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The relationship between attitudes, emotions and the intention to use the digital rehabilitation solution: Insights from Rwandan rehabilitation professionals

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Abstract

Limited access to rehabilitation is a major challenge in low- and middle-income countries (LMIC). Digital rehabilitation (DR) has the potential to decrease this gap by offering effective and safe rehabilitation services for clients. This study aimed to investigate the relationship between rehabilitation professionals' emotions and attitudes and intention to use the DR solution. Data was collected during two time periods in Rwanda: from July to November 2022, and from October 2023 to January 2024. A total of 58 rehabilitation professionals (67% men) completed the online survey at the beginning of the implementation of the DR solution and out of those, 23 (40%) responded to the follow-up survey. Attitudes were explored using Information Technology Attitude Scales for Health (ITASH), divided into three categories: 1) negative, 2) neutral, and 3) positive. Emotions were explored using an emotional scale with two factors "distress" and "positive arousal". The intention to use the DR solution was assessed using a seven-point Likert scale, divided into three categories: 1) will not continue (points 1 to 3), 2) neutral (point 4), and 3) will continue (points 5 to 7). Crosstabs and Chi-Square were used to evaluate dependence between attitude and intention to use the DR solution. Binary logistic regression was used to assess the relationship between distress and positive arousal and intention to use the DR solution. Initially 91% of respondents had a positive attitude toward DR (M = 64, SD = 6.3). and positive attitude remained (M = 57, SD = 7.3, p = .860) at follow-up. A significant relationship between positive attitude and intention to use the DR solution ($\chi 2 = 18.33$, $p < 0.001$) was found. Positive arousal was significantly related to a higher intention to use the DR solution (OR = 1.29, p = .008), while distress was not (OR = .89, p = .22). Distress decreased significantly (M = 9.7, SD = 3.0, p = .02) during the follow-up. The results do not definitively determine a relationship between attitudes, emotions, and the use of the DR solutions. However, positive emotions and attitudes appear to be linked to a higher intention to use the DR solution. Further research with a larger population is needed to confirm the relationship between emotions, attitudes, and use of the DR solutions in LMIC context.

Keywords: emotions, attitude, rehabilitation, digitalisation, survey

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Introduction

It's been estimated that one in three people globally are living with health conditions that may benefit from rehabilitation [1,2]. Access to rehabilitation services is challenging for people with disabilities in low- and middle-income (LMIC) countries [3–5]. The high cost of rehabilitation services, a shortage of rehabilitation professionals, facility and logistical issues, and a lack of leadership and governance are identified as some of the barriers to accessing rehabilitation services in the LMICs [6]. In Rwanda, significant barriers to accessing rehabilitation services are the geographical barriers and a low density of professionals, with over 14 million inhabitants being served by approximately 360 physiotherapists, fewer than 30 occupational therapists, and fewer than 10 speech and language therapists [7].

Globally, the need for rehabilitation services is projected to grow due to demographic shifts and the increase of non-communicable diseases, while in Rwanda, this need is further amplified by significant road traffic injuries [2,7]. Digitalising rehabilitation services not only addresses the rising demand but is also crucial for countries with limited resources, such as Rwanda and other nations in sub-Saharan Africa [6,8]. The WHO defines rehabilitation as "*a set of interventions designed to optimize functioning and reduce disability in individuals with health conditions in interaction with their environment*" [9], but there is no shared understanding of the terminology related to digital services in rehabilitation [10]. In this research, the term *digital rehabilitation* (DR) refers to using digital technologies as part of the rehabilitation process aiming to optimize functioning and reduce the disabilities of the individual in interaction with their environment [11]. DR includes but is not limited to the use of tele- and remote rehabilitation applications, automated AI-based services, robotic assistance, wearables, emails, videos, speech, and text messaging solutions, and currently there is a wide range of different DR solutions available for therapists [11]. For example, mobile health (mHealth) solutions can significantly improve rehabilitation delivery in countries with limited resources [12].

