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RESEARCH REPORT: MSc PHYSIOTHERAPY

Investigating the attitudes of physiotherapists about telerehabilitation and their opinions on its feasibility in South Africa

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A dissertation submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in fulfilment of the requirement for Master of Science in Physiotherapy.

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DECLARATION

I, Tylla Thomas, student number 605990, declare that this Research Report is my own work and has not been submitted anywhere else for examination or publication. It is being submitted for the Degree of Master of Science in Physiotherapy at the University of the Witwatersrand, Johannesburg.

Signature of Student ……

Date: 02/11/2022

Place: Johannesburg, Gauteng, South Africa

DEDICATION

I dedicate this research report to God Almighty who has provided me with the wisdom and guidance, strength, and perseverance to achieve all that I have. I also dedicate this paper to my parents, Tania and Shayle, and my sister, Shae, who have supported and motivated me throughout this journey. I thank you for instilling a tenacious spirit within me, and a strong belief that I can achieve anything I put my mind to.

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ABBREVIATIONS

ANOVA	analysis of variance
BI	behavioural intention
COPD	chronic obstructive pulmonary disease
Covid-19	corona virus disease
DM	diabetes mellitus
EA	early adoption
ECG	electrocardiogram
HPCSA	health professions council of South Africa
KMO	Kaiser- Meyer- Olkin
MDT	mechanical diagnosis and treatment
mHealth	mobile wearable technology
MTQ	modified telerehabilitation questionnaire
NMSPG	neuromusculoskeletal physiotherapists group
PCA	principal components analysis
PLS-PM	partial least-squares path modeling
PEOU	perceived ease of use
PU	perceived usefulness
RedCap	research electronic data capture
SASP	South African Society of Physiotherapy
SATMA	South African Telemedicine Association
SMS	Short Message Service
UA	user acceptance

OPERATIONAL DEFINITIONS

Variable	Definition
Attitudes	A psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor (Eagly & Chaiken, 2007)
Opinions	A view or judgement formed about something, not necessarily based on fact or knowledge (Lexico.com, 2022)
Telehealth	The provision of healthcare remotely by means of telecommunications technology (Investopedia, 2022)
Telemedicine	The remote diagnosis and treatment of patients by means of telecommunications technology (Catalyst.nejm.org, 2022)
Telerehabilitation	The delivery of rehabilitation services via information and communication technologies (Brennan, Mawson, & Brownsell, 2009)

CHAPTER 1: BACKGROUND AND NEED

1.1 Introduction

There has been a surge of research and clinical application of technological devices, and applications in healthcare worldwide (Holland, 2017). These have adopted different names, such as "mHealth" (Blumenthal, Wilkinson, and Chignell, 2018), "telerehabilitation" (Kairy et al., 2013), and narrowing further to "telephysiotherapy" (Holland, 2017). Due to advances in mobile and computerized applications and devices; people are becoming more responsive to adapt to different aspects of their lives virtually. Rehabilitative services are also being applied as such, as there is an increase in the use of in-home telerehabilitation programs that continue the treatment of patients who are situated far away from their healthcare facilities and cannot attend face-to-face sessions regularly (Holland, 2017).

Hailey et al. (2010); Russel (2007); and Kaur et al. (2004), agree that providing rehabilitative services at a distance is considered telerehabilitation. Modes of videoconferencing between physiotherapists and their patients make provision for better access to healthcare and can reduce the number of face-to-face sessions (Laver et al., 2011). Improvement in adherence to therapy has been shown through verbal motivation via telephonic calls and emailing home exercises and/or advice to patients. Mobile applications have become an aspect of daily use whereby preloaded videos of exercises, home advice, and reminders are set to achieve person-specific aims. Wearable sensors and mobile technology (mHealth) have been used in the monitoring of daily activities (Dobkin and Dorsch, 2011).

Telephysiotherapy interventions have been adopted for various acute and chronic musculoskeletal conditions and cardiopulmonary conditions (Holland, 2017). The progressive approach to using telerehabilitation therapies overseas, either as an adjunct or in place of conventional health care services, has emphasized the importance of goal setting (Holland, 2017) as this has been shown to improve adherence and motivation to therapeutic programs. Improved exercise endurance, reduced symptoms, and increased physical function, as well as overall improved health-related quality of life, are outcomes of telerehabilitation care (Holland, 2017).

Mars (2011) outlined the factors affecting the lack of telerehabilitation services in South Africa to be: the burden of disease, lack of human resources concerning the number of patients, as well as the effects thereof on healthcare workers and the broader aspect of the health system in South Africa, both in the public and private sector. He suggested that more awareness of telerehabilitation and scope of practice be made in South Africa as there is a huge gap in understanding among physiotherapists and other healthcare professionals.

