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Perspective of Professionals on Digital Rehabilitation in Vietnam

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Abstract

This study intended to explore healthcare professionals' views on digital rehabilitation technologies in Vietnam specifically their perceptions, challenges and impact on patient outcomes. The research adopted an interpretivist philosophy and a qualitative exploratory design and comprised eight individual semi-structured interviews with healthcare professionals. Analysis of data was done using thematic analysis to identify the patterns and the themes within. Findings revealed three main themes including (**1**) involvement with training personalised care in terms of remote support benefits and limitations of inadequate training; (**2**) usability and accessibility call for patient involvement using easy-to-use tools and reveals the barriers in rural areas; (**3**) data security and standardisation addresses concerns on privacy, accepting non-specialised platforms, and the necessity of unified digital systems. The study concluded that digital rehabilitation technologies offer a strong potential for improving patient care and accessibility, but that there are training gaps, systemic problems and data management problems to be overcome. These problems can be overcome by policymakers, healthcare providers and technology developers working together. Future studies will require larger samples, mixed methods, and patient stories, to ultimately develop a richer picture of digital rehabilitation across a wider range of settings.

Keywords: Digital Rehabilitation, Healthcare Professionals, Vietnam, Usability and Accessibility and Data Security and Standardisation

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1 Introduction

Digital rehabilitation, a new field, uses technology to deliver healthcare solutions intended to restore or improve physical and mental functions. It has gained attention globally as an alternative and/or as a complement to traditional rehabilitation practices due to the development of telehealth, wearable devices and artificial intelligence (AI) technologies (Reisdorf & Rikard, 2018). In Vietnam, the healthcare sector is evolving at a fast pace and thus it cultivates an environment in which digital rehabilitation technologies may be integrated. Nevertheless, the use of these technologies is dependent on how the potential users and facilitators, health care professionals perceive the implementations and hence its successful implementation and effectiveness (Arntz et al., 2023). This research delves into how Vietnamese healthcare professionals view digital rehabilitation in terms of perceived efficiency technical issues and patient outcomes.

1.1 Background

Rehabilitation, a term for older than the allied health discipline by the same name, has long referred to early intervention in the form of physical therapy to restore movement and function after either illness or injury. In the 20th century with the arrival of prosthetics and assistive mobility tools, the first technology integration into rehabilitation took place (Correia et al., 2021). In the last two decades, digital health technologies such as virtual reality (VR), telemedicine, and AI-based platforms have transformed the methods of rehabilitation. Rehabilitation in the digital or technology-assisted domain is a wide gamut of solutions, among which there are telerehabilitation solutions, robotics-assisted therapy and sensor-based monitoring systems (Zivanai & Mahlangu, 2022).

The healthcare system in Vietnam has been in a constant state of change since the 1990s. Investment in healthcare infrastructure and access has grown under economic reforms under Đổi Mới (Võ & Löfgren, 2019). However, Vietnam is facing a high burden of non-communicating diseases and an ageing population. A high proportion of deaths in Vietnam are due to NCDs, many of which necessitate long-term rehabilitation services; 80% of them die from NCDs (WHO, 2024). The need for efficient and scalable rehabilitation solutions, including digital rehabilitation technologies reflects the trends in the country´s growing health care demands.

Digital rehabilitation has promising outcomes in exploiting patients' outcomes, cutting healthcare costs and increasing access to care globally. An example is the United States (US) and the United Kingdom (UK) embracing the adoption of telerehabilitation which allows patients to receive therapy remotely (Isernia et al., 2019). In this sense, motion sensors and smart watches lend real-time monitoring of patients through which health professionals can design a treatment plan appropriately. Moreover, cognitive rehabilitation and physical therapy applications of VR are used to create immersive environments that increase patient engagement (Nabutovsky et al., 2020).

However, the adaptation of digital rehabilitation in Vietnam still finds its primary stages. A confluence of limited access to advanced technologies, inadequate digital literacy among healthcare professionals and related infrastructure gaps stands in the way of widespread implementation. Vietnam has been leaning towards digitalization and the National Digital Transformation Programme by 2025 points to the opportunity of integrating digital health solutions in mainstream healthcare practise (ITA, 2024). The programme focuses on the development of a digital health ecosystem through telehealth and electronic health records which will provide a scenario for the development of digital rehabilitation technologies.

However, developments in Vietnam's healthcare sector suggest that digital solutions are gaining more and more attraction. For example, when the COVID-19 pandemic broke out, the Vietnamese government vigorously facilitated the use of telemedicine to facilitate continuity of care and prevent contact of patients with infections (Osewe, 2021). Digital tools used for rehabilitation have also started to be tested in rehabilitation centres as an aid to better patient care. But because usually, these technologies are being integrated ad hoc, there is no unified strategy, no unified framework to do that (Li et al., 2021). Furthermore, digital rehabilitation is underexplored in terms of healthcare professionals' perceptions and experience with digital rehabilitation hence, making a critical knowledge gap that this study intends to address.

1.2 Problem Statement

At the forefront of boosting the adoption of digital rehabilitation technologies in Vietnam lies its commitment to digital transformation and the rising need for scalable healthcare solutions. However, several barriers prevent these technologies from being implemented and used

successfully. A key challenge is a very limited understanding of how healthcare professionals see digital rehabilitation tools in terms of efficiency and feasibility (Cao et al., 2024). Digital rehabilitation technologies succeed (or fail) to the degree to which healthcare professionals accept them. What they perceive will impact patient acceptance, adherence to therapy and eventually outcomes. Research from other countries reported that healthcare professionals' fears over technology usability, data security, as well as patient engagement play a major role in the success of digital rehabilitation programmes (Kosowicz et al., 2023). However, in Vietnam, there is little comprehensive research into these aspects. For example, while digital health efforts such as telemedicine are encouraged (Tran et al., 2022), the specific problems faced by those to bring digital rehabilitation to action are not known.

Another problem clogging digital rehabilitation in Vietnam is technical challenges. A report indicates that less than 20 per cent of healthcare facilities in Vietnam are equipped with advanced medical technologies, including digital rehabilitation tools (WHO, 2024b). These challenges are compounded by limited infrastructure, unreliable internet connectivity in rural areas and a lack of standardised training programmes for healthcare professionals. Another important dimension of digital rehabilitation is patient outcomes. Although international studies show that digital rehabilitation increases functional ability, reduces pain, and improves quality of life, there is little evidence from Vietnam to prove these claims. For example, Hassett et al. (2020) found that digital rehabilitation significantly enhanced mobility and mental health in stroke patients in Australia. However, such studies are scarce in the Vietnamese context. Lack of evidence in this gap thus hinders the true evaluation on how digital rehabilitation technologies can be used to enable patient outcomes improvement in Vietnam.

Moreover, the sociocultural context within Vietnam provides distinct challenges and opportunities for digital rehabilitation. Digital health solutions depend on traditional beliefs about health and healing and varying levels of digital literacy among patients and professionals. For example, a significant portion of rehabilitation patients, most of them being older adults who are not familiar with or trust the use of digital technology (Szeto et al., 2023). For digital rehabilitation to work seamlessly in Vietnam's health environment, these socio-cultural barriers must be addressed.

