



Awareness about Digital Rehabilitation Among the Physiotherapists in Pakistan

Bhain Devi

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Devi Bhain

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Abstract

Digital rehabilitation, also termed as tele rehabilitation enables the distant delivery of rehabilitation services, thereby increasing accessibility and efficacy. Worldwide, the healthcare service sector is gradually admitting the advantages of digital rehabilitation. Digital rehabilitation offers a resourceful means for providing suitable physical therapy facilities to patients at the comfort of their homes. The objective of the study was to evaluate level of awareness, attitudes, perceptions and barriers concerning digital rehabilitation services among the Physiotherapists in Pakistan. The data was collected using a cross-sectional survey research design from 255 physiotherapists via online google form. The study population includes 76 (33%) male and 154 females (67%). Participants having an advance knowledge of Information technology showed a significant inclination to attend training programs ($p < 0.05$).

Digital rehabilitation offers an optimistic approach to enhance physiotherapy facilities in Pakistan. Inadequate amenities, poor set-up, lack of knowledge and insufficient funding determine failures in continuing the practice of digital rehabilitation. The findings also indicated that the existing courses do not incorporate the proficiencies required for professionals suggesting the need to incorporate such programs in the syllabuses.

These obstacles must be addressed so that the physiotherapist's community in Pakistan can reinforce digital rehabilitation to improve patient outcomes and promote the profession.

Key words

Digital Rehabilitation, Information and communication technology, Telerehabilitation Health care

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List of Abbreviations

(AR): Augmented Reality

(CA): Cronbach's Alpha

(COPD): Chronic Obstructive Pulmonary Disease

(CVA): Cerebrovascular Accidents

(DPT): Doctor of Physical Therapy

(ICT): Information and communication technology

(KR-20): Kuder and Richardson

(PPTA): Pakistan Physical Therapy Association

(VR): Virtual Reality

IT: Information Technology

SPSS: Statistical Package for Social Sciences

1 Introduction

Digital rehabilitation, also termed as tele rehabilitation embodies a novel method in the field of physiotherapy. By employing digital facilities, tele rehabilitation enables the distant delivery of rehabilitation services, thereby increasing accessibility and efficacy. This advanced method covers a comprehensive collection of devices and applications such as videoconferencing, artificial intelligence, mobile applications, and wearable devices intended to boost patient recovery and smooth care delivery. The incorporation of digital rehabilitation is in accord to the worldwide pattern of integrating information and communication technology (ICT) into healthcare, a tendency that has attained noteworthy attraction globally (Maresca et al.,2020).

Worldwide, the healthcare service sector is gradually admitting the advantages of digital rehabilitation. Studies have shown that tele rehabilitation can be as productive as conventional face to face therapy for a variety of situations, covering musculoskeletal ailments, stroke rehabilitation, and chronic pain management. It provides several benefits including augmented patient engagement, constant patient monitoring, tailored interventions and economical delivery of service. (In the context of physical therapy rehabilitation plays a key role in monitoring the progress in recovering from cerebrovascular accidents (CVA) (Opele et al.,2020; Niknejad et al. 2021; Mani et al.,2017). Artificial Intelligence (AI) in this regard simplifies robotic and high-tech methods to get control of neural challenges, aiding successful and in time induction of therapy. The comfort and effectiveness of performing physical therapy at home for both valuation and continuing monitoring, highlights its worth and viability, specifically when initiated immediately after disease onset, as suggested for optimum recovery (Lee et al.,2023; Robler et al., 2021; Keldsen et al.,2020; Geisler et al.,2019).

Digital rehabilitation also increases accessibility to facilities for those in rural areas, alleviating the need for travel to approach a particular care. This mode of rehabilitation provides adaptability and liberation to patients as well as their families, which is advantageous in rural settings. Moreover, the using videoconferencing in urban setting offers an economical way of screening further showing the flexibility of tele rehabilitation. Collectively, digital rehabilitation offers a resourceful means for providing bearable and suitable physical therapy facilities to patients at the comfort of their homes, exploiting telecommunications to simplify the continuing evaluation and improvement of recovery procedures (Harkey et al.,2020; Canfell et al.,2021; Anderson et al.,2022).

Tele rehabilitation includes two primary modalities: “Contemporaneous”, which includes real time interaction of therapists but from different locations. “Non-Contemporaneous”, which covers

anachronic “store and forward” data transmission containing video clips, digital images and other telecommunications devices. This contrast underscores the versatility of tele rehabilitation to numerous clinical and patient requirements. In spite of the benefits of tele rehabilitation, its execution stresses an in-depth comprehension of care delivery ethics and reliability, along with a devotion to keeping the quality of care. Consequently, healthcare professionals should foster a solid collaboration with tele rehabilitation developers to make sure the success of these facilities (Anderson et al.,2022)

However, the effective execution of digital rehabilitation, needs capable infrastructure, appropriate education of healthcare professionals and embracing from both professionals as well as patients. In context of Pakistan, attention to digital health solutions has been rising, stimulated by the escalating infiltration of the internet and smartphone. Until 2022, infiltration of internet in Pakistan has been mounted to nearly 36.5%, with over 100 million users (Latif et al.,2023; Ali et al.,2022). This notable internet accessibility signifies a strong opportunity for digital health interventions, covering digital rehabilitation. Regardless of this potential, the acceptance and execution of digital rehabilitation in Pakistan stays at an initial phase. There is a scarcity of studies about the awareness and acceptance of digital rehabilitation among physiotherapists, considering that they are the main contributors in the process of rehabilitation. Comprehending their awareness attitude, perception and the factors impacting the embracing of digital rehabilitation is vital for successfully incorporating these facilities into conventional healthcare system.

2 Problem Statement and Significance of the Study

In spite of the likely advantages of digital rehabilitation, there is a considerable gap in research regarding its awareness and acceptance among physiotherapists in Pakistan. Physiotherapists are main contributors in the rehabilitation process and their attitudes and perceptions regarding digital devices crucially influence the implementation and progression of such interventions. This study aimed at addressing this gap by investigating the current level of awareness about digital rehabilitation among physiotherapists in Pakistan, revealing barriers to its acceptance, and proposing plans to encourage its usage in clinical setting.

The results of this study are expected to afford valuable penetration into the recent situation of digital rehabilitation in Pakistan. Identification of the awareness levels and possible barriers confronted by professional linked to physiotherapy, the research may apprise health care service providers, government agencies, researchers and healthcare professionals about the essential steps to boost the incorporation of digital rehabilitation. This consequently can result in enhanced patient outcomes, augmented availability to rehabilitation services, and a more well-organized health care structure. Moreover, the study is instrumental to the existing body of knowledge regarding digital rehabilitation, offering fundamentals for further research and strategy building

3 Literature Review

Digital rehabilitation has been thoroughly investigated and implemented in several countries, indicating substantial prospective in augmenting the excellence and convenience of rehabilitation services. Researches specifies that tele rehabilitation can be as potent as conventional face to face service for numerous situations covering stroke, musculoskeletal ailments and pain management (Cottrell et al., 2020; Zhang et al., 2021). A review of studied revealed that tele rehabilitation is approximate to traditional methods in context of clinical efficacy, patient involvement, and healthcare utility (Baigi et al., 2022). It provides augmented patient involvement and adherence by offering appropriate and flexible access to physiotherapy sessions. Intensive care through wearable tools and mobile application allows healthcare professionals trace outpatient improvement and regulate treatment strategies in real time (Perez et al., 2021; Rigamonti et al., 2020). Additionally, digital rehabilitation may decrease health care expenses through curtailing the necessity of physical setup and aiding remote service delivery (Butzner et al., 2021; Brigo et al., 2022; McMaster et al., 2021).

