treadmill systems‡			

Continued

Table 1 Continued

Item	Questions	Answer-option	Description of options/logic applied
Access	Do you have access to robotic devices and treadmill systems in your daily work?	1. No access 2. Very difficult 3. Difficult 4. Neutral 5. Somewhat easy 6. Easy 7. Very easy	7-point Likert scale
Type of device (access)	What is (are) the name(s) of the robotic device(s) and treadmill system(s) you have access to in your motor rehabilitation practice?	Five multiple textboxes	Open-ended answer
Type of devices (use)	What is (are) the name(s) of the robotic device(s) and treadmill system(s) you use in your motor rehabilitation practice?	Five multiple textboxes	Open-ended answer
Frequency of usage	How often do you actually use robotic devices and treadmill systems in rehabilitation?	1. Never 2. Very rarely (less than once/month) 3. Rarely (at least once/month) 4. Occasionally (several times a month) 5. Sometimes (at least once/week) 6. Often (every day) 7. Always (during almost all rehabilitation sessions)	7-point Likert scale
Rehabilitation objectives	For which rehabilitation objectives do you use robotic devices and treadmill systems in rehabilitation?	1. I have never used robotic devices and treadmill systems before 2. Improve the joint and bones, muscle and movement functions at the lower limb level (neuromusculoskeletal and movement-related functions, lower limb) 3. Improve the joint and bones, muscle and movement functions at the trunk level (neuromusculoskeletal and movement-related functions, trunk) 4. Improve the joint and bones, muscle and movement functions at the upper limb level (neuromusculoskeletal and movement-related functions, upper limb) 5. Changing and maintaining body position 6. Walking and moving 7. Carrying, moving and handling objects 8. Self-care (washing, dressing, eating, etc) 9. Community, social and civic life (recreation and leisure, play, sports, etc) 10. Other	Multiple choice question Inspired from International Statistical Classification of Diseases-10
Acceptance of robotic devices and treadmill systems‡			
Intention to use	If I have access to rehabilitation robotic devices and treadmill systems, I intend to use it/to prescribe it	1. Strongly disagree 2. Disagree 3. Somewhat disagree 4. Neutral 5. Somewhat agree 6. Agree 7. Strongly agree	7-point Likert scale
Performance expectancy (PE)	I believe that rehabilitation with robotic devices and treadmill systems complements or enhances the therapist's abilities	1. Strongly disagree 2. Disagree 3. Somewhat disagree 4. Neutral 5. Somewhat agree 6. Agree 7. Strongly agree	7-point Likert scale
	I think that the use of rehabilitation robotic devices and treadmill systems has the potential to improve motor outcomes	1. Strongly disagree 2. Disagree 3. Somewhat disagree 4. Neutral 5. Somewhat agree 6. Agree 7. Strongly agree	7-point Likert scale
	I think that the use of rehabilitation robotic devices and treadmill systems encourages active participation of the patient	1. Strongly disagree 2. Disagree 3. Somewhat disagree 4. Neutral 5. Somewhat agree 6. Agree 7. Strongly agree	7-point Likert scale