Therefore, given these complexities, there is a clear need for in-depth research to understand healthcare personnel's views about digital rehabilitation in Vietnam. Interview-based studies (qualitative) can offer invaluable information about their experience and their barriers, challenges and perceptions while allowing for adapted strategies to be developed to tackle barriers and optimise the implementation of digital rehabilitation technologies. This is especially important given the Vietnamese context of rapid digitalisation, in which evidence-based approaches are critical to enable effective, equitable adoption of digital health innovations. In filling this existing knowledge gap, this study aims to explore the main aspects that impact healthcare professionals' perceptions of digital rehabilitation in Vietnam. The research explores technical challenges, and patient outcomes and aims to provide a holistic picture of what drives the adoption and effectiveness of these digital rehabilitation technologies. These findings will be useful to inform policy and practice to promote the integration of digital rehabilitation in Vietnam's healthcare towards better patient care and outcomes.

1.3 Research questions

i. What are the main aspects influencing healthcare professionals' perceptions of the efficiency of digital rehabilitation technologies in Vietnam?
ii. What are the most important technical challenges faced by healthcare professionals while implementing digital rehabilitation technologies in Vietnam?
iii. How does the usage of digital rehabilitation technologies impact patient outcomes in relation to improvement in function and quality of life?

2 Literature Review

2.1 Introduction

According to Reisdorf and Rikard (2018), digital rehabilitation describes an innovative form of delivery of therapeutic interventions by using digital technologies, i.e. virtual reality (VR), telemedicine, wearable devices, and mobile applications. These advancements have transformed the practice of traditional rehabilitation by making them more accessible, personalised and cost-effective. Digital rehab uses technology to design exercises, track progress, and provide real-time feedback; a viable option to tackle the issues of poor access to qualified healthcare facilities and/or professionals in rural and under-serviced areas (Arntz et al., 2023). This is a paradigm shift in rehabilitation practice, utilising technology where tech is used to add value to the management to improve the outcomes of the patients and increase the efficiency of the rehabilitation programme.

The aim of this literature review is threefold: Issues of examining the theoretical framework of digitally inspired rehabilitation, professional roles and perceptions of the implementation, and effectiveness and barriers of these technologies are discussed. In addition, this review attempts to emphasise the significance of interdisciplinary collaboration and to show how the emergence of technology must be in tune with ethical and policy concerns. The literature review orientates itself through these dimensions guiding the exploration of how digital rehabilitation is forging new directions for contemporary therapeutic practises as well as how professionals engage in its development. Finally, this study highlights the decisive character of professional insights in establishing digital rehabilitation as something appropriate for inclusion in healthcare systems.

2.2 Theoretical Framework

Digital rehabilitation involves implementing technology in therapeutic procedures to facilitate the easing of access, efficiency and outcomes of a patient. To better understand professionals' perspectives on this emerging field, a strong theoretical foundation is needed. There are two relevant theories, the *Technology Acceptance Model (TAM)* and the *Diffusion of Innovation (DOI) Theory.*

TAM

Davis (1989) proposed the TAM which explains how users come to accept and use a technology. It focuses on two key factors: (1) Perceived Usefulness (PU) and (2) Perceived Ease of Use (PEOU). PU measures how the 'professional impact' of digital rehabilitation will help people deliver therapeutic outcomes. PEOU measures how easy it will be for them to use it. In Vietnam, the acceptance of digital rehabilitation is influenced by the usability of the platforms, cultural adaptability of the tools and guidance of the professionals. With the application of TAM, this study can reflect on professionals' practical concerns and attitudes about their adoption of digital tools in rehabilitation (van der Ham et al., 2020).

DOI Theory

Created by Rogers (1962), the DOI theory describes how an innovation is adopted in a social system. Five characteristics, namely *relative advantage, compatibility, complexity, trialability, and observability*, are identified to influence adoption rates. For digital rehabilitation, the relative advantage, for instance, will consist of the greater accessibility to remote patients whilst compatibility would consider the degree of correlation of the technology with Vietnam's existing health infrastructure. The willingness of professionals in Vietnam to integrate digital rehabilitation into practice can be understood concerning how they perceive these characteristics (Wurster et al., 2024). Furthermore, the theory considers opinion leaders and early adopters essential in promoting the acceptance of innovations, as such practice is important in hierarchical professional settings as in Vietnam.

TAM with DOI offers a solid framework to investigate adoption, barriers and facilitation in digital rehabilitation technology adoption by professionals in Vietnam.

2.3 Reviewing Digital Rehabilitation Concept

Digital rehabilitation is the use of digital tools and technologies to deliver therapeutic rehabilitative interventions to achieve or maintain physical and mental health. This encompasses a wide variety of applications including telemedicine, VR/AR, game-based approaches, wearable devices and

mobile health (mHealth) applications. AFRIDI and KHAN (2024) found that digital rehabilitation represents a paradigm shift in the provision of healthcare services with the provision of care remotely and increased patient participation through interactive platforms. In addition to providing greater accessibility, customization is possible within the rehabilitation plans depending on the individual needs, improving outcomes.

Digital rehabilitation goes back to the penetration of telemedicine and primitive biofeedback systems in the 1980s and 1990s. On the back of basic computer algorithms and communication technologies, these systems were the forerunners to more sophisticated platforms (Reisdorf & Rikard, 2018). With the accelerating growth of computing power, and the emergence of the internet in the 2000's, digital rehabilitation tools started to boom. VR and AR were brought to prominence as technologies to support immersive treatments for various conditions, including stroke recovery, chronic pain management, and more (Redfern et al., 2022). Similarly, in recent years, AI and Machine Learning have begun to find integration within rehabilitation technologies. Now AI algorithms can analyse real-time patient data and provide back personalised feedback and adaptive therapy plans. Ahmed et al. (2020) showed that machine learning models embedded in digital rehabilitation tools make forecasts of patient progress so that treatment protocols can be adjusted promptly.

Digital rehabilitation has experienced many new developments in the last few years, specifically during the COVID-19 pandemic that emphasised the necessity of remote healthcare services. One of the important trends is the use of VR and AR to create immersive physical cognitive therapy. Prajjwal et al. (2024) demonstrated the significant efficacy of VR-based rehabilitation in improving motor function in stroke patients. AR technologies are also being used in post-surgical recovery or for sports injury rehabilitation to provide real-time visual feedback to support improved patient performance. They also elevate their role in digital rehabilitation, for digital rehabilitation by facilitating continuous monitoring of vital signs and physical activity. Data is collected from devices such as smartwatches and motion sensors, which then inform therapy adjustments to fine-tune the treatment. Kordatos and Stavrakis (2020) depicted that wearable technology greatly enhanced adherence to rehabilitation programmes, especially among patients recovering from musculoskeletal injuries. Another major innovation is the case of gamified digital rehabilitation platforms. They use gamified mechanisms that encourage patients and increase engagement. For

instance, Gmez-Portes et al. (2020) showed that gamification in rehabilitation increases adherence and outcomes in paediatric and geriatric populations. Similarly, telemedicine advances have prompted hybrid rehabilitation models allowing patients the convenience and flexibility of a hybrid model (in-person or remote) for continuity of care.