However, the acceptance of digital rehabilitation come up with numerous challenges. Scientific barriers,

including the accessibility and dependability of internet connection are important concerns, specifically in remote areas (Rahiem et al., 2020). Furthermore, the lack of related education and IT skills may obstruct the constructive usage of digital rehabilitation facilities. Apprehensions concerning data security and privacy also lead to problems as patients and professionals' providers can be worried about unforeseen risk linked to digital services (Blandford et al., 2020).

3.1 Digital Rehabilitation in Developing Countries

In emerging nations, the implementation of digital rehabilitation is impacted by distinctive challenges and prospects. Inadequate assets, poor infrastructure, and monetary limitations are common problems that influence the execution of digital health facilities (Rahiem et al., 2020). Nevertheless, the potential advantages of digital rehabilitation in enlightening access to health care facilities in distant areas are predominantly notable in these settings. Research performed in India confirmed the viability and efficiency of telerehabilitation for stroke patients, underscoring its benefit in addressing the gap in rehabilitation amenities in rural setting (Chen et al., 2015). Likewise, in Brazil, digital rehabilitation has been employed to deliver distant physiotherapy sessions to patients having chronic obstructive pulmonary disease (COPD), ensuing in better patient recovery and lower health care costs (Tenforde et al., 2020; Ali et al., 2022).

These instances highlight the prospective of digital rehabilitation to improve health care outcome in emerging countries. But, effective execution needs addressing the specified challenges confronted in these settings, such as upgrading digital infrastructure, providing educating healthcare service providers along with making sure the bear ability and convenience of digital rehabilitation services (Rahiem et al., 2020).

3.2 Digital rehabilitation technologies

Digital rehabilitation technology is related to the usage of digital devices to augment the rehabilitation processes. As a consequence of the increasing demand in rehabilitation facilities, a switch to the usage of technology is indispensable. Digital rehabilitation technologies have appeared as ground breaking facility in the field of health care providing numerous advantages for care of patient care and health services. These technologies are offered to improve mobility and decrease the impairment of people coping with health challenges. They have created positive influence on self-care by allowing patients to boost their lifestyle, vital in distance-based rehabilitation. (Arntz et al., 2023). Numerous technologies have been employed to simplify distant evaluation of patient outcomes (Brigo et al., 2021). These

technologies include virtual reality (VR), augmented reality (AR), tele rehabilitation, and wearable devices which are gradually getting familiarity among professionals for enhancing the rehabilitation procedure.

3.2.1 Virtual and Augmented Reality

VR and AR have been considerably evaluated for their possible advantages in rehabilitation. Specifically, VR has demonstrated potential in lowering strain and handling discomfort for patients in acute care. It has been revealed that VR may efficiently regulate consideration and attitude by decreasing pain perception and improve the overall therapy outcome. Application of VR in acute care have been linked with enhanced quality of sleep and reduced concern among clients (Kanschik et al.,2023)

3.2.2 Wearable Inertial Sensors

Wearable inertial sensors as well as accelerometers and gyroscopes are employed to assess gait and balance. Such tools are beneficial in measuring the efficacy in situation such as Parkinson disease and post stroke rehabilitation. These devices offer constant, real time readings helping practitioners in tracking progression and altering recovery plans. The effectiveness and consistency of these devices have been confirmed (Kobsar et al.,2020).

3.2.3 Digital Health Tools and Patient Involvement

Mobile applications and electronic patient-reported outcome measures (ePROMs) are increasingly gaining familiarity among professionals. Such tools enable better patient involvement offering improved symptoms tracking and adherence of treatment. These tools also allow distant monitoring and care that is specifically valuable for handling chronic conditions and follow up treatment (Seron et al.,2021).

3.3 The State of Digital Rehabilitation in Pakistan:

The health care structure in Pakistan faces many challenges covering scarcity of funds, unbalanced accessibility of health care amenities and a high rate of disease (Memon et al., 2024). These obstacles produce a captivating situation for the embracing of advanced solutions like digital rehabilitation. The growing infiltration of the internet and mobile smartphones in Pakistan offers an important prospect for the execution of digital health interventions.

3.4 Awareness and Acceptance Among Physiotherapists:

Physiotherapists has a crucial role in the rehabilitation process and their attitudes concerning digital

tools significantly influence the implementation and prosperity of digital rehabilitation interventions. In context of Pakistan Studies there is a lack of studies concerning the awareness and acceptance of digital rehabilitation among physiotherapists, however insights may be extracted from studies performed in other settings. Research from the United States showed that therapists usually recognize digital rehabilitation optimistically accepting its benefit in enhancing patient outcome and better accessibility to services (Cottrell et al.,2020). Nevertheless, apprehensions regarding the consistency of devices, the quality of patient health care provider interaction and the danger of reduced patient adherence were also noticed. Similarly researches from Australia and Europe have also reported passion and disbelief towards the usage of digital rehabilitation (Tenforde, et al., 2021).

4 Objectives and Research Questions

Evaluate the level of awareness concerning digital rehabilitation among physiotherapists in Pakistan: Determining to what extent physiotherapists are familiar with digital rehabilitation facilities and their applications. Explore the attitudes and perceptions of physiotherapists towards digital rehabilitation: Understanding the views and opinions of physiotherapists concerning the convenience and obstacles of digital rehabilitation. Find the barriers to the implementation of digital rehabilitation facilities: Examine the challenges as well as obstacles that restrain physiotherapists from implementing digital rehabilitation at their settings.

1. What are the current awareness levels of physiotherapists in Pakistan regarding digital rehabilitation?
2. What is level of knowledge and skills of physiotherapists in utilizing digital rehabilitation tools
3. What are the attitudes and perceptions of physiotherapists towards incorporating digital technologies into their practice?
4. What are the barriers and challenges hindering the adoption of digital rehabilitation in physiotherapy?
5. What are recommendations for enhancing awareness and facilitating the integration of digital rehabilitation among physiotherapists in Pakistan?

5 Research Methodology

This section provides comprehensive material regarding how this research was conducted by answering the research questions through mixed method of research and concentrating on the research objectives. The data collection and the analysis method has been also defined.

5.1 Data Collection Procedure:

The research questions for this study are grounded on review of different studies conducted concerning the significance of digital rehabilitation in Pakistan. Such studies are a preliminary to the study objective and makes the ground on which the research questions were answered. We need to look at the current healthcare situation in Pakistan to understand how healthcare providers are using new high-tech medical solutions. In addition, it has been hypothesized that digital rehabilitation is fully capable to enhance public health, so this innovative health care delivery system must be encouraged by the Pakistani agencies and the health care service providers (To et al., 2019; Ullah et al., 2021).

This research was conducted by employing a mixed method survey including a cross-sectional research method as it is feasible and economical as compared to the longitudinal study design which includes the collection of data repeatedly (Fah et al., 2021). Our study evaluated the attitudes, perceptions, opinions and concerns of physiotherapists about digital rehabilitation. The quantitative data were collected by deploying a questionnaire as a research instrument in the current study. The questionnaires are extensively considered as valuable tool for collection of information providing numerical and quantifiable data. They may be administered in absence of the researcher and are comparatively simple to analyze (Schuman-Olivier et al., 2020).