Engaging users in DR interventions and healthcare services is a complex process [13]. Previous research has yielded numerous theoretical models that describe the factors influencing user acceptance and behavior toward technology. [14]. The technology acceptance model (TAM) and the unified theory of acceptance and use of technology (UTAUT) are the most actively used theoretical models in healthcare [15–17]. TAM includes the constructs of perceived usefulness and perceived ease of use as determinants of attitudes toward using technology, intention to use technology, and actual use of technology [18]. UTAUT consists of four key constructs: performance expectancy, effort expectancy, social influence, and facilitating conditions, which influence users' behavioral intention to use technology and their subsequent usage behavior [19]. Based on the previous research on technology acceptance, attitude seems to be the strongest predictor of intention to use technology [15].

In addition, the fit between individuals, tasks and technology (FITT) framework suggests that IT adoption in clinical settings depends on the alignment between user characteristics (e.g., emotions, motivation), technology features (e.g., usability, performance), and the nature of clinical tasks and processes (e.g., task complexity) [20]. Previous research shows that how users interact with technology and tasks, especially in healthcare, is crucial for successful IT adoption [20].

In psychology, many models of attitude have been proposed during the past decades [21]. One model is the tripartite model or ABC's of attitude [21,22]. In this model, the components of attitudes are the affective or emotion component, the behavior component, and cognitive or belief component [21,22]. Based on the tripartite model, people's behavior is affected by their emotions and beliefs [21].

The rapid development of technology has led to a significant increase in research on technology acceptance [23]. However, the role of emotions has often been overlooked [24]. Emotions, affect, and feelings are often used interchangeably but these terms have distinct meanings, especially in psychological literature. Emotions can be seen as intense, short-lived experiences that arise in response to certain stimuli [25,26]. Emotional reactions are influenced by cultural norms, and can be defined as preconscious social expressions of feelings, while affects, which are more unconscious reactions to internal or external stimuli, can be seen as predecessors to both feelings and emotions [25]. Feelings are conscious and subjective interpretations of emotions or bodily sensations [25,27]. Emotions have a significant role in our decision-making and behavior in daily life, particularly within the contexts of healthcare [24,28,29]. Furthermore, emotions appear to influence the acceptance of technology [30]. Previous research indicates that positive emotions such as enjoyment and satisfaction, serve as mediating factors in the acceptance of new technology, while negative emotions, such as fear and frustration, can hinder technology adoption [31,32]. Also, user experiences with digital services are influenced by emotions, both positively and negatively [33]. Notably, positive emotions serve as a mediating factor in the acceptance of new technology [33,34].

Aim of the study

Building on previous research that emphasizes the role of emotions in adopting new technologies and the identified need for implementing DR solutions in low-resource settings, this study aimed to explore the relationship between rehabilitation professionals' emotions, attitudes, and intention to use the DR solution in their practice in Rwanda. In addition, the aim was to examine how their attitudes and emotions change after using the DR solution. This study adopts an exploratory approach to provide insights into the role of emotions and attitudes in shaping the adoption and use of the DR solution. Our research questions were:

Q1: What is the relationship between emotions and intention to continue using the DR solution?

Q2: What is the relationship between attitudes and intention to continue using the DR solution?

Q3: How have attitudes and emotions toward the DR solution changed among rehabilitation professionals at the beginning and after implementation?

Material and methods

Study design and participants

This study was part of the research project Co-innovation of Digital Rehabilitation in the Global Marketplace (DIRECT). The project aimed to increase access to rehabilitation with a digital-first approach to providing rehabilitation services through evidence-based practice [35,36]. During the project, the goal was also to establish research-driven ecosystems in the Eastern Africa and Southeast Asia regions and create new business opportunities for Finnish companies through evidence-based practice [37]. The project was led by the Institute of Rehabilitation, Jamk University of Applied Sciences,

Finland. Research activities in Rwanda were done in collaboration with the University of Rwanda and the Centre of Excellence in Biomedical Engineering and eHealth (CEBE) and ethical approval was received from the Rwanda National Ethics Committee (RNEC).