Digital rehabilitation is increasingly centred on AI, given its ability to analyse data robustly and allow for bespoke rehabilitative treatment. Thus, to improve the quality of physical therapy sessions, AI-powered tools can analyse patient movements and give feedback to patients in real-time. As reported by Kelly et al. (2019), the emerging AI algorithm is predicting the possible therapy outcomes and identifying risks before their occurrence so necessary adjustments can be made. Talking of this technology, it has also proved useful in developing chatbots and virtual assistants that help patients perform their exercises alongside offering support with the patients being able to do away with having to be constantly supervised by humans. For instance, Nussbaum et al. (2019) found that mobile rehabilitation tools enhance functional outcomes of patients with chronic conditions (e.g., arthritis and cardiovascular diseases). Also, it has been found that these technologies are especially powerful for solving the psychological problems of rehabilitation. According to Lindner (2021), VR-based cognitive therapy has promise in the management of anxiety disorders and PTSD. However, adoption rates among healthcare professionals and patients are varied. Technological literacy, accessibility, and perceived benefits are factors influencing adoption. Marziniak et al. (2018) affirms that most professionals have greater technological dexterity which makes it easy for them to welcome technology in rehabilitation tools.

2.4 Professional Roles in Digital Rehabilitation

2.4.1 Roles of healthcare professionals in digital rehabilitation

While healthcare professionals are not vital for the digital provision of rehabilitation, they have a significant role, in ensuring that technology is used as it should be, to improve patient outcomes. Digital tools adoption and integration leaders are primarily among physical therapists, occupational therapists, and psychologists. They are extremely important as developers of digital rehabilitation interventions designing, implementing, and evaluating them (Postolache et al., 2021). Wearable devices, VR systems, and telehealth platforms are commonly used by physical therapists to help patients regain mobility and strength. For example, wearable sensors can track motion and give

real-time feedback on physical exercises, increasing accuracy and decreasing the chance of injury. As per Lu et al. (2020), patients in wearable health device systems displayed a better adherence and accuracy rate compared to those in traditional physical therapies.

In the contemporary era, occupational therapists concentrate on increasing patient capability to serve in everyday activities, like utilising AR or rethinking gamified platforms. These tools simulate real-life situations as patients can practise and practise tasks like cooking or dressing in a motivating environment. According to Ali and Arumugam (2021), gamified rehabilitation platforms registered increased cognitive engagement and task completion rates in patients recovering from stroke. Psychologists, too, have a key role to play, especially in coping with the emotional and cognitive aspects of rehabilitation. Virtual reality exposure therapy (VRET) is becoming more widely used for conditions such as PTSD and anxiety. Deng et al. (2019) found that VRET resulted in a substantial decrease in PTSD symptomatology, and participants retained significant relief of symptoms at six-month follow-ups after treatment.

2.4.2 Interdisciplinary collaboration in digital rehabilitation

Collaborating across disciplines is often essential for the provision of effective digital rehabilitation where multiple professionals from different areas of expertise design holistic treatment plans. It guarantees a physical and psychological approach to rehabilitation, leading to better patient results. In digital rehabilitation, there are teams of interdisciplinary: healthcare professionals, software developers, and data analysts (Krause-Jüttler et al., 2022). Tools are developed with user-centred clinical insights from healthcare professionals and supported by developers and analysts to be technology-robust and data-driven. For example, Prodoehl and Kahnert (2022) suggested a VR rehabilitation system which can aid post-surgical recovery with interdisciplinary collaboration. Surgeons, physical therapists and VR designers were involved to ensure the system met clinical standards by being intuitive and user-friendly to the patients. Collaboration beyond healthcare includes policymakers and educators who have important roles in scaling digital rehabilitation practices. Policymakers make the regulations and funding models to support the adoption of digital tools and educators train professionals to use effectively these technologies. Roy et al. (2024) argued that collaboration between healthcare professionals and researchers across disciplines is considered essential to the success of digital rehabilitation programmes regarding overcoming barriers such as limited technological literacy among health professionals.

2.4.3 Professional Adaptation to Digital Tools

The success of digital rehabilitation depends on healthcare professionals' adaptability and openness to digital tools. Some professionals are enthusiastic about these technologies, but some are more wary and need to be convinced of the efficacy and usability of these technologies. Research shows that targeted exposure and training can make a big difference in professionals' attitudes and adoption rates. Kononowicz et al. (2019) showed that healthcare professionals who received structured training in the use of digital tools have stronger confidence in using these tools and greater satisfaction in their practice. In addition, Chehade et al. (2020) indicated that professionals who used digital rehabilitation platforms more consistently performed better for patient outcomes than those who rarely use such a platform, highlighting the significant part that professional adaptation plays.

Arguably, digital rehabilitation would be difficult without professional organisations and associations. These entities provide the guidelines for the training programmes and certifications that help medical professionals develop the necessary skills and knowledge. For example, the American Physical Therapy Association (APTA) introduced a series of webinars and workshops on the integration of digital tools in physical therapy practice (Lee et al., 2024). These organisations also work for changes in policies and utilisation support for the adoption of digital rehabilitation technologies. WFOT (2020) reports that scaling digital rehabilitation practices at a global level requires increased funding for digital tools and professional training.

Healthcare professionals implementing digital rehabilitation must comply with ethical and legal considerations to ensure patient safety and privacy. Its tasks include obtaining informed consent, securing data and being professionally accountable. According to Townsend et al. (2015), the interviewed professional users of digital tools lacked guidance or training on how to use the data ethically. In addition, navigators of the digital rehabilitation legal landscape are professionals who must contend with the differences in legal provinces for digital rehabilitation. As such, understanding these legal requirements is important to conform to and avoid any liabilities. Technology is also likely to develop, and the role of healthcare professionals in digital rehabilitation is likely to expand. Additionally, AI may be used to assist with decisions in the future and predictive analytics might be used to chime rehabilitation plans to that individual (Ktistakis et al., 2022). These advancements will necessitate ongoing training and interdisciplinary collaboration and will

necessitate adaptation by professionals. Furthermore, it will also put more pressure on digital tools to cater to increasingly patient-centric demands, which will necessitate greater customisation as the market grows (Torous et al., 2021). To implement this shift, professionals will need to work closer, develop more engagement with patients and use patient feedback to improve and refine digital rehabilitation practises. Seljelid et al. (2020) emphasises the need for patient involvement in the design and implementation of digital tools, characterised by the greater involvement of patients in the design and implementation of digital tools substantially improving user satisfaction and outcomes.

2.5 Perceptions and Attitudes of Professionals Towards Digital Rehabilitation

2.5.1 Understanding the acceptance and adoption of digital rehabilitation

The adoption and acceptance of digitalization within rehabilitation technologies by professionals rely on their perceived utility, ease of use, and trust in the technology. Using the technology acceptance model (TAM), Davis (1989) asserts that innovations are adopted by healthcare professionals when they perceive these tools as helpful to clinical practice and easy to integrate with workflows. Cerchione et al. (2023) in the context of digital rehabilitation demonstrate that it is easy for healthcare providers to see tangible advantages, including better patient outcomes, as well as better efficiency, which enables them to embrace these technologies. Acceptance levels differ greatly by discipline, though. Though physical rehabilitation seems to be generally slow at adopting new practices, physical therapists and occupational therapists have shown more enthusiasm for tools like VR and wearable devices. In contrast, Di Carlo et al. (2021) make the case to psychologists who are concerned that digital platforms cannot fully replicate face-to-face therapy nuances. These findings indicate that the level of acceptance varies greatly based on the degree to which technology fits the needs of each profession.