The questionnaire included both open and close ended statements which were incorporated after a comprehensive review of relevant studies (Chithapuram et al., 2023; Yeung et al, 2023; Trenfield et al, 2022; Marwaha et al, 2022). Structured questions specifically close ended provide several advantages as they enable to generate frequencies of responses, provide opportunities for further statistical analysis as well as can be labelled to compare various groups (Levitt et al, 2022). The primary objective of the questionnaire (Appendix 1) was to evaluate the perceptions and experiences of physiotherapists concerning digital rehabilitation. The scopes of the statements are based on the digital rehabilitation service respondents have experienced and future of digital rehabilitation. Every statement was developed in context of the present study. The process involved rigorous feasibility, reliability, validity and significance to the research objectives (Batool, et al, 2022)

In total questionnaire was consists of eighteen questions (Appendix 1). The initial ten questions gathered the demographic characteristics of the respondents. Three questions were incorporated in section two to evaluate the awareness and knowledge of digital rehabilitation among physiotherapists. Section three includes six questions to gauge the attitudes and perceptions among the study participants. Similarly, one question was included in section four to know about the barriers to digital rehabilitation among the respondents. Finally, two questions were devoted to section five to know about the respondent's opinion regarding training and support of digital rehabilitation. The last two statements of this section were open-ended to know about respondent's opinion and their recommendations concerning the current condition of phenomenon of digital rehabilitation in Pakistan.

The content validity of questionnaire was done to inspect the degree to which statements of the questionnaire are actually based on the research objective. This examined that how well statements of the questionnaire are able to cover all relevant aspects of a construct (Mizrahi et al., 2021). The process is finalized by taking the viewpoints of professionals working in the areas related to digital rehabilitation. The professionals evaluated the design of the questionnaire, length of the statements, their clarity, meaning and ability to measure the relevant construct (Rapee et al., 2023). The questionnaire was piloted after the confirmation regarding its validity and adequacy. The pilot test was employed to assess the reliability and validity of the questionnaire. The contents of the questionnaire were revised and refined after getting valuable feedback. Few authors have recommended near 30 while others have suggested 12 respondents for a pilot study (Brown 1995; Julious 2005). Therefore, it was decided to recruit 15 respondents for a pilot test (Appendix 2). The gathered data was then used to compute and evaluate the reliability of the questionnaire. Two measures namely Cronbach's coefficient alpha (CA) and the Kuder and Richardson (KR-20) were used to examine the internal consistency reliability of the questionnaire. The reliability of binary variables was computed using KR-20 (q2.1, q2.2, q2.3, q3.1) whereas CA was used for the variables reported on Likert scale (q3.3, q3.4, q3.5). Both KR-20 and CA demonstrated the threshold value of 0.7 for internal consistency reliability (Hair et al., 2021; Hair et al., 2019), therefore reliability of the questionnaire was verified (Table 1).

Table 5.1. Reliability of the Questionnaire

Construct	Items	α
Awareness and Knowledge	3	0.73
Attitudes and Perceptions	8	0.89
Barriers	5	0.76

5.2 Target Group:

Sample size was calculated using online program Open EPI ([OpenEpi - Toolkit Shell for Developing New Applications](#)). Setting alpha (α) = .05, confidence level = 95% and reported proportion of physiotherapists recognized digital rehabilitation as a legitimate service = 79.1% (reference) which yields the minimum sample size of 255. The selection of study population was based on a non-probability convenience sampling technique targeted at clinical as well as academic physiotherapists based in Pakistan with minimum of six months of relevant experience. The inclusion criteria were that respondents must be physiotherapists having age ≥ 24 years having both genders to make sure a diverse sample, the respondents may or may not be practicing digital rehabilitation. Exclusion criteria include undergraduate Doctor of Physical Therapy (DPT) students and various other health practitioners such as pharmacists, speech therapists and occupational therapists.

5.3 Data collection:

Data was collected through a self-structured Questionnaire, disseminated through an online Google Form. Online surveys are influential and authentic tool for conducting research. Moreover, online surveys are less expensive and represents a rapid and simple process to collect information. The respondents were contacted through emails and WhatsApp and social media with a request to click on the link and complete the survey. The emails and WhatsApp information of respondents was gathered by using professional and social contacts in Pakistan as well as using channel of Pakistan Physical Therapy Association PPTA. Research have professional background of Physiotherapist used social media, WhatsApp groups for data collection and used professional email address for request to fill the google forms. Data collection occurred from April 2024 to May 2024. In the current study three hundred fifty respondents were contacted through emails and WhatsApp. A total of three reminders (one every 15th day) were sent to the potential respondents, which results in two hundred twenty-five responses. The data concerning twenty-five respondents was omitted due to missing information. So, $n=230$ responses were considered for the analysis. The study followed the rules as indicated in the Declaration of Helsinki, assuring the protection of respondent rights, privacy, and informed consent. Respondents were updated regarding the purpose of the study, and their right to move out of the study at any stage without any consequences.

5.4 Data Analysis:

After the completion of data collection, the statistical analysis was performed using Statistical Package

for Social Sciences version (SPSS version 26.0). This step related to a comprehensive inspection and interpretation of numerical data, using suitable statistical procedure to assess the awareness, attitudes, and experiences of physiotherapists concerning digital rehabilitation. The analysis was planned to detect significant insights, enhancing the current knowledge on digital rehabilitation process among physiotherapists. For continuous variables mean and standard deviations were calculated. For categorical variables, frequencies and percentages were calculated. Statistical significance was set at $p < .05$. By employing this systematic approach, the aim of this study was to provide sufficient evidence related to the skills and mentality of physiotherapists in adopting and implementing digital rehabilitation in their routine practice.

6 Results

The study population includes 76 (33%) male and 154 (67%) all respondents were aged between 25 to 44 years. Majority of respondents were Clinical Physiotherapists 136 (59.1%), whereas, 62 (27%) were Senior Physiotherapist, 9 (3.9%) were Physiotherapy Manager, remaining 23 (10%) did not provide information about their profession. 78 (33.9%) had 0-2 years of experience as a physiotherapist, 70 (30.4%) had 3-5 years of experience as a physiotherapist, 49 (21.4%) had 5-8 years of experience as a physiotherapist and 33 (21.4%) had more than 8 years of experience as a physiotherapist.

Table 6.1: Sociodemographic profile of Study Population

Characteristics	Frequency	Percent
GENDER		
Male	76	33%
Female	154	67%
Profession		
Clinical Physiotherapist	136	59.1%
Senior Physiotherapist	62	27%
Physiotherapy Manager	9	3.9%
others	23	10%
Experience		
0-2 years	78	33.9%
3-5 years	70	30.4%
5-8 years	49	21.4%
9 and above	33	14.3%

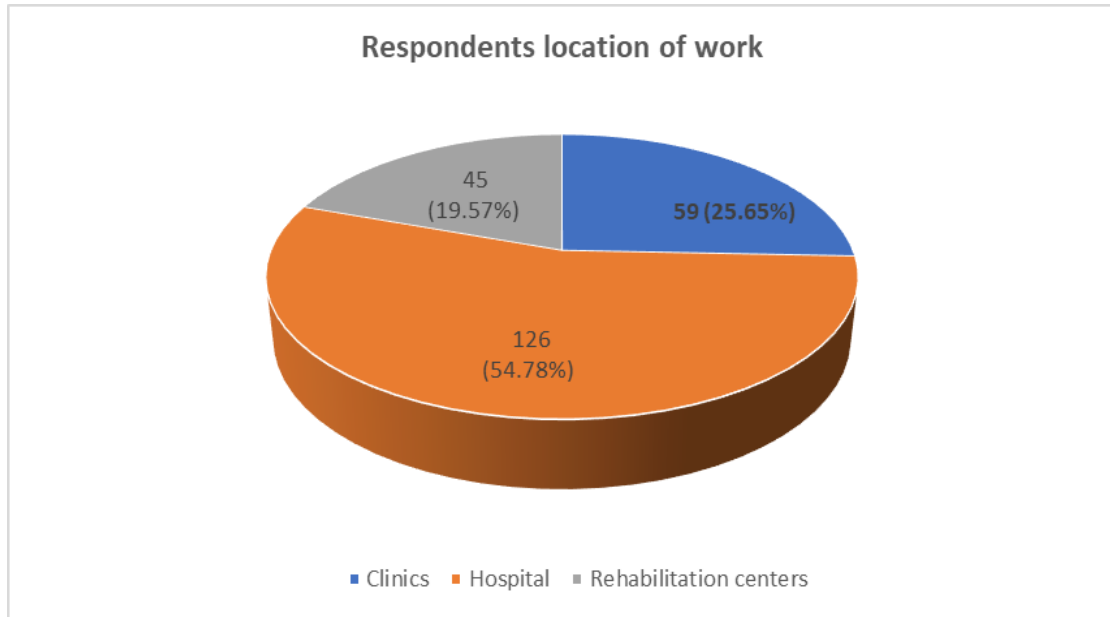


Figure 6.1 Respondents work location

Figure 6.1 shows the workplace location of the respondents. Majority of the participants were working in hospitals 126 (54.78%), 59 (25.65%) of the respondents were associated to private clinics, while 45 (19.57%) were working in rehabilitation centers.