As a part of this research project, the DR solution called Physitrack was piloted among the rehabilitation professionals in Rwanda. Physitrack has an exercise library, and it offers home exercise programs through its mobile application (PhysiApp) and a clinician portal [38]. Participants of the pilot were asked to provide feedback on their experiences with Physitrack. They received initial training and were given access to the system. Those who had used Physitrack for at least one week provided feedback on their initial experiences in the first survey.

Data collection

Data collection began in July 2022 in Rwanda. A convenient sample of participants was recruited for the pilot. The Rwandan Physiotherapy Association assisted with the recruitment of participants by sharing the details of their members with the help of a local research coordinator. Participants were provided detailed information about the research through email, and they were invited to participate in the study. Participation was voluntary.

An electronic link to the first online survey was sent to healthcare professionals who expressed interest in the research. Participants were reminded about the ongoing survey using WhatsApp messages. A follow-up survey was sent to those who responded to the first survey. Individual links were used to gather responses for the follow-up study, and several reminders via email and WhatsApp were sent to encourage participation.

Measurements

Data was collected with an online survey in English with the Webropol survey platform. The following data were collected: 1) Background information: gender, years of experience in rehabilitation, experience of ICT and digital health/rehabilitation technology. 2) The emotions toward the DR solution were assessed with an emotional scale adopted from Saariluoma and Jokinen's [34]. The emotional scale was designed to assess users' emotional experiences by analyzing a wide range of basic emotions [34]. The question was "When I think about Physitrack in rehabilitation I feel:" followed by the 15 emotions and feelings. The scale contained a 5-point scale for respondents to rate their emotions and feelings from 1 (not at all) to 5 (very much). In the present study, Cronbach's Alpha of the emotional scale was .73. 3) The attitudes toward information communication technology (ICT) and the DR solution were assessed with a short form of the Information Technology Attitude Scales for Health (ITASH) [39,40]. The ITASH was originally developed to measure healthcare professionals' attitudes towards IT use in healthcare settings, focusing on factors such as efficiency of care, education, training, development, and control [39]. The short form of ITASH [40] included 19 items which were evaluated with a four-point scale from 1 (strongly disagree) to 4 (strongly agree). The question was "What are your thoughts about using Information Communication Technology (ICT) solutions such as Physitrack in rehabilitation". The ITASH statement values were reversed where necessary to allow the calculation of the sum. In this study, the ITASH factors identified in previous studies [39,40] were not used since we were interested in the overall attitude measured by ITASH. The minimum score of ITASH was 19 and the maximum score was 76. In the present study, Cronbach's Alpha of the ITASH was .80. 4) The intention to continue using the DR solution was

assessed with the statement: "I will continue using Physitrack in the future" evaluated with a seven-point scale from 1 (strongly disagree) to 7 (strongly agree).

Data analysis

The data from the initial- and follow-up survey were imported into IBM SPSS Statistics version 28. The initial survey data was used to investigate the answers to research questions 1 and 2, while the combined data from both surveys were used to investigate research question 3. Both datasets were checked and adjusted for analysis. Descriptive statistics, including frequencies, percentages, means, and standard deviations were used to analyze participants' background information.

The emotional scale was analyzed using factor analysis with principal axis factoring, fixed to two factors, and Promax rotation with Kaiser normalization. The Kaiser-Meyer-Olkin (KMO) measure was used to verify the sampling adequacy, with an acceptable limit set at 0.5 [41]. Bartlett's test of sphericity was used to evaluate the overall significance of the correlation matrix, which needed to be statistically significant ($p<.001$) for factor analysis to proceed [42]. Cronbach's alpha assessed the reliability of the factors, with a threshold of 0.7. Based on this analysis, two summary variables were created.

The ITASH scores were re-coded into three categories: scores from 19 to 38 indicated negative attitudes, 39 to 56 indicated neutral attitudes, and 57 to 76 indicated positive attitudes toward ICT [39]. This re-coded variable was used in further analyses.