Continued

Table 1 Continued

Item	Questions	Answer-option	Description of options/logic applied
	I think that rehabilitation robotic devices and treadmill systems adds value to what a conventional approach offers	1. Strongly disagree 2. Disagree 3. Somewhat disagree 4. Neutral 5. Somewhat agree 6. Agree 7. Strongly agree	7-point Likert scale
	I think that rehabilitation robotic devices and treadmill systems give the opportunity for family members to participate in the rehabilitation process	1. Strongly disagree 2. Disagree 3. Somewhat disagree 4. Neutral 5. Somewhat agree 6. Agree 7. Strongly agree	7-point Likert scale
	I think that the use of rehabilitation robotic devices and treadmill systems is appropriate within my clinical practice	1. Strongly disagree 2. Disagree 3. Somewhat disagree 4. Neutral 5. Somewhat agree 6. Agree 7. Strongly agree	7-point Likert scale
	I think that the use of rehabilitation robotic devices and treadmill systems is a strategy to increase the number of potential clients	1. Strongly disagree 2. Disagree 3. Somewhat disagree 4. Neutral 5. Somewhat agree 6. Agree 7. Strongly agree	7-point Likert scale
	I think that rehabilitation robotic devices and treadmill system devices make my work more interesting	1. Strongly disagree 2. Disagree 3. Somewhat disagree 4. Neutral 5. Somewhat agree 6. Agree 7. Strongly agree	7-point Likert scale
Social influence (SI)	People whose opinions I value think I should use rehabilitation robotic devices and treadmill systems	1. Strongly disagree 2. Disagree 3. Somewhat disagree 4. Neutral 5. Somewhat agree 6. Agree 7. Strongly agree	7-point Likert scale
	My supervisor thinks I should use rehabilitation robotic devices and treadmill systems	1. Strongly disagree 2. Disagree 3. Somewhat disagree 4. Neutral 5. Somewhat agree 6. Agree 7. Strongly agree	7-point Likert scale
Effort expectancy	Rehabilitation robotic devices and treadmill systems are too complex (eg, the task could be accomplished using simpler technology)	1. Strongly disagree 2. Disagree 3. Somewhat disagree 4. Neutral 5. Somewhat agree 6. Agree 7. Strongly agree	7-point Likert scale
Barriers‡			

Continued

Table 1 Continued

Item	Questions	Answer-option	Description of options/logic applied
I see the following as barriers to my use of rehabilitation robotic devices and treadmill systems in my practice	Lack of financial resources	Scale 0: Not at all a barrier 6: Extreme barrier	7-point Likert scale
	Lack of confidence (technophobia)	Scale 0: Not at all a barrier 6: Extreme barrier	7-point Likert scale
	Lack of time to learn how to use it/them	Scale 0: Not at all a barrier 6: Extreme barrier	7-point Likert scale
	Lack of time to set up and clean up	Scale 0: Not at all a barrier 6: Extreme barrier	7-point Likert scale
	Lack of robustness (in situations like heavy use, pulling and drooling)	Scale 0: Not at all a barrier 6: Extreme barrier	7-point Likert scale
	Lack of access to evidence on effectiveness	Scale 0: Not at all a barrier 6: Extreme barrier	7-point Likert scale
	Poor evidence-based knowledge to support its effectiveness and use	Scale 0: Not at all a barrier 6: Extreme barrier	7-point Likert scale
	Lack of accessible assistance (specialised instruction or specific person)	Scale 0: Not at all a barrier 6: Extreme barrier	7-point Likert scale
	Lack of initial training	Scale 0: Not at all a barrier 6: Extreme barrier	7-point Likert scale
	Lack of educational opportunities	Scale 0: Not at all a barrier 6: Extreme barrier	7-point Likert scale
	Lack of training opportunities	Scale 0: Not at all a barrier 6: Extreme barrier	7-point Likert scale
	Space-related issues (eg, insufficient or inappropriate space)	Scale 0: Not at all a barrier 6: Extreme barrier	7-point Likert scale
	Rehabilitation robotic devices and treadmill systems are not adapted to my patients	Scale 0: Not at all a barrier 6: Extreme barrier	7-point Likert scale
	Low motivation of children to participate	Scale 0: Not at all a barrier 6: Extreme barrier	7-point Likert scale
	Low motivation of families to participate	Scale 0: Not at all a barrier 6: Extreme barrier	7-point Likert scale

*'Other' is an open-answer option, the requirements regarding the textbox are a single line of text between 1 and 50 characters.
†Figure 1 is presented before question 13.
‡A part with the same design was created for virtual reality/gaming systems, and telehealth and phone/tablet apps.