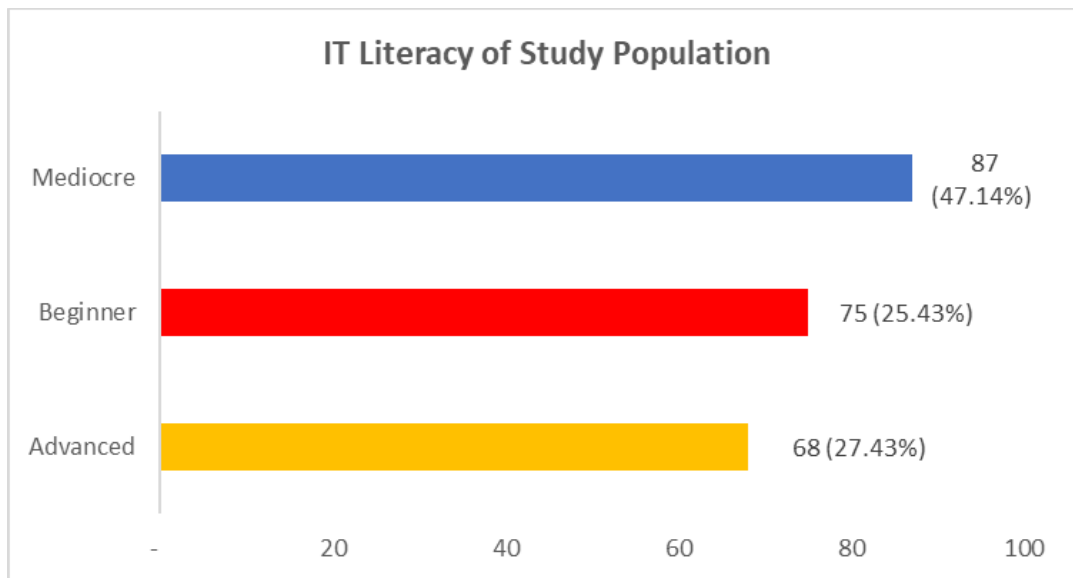


Figure 6.2. IT Literacy of the Study Population

Figure 6.2 indicate that nearly half of the respondents had mediocre IT literacy rate 87 (47. %) whereas 68 (27.8%) had advance knowledge of IT. Only 75 (25.2%) had a beginner level knowledge of IT.

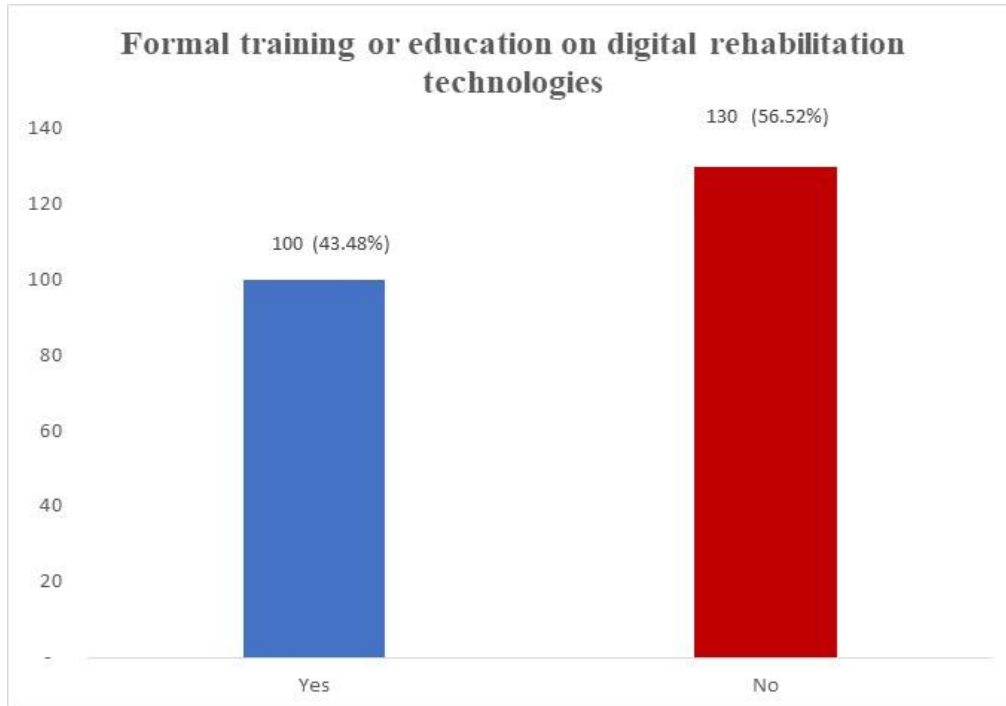


Figure 6.3 Respondents formal training or education on digital rehabilitation technologies

Figure 6.3 shows that 100 (43.5%) had received formal training regarding digital rehabilitation technologies, whereas 130 (56.5%) had not received any training.

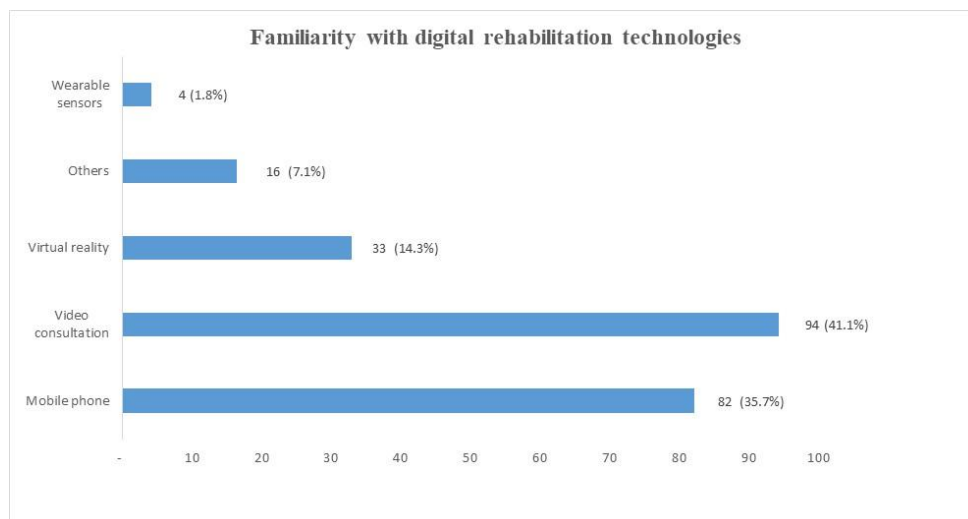


Figure 6.4 Respondents familiarity with digital

Figure 6.4 shows responses of the study population regarding their familiarity with digital rehabilitation technologies. Majority of the participants (41.1 %) stated their familiarity with video consultation. Whereas (35.7%) claimed their familiarity mobile phone, only (1.8%) claimed familiarity with wearable sensors.