The statement "*I will continue using Physitrack in the future*" was used to assess the intention to use the DR solution. The seven-point Likert scale was categorized into three categories: 1) from 1 to 3: will not continue; 2) 4 neutral, and 3) from 5 to 7: will continue. This categorized variable was used to analyze relationships between emotions, attitudes, and intention to use.

The relationship between attitudes and the intention to continue using the DR solution was examined using crosstabs and the Chi-Square test. The dependency between emotions and the intention to continue using the DR solution was analyzed with binary logistic regression. A significant level of $p < .05$ was considered statistically significant. The combined dataset was analyzed by using a paired sample T-test.

Results

A total of 58 rehabilitation professionals replied to the first online survey, and 23 of them (40%) responded to the follow-up survey. The majority of participants were physiotherapists, with one prosthetic and orthotics professional also taking part in the survey. In the initial survey, 67% (n = 38) of respondents were men, whereas in the follow-up survey the proportion increased to 78% (n = 18). In the initial survey, a total of 26 (47%) rated their experience with information technology to be quite extensive (n = 16, 29%) or very extensive (n = 10, 18%). Of those who dropped out, a total of 12 rehabilitation professionals (35%) rated their experience with information technology as quite extensive (n = 8, 22%) or very extensive (n = 5, 13%).

Attitudes and intention to continue using the DR solution

Initially, 91% of respondents' ITASH score was 57 or above indicating a positive attitude toward ICT and DR (M = 64, SD = 6.3). Most of those who had positive attitude (96%) intended to continue using the DR solution. Of those who had a neutral attitude (n = 5), two intended to continue using the DR solution

and three did not. Analysis of the data from the initial survey indicated that the participants' positive attitude was associated with the use of the DR solution ($\chi^2 = 18.33$, $p < 0.001$) (Figure 1).

Emotions and intention to continue using DR solution

The requirements for factor analysis were met since KMO measure was .76 and Bartlett's test of sphericity was statistically significant ($\chi 2 = 430.78$, df = 91, p<.001). The communalities of the emotional scale items varied from .30 to .90. The lowest communality was found in the item "surprised" which also did not fit any of the two factors. Researchers decided to exclude the item "surprised" in further analysis.

A forced two-factor model was used to analyze the remaining 14 items, ensuring that the items were constrained to load onto two predetermined factors. The scree plot supported the use of two factors. Table 1 presents the factor loadings for the 14 items after rotation (Promax with Kaiser normalization). All items exhibited loadings greater than .50 on their respective factors, indicating clear and strong associations. The two factors explained 33.4% and 18.2% of the variance, respectively (total 51.6%). Factor 1 had a Cronbach's alpha of .87 and factor 2 had a Cronbach's alpha of .86, indicating good internal consistency for the items with each factor.