section will be used to form the adapted UTAUT (unified theory of acceptance and use of technology) model used to measure the acceptance of technologies.[33] The UTAUT model integrates previous models with the behavioural intention perspectives and use of technologies (eg, TAM, TAM 2, TBP, etc).[33] According to the UTAUT model, four constructs play a role as direct predictors of behavioural intention to use the technology under study and two have a direct influence on use behaviour. Performance expectancy (PE), effort expectancy (EE) and social influence (SI) are direct determinants of behavioural intention; whereas facilitating conditions (FC) and behavioural intention to use the technology are the two determinants that have a direct impact on use behaviour.[33] PE is defined as the degree to which an individual believes that using the system will help him/her to attain gains and enhance his/her job performance, EE is defined as the degree of ease of use of the system, SI is defined as the degree to which an individual perceives that important others believe he/she should use the system and FC is defined as the degree to which an individual believes that an organisational and technical infrastructure exists to support use of the system.[33] This model is recommended in the healthcare context but must be adapted to the specific context of the study (figure 2).[34] Thus, on the basis of previous research and discussion with the steering committee, we

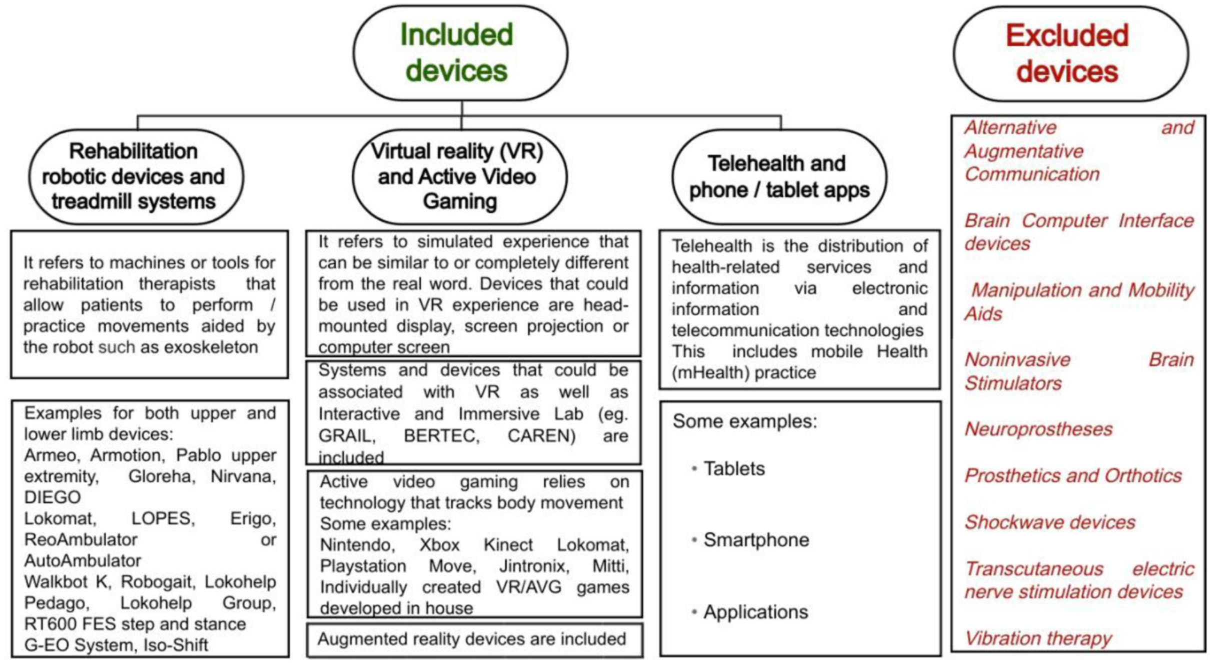

Figure 1 Technology categories targeted by the survey.