Table 6.2: Cross-tabulations of Formal training on digital rehabilitation and ICT Literacy

ICT Knowledge	Formal training on digital rehabilitation technologies		Total	P-Value
	Yes	No		
Average	37	50	87	0.027
Beginner	28	47	75	
Advanced	40	28	68	

Table 6.2 shows when the relationship between IT literacy and attendance at digital rehabilitation program was examined, a notable pattern was witnessed. Participants having an advance knowledge of Information technology showed a significant inclination to attend training programs, with 40 out of 68 in this category affirming attendance which suggests a positive correlation between IT literacy and professional engagement (Table 1; $p < 0.05$). Whereas, beginners in IT literacy did not show any significant inclination towards engagement in professional training with 28 out of 75 attending training programs. Similarly, respondents with average IT skills also did not show any significant intend in attending professional digital rehabilitation training program as out of respondents with average IT literacy, only 37 attended professional training program.

Table 6.3: Digital rehabilitation knowledge and awareness

Digital rehabilitation knowledge and awareness	N	%
Are you aware of digital rehabilitation applications with video-conference systems, mobile applications, sensor technologies, and augmented virtual reality systems?		
Yes	100	43.48%
No	130	56.52%
If yes, where did you learn about tele rehabilitation applications?		
Lesson	62	27%
Seminar/congress/symposium	48	21%
Internet	99	43%
Hospital-internship-practice	21	9%
If no, why do you think you are not aware of these tele rehabilitation platforms?		
No courses/curriculum	82	63%
Since it is not applied in practice	31	24%
Technical issues	5	4%
Other	12	9%

Table 6.3 shows the awareness and knowledge of respondents regarding digital rehabilitation. 130 respondents (56.52%) were not aware about digital rehabilitation technologies. 82 respondents (63%) who were not aware about digital tele rehabilitation stated that the reason they do not have knowledge about digital rehabilitation is the lack of a curriculum (Table 2).

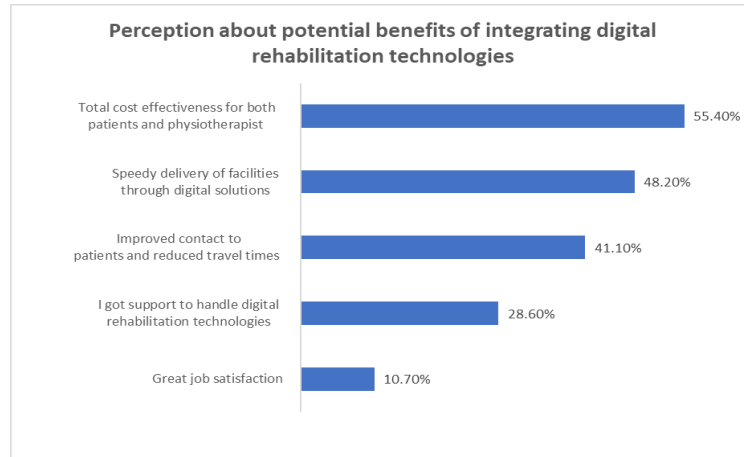


Figure 6.5 Potential benefits of integrating digital rehabilitation technologies

Figure 6.5 demonstrates the major perceptions of physiotherapists regarding potential benefits of integrating digital rehabilitation technologies into physiotherapy practice. A majority (55.4%) of the respondents selected total cost effectiveness for both patients and physiotherapist as one of the most potential benefits. Whereas 48.20% of the respondents selected speedy delivery of facilities through digital solutions as the second most potential benefit. Only 10.7% of respondents stated greater job satisfaction as the potential benefit of integrating digital rehabilitation technologies into physiotherapy practice.

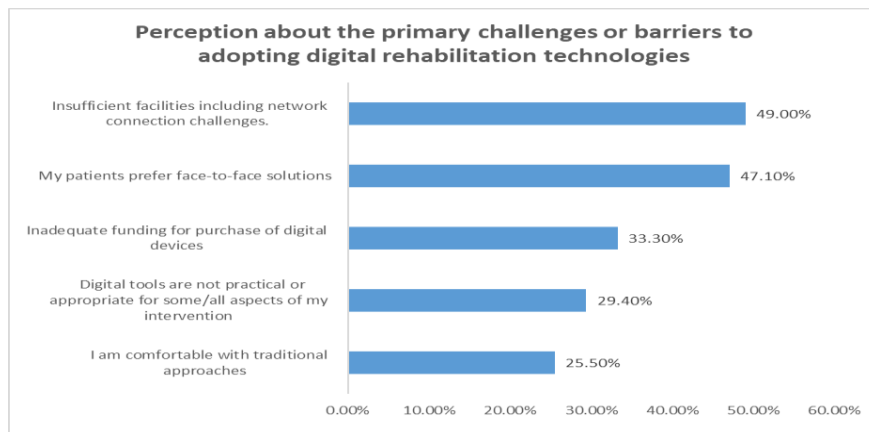


Figure 6.6 primary challenges or barriers to adopting digital rehabilitation technologies

Figure 6.6 shows the barriers to adopting digital rehabilitation about 49 % of the respondents believed that insufficient facilities including network connection challenges as a major barrier and 47% of respondents reported that their patient's priority to meet face to face as a barrier to adopting digital rehabilitation. Whereas 33.3% reported inadequate funding for purchase of digital devices as a barrier and 25.5% reported their comfort with traditional approached as a barrier.

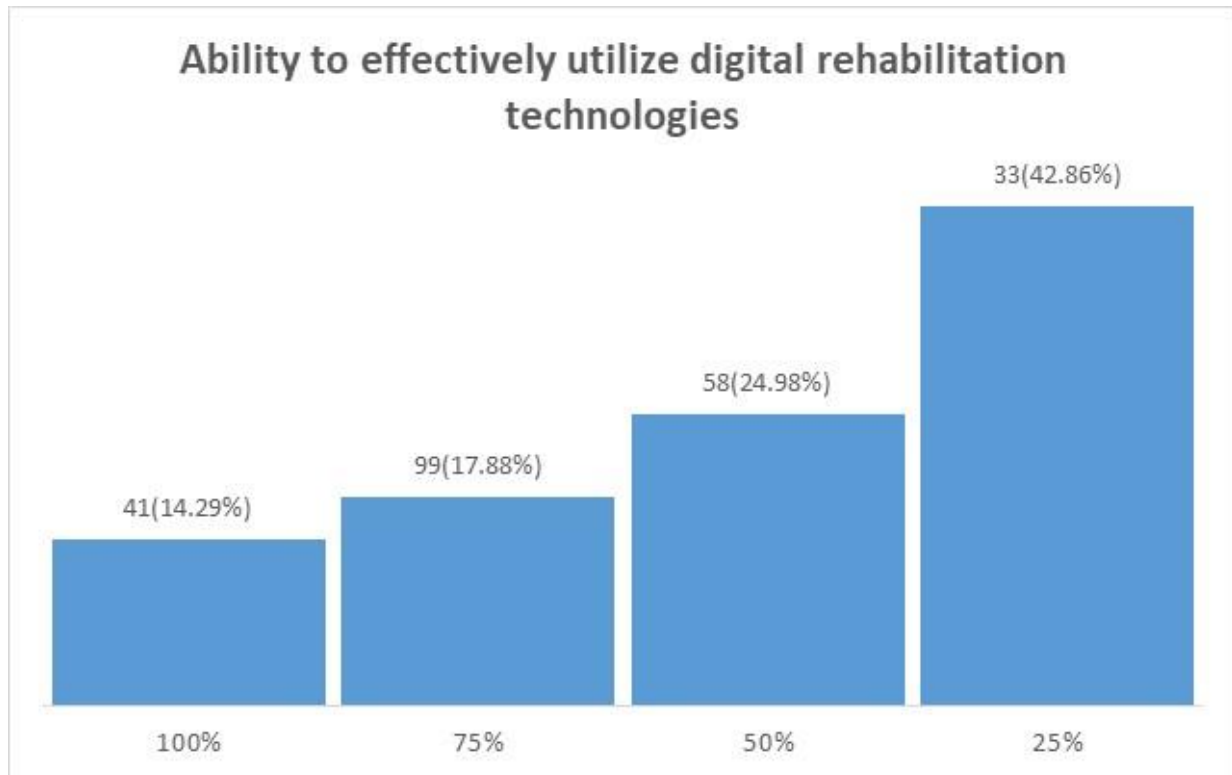


Figure 6.7 Ability to effectively utilize digital rehabilitation technologies

Figure 6.7 depicts the number of respondents and percentage of their ability to effectively utilize digital rehabilitation technologies. Forty-one (14.29%) of the respondents stated that they are 100% confident in effectively in utilizing digital rehabilitation technologies. Ninety-nine (17.88%) of the respondents claimed that they are 75% confident in effectively in utilizing digital rehabilitation technologies. Whereas, thirty-three (42.86%) of the participants reported that they are 25% confident in effectively in utilizing digital rehabilitation technologies.