2.5.2 Perceived Benefits and Challenges

Digital rehabilitation is perceived by professionals to provide several benefits. A clear advantage resides in the prospect of increased patient engagement. Despite the benefits of gamified rehabilitation platforms being able to motivate patients, and improve adherence to therapeutic regimens, these platforms face firsthand the problems of a lack of evidence in their design. As an

example, Steiner et al. (2020) showed that gamified digital tools resulted in an increased adherence to paediatric musculoskeletal injury recovery. Likewise, remote monitoring tools provide real-time feedback to healthcare providers, allowing them to act quickly and adjust the therapy plan to ensure that such therapy is as accurate and effective as possible (Chen et al., 2021). Another major advantage is being able to interact with underserved populations. Telemedicine and mobile health (mHealth) applications can overcome many geographical and financial barriers for rural or low-income patients to access rehabilitation services. For example, Jones et al. (2020) underpinned that digital rehabilitation technologies can fill disparities in access to healthcare for conditions which require long-term rehabilitation.

However, professional adoption of digital rehabilitation technologies has notable challenges. Limited access to high–speed internet and inadequate training present the current technological barriers limiting effective implementation. Additionally, the ethical aspects regarding the safety of patients and customer's consent to the collection of their data still exist. According to Grön (2021), healthcare professionals are uncertain of the ethical ramifications of data-intensive technologies and pointed towards the need for clearer guidelines and training on these issues.

2.6 Effectiveness of Digital Rehabilitation

Early evidence suggests that digital rehabilitation technologies are shown to be as, and sometimes more, effective than traditional rehabilitation methods. Consistently, studies show how digital platforms can improve accessibility, engagement, and personalised care of patients. For example, Hewitt et al. (2020) performed a systematic review of digital rehabilitation tools compared to traditional methods in the management of musculoskeletal disorders. They found that digital tool users were more likely to stick to their treatment plans than patients in a typical setting. Also, online platforms, VR, and other digital services play a better role in achieving better results. VR-based rehabilitation for stroke patients is faster and more effective than conventional therapies in terms of motor function and recovery speed (Prajjwal et al., 2024). Since VR provides patients with immersive environments, patients learn better, are more engaged, and improve neuroplasticity and functional recovery. However, the ability of digital rehabilitation to succeed depends on the type of condition to be treated. Digital tools are brilliant for physical and cognitive rehabilitation but may not be ideal for more complex emotional and psychological support cases. Kuhn and Owen (2020)

found that although VRET was proven to be effective at treating PTSD, it was not enough as people with severe trauma needed face-to-face therapy to treat it.

Digital rehabilitation has been reported by healthcare professionals to deliver many positive outcomes. According to Tamayo-Serrano et al. (2020), therapists reported that gamified rehabilitation platforms lead to an increase of patients' motivation and engagement. With these tools, patients found exercises fun and got instantaneous feedback that made them feel accomplished. Along with that, wearable devices have also been lauded for their ability to monitor patient progress. Ibrahim and Ali (2023) showed that wearables such as smartwatches and motion sensors allowed professionals to monitor patient activity and customs therapy plans in real-time. However, this capability proved useful even for the patients who had undergone surgeries and were being treated, particularly outside the clinical environment.

The effectiveness of digital rehabilitation is validated through the alignment of professional observations with patient-reported outcomes. For example, in their study, Agbemanyole et al. (2024) underscore the contribution which digital tools can have to adherence – that is, a critical component to achieving successful outcomes. Digital platforms also tend to be more convenient and interactive, and they are reported by patients more often as preferable to traditional platforms. The mindfulness, advice, and encouragement of professionals help you understand how digital tools should be inserted in supreme care designs. Many practitioners support a hybrid approach, where digital and traditional methods are combined to achieve the maximum benefits. For instance, as noted by Tian et al. (2019), hybrid approaches resulted in reduction in recovery time for patients suffering from orthopaedic injuries, by reckoning with the trade-offs of the flexibility of digital tools for the catering of in-person care

2.7 Barriers and Challenges in Digital Rehabilitation

However, the viability of digital rehabilitation is threatened by several technological impediments to its widespread adoption. A big challenge lies in accessibility: particularly in rural and low-income areas where high-speed internet and advanced devices are not available. A digital divide contributes to health disparities wherein vulnerable populations have limited access to emerging rehabilitation methods (Latulippe et al. 2021). Furthermore, usability is an issue, as patients and professionals

neither find digital platforms user-friendly. According to Wisniewski et al. (2020), the digital rehabilitation tool interface can be difficult to navigate reducing their willingness to incorporate these tools in their clinical practice. Similarly, older patients, and patients in general have trouble adhering to the technical aspects of using digital tools leading to lower engagement and adherence.

The use of digital technologies in healthcare poses crucial ethical and privacy issues. Sensitive patient data such as health metrics, behavioural patterns and personal information are collected by many of these digital rehabilitation platforms. This data must be secured, yet breaches and unauthorised access exist as ever-present risks. In their paper, Bucci et al. (2019) reiterated the necessity of robust data protection frameworks which can help increase users' confidence in the security measures of the digital tools they use. Moreover, there is also an ethical issue with informed consent. Patients must be educated in how they can understand how their data will be used and how that data will be stored, but studies show that many professionals struggle to explain those aspects. To build trust between patients and providers in digital rehabilitation, clear guidelines for ethical practice are required (Katapally & Ibrahim, 2023).

2.8 Conclusion

This literature review has explored many aspects of digital rehabilitation, and how digital rehabilitation is redefining patient care. VR, wearable devices, and telemedicine platforms all prove digital rehabilitation technology as an effective way to improve patient engagement, increase accessibility and promote better therapeutic outcomes. Digital tools for physical, occupational and psychological health rely heavily on professionals, such as physical therapists, occupational therapists and psychologists, whose perceptions of the adoption and use of these tools influence their successful implementation.

Although beneficial, technological barriers, ethical issues, and policy restrictions have hindered the broad application of digital rehabilitation. Limited access to digital tools in underserved areas, data privacy risks, and the stated need for standardised training to bring the physical and digital worlds together showcase the complexities of integrating the new with the old. The delivery of equitable and seamless computational psychiatry requires collaboration among healthcare professionals, policymakers and technology developers to address these barriers while maintaining ethical

practice and equitable access. Conclusions drawn from this review emphasise the importance of interdisciplinary collaboration, professional training and policy reforms to integrate gaps in digital rehabilitation adoption.

3 Methodology

3.1 Research Philosophy

To understand the perspectives of healthcare professionals on digital rehabilitation in Vietnam, this study adopted an **interpretivist** research philosophy. The objective of interpretivism is for the exploration of subjective experiences, or the exploration of social phenomena within its context (Patten, 2016). Such a philosophical take on the project uncovered the professionals' perspectives on, and issues surrounding digital rehabilitation technologies. The study aimed to offer a more nuanced understanding of participants' perceptions of such technologies and their implications for practice by focusing on the kinds of meanings and interpretations the participants constructed of these technologies. The auspice of the research was, thus, one of exploring, and the interpretivist approach was of value in understanding the participants' viewpoints.