formulated the questions that evaluate acceptance taking into account the specificity of our domain (ie, motor rehabilitation in children) and the fact that we aimed to question professionals about categories of technology and not individual devices.[12 13 27 31] Therefore, we contextualised and specified questions about PE (ie, 'I think that rehabilitation robotic devices and treadmill systems can improve motor outcomes' or 'I think that rehabilitation robotic devices and treadmill systems provide an opportunity for family members to participate in the rehabilitation process'). We orientated the questions to focus on barriers rather than FC to fit with previous research on professional practice conditions in rehabilitation in which organisational and technical infrastructure appeared as barriers, as well as the feedback from the pilot testers.[27 31] We also added specific barriers that were identified in a study that described challenges in rehabilitation technology use in a child with disability.[28] Finally, we reformulated the question about EE using a negative formulation (ie, 'I think that robotic devices and treadmill with body weight support systems are too complex').

To minimise order bias, the order of appearance of parts 3, 4 and 5 is randomised by a block randomisation feature.

Items for the questions about access, use, acceptance and barriers are rated on a 7-point Likert scale because these scales provide an accurate measure of a participant's true perspective and are appropriate for electronically distributed and otherwise unsupervised usability questionnaires.[35]

Part 6 includes two open-ended questions to gather general information about the expectations of the rehabilitation professionals regarding digital technologies.

Because the survey is addressed to rehabilitation professionals, adaptative questioning is not used. It is possible to review and change responses, however, no completeness check is proposed.

Questionnaire translation

The English version of the survey was translated into 20 languages (Bosnian, Croatian, Danish, Dutch, Estonian, French, Georgian, German, Italian, Lithuanian, Polish, Portuguese, Romanian, Slovenian, Spanish, Turkish and Ukrainian) using online translation platforms (DeepL and Google translate). The first drafts of the translated surveys were corrected by the EACD national coordinators in the appropriate language. Finally, the survey was only developed in languages for which feedback from

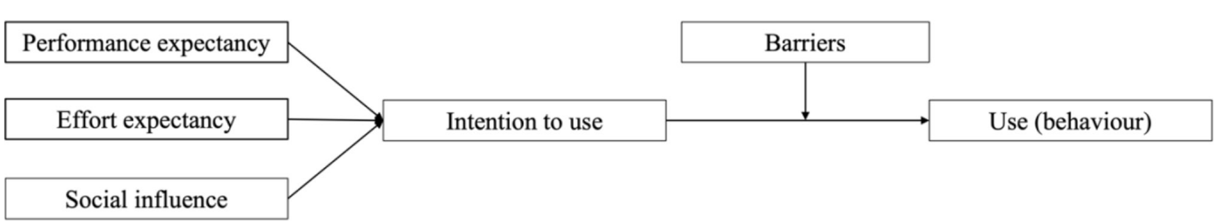

Figure 2 The modified unified theory of acceptance and use of technology (UTAUT) model used in this study to explore the level of acceptance of technologies by professionals in paediatric motor rehabilitation across Europe. The UTAUT model presented here was adapted from the original UTAUT model.[33]

the national coordinator had been obtained; therefore, it exists in 20 languages (English and 19 translations) (online supplemental appendix 1).

Online version

Once the survey was uploaded onto the online host platform, pretesting of the usability and technical functionality of the online questionnaire and the language versions, was performed by 11 national coordinators and early career researchers. Participants were asked to check the exact match (including the questions and response options) between the original English version and the translated versions. In this final step, some minor adjustments were made to facilitate survey completion by respondents.

Survey dissemination

The dissemination strategy plan was elaborated by the steering group and is performed by the EACD back-office coordinator (MK). The strategy involves convenience sampling. No incentive is proposed. Survey links are shared via email to the EACD members. The survey link is also shared through the EACD website, which is addressed to rehabilitation professionals across Europe (https://www.eacd.org). To maximise distribution across European and non-European countries involved in the EACD (Israel, Georgia and Turkey), and to reach different types of professionals, the national coordinators are disseminating the survey within their networks (local, regional and national), including national organisations for childhood disabilities. They are also asked to record their dissemination approach in an Excel file (inform if they used mailing lists, reached scientific or professional organisations, and detail the frequency of reminders sent and the geographic coverage of their actions) in order to outline the dissemination process of the survey. The survey is also advertised on social media, online events, during the EACD congress and national congresses (eg, SFERHE, Société Francophone d'Etudes et de Recherche sur les Handicaps de l'Enfance). Therefore, the initial contact with the participants could be either via the internet or direct. To maximise the number of responses, an open-access survey is used.