Table 6.4: Respondents attitude and perception

Attitudes and Perceptions	Mean	SD	SDA	D	N	A	SA
I believe that digital rehabilitation technologies can improve patient outcomes compared to traditional rehabilitation methods.	3.64	0.88	0.43	8.70	35.65	37.39	17.83
The current use of digital rehabilitation solutions is better than traditional methods	1.88	0.85	32.10	57.10	3.60	5.40	1.80
The use of digital rehabilitation programs is more or less the same as traditional methods	1.79	0.89	40.92	48.10	4.99	3.99	2.00
I believe digital rehabilitation has a role to play in future delivery of healthcare services.	3.5	0.97	-	16.08	35.66	30.37	17.88

SD=Standard Deviation, SDA=Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree

Table 6.4 shows the mean values and percentages of respondent's perception about digital rehabilitation. The analysis revealed that a greatest mean score was found (mean=3.64, agree=37.39.2% and strongly agree =17.83%) regarding the question (I believe that digital rehabilitation technologies can improve patient outcomes compared to traditional rehabilitation methods). About 17.88% of participants strongly agreed and 30.37% of participants agreed that digital rehabilitation can play a role in future. Majority of the participants strongly disagreed (32.1%) and 57.1% of participants disagreed about the current use of digital rehabilitation is better than traditional methods. Whereas 40.92 % of the participants strongly disagreed and 48.1% of participants disagreed that the digital rehabilitation is similar to traditional methods.

7 Thematic Analysis of the Survey

The open-ended questions were analyzed by employing a thematic analysis to achieve realities and to discover perceptions of respondents to make sure that the analysis enclose themes that the survey questions might have missed and to make sure that suitable facts which are pertinent to the research objective have been captured (Byrne, 2022). Thematic analysis is a valuable method to attain opinions, views and values from the data. In this study a famous thematic analysis approach proposed by Braun & Clarke (2014) was used to identify trends in the qualitative data (Byrne, 2022).

Figure 7.1 Braun & Clarke (2014) Six step thematic analysis approach



Familiarization with the data

To get familiarity with the responses, they were reviewed multiple times to attain an extensive apprehension about the responses in context of the survey questions.

Initiating coding generation:

The researcher then recognized resemblances in the responses and allocated preliminary codes to capture the important thoughts and trends in the study responses. The codes were generated scientifically using MS Excel. As suggested the spirit behind coding of responses is to determine suitable number of codes for the analyses of qualitative data by (Kooteh et al., 2020).

Searching for themes based on the initiating codes:

The researcher then observed trends, resemblances, repetitive concepts within the generated codes across the survey responses. For example, concerning to question “How do you think the healthcare system in Pakistan can better support physiotherapists in adopting and utilizing digital rehabilitation technologies?” the author defined the theme “Training Programs” from the codes “education”, “workshops”, “seminar”, “webinars” and “awareness sessions”

Reviewing the themes:

The themes were then revised and it was confirmed that the codes allocated to every theme were pertinent. This was achieved by merging codes or neglecting irrelevant codes.

Theme defining and labeling:

At this step a thematic chart was drafted for visualizing the association among the themes and generated codes to establish, recognize, and connect the patterns from the survey data. In the current study, MS Excel sheet was used for generating the codes and creating the tables.

Report and findings:

Finally, the themes were interpreted, considering the obstacles of the study together with recommendations that how digital rehabilitation could be integrated in the main stream courses of health care professionals.

8 Results

The aim of the survey was to explore views, opinions, attitudes and perceptions of physiotherapists towards digital rehabilitation along with the barriers to the implementation of digital rehabilitation facilities in Pakistan.

“Question 5.1: What type of support or resources do you believe would be most beneficial in facilitating the integration of digital rehabilitation technologies into physiotherapy practice?”

Respondents provided mixed comments; however, five themes were consistently emerging from the survey which are mentioned below.

8.1 Continuous Professional Development:

Physiotherapists reported the need of training programs covering the use of digital rehabilitation facilities, mobile applications and emergent technologies. Examples of comments from respondents.

“Workshops and training programs are mandatory to make sure the proficiency in using advance digital facilitates. Continuous professional education will help us remain abreast about the modern technologies.”

“Physiotherapist must be educated about the new trends in health care service delivery.”

8.2 Access to Advance Infrastructure

Enhancing digital set-up, together with dependable internet connections and availability of hardware equipment is needed, specifically in remote areas. Physiotherapists emphasized the need of investment in robust infrastructure. Examples answers from respondents are below.

“The absence of internet connections in many rural areas is the major hurdle in using digital rehabilitation facilities. Improving the digital infrastructure is central for availability of these services”.

“Advance health care infrastructure is not available to initiate modern facilities”.

8.3 Patient Training

Availability of educational programs, interactive workshops and training is critical for patients to enhance their technological awareness. Physiotherapists proposed that easy to use guidelines and informative videos might assist patients in becoming more relaxed with digital rehabilitation facilities. Few comments of respondents are depicted below:

“Educational programs such as interactive seminars and videos can help patients in learning functionalities of digital tools. This will result in improved patient involvement as well as adherence to therapy”.

“Patients are reluctant to trust digital health care devices”.

“I believe that it is important to facilitate patients with such technological advancements”

8.4 Funding and Financial Support:

Financial support which includes subsidies and donations that may support healthcare organizations and physiotherapists to invest in advance digital tools and infrastructure. Professionals reported that public-private partnerships will be valuable. Physiotherapist comments are presented below:

“Funding of government agencies and private companies will allow us to invest in the mandatory digital tools and infrastructure to make these facilities more attainable”.

“In a country like Pakistan, there are numerous areas where internet service is either not available or if available, internet connectivity is very poor”

8.5 Collaborative Platforms and Peer Support Networks:

Creating platforms and peer networks where professionals may exchange ideas and best practices which can promote a supportive community. Such platforms may simplify exchange of knowledge and collective problem-solving. Few comments are presented below:

“Collaborative platforms and peer networks will motivate us to exchange our skills and learn collectively which will result in improved delivery of services”.

“Government and private institute must emphasize in digital rehabilitation technologies to facilitate the rural area patient who cannot afford much expenses”

Qualitative analysis of question 5.2 “How do you think the healthcare system in Pakistan can better support physiotherapists in adopting and utilizing digital rehabilitation technologies?”

In response to this question, the following four themes were consistently emerging from the survey.

8.6 Training Programs

Physiotherapists highlighted the initiation of training programs by the healthcare system. Such programs should include both technical aspects as well as clinical application to integrate digital rehabilitation into existing practices. Few respondents commented as:

“The healthcare provider must conduct training programs and workshops regularly particularly customized as per needs of physiotherapists. Such programs will enable us to remain updated with the skills and knowledge required to integrate digital rehabilitation into our practice.”