The South African Telemedicine Association (SATMA) has identified telerehabilitation as an area for development in South Africa. Due to the "lockdown" due to Covid-19 in South Africa from the 26th of March 2020 at midnight and further being extended to adjusted alert level 1 from 1 October 2021, the need for telemedicine was highlighted for the treatment of patients by their health practitioners. The Health Professions Council of South Africa reiterated the ethical guidelines for practicing telemedicine (HPCSA, 2014) whereby a face-to-face relationship between the patient and the health practitioner needs to be established before the use of telemedicine.

This study aims to investigate the attitudes of physiotherapists on telerehabilitation and to understand the opinions of physiotherapists about the feasibility of telerehabilitation in South Africa. To do so, a questionnaire, The Modified Telerehabilitation Questionnaire (MTQ), was created by the investigator, using the previously validated Technology Acceptance Model (TAM) and the further adapted Physiotherapy Mobile Acceptance Questionnaire (PTMAQ).

The Technology Acceptance Model (TAM), created by Venkatesh and Davis (2000), asked questions that evaluated the perceived usefulness, perceived ease of use, behavioural intention to use, and usage behaviour (Venkatesh and Davis, 2000) of a specific group in terms of new technology (Blumenthal, Wilkinson, and Chignell, 2018). This standardized, generic questionnaire has been used to investigate attitudes towards technology adoption. The perceived usefulness (PU) and perceived ease of use (PEOU) were found to be the strongest determinants of behavioural intention to use (BI) a new technology, and the perceived ease of use (PEOU) affected the perceived usefulness (PU) directly (Wu, Wang, and Lin, 2007).

Building on the TAM; The Physiotherapy Mobile Acceptance Questionnaire (PTMAQ) was developed to create a suitable questionnaire for the investigation of physiotherapists' attitudes in Toronto, Canada. Therefore, adopting similar methods to the previously validated Physiotherapy Mobile Acceptance Questionnaire (PTMAQ), this study will exclude actual behaviour and intention to use technology immediately (Blumenthal, Wilkinson, and Chignell, 2018) because the use of telerehabilitation is not common daily practice in physiotherapy in South Africa.

Telerehabilitation was not a priority in the provision of therapeutic services because of the ease of face-to-face contact sessions. Communication between healthcare providers and patients was done at their consultations or via telephone and/or email. However, due to Coronavirus disease (Covid-19), health professionals were advised to limit face-to-face consultations, especially with high-risk patients. This decision, therefore, affected therapy programs and patients' well-being, as well as the broader aspect of the provision of services in the private and public healthcare sectors. These adverse effects prompted the Health Professions Council of South Africa (HPCSA) to permit virtual therapy sessions between health professionals and patients that they have previously assessed and treated in person. This shift in the provision of healthcare services has not been a smooth transition as there are no formalized courses on telerehabilitation, no specific legislation, and no change in the infrastructure to conduct telerehabilitation sessions at all health facilities.

There are various challenges that healthcare professionals are facing regarding the effective conduction of telerehabilitation services as well as the feasibility thereof at their facilities. As there is no literature to date reporting the use of telerehabilitation among physiotherapists in South Africa; the attitudes of physiotherapists regarding the use and willingness to conduct telerehabilitation is an important steppingstone to the implementation thereof. The feasibility of efficient and effective telerehabilitation sessions being conducted is based on the challenges faced by the health professional and their capabilities to conduct a session and the limitations of the health facility. Looking at these challenges in the pre-implementation stage will assist in overcoming all the barriers before successfully conducting telerehabilitation.

1.2 Problem Statement

Advances in clinical research and application of telemedicine and telerehabilitation are continuously being made overseas but very little thereof is currently seen in physiotherapy in South Africa (Mars, 2011). There is a plethora of studies, outside of South Africa, investigating the use of sensors (Bahadori, Immins, and Wainwright, 2018), mobile applications (Stütz et al., 2017), virtual reality (Corbetta, Imeri and Gatti, 2015), and other technological devices used in physiotherapy on various health conditions. However, very few studies have been reported in South Africa. The South African Society for Physiotherapy has acknowledged the use of telephonic support and video conferencing for students at universities, yet minimal is being utilized between practitioners and their patients (Mars, 2011). More research needs to be done regarding the reasons why this is currently happening, and possible suggestions need to be made for the application of technology in South Africa. Aside from that available through HPCSA (2014), more resources and education need to be put aside for health care providers to equip them with knowledge and skills that can be provided at reasonable costs.

1.3 Research question

What are the attitudes of physiotherapists regarding the use of telerehabilitation and their opinion of its feasibility of it in daily practice in South Africa?

1.4 Aim of the Study

To investigate the attitudes of physiotherapists and their opinions on the feasibility of telerehabilitation in daily practice in South Africa.

1.5 Objectives of the Study

1.5.1 To describe the demographic profile of physiotherapists working in South Africa.

1.5.2 To determine the attitudes of physiotherapists about the use of technology for rehabilitation in South Africa.

1.5.3 To determine the feasibility of using technology for rehabilitation in their