No cookies assigning a unique user identifier to each client computer are used.

Previous literature on the topic is scarce and provides few references for sample size calculation. We hypothesised that the inclusion of at least 500 respondents would enable the identification of determinants using univariate and multivariate analyses: that is, this sample size will allow us to reliably estimate, with 80% power and 95% CI, a proportion of positive responses of 10%, in four strata, such as 'professional background' or 'European regions', respectively, physiotherapists, occupational therapists, physicians and other therapists or North, East, West and South Europe. To achieve the target recruitment, we hypothesised that about 1 year would be necessary (from December 2021 to December 2022).

Data analysis and statistics

Responses will be automatically collected through the survey platform.

Responses from participants who are not working in motor rehabilitation with children will be excluded. Responses from participants who have not completed at least part 1 (description of the respondent) and one part from parts 3, 4 or 5 about technologies will be excluded. Completion rate will be evaluated by dividing the number of respondents who fulfilled part 1 and at least one part from parts 3, 4 or 5 by the number of people who have not completed part 1 and at least one part from parts 3, 4 or 5. The sample characteristics and the study outcomes (ease of access, frequency of use and type and purpose of use) will be summarised using descriptive statistics. The association between study determinants and each outcome will be estimated using univariate analyses. We will consider non-modifiable and modifiable individual rehabilitation professional factors (ie, sociodemographic characteristics such as gender or years of work experience and intention to use) as well as modifiable and non-modifiable environmental factors (ie, type of professional practice and patient characteristics) as determinants. Multivariate modelling will be performed for each study outcome and predictive performance will be assessed.

Regarding the proposed acceptance model, we will test the multivariate research model using the partial least squares structural equation modelling (PLS), which estimates complex cause-effect relationships in path models with latent variables (Jones *et al*[36] 2022). The PLS measurement model will be evaluated by measuring: (1) the reliability of each construct (Cronbach's alpha); (2) the convergent validity of each set of items with respect to their associated construct, by examining the factor loadings of the items on the model's constructs and (3) discriminant validity with the AVE (Average Variance Extracted) indicator. The PLS structural model will be evaluated with path coefficients, the explained variance (R2) and the effect size (f2) for each path segment of the model.

Patient and public involvement

This study was designed by a multidisciplinary steering committee that was composed of professionals involved in paediatric motor rehabilitation (physicians and physiotherapists) and the mother of a child with disability. The steering committee worked closely with the EACD national coordinators and thus with local professional organisations involved in motor rehabilitation for children. The outcomes of the survey will be shared with EACD members, local professional organisations involved in paediatric motor rehabilitation, the families of children who participate in motor rehabilitation, patient organisations and public authorities. Industries and companies will be able to make a written request for access to the results of the survey. The steering committee will consider the requests and share the data with those interested in rehabilitation technologies for children with disabilities.

Those stakeholders can all play a role in the implementation of digital technologies for motor rehabilitation. The dissemination of results will facilitate the alignment of current and future developments with the needs of end users and the cocreation of participatory approaches involving all stakeholders.

Ethics and dissemination

The study is conducted according to current French legislation (loi Jardé (n°2012-300)).[37] The study protocol was submitted to Brest CHRU Institutional Review Board which considered that ethical committee approval was not necessary for this research.