3.2 Research Design

A **qualitative** research design was chosen for analysing the complex context-specific phenomenon such as the adoption of digital rehabilitation technologies. The data used was rich and detailed enough to capture the experience and insight of healthcare professionals and this qualitative approach was used to gather it. This design enabled a deep dive into the elements that affect their perceptions, the technical hurdles they encounter, and patient outcomes resulting from these technologies. The qualitative design approach also was flexible in the way the researcher could collect and analyse data to allow for themes and patterns to arise organically from participants' responses. (Walliman, 2021)

3.3 Research Approach

This study adopted an **exploratory** approach to study an area having little previous research in Vietnam. As a new field, digital rehabilitation, this research was exploratory, seeking to discover the different dimensions of its adoption and use. By this approach, the researcher could explore some areas which may not have been explored or studied in extensive detail (Coe et al., 2021). Not only did the open-ended and flexible nature of exploratory research allow the diverse experiences and challenges experienced by healthcare professionals to be captured, but it also contributed to a greater knowledge of this nascent topic.

3.4 Sampling

A total of 8 healthcare professionals who are actively working with digital rehabilitation in Vietnam were selected by convenience sampling. Due to the availability of participants who met the inclusion criteria, including having direct experience with digital rehabilitation technologies, convenience sampling was chosen. As a non-probability sampling method, this sampling method allowed the researcher to involve professionals who were already available and willing to contribute and thereby have quick access to the investigation of the relevant data (Etikan et al., 2016). With eight participants, the sample size was big enough to ensure that the study had diverse points of view, yet small enough to be within a reasonable scope for qualitative analysis. To contribute to relevance and insight, each participant was selected based on their expertise and experience.

3.5 Data Collection

Data was collected through semi-structured interviews ensuring a balance between guided questioning and the flexibility to go into depth on topics. The researcher used a predefined set of open-ended questions in semi-structured interviews, provoking participants to elaborate their responses. This method was particularly effective in revealing detailed perceptions, challenges and experiences with digital rehabilitation by healthcare professionals. The interviews were carried out, through online platforms between 30 to 40 minutes long. With the participants' consent, the interviews were audio-recorded to allow accurate transcription and analysis. Semi-structured interviews allowed the researcher to shape the questions on the go, drawing from the flow of conversation to allow for a more thorough understanding of the topic (Esser & Vliegenthart, 2017).

3.6 Data Analysis

Thematic analysis by Braun and Clarke (2006) was applied and used to analyse the data obtained from the semi-structured interviews using a widely used method for identifying, analysing, and interpreting the patterns of meaning from data within qualitative research. Since it is flexible and appropriate to deal with the abundant, detailed narratives from healthcare professionals, thematic analysis is chosen. The analysis involved a **six-phase process**: *familiarisation, creating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the final report.*

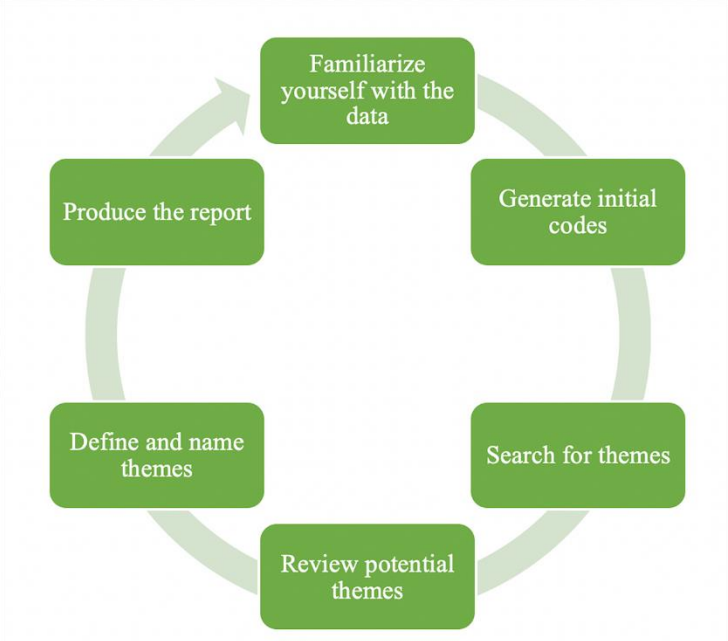

Figure 1: Thematic analysis

Adapted from Braun and Clarke (2006)

The transcribed interviews were read multiple times to familiarise with the data initially. The research questions were then systematically coded for evidence of key phrases and statements through a process of identifying both descriptive and interpretative codes to capture explicit as well as implied meanings. These codes were put together into possible themes that were some sort of recurring pattern or concept in terms of healthcare professionals' perceptions, technical difficulties, and patient results.

To ensure that the data had been properly categorised within each theme and that they were coherent and distinct. The data was manually analysed in terms of the thematic content of the data to ensure a deep engagement with the data and address context-sensitive nuances. Using thematic analysis allowed the study to employ a method for studying these deeply embedded insights, within the participants' responses, in an orderly way albeit providing flexibility.

3.7 Ethical Concerns

The university's ethical approval for data collection was obtained beforehand. All participants provided informed consent regarding the purpose of the study, its methods and their rights, and were informed that they could withdraw at any time and with no repercussions. All participants

gave written informed consent. All data were stored securely, and participants were assigned pseudonyms (P1, P2 and so on) to maintain confidentiality and anonymity. Care was also taken to make participants not feel compelled to participate or that their responses were treated insensitively such that an individual would not be harmed.

3.8 Conclusion

Overall, an interpretivist philosophy, qualitative exploratory design, and thematic analysis were employed in this study to investigate healthcare professionals' perspectives on digital rehabilitation in Vietnam. As such, the research used rigorous and ethically sound methods to offer important insights into the factors impacting these perceptions, technical challenges and patient outcome impact, an area left largely unaddressed in the sparse literature on this emerging topic.

4 Results and Analysis

4.1 Introduction

The findings of the semi-structured interviews with healthcare professionals in Vietnam conducted in this chapter investigated the healthcare professionals' perspectives on digital rehabilitation technologies. This chapter aims to analyse the data collected to answer the research questions about the factors affecting perceptions, the technical challenges present, and the effect of these technologies on patient outcomes. Thematic analysis was employed to identify key insights and patterns that would help to develop a complete meaning of the experiences and views of the professionals.

Eight female digital rehabilitation experts (health care professionals) with a broad variety of expertise participated in this study. Their ages were between 23 to 40 and they belong to different professional areas such as physiotherapists and rehabilitation doctors, a therapist and a traditional medicine doctor. By variety, the study had a range of perspectives on digital rehabilitation in Vietnam, a multi-faceted subject. To keep participants anonymous, they were coded as P1 to P8. Six of the participants were female, demonstrating the strong presence of women in Vietnamese healthcare, and importantly in rehabilitation practices. The value of including a traditional medicine doctor (P4) in insight into integrating traditional practice and modern digital rehabilitation technologies. In this chapter, the study captures their experiences in their own words, their challenges in the professional setting as well as their observations on patient outcomes.