“Healthcare must organize the workshops to support Physiotherapist community”

8.7 Access to Technological Resources

The healthcare providers must make sure that physiotherapists have access to the mandatory resources such as hardware, software, and digital tools. This involve providing funds for purchase of digital facilitates and infrastructure. Few commented are presented below:

“The healthcare providers must allot funds for acquiring digital rehabilitation technologies. Physiotherapy system in Pakistan lack the necessary resources and technology to implement these tools efficiently.”

"Establishing dependable and fast internet connection particularly in remote areas is key for the implementation of digital rehabilitation."

8.8 Technical Support and Assistance

Physiotherapists emphasized the availability of dependable technical support from the healthcare system. The support must address any technical problems or difficulties in handling digital rehabilitation technologies.

"The healthcare system should establish a dedicated technical support team that physiotherapists can reach out to whenever they encounter problems with digital tools. Prompt assistance is essential to ensure uninterrupted patient care," emphasized physiotherapists from Karachi.

"There should be a devoted technical support team to whom physiotherapists can contact in case of any problems in using digital devices. Rapid assistance technical support is mandatory to continue continuous patient care"

"Constant care of equipments and updates of applications would avoid technical problems which disturb patient treatment."

8.9 Policy and Regulatory Framework

The healthcare providers should make transparent rules and regulatory frameworks to administer the utilization of digital rehabilitation in practice of physiotherapy. The policies must take into consideration problems like data privacy and security. Few respondents commented as:

"The healthcare system must prepare guidelines and rules related to digital rehabilitation. This will not only provide transparency and guidance to professionals but will also promote confidence in embracing these technologies."

"Clear monitoring rules concerning the usage of digital rehabilitation facilities would offer guarantee and standard practices."

9 Discussion

This study was conducted to determine the knowledge, awareness, and perception among physiotherapists about digital rehabilitation in Pakistan. The study identifies that there is a growing interest, several gaps and challenges that condition to be addressed to fully strengthen digital rehabilitation in Pakistan.

The results indicated that most of the respondents had ordinary level of IT literacy which means the basic ability to efficiently use and know technology tools and resources. A noteworthy ratio of professional physiotherapists who received formal training showed considerable understanding and were expected to integrate digital devices into practice. On the other hand, those who did not received formal training were not expected to use these digital technologies.

A substantial portion (41.1%) of respondents claimed their acquaintance with video consultation, making it the most acceptable tool among physiotherapists. This indicate that video consultations are beginning to infiltrate into practices more rapidly as compare to other technologies. This may be due to their ease of use along with the restriction of circumstances such as the COVID-19 (Chithapuram et al.2023). Proportion of individuals familiar with mobile phones for digital rehabilitation was 35.7%, suggesting an average engagement with this handy and reachable technology. The study indicated that good IT skills are correlated with higher engagement in professional development in the context of digital rehabilitation ($p < 0.05$), suggesting the significance of IT skill in modern practices related to healthcare (Saeed et al.2024).

The study results revealed that most of respondents do not possess relevant awareness and knowledge about digital rehabilitation and its implications. Similarly, many respondents suggested to include digital rehabilitation in their educational curriculum at the graduation level. The results are consistent with another study which revealed that curriculum about digital rehabilitation must be integrated at graduate level to better equip students with the modern health care facilities and compete at the international level (Başer et al.,2022).

A study conducted in Poland showed that 69% of respondents were keen in including curriculum about digital (Mun et al.,2024). It appears unjustifiable to anticipate digital rehabilitation service to be regularly used when professionals are not updated with basic concepts, rules, regulation and principles in academic setting before joining the profession. Due to this reason, a detailed program related to digital rehabilitation must be introduced at the graduate level to promote digital rehabilitation in health care service (Sipanoun et al.,2022). Such strategies will help in promoting telemedicine, reinforce the

educational infrastructure of physical therapy students, and offer them with numerous openings to enhance their expertise to health-related computer technologies (Sipanoun et al.,2022). Customized training programs must be arranged for therapists in digital rehabilitation practices for the initial comfort of the therapist and to balance hindrances which may rise due to strangeness with the modern technology (Subedi et al.,2022).

In our study, most of respondents (55.4%) recognized that cost efficacy is the major advantage of digital rehabilitation. The result indicate that respondents are clear regarding the financial benefit offered by the digital technologies such as reduction in traveling expenses for patients and augmenting time management for physiotherapists. These results are in accord with the international studies that have concluded that reduced cost is a major benefit of telehealth and digital rehabilitation (Subedi et al.,2022).

Moreover, 48.2% of respondents stated the speedy delivery of services as a key benefit of integrating digital rehabilitation into physiotherapy practice, reflecting the acknowledgement of the fact that rapid response is a key in critical care settings where in time mediation may influence patient outcomes. This is similar to previous findings concluding that high tech technologies can augment efficacy of healthcare services (Mann et al.,2021)

Additionally, only 10.7% of respondents stated job satisfaction as an advantage of incorporating digital rehabilitation technologies into physiotherapy practice. This result indicate that several therapists did not recognize that digital tools can improve professional learning by minimizing physical stress by offering flexible working circumstances and permitting better patient outcomes. Enlightening these possible advantages among therapist may help in increasing their embracing and passion for digital rehabilitation.

European studies have overall reported increased levels of job satisfaction concerning utilization of digital tools in physiotherapy. A study conducted in Germany revealed that nearly 68% of physiotherapists perceived that digitalization can offer conducive working environment whereas 58% sated that it offers better communication with coworkers, reflecting a wider embracing and comfort level in comparison to Pakistani counterparts (Estel et al., 2022). Similarly, a study conducted in Croatia has also reported a higher level of job satisfaction among physiotherapy professionals (Puhanić et al., 2022). Such differences highlight the call for better set-up as well as collaborative strategies in Pakistan to augment the implementation of digital rehabilitation facilities in physiotherapy practice.

Approximately one half of the respondents claimed that inadequate amenities as well as challenges linked to internet connectivity as a major barrier in adopting digital rehabilitation. This result highlights the significance of robust set-up to implement digital rehabilitation. The implementation of digital rehabilitation services may be jeopardized in areas where internet access is unstable or inadequate. A considerable proportion of therapist (47%) stated that their patient prefer face to face therapy sessions which poses a hinderance in the adoption of digital rehabilitation. A study conducted in Iran found that most of the respondents were of the view that the excluding therapeutic effect of touch in therapy is a drawback of telerehabilitation as touching the patient in therapy sessions is pivotal for an effective treatment and patient satisfaction (Başer et al.,2022). Even though there are advance telerehabilitation systems like the Australian eHABTM system that integrate instantaneous video conference and remote diagnosis comparable to the conventional face to face therapy. However, no appropriate substitute for hands on has been initiated (Jansson et al.,2022). Farren et al., (2022) reported that tele practice is not adequate as a substitute to face to face sessions. Whereas research suggested that a hybrid model also be beneficial, this mixed personalized healthcare enables flexible telehealth adaptation. However, they acknowledge a bright prospective of telehealth services (Reynolds and O'Donovan et al., 2020).

Our study results indicate a small proportion of respondents (14.3%) claimed their confident to efficiently utilize digital rehabilitation technologies. This group may consist of people with good IT skills and have exposure to concerned. 42.9% of respondents stated low confidence in their skill to employ digital rehabilitation technologies efficiently. This suggest that a considerable gap in skills that may be linked to lack of training and restricted access to digital rehabilitation methods.

The majority of respondents believed that digital rehabilitation technologies have a significant role to be played in the future in term of improved patient treatment (mean=3.64). The results are in accord to the international studies where digital rehabilitation has been found to improve patient involvement, convenience to therapy plans by employing distant monitoring and personalized interventions (Hohenschurz-Schmidt et al.,2022).