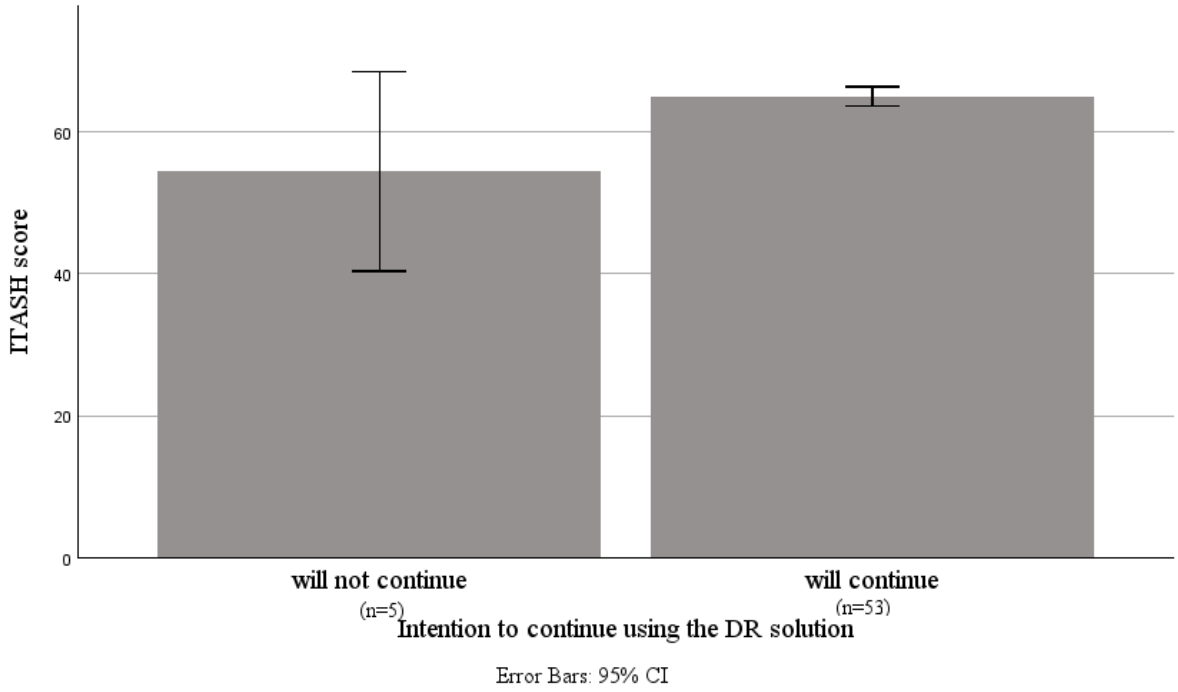

Figure 1. Figure 1. Mean (95% confidence intervals) profiles of attitudes toward ICT and DR measured by ITASH score according to the intention to continue using the DR solution.

Table 1. Emotional scale items according to factor loadings among participants.

Emotional scale items	Factor 1 Positive arousal	Factor 2 Distress
delighted	.55	-.10
satisfied	.81	-.29
pride	.66	-.29
excitement	.85	-.31
determination	.88	-.32
vigilance	.71	-.10
sad	-.22	.55
angry	-.26	.83
anxiety	-.30	.78
afraid	-.21	.59
frustration	-.13	.69
guilt	-.05	.70
displeasure	-.20	.76
desperation	-.26	.51

Extraction method: Principal Axis Factoring; rotation method: Promax with Kaiser normalization.

Based on the identified two factors, two summary variables were created and labeled “positive arousal” and “distress”. Positive arousal included six items (delighted, satisfied, pride, excitement, determination, and vigilance) and distress included eight items (sad, angry, anxiety, afraid, frustration, guilt, displeasure, and desperation). The value of positive arousal varied from 6 to 30 and distress from 8 to 40.

Analysing the data collected in the initial phase of the pilot, positive arousal was found to be significantly associated with a higher intention to use the DR solution (OR = 1.29, p = .008), while distress was not (OR = .89, p = .22) (Figure 2).