Table 1: Participants details

Participant Code	Gender	Age	Position/Profession
P1	Female	23	Physiotherapist
P2	Female	33	Physiotherapist
P3	Female	40	Therapist
P4	Male	37	Traditional Medicine Doctor
P5	Female	27	Rehabilitation Doctor
P6	Female	26	Rehabilitation Doctor
P7	Female	37	Rehabilitation Doctor
P8	Female	34	Rehabilitation Doctor

4.2 Theme 1 - Engaging with Training Personalized Care

The first theme explores how digital rehabilitation tools enable the delivery of personalised care but also the challenges that healthcare professionals face with the implementation and usage of those technologies.

Enhancing remote support for personalized care

The rise of digital rehabilitation technologies has brought along supported remote intervention by healthcare professionals, especially for patients requiring consistent monitoring and guidance. Participants stressed that these tools enable personalised care through direct patient interaction that improves accessibility and motivation. Participants stated as follows: “I think it's more beneficial, like having a family doctor for patients that they can contact remotely.” (P1) “Patients feel motivated when they see their progress through digital tools.” (P5) “For remote areas, connecting via apps helps patients avoid traveling long distances.” (P4)

Zalo and other digital tools serve as tools to bring patients and professionals closer as the distance is a factor – be it rural or remote. This finding is also supported by studies, which note that using telemedicine tools improves the access rate to healthcare, promotes better communication with patients, and supplies better adherence to treatment plans (Barbosa et al., 2021). However, a primary challenge still lies in how to make these tools more accessible and usable to patients since their usability and accessibility make or break outcomes (Haleem et al., 2021).

Addressing Training Gaps and Technical Knowledge

Participants acknowledged the need to synchronise training programmes and provide better support to operate rehabilitation technologies. Participants stated as follows: “Some machines are hard to operate, and manuals are not comprehensive.” (P6), “If you want to deploy technology, it must be synchronized with training and providing machinery.” (P4) “Most of them are doctors who have just been trained for a few months. So that is the difficulty in accessing rehabilitation in this area.” (P4)

Studies highlight the significance of having healthcare providers possess the technical skills to be able to use digital rehabilitation tools adequately (Senbekov et al., 2020). Without adequate training or professional development in the use of these tools, healthcare professionals may struggle to fully realise the potential of these tools in achieving patient outcomes. Furthermore, Prins et al. (2024)

argue that well-structured training programmes are essential to instilling confidence and competence in users and adopting digital technologies without a hitch in clinical practice. Overall, digital rehabilitation technologies offer considerable promise for personalised care and remote support, but to achieve that potential there are training gaps that need to be addressed, and usability needs to be improved.

4.3 Theme 2 - Importance of Usability and Accessibility

The second theme explores how the caring design of digital rehabilitation technologies can encourage patient engagement and increase the efficiency of treatments. Similarly, this theme discusses usability and accessibility-related barriers healthcare professionals face regarding usable, inclusive digital solutions.

Enhancing patient engagement through usability

Healthcare professionals stressed that user-friendly digital tools gave a huge boost to patients' motivation and engagement. Patients can track their progress and use rehabilitation technologies easily and encouragingly, which makes them stick to their plan, thereby improving their outcomes. Participants opined: "Patients feel motivated when they see their progress through digital tools." (P5, "It helps me treat more patients effectively, but the apps must be user-friendly and error-free." (P7).

This result highlights the necessity of human-centred design applied to interfaces that address the variety of needs of patients. Usability represents a key determinant of patient adherence to digital rehabilitation programmes as shown in the studies. Based on Wei et al. (2020), platforms with easily understandable navigation, timely feedback to users, and visual facilitation promote patient participation. Additionally, if these tools can be utilised on their own by patients with minimal supervision, then healthcare professionals will be able to attend to more people and do so with higher quality of care. The findings also showed that user-friendly tools aid clinical practice efficiency. Digital tools that aim to enhance usability are said to shorten the time professionals spend troubleshooting, thereby freeing up scarce resources to put towards patient care (Nguyen et al., 2021). For these reasons, usability strongly influences the effectiveness of digital technologies for rehabilitation.

Barriers to accessibility in remote areas

Yet digital rehabilitation tools represent a more accessible option for many and can offer a means to reach people for whom remote rehabilitation can present significant challenges. The usage of these tools in underserved regions is often hindered by limited internet connectivity, lack of technological literacy, and resource constraints. Participants stated: “For remote areas, connecting via apps helps patients avoid traveling long distances.” (P4), “We don’t have a nationwide platform; each hospital operates independently.” (P3)

Digital rehabilitation tools may have the potential to transform healthcare delivery in that they may help reach patients in rural or remote settings who encounter barriers to accessing in-person care due to logistical reasons. Studies however show that uneven infrastructure development worsens the digital divide, restricting the reach of these technologies (Vu et al., 2021). According to Tran et al. (2022), Vietnam hospitals lack standardised digital platforms, thus exacerbating access problems because, in Vietnam, a patient often must move across several systems, which can be confusing for patients and time-consuming. The gaps that need to be bridged to connect these populations include government-subsidised internet access and the development of unified digital health platforms. Bui et al. (2021) suggest that it is recommended that investment in digital rehabilitation technologies should be made into scalable, mobile-friendly solutions that cater to the needs of remote communities to ensure digital rehabilitation technologies can be adopted equitably.

Overcoming usability challenges in technology adoption

Participants were concerned that some rehabilitation tools were technically complex, and this posed challenges for inviting both healthcare professionals and patients to fully engage with these technologies. The key challenges were the poorly designed interfaces, inadequate support materials and language barriers. Participants argued, “Some machines are hard to operate, and manuals are not comprehensive.” (P6). “If you want to deploy technology, it must be synchronized with training and providing machinery.” (P4)

Digital tools’ usability is often impacted by the provision of such training resources and the alignment of the technology with user needs. Vuong et al. (2019) opine tools without clearly defined instructions or overly complicated tools will cause frustration and therefore lower the adoption rates from healthcare professionals. Further, the benefits of digital rehabilitation fall short when patients battle with the use of these tools on their own. According to Nguyen et al. (2023), the usability issues can be reasonably addressed by co-designing the digital tools with end-user inputs,

including patients and healthcare professionals. Additionally, usability problems of advanced rehabilitation technologies frequently cross over into other critical systemic problems like funding for advanced rehabilitation technologies in public healthcare settings. The result of this study is consistent with Tran et al. (2022), suggesting that public-private alliances would be the most suitable option to guarantee that healthcare providers are equipped with the newest digital tools supported by generalised training programmes. In doing so, this thesis presents findings that illustrate the dual need for usability and accessibility to ensure the success of digital rehabilitation technologies in Vietnam. From one aspect, user-friendly designs encourage patients and improve the efficiency of healthcare delivery. However, systemic barriers like infrastructure constraints, resource inequities, and disjointed platforms impede accessibility for underserved populations.