10 Ethicality and reliability of the research

Ethicality and reliability are vital to avoid any bias and professionally complete the collections and analysis of the data. In the same vein, Suomäki et al., (2019) also stated that ethics is also related to selecting the right target population for the study and not inflicting harm on the respondents. As per the European code of conduct for research reliability are truthfulness, respect to the object and to people and persons involved in the process of research. The questionnaire was self-administered and

voluntary; before filling the survey questionnaire the consent form informed the individuals regarding the objective of the research, risks and benefits of participating in the current study. The survey was kept anonymous to ensure the confidentiality of the respondents meaning that no individual recognizable information was gathered

All the gathered data was kept secure and privacy of the data was observed. The data collected in this study was collected explicitly for this research and was only made available to the researcher who conducted the study. These principles were upheld throughout the different stages of the research by making sure that the same question was posed to all the individuals in the study and the same method of coding and interpreting data was used. Respect to the participants' opinion was given importance and they were used for the current study and there was responsibility to my thesis supervisor.

The data was analyzed in order to find the key results and trends that emerged such that conclusions and recommendations can be drawn. For this reason, the researcher was aware about his responsibility to not get involved in any sort of the misconduct by means of fabrication (that is altering data or results. The survey data collected through google form was accessible to my supervisor and me as the researcher. The data was collected in MS Excel and eventually exported to Statistical Package for Social Sciences version (SPSS version 26.0). Both MS Excel and SPSS files were placed at a safe location throughout the analysis process and were removed in such a manner that that there is no way for me to reuse the data files again. (Finnish Social Science Data Archive)

11 Conclusions & Recommendations

Digital rehabilitation offers an optimistic approach to enhance physiotherapy facilities in Pakistan. Inadequate amenities, poor set-up, lack of knowledge and insufficient funding determine disasters in continuing the practice of digital rehabilitation. These hurdles should be addressed so that the physiotherapist community in Pakistan can strengthen digital rehabilitation to enhance patient outcomes and promote the profession.

Grounded on the research outcomes, the following recommendations have been made for health care service providers, government agencies, researchers and healthcare professionals. First, it is important to initialize continuous educational programs such as workshops and seminars concentrating digital rehabilitation services. These programs must have access to all therapist across Pakistan irrespective of their geographical location. Second, investing to improve the digital infrastructure in healthcare facilities is crucial to make sure dependable internet connectivity and accessibility to relevant hardware and software. Third, developing and implementation of policies that encourage the usage of digital

rehabilitation. This include covering ethical and legal matters, safeguarding patient data safety, and disseminating monetary support for acquiring technology. Fourth, encouraging evidence-based research on the benefits of adopting of digital rehabilitation at various setting.

12 Limitations

There are few drawbacks of the thesis that must be considered. First, the design of the study was cross sectional which means the study only provided awareness levels of the respondents at one point in time and changes over the time could not be established. Second, the majority of the respondents were from urban areas Karachi and Lahore (70%), which may result in regional bias. In future strategies should be developed to include individuals from remote regions of Pakistan as well. By doing the results of the study will become more generalizable. Finally, since the responses were gathered by using questionnaire, therefore the element of self-reporting (over estimation or under estimation) by individuals concerning the use of digital rehabilitation cannot be neglected.

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APPENDIX-I: LETTER OF CONSENT

My name is Bhain Devi, I am a master's degree in digital rehabilitation, student of Jyvaskyla University of the Applied Sciences (Jamk), Institute of Rehabilitation. I would like to invite you to take part in a research study. Participation in the study is entirely voluntary, so you may choose whether to take part.

I'm interested in finding out about the current awareness level of physiotherapists in Pakistan regarding digital rehabilitation to assess the knowledge and skills of physiotherapists in utilizing digital rehabilitation tools and attitudes and perceptions of physiotherapists towards incorporating digital technologies into their practice. You will be required to participate in an online survey. This will require roughly 5 minutes of your time. All information will be preserved confidentially throughout the process.

Possible benefits: The advantage of this research will be awareness about digital rehabilitation in the era of physiotherapy.

Possible risk and side effects: There have been no significant risks and no such side effects of this study.

Confidentiality: All of your personal information and data will be kept confidential.

Withdrawal: Your participation in this study is entirely voluntary, and that you are allowed to withdraw or discontinue.

By signing this form, I willingly agree to participate in this research.

Name & Signature of participate

Name & Signature of researcher.

Date.

APPENDIX-II: QUESTIONNAIRE

The Awareness About the Digital Rehabilitation among The Physiotherapists in Pakistan.

Section 1: Demographic Information

1.1. Gender:

- Male
- Female
- Prefer not to say

1.2. Age:

- 25-40 years
- 41-55 years
- 56 years above
- Prefer not to say

1.3 Role of profession:

- Clinical specialities
- Senior physiotherapist
- Physiotherapy manager
- Other

1.4. Years of experience as a physiotherapist:

- 0-2 years
- 3-5 years
- 5-8 years

- 9 and above

1.5. Type of healthcare setting:

- Hospital
- Clinic
- Rehabilitation Centre
- Other (please specify)

1.6. Geographical location:

- Urban
- Rural

1.7. Information Technology Literacy

- Beginner
- Mediocre
- Advanced

1.9. Have you received any formal training or education on digital rehabilitation technologies during your professional development?

- Yes
- No
- others

1.10. Please list any digital rehabilitation technologies or tools you are familiar with:

- Video consultation
- Wearable sensors
- Mobile phone

- Virtual reality
- Others please specify:

Section 2: Awareness and Knowledge

2.1. Are you aware of telerehabilitation applications with video-conference systems, mobile applications, sensor technologies, and augmented virtual reality systems?

- Yes
- No

2.2. If yes, where did you learn about telerehabilitation applications?

- Lesson
- Seminar/congress/symposium
- Internet
- Hospital-internship-practice

2.3. If no, why do you think you are not aware of these telerehabilitation platforms?

- No courses/curriculum
- Since it is not applied in practice
- Technical issues
- Other

Section 3: Attitudes and Perceptions

3.1. What is your perception of the potential benefits of integrating digital rehabilitation technologies into physiotherapy practice? You can tick more than one

- I got support to handle digital rehabilitation technologies
- Total cost effectiveness for both patients and physiotherapist

- Speedy delivery of facilities through digital solutions
- Improved contact to patients and reduced travel times
- Great job satisfaction

3.2. How confident are you in your ability to effectively utilize digital rehabilitation technologies in patient care.

- 100%
- 75%
- 50%
- 25%

3.3. I believe that digital rehabilitation technologies can improve patient outcomes compared to traditional rehabilitation methods?

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

3.4. The current use of telehealth solutions is better than traditional methods (Face to Face)

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

3.5. The use of telehealth programs is more or less the same as traditional methods (Face to Face)

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

3.6. I believe telehealth has a role to play in future delivery of healthcare services.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

Section 4: Barriers**4.1. What do you perceive as the primary challenges or barriers to adopting digital rehabilitation technologies in your practice? you can tick more than one**

- Inadequate funding for purchase of digital devices
- I am comfortable with traditional approaches
- My patients prefer face-to-face solutions
- Insufficient facilities including network connection challenges.
- Digital tools are not practical or appropriate for some/all aspects of my intervention

Section 5: Training and Support

5.1. What type of support or resources do you believe would be most beneficial in facilitating the integration of digital rehabilitation technologies into physiotherapy practice?

5.2. How do you think the healthcare system in Pakistan can better support physiotherapists in adopting and utilizing digital rehabilitation technologies?

Thank you for participating in this survey. Your responses are valuable for advancing our understanding of the awareness and readiness of physiotherapists in Pakistan towards digital rehabilitation technologies.