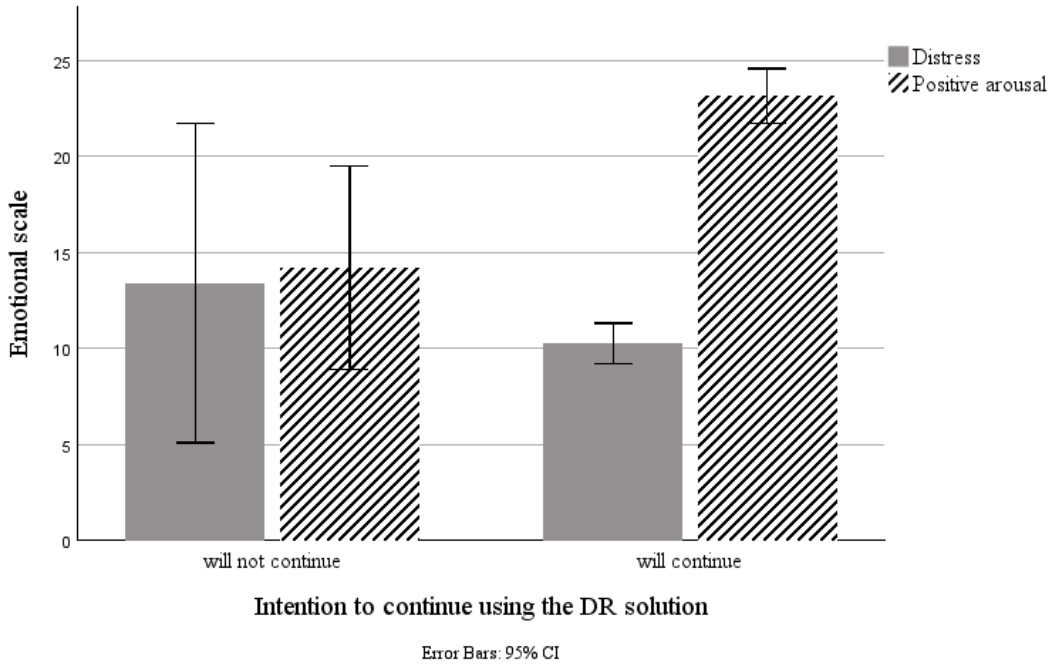

Figure 2. Emotions and intention to continue using the DR solution. Mean of emotional scales and intention to continue using the DR solution with 95% confidence interval (CI).

Change in emotions and attitudes during the pilot

Initially (n = 23) when thinking about the DR solution, the positive arousal (M = 21.8, SD = 5.7) of respondents was higher than the distress (M = 12.1, SD = 5.7) even though the maximum scale of distress was higher. In the follow-up, distress decreased significantly (M = 9.7, SD = 3.0, p = .02). Positive arousal was at the same level in the follow-up (M = 22.4, SD = 5.9, p = .59). Among those who dropped out, positive arousal was at the same level (M = 21.8, SD = 6.2) as those who continued to the follow-up survey. However, distress was lower among those who dropped out (M = 9.9, SD = 2.7).

Initially (n = 23) most of the respondents had a positive attitude toward digital rehabilitation solution (M = 61, SD = 6.6), and only four (14%) respondents had a neutral attitude. At follow-up, the ITASH score decreased, but the decrease was not statistically significant (M = 57, SD = 7.3, p = .860). At follow-up, 50% (n = 14) of respondents still had a positive attitude and 32% (n = 9) had a neutral attitude toward the DR solution. Of those who dropped out 96% had a positive attitude toward ICT and DR (M = 61, SD = 7.3).

Discussion

The present study aimed to examine the relationship between rehabilitation professionals' attitudes, emotions, and intention to use the DR solution in their practice as well as changes in attitudes and emotions after the piloting of the DR solution in an LMIC context. Our findings revealed a significant link between positive attitudes and emotions toward technology and a higher intention to continue using the DR solution. These findings align with earlier studies conducted in high-income countries [15,42,43], which also identified a positive association between positive attitudes and the

willingness to adopt digital tools. It seems that attitudes, emotions, and the intention to use the digital solution in rehabilitation are independent of a country's income level. Previous research [30,33] found that positive emotions mediate technology acceptance and use. For instance, Beaudry and Pinsonneault [44] found happiness and excitement positively related to IT use, while anxiety had a negative impact. Although our study included anxiety in the distress summary variable, we found that distress did not significantly influence the intention to continue using the DR solution.

The findings relating to positive attitudes and emotions indicate that it may be beneficial to pay attention to users' attitudes and emotions toward new technology already at the beginning of the implementation. In an earlier study, expected performance results and effort expectancy were shown to be important factors influencing healthcare professionals' attitudes toward new technology [15]. From a psychological perspective, the positive emotions and beliefs that users have toward ICT in their work, along with their behaviors, influence their attitudes [21,22,45]. Proper education and emotional user engagement can be meaningful factors during the implementation of a new digital solution to enhance positive attitudes. Also, human-centered design in DR development ensures that technology is acceptable and meets the needs of both clients and professionals.