There is prior work supporting the idea that usability is a key factor in the successful adoption of digital health tools. Intuitive designs together with progress tracking in real-time and configurable interfaces promote more engagement from patients and healthcare providers, according to Tran et al. (2022). Le and Nguyen (2023) also highlight the need for accessibility-focused solutions, like mobile-friendly platforms, and offline functionality. However, these issues are not easily solved, and a form of coordinated effort is needed from multiple stakeholders. The development of nationwide digital health platforms must be a centrepiece of priorities for policymakers, integrating across hospitals and clinics.

4.4 Theme 3 – Data Security and Standardization in Digital Rehabilitation

The third theme revolves around Data Security and Standardisation in Digital Rehabilitation; the challenges that Healthcare Professionals face with data security, security properties, and the absence of standard digital rehabilitation platforms in Vietnam.

Concerns about data privacy and security

The privacy and security of patient data in digital rehabilitation systems are of great concern to participants. The use of social media apps and applications for non-specialised, generic communication and data management was at the root of these concerns. Participants asserted: “Zalo or Facebook are often hacked. I can’t trust them for secure patient data.” (P2). “In the villages, people only use phones, use Zalo and Facebook. As for data management, we use software here.” (P4).

The risk of patient confidentiality and professional integrity breaches also exists due to data security breaches, including hacking or unauthorised access. Since, in digital healthcare systems, sensitive health information should be protected (Nguyen et al., 2022), this statement is in line with these studies. As per Vuong et al. (2019), patient data are more vulnerable to being leaked out to non-secure platforms such as Zalo or Facebook, which are not developed for healthcare purposes, because they rely on platforms that are not designed for healthcare in rural areas where there are not well-equipped digital infrastructure for healthcare. Results indicate there is an immediate need for robust security protocols with digital rehabilitation technologies. Thus, encrypting platforms and educating professionals on safe data management practices substantially reduces these risks and provides patients with a high degree of trust, as well as regulatory compliance.

Fragmentation in digital platforms

Participants also repeatedly raised the issue of the absence of a single, digital platform that can manage patient data and allow for rehabilitation services. The result of this fragmentation is inefficiencies and confusion for patients and healthcare providers. Participants said, “We don’t have a nationwide platform; each hospital operates independently.” (P3). “In terms of data management, who will manage the patient’s data? Or doctors giving advice – who controls it?” (P1)

However, there are no standardised digital platforms for such interoperability and coordination between healthcare providers. As mentioned by Moy et al. (2023), fragmented systems lead to disjointed patient information, creating a gap and inconsistencies in care delivery due to time delays. In addition, it is difficult for patients to access care across several systems when they are to be seen in multiple facilities.

This problem can be solved using a unified, nationwide digital platform for rehabilitation services that will permit data sharing and improve efficiency and the patient experience. According to (Epizitone et al., 2023), healthcare providers, policymakers, and technology developers should work together to construct integrated platforms categorised specifically for Vietnam's healthcare. Data must be gathered, organised, maintained, and preserved without difficulty, and with greater consistency and efficiency, and this can only be achieved through standardised data management practices.

Need for standardised data management practices

Participants emphasised that data management practises need to be standardised in order to achieve a degree of consistency, accuracy and accountability in digital rehabilitation systems. This requires defining protocols for data collection, storage and usage and dealing with ethical aspects of patient data. Participants stated: “I can save treatment processes, and I will also have some patient data for research purposes.” (P8), “In terms of data management, who will manage the patient’s data? Or doctors giving advice – who controls it?” (P1).

Standardised data management not only enables better patient care it also supports secondary uses such as research and policy making. As per Vu et al. (2021), constructing standardised protocols permits the ethical use of data to progress medical information while keeping data integrity intact. But participants were clear that in the absence of clarity about data ownership and accountability, the dream is far from achievable. However, these concerns can be addressed through the development of clear policies on data ownership, ethical usage, and ownership of management responsibilities. According to Nguyen et al. (2023) the introduction of national guidelines on data management, which are supported by regular audits and compliance cheques on equipment, can help to build trust and increase the consistency of digital rehabilitation systems.

4.5 Chapter Conclusion

This chapter explicates the findings from interviews with healthcare professionals regarding how they experienced digital rehabilitation technologies in Vietnam. The first theme was the way that digital tools enable remote support and personal care in rural areas, but gaps in knowledge and training hinder their successful use. The second theme highlighted how usability and accessibility matter – usable and accessible technologies make a difference in patient motivation and treatment efficiency. However, meanwhile, systemic obstacles like limited rebalancing infrastructure and compartmentalised platforms continue to be major hindrances. The final theme discussed data security and the lack of standardisation of digital platforms. Critical barriers to achieving trust and efficiency in digital rehabilitation systems include issues such as privacy breaches, relying on non-specialised platforms, and unclear data management protocols.

Collectively, findings from this thesis present new knowledge about the advantages and drawbacks of digital rehabilitation technologies from a Vietnamese perspective. To resolve these issues, policymakers, healthcare providers, and technology developers must work together to make the

systems more usable, enhance training programmes, and establish secure, standardised systems. When these barriers are overcome, digital rehabilitation technologies will be more easily integrated into the healthcare landscape of Vietnam to lead to better patient outcomes and access to care.

5 Conclusion and Recommendations

5.1 Summary of Findings

This study explored healthcare professionals' perspectives on digital rehabilitation technologies in Vietnam, focusing on three key themes: Interact with Training Personalised Care, Importance of Usability and accessibility, and Data security and standardisation. This demonstrated the application and potential of participatory design as a strategy to enhance participatory approaches in rehabilitation practice, including the capture, analysis and synthesis of rich insights into the adoption of digital tools in rehabilitation.

Regarding the first theme, the participants stated that digital tools had the potential to increase engagement in patients and personalised care delivery. A major advantage was remote support, and patients who lived in rural and remote areas could access rehabilitation services without travelling long distances. Mobile apps, for example, allowed a way for patients to witness their progress visually, and communicate with healthcare providers. However, a lack of synchronised resources and insufficient training hindered the full utilisation of these technologies.

For the second theme, it was observed by participants that tools with an intuitive interface were able to engage patients and increase treatment efficiency. Barriers included limited infrastructure, fragmented digital platforms, and the absence of standardisation — especially in remote areas. The results highlighted the necessity of unified and mobile-compatible platforms and inclusive solutions, which address Vietnam’s context for healthcare.

The third theme included concerns regarding privacy, security and data management. But risks of hacking and data breaches were cause for concern to participants as patient data was sensitive and they were wary of using non-specialised platforms such as Zalo or Facebook to store this data. There was no unified national platform for sharing and integrating the data between hospitals. Data usage from an ethical point of view especially in research raised the need to have standardised protocols and explicit policies on who owns the data and who is accountable for it.

In general, the results proved the potential of digital rehabilitation technologies to revolutionise healthcare delivery in Vietnam and outlined what are crucial gaps in training, usability, accessibility, and data management that need to be resolved to fully leverage their impact.

5.2 Implications of Findings

First, the possibility of using digital rehabilitation technologies to improve personalised care and patient engagement raises the need for further investments in these tools. Digital tools can assume a significant function in decreasing medical separation by improving get-to-recovery administrations, particularly in underserved territories. However, the challenges determined which include gaps in training and technical knowledge insufficiency mean that technology adoption must be coupled with comprehensive training for healthcare professionals. Policymakers and healthcare institutions should therefore establish capacity building initiatives to equip professionals with the skills to use these tools properly.