SurveyMonkey-Momentive is the hosting platform. Its information systems and technical infrastructure are hosted within SOC 2 accredited data centres. It has been awarded ISO 27001 certification. It can use respondents' information to improve its services. It does not share information or data with third parties. Respondents have access to the privacy notice.[38] No personal information is collected by the survey. It is not possible to identify or trace responders (no email or IP address), thus anonymity is guaranteed.[39]

Study findings will be presented at national and international meetings and submitted for publication in a peer-reviewed journal.

DISCUSSION

The WHO recognises that digital health technologies can strengthen health systems by addressing health service delivery challenges and enhancing the coverage and quality of health practices and services. Investigation of the use of digital technologies in paediatric motor rehabilitation practice as well as the factors that contribute to their use by rehabilitation professionals is critical to enhance quality of care and outcomes and to optimise healthcare system expenses.

By proposing a survey designed by a multidisciplinary group from different European countries to professionals with different backgrounds in different practice settings, we will be able to provide data to enlighten these currently unexplored issues. The aim is not to survey a representative sample and draw statistical inferences about the population of professionals who practice motor rehabilitation with children, but to explore the relationships of both professionals and practice features to the use of technologies. The study includes different outcomes and will generate data on the use of, access to and the acceptance of digital technologies; it covers individual and environmental factors, some of which are modifiable and actionable into recommendations. Our hypothesis is that, in paediatric motor rehabilitation, rehabilitation technologies do not fulfil their potential because of generally poor use of digital technologies. The use of technologies in clinical practice may be limited by both individual and environmental factors, thus different types of actions are required to increase their use. We hypothesise that rehabilitation technology use is limited by the lack of access, and that financially accessible devices are needed. We further hypothesise that lack of time and training are also barriers to technology use: this could be remediated by knowledge translation interventions as well as organisational adaptations at the care structures level.[27 31] At an individual level, we hypothesise that professionals, especially younger professionals, have a good acceptance of digital technologies.

To be able to fulfil our objectives and verify our hypotheses, we are paying specific attention during the dissemination to reach professionals with different practices. The survey is disseminated through the EACD network. We have also implemented a strategy that involves a national coordinator in each country who knows and can consider the local context when reaching respondents. To our knowledge, no data are available at the European level to describe the population of rehabilitation professionals, therefore we cannot evaluate representativity. Previous literature on the topic is scarce, therefore we cannot use direct references for the sample size justification. Users of digital technologies may be more motivated to share their experience with those technologies and they may be more motivated to complete the whole questionnaire than non-users, which may induce a risk of bias of the acceptance results. To identify this potential bias, we will calculate the completion rate and compare the responses of the group of included respondents with the group of respondents who did not complete part 1 and at least one part from parts 3, 4 or 5.

The survey responses are self-reported by professionals, which may bias the results. This choice was made because we believe that the successful development of new technologies and their implementation will only occur when the emphasis is placed on user-centred design, implementation and evaluation. Taking into account professionals' views might drive future developments.[24] To mitigate this bias and increase internal validity, quality checks will be performed. For the same reason, pilot tests were performed with professionals with different backgrounds and from different countries. We hope that the data obtained from respondents will provide avenues for future research and future developments of digital technologies that fit with clinical practice.

In the specific domain of paediatric motor rehabilitation technologies, the end users are not only the rehabilitation professionals but also the children and their families. The focus of this study is on rehabilitation professionals and not on children with disabilities and their families because the access of these real end users to digital technologies is determined by the acceptance and use of technologies by professionals. The results will have to be completed with feedback from children and families.[28]

Theoretical models of use of technologies are widely used to identify individual factors which have to be taken into account while implementing technologies. The UTAUT model is recommended in healthcare but has to be specifically adapted to the context. We performed a rapid review of the literature to be able to adapt this model to fit with the practice of paediatric motor rehabilitation because we did not find any study that used an adapted UTAUT model in our specific field. We plan to perform an analysis to validate this model. The analysis plan clearly differentiates the descriptive study from the explanatory analysis that will validate a theoretical model of use of technologies. This model might be used in future studies aiming to foster digital health technology uptake in paediatric motor rehabilitation.

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