During the use of the DR solution, a small decrease in the ITASH score was observed in this study. This may imply that the DR solution did not fully meet the expectations of the users. A previous study by Konttila et al. [46] showed that positive experiences have a positive influence on healthcare professionals' attitudes and motivation to use technology in their work. Also, positive emotional experiences with technology seem to be associated with technology acceptance and use [33]. This suggests that it could be beneficial to follow the implementation process and gather post-implementation feedback to determine the effectiveness of the DR solution in meeting user needs and expectations.

To the best of our knowledge, this study was the first to evaluate emotions toward technology in a follow-up setting. The follow-up data revealed a significant decrease in distress compared to the initial phase of the pilot. This may indicate that users became more confident and proficient in using the DR solution, but further research is needed to confirm these changes and investigate the possible factors behind this change.

These findings are especially relevant for Sub-Sahara African countries, where access to rehabilitation services is limited due to resource constraints [5,7]. The positive attitudes and emotions toward the DR solution observed in this study suggest that similar approaches could be successfully implemented in LMICs to improve access. Further research, especially from the perspective of rehabilitation clients, is needed to identify the most suitable solutions. Additionally, it is essential to consider barriers related to legislation, infrastructure, and policies. Future research should also address societal and systemic levels to ensure effective integration into various levels of healthcare.

In this research the emotional scale of Saariluoma and Jokinen [34] was used in data gathering. Although the difference between the concepts of emotions, feelings and affects is not clear the used scale contained items that can be considered as emotions (e.g. sad and angry), feelings (e.g. satisfied, pride, and frustration), and affects (e.g. anxiety and vigilance). In the future, it is recommended to more deeply consider these

concepts and the differences related to technology use. It is also suggested to use validated scales, such as The Positive and Negative Affect Schedule (PANAS) [47], or to develop more suitable and usable measurements for evaluating emotions and feelings toward technology.

Future research could delve deeper into the connection between emotional factors and technology acceptance. A deeper understanding of all the factors affecting the use of DR would benefit the implementation of new technologies in the rehabilitation process and help to achieve the expected benefits of digitalisation. In the future, follow-up studies should be conducted to increase the understanding of how experiences will affect the attitudes and emotions toward technology after the implementation. Finally, theoretical frameworks should be examined critically in DR, and in future studies, it is beneficial to explore how individual factors such as emotions, feelings, and attitudes are reflected, e.g., in the FITTE framework.

Strengths and limitations

A strength of this research was the follow-up setting. The data used in this study were collected among rehabilitation professionals in Rwanda, which can be seen as a strength since quite a few studies related to digitalisation in rehabilitation have been published in this area or even in LMICs [48].

Nevertheless, this study has several limitations. The target group was not recruited randomly and thus the results might not be generalized to the wider population. The study experienced several dropouts, which is important to consider when interpreting the results. Those who dropped out appeared to have less experience with digital technology compared to those who continued to the follow-up. Despite this, the dropouts showed a positive attitude and lower distress levels compared to those who completed the study. The findings revealed that participants generally held positive views toward the DR, suggesting that those with negative attitudes may have been less inclined to participate in the research. Already in the first data collection, participants had some experience with the DR solution in question and this may have affected their attitudes and emotions.

Conclusion and practical implications

Given the current findings, a definitive relationship between attitudes, emotions, and the use of the DR solution cannot be ascertained. However, positive emotions and attitudes seem to be associated with a higher intention to use the DR solution. It appears that attitudes, emotions, and intention to use the DR solution are not influenced by a country's income level. The study indicated that over time the distress toward technology decreased significantly, while positive arousal toward technology remained the same. Additionally, most respondents initially had a positive attitude towards DR, and a slight, non-significant decrease in positive attitude was observed at follow-up. Therefore, considering users' emotions and attitudes could be advantageous when developing and implementing DR solutions. In the development of new DR solutions, it is also important to ensure a positive user experience which can foster positive emotions and attitudes and increase the likelihood of using the new solutions.

Conflict of interest statement

The authors report no conflicts of interest in this work.

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