Second, usability and accessibility were identified as essential determinants of the success of digital rehabilitation. It concluded that it is important to design user-friendly, intuitive platforms fitting the needs of patients and professionals. Whether technology developers adopt a user-centred approach to the development of digital rehabilitation tools in general, is a finding of importance to this issue. For these tools to reach diverse populations they must include features such as multi-language and mobile compatibility.

The findings also implicate data security and standardisation. Risks to patient confidentiality and inefficient care delivery stem from the absence of robust security measures and unified platforms. These gaps must be met by the policymakers who need to establish national standards for data management while protecting the secure and ethical use of patient information. For integrated, secure systems to be developed, and trusted by users, collaboration is needed among regulatory bodies, healthcare institutions and technology developers.

Finally, when people discuss data ownership and usage-related ethical issues, swift guidelines with accountable mechanisms can prevent such dilemmas. These concerns must be addressed to facilitate the adoption of digital rehabilitation technologies and to help rebuild trust.

5.3 Recommendations

First, training programmes for healthcare professionals must be enhanced. Training sessions should comprehensively train providers in the use of digital rehabilitation tools, technically and in the context of clinical practice. Continuous learning can be supplemented by user-friendly manuals and video tutorials to assist users build confidence in deploying these technologies properly.

Moreover, investing in infrastructure will allow people, especially those in underserved areas, accessibility. Increased internet access increases access to digital rehabilitation in rural and remote regions. In addition, government subsidies and incentives may be endowed on healthcare facilities to adopt digital technologies, which will bridge the gap in the delivery of healthcare which was previously biassed based on the region.

Another step is the development of unified and standardised digital platforms. There is a need for a national platform that sucks together data from hospitals and clinics which can be seamlessly integrated across hospitals and clinics to address challenges of fragmentation and efficiency – allowing for consistent data sharing and better patient management.

Similarly, user-centred design principles become vital when creating digital tools that are accessible and inclusive. For healthcare professionals and patients, these tools need to be co-designed to be intuitive and to consider the needs of a broad range of users. Usability and engagement can be improved when features like real-time progress tracking, multi-language support, and offline functionality have been prioritised.

There must be clear data management policies to deal with concerns around privacy, ownership and accountability. Clear protocols for ethical data usage will be defined and training provided to professional staff as to how these can be applied to promote transparency and build trust. Digital rehabilitation solutions will also simultaneously address the barriers to funding and implementation by promoting public-private partnerships which will bring in the combined expertise of mutual stakeholders to address systemic challenges which could otherwise be technical limitations.

5.4 Limitations and Future Research

First, with only eight participants, while this sample size was sufficient for exploratory research, the results cannot be generalised to the population of healthcare professionals in Vietnam. Further research could focus on a larger, more diverse sample to broaden the range of perspectives and experiences established.

Second, the qualitative study design, although suitable to explore the subjective experience and to identify themes, was not possible to derive statistical analysis or causal inferences. Future work may adopt mixed-methods methods by integrating qualitative results with quantitative results to present a more holistic view of digital rehabilitation technology adoption and its effect.

Further, the study only obtained healthcare professionals' perspectives without those of patients, which offer important views for a comprehensive value assessment of digital rehabilitation systems. Future studies should include patient experience and outcomes to provide a well-rounded view of the effectiveness and usability of these technologies.

Finally, this study was limited to the context of Vietnam’s healthcare. Further research might identify best practices and challenges specific to other countries or regions with cross-cultural comparisons, boosting the reusability of findings and thus leading to global improvement in digital rehabilitations.

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Appendices

Appendix 1. Thematic analysis table

Thematic Analysis Table

Sample Excerpts from the Interview	Codes	Initial Themes	Final Theme
"I think it's more beneficial, like having a family doctor for patients that they can contact remotely." (P1)	Remote support	Benefits of digital tools	**Engaging with training personalized care**
"Zalo is convenient, but I can’t monitor whether patients are practicing correctly or not." (P1)	Limited monitoring	Challenges in effectiveness	
"Some machines are hard to operate, and manuals are not comprehensive." (P6)	Training issues	Training and technical knowledge gaps	
"If you want to deploy technology, it must be synchronized with training and providing machinery." (P4)	Synchronized machinery	Lack of training and technical resources	
"Patients feel motivated when they see their progress through digital tools." (P5)	Motivation	Improved patient engagement	
"It helps me treat more patients effectively, but the apps must be user-friendly and error-free." (P7)	Usability, efficiency	Role of technology usability	**Importance of usability and accessibility**
"For remote areas, connecting via apps helps patients avoid traveling long distances." (P4)	Accessibility, convenience	Improved access to rehabilitation services	

"We don’t have a nationwide platform; each hospital operates independently." (P3) “In terms of data management, who will manage the patient’s data? Or doctors giving advice – who controls it?” (P1)	Lack of standardization	Fragmentation and lack of standardization	
“Most of them are doctors who have just been trained for a few months. So that is the difficulty in accessing rehabilitation in this area” (P4)	Less training	Lack of doctors’ training	
"Zalo or Facebook are often hacked. I can’t trust them for secure patient data." (P2)	Data security	Concerns about security	**Data security and potential privacy**
“In the villages, people only use phones, use Zalo and Facebook. As for data management, we use software here.” (P4) “We use computer to save patient data and to do all of the electronic hospital file online.” (P6)	Data management	Use of specialized software	
“I can save treatment processes, and I will also have some patient data for research purposes.” (P8)	Data usage	Concerns on data use in research	

Appendix 2. Title of the Appendix

INTERVIEW FRAME FOR REHABILITATION PROFESSIONALS

CREATING SCALABLE AND AFFORDABLE DIGITAL REHABILITATION SOLUTIONS IN VIETNAM

Background information:

Age: _____

Gender: _____

What is the highest level of education you have completed?

- Did not attend school
- At most elementary, primary school, or equivalent
- At most secondary school, or equivalent
- Technical/vocational qualification or equivalent
- Bachelor's degree or equivalent
- Professional degree, master's degree or equivalent

- PhD/doctoral degree

Profession: _____

Years of experience:

Main themes:

1. Availability, accessibility and needs of rehabilitation services in Vietnam from professional perspective.

a) How would you describe the availability and accessibility of rehabilitation services?

- What kind of facilitators have you identified?

- What kind of barriers have you identified?

a) What are your future expectations about rehabilitation services in Vietnam?

2. Facilitators and barriers using technology as part of rehabilitation.

a) What kind of technology do you use in your everyday life?

b) How would you rate your experience with using different technologies?

- None

- Very little
- Average
- Quite extensive
- Very extensive

c) Could you describe the experiences you have of using technology for rehabilitation or other health services?

d) How would you rate your experience with using digital health technology?

- None
- Very little
- Average
- Quite extensive
- Very extensive

e) Have you used any technology as part of rehabilitation?

f) How would you describe its significance in your work?

- Benefits
- Challenges

g) Have you used tele/remote rehabilitation in your work?

  - Is it commonly used in your hospital/ in Vietnam?
  - What kind of facilitators have you identified? OR you think there would be?
  - What kind of barriers have you identified? OR you think there would be?

h) What are your expectations for digital rehabilitation technology in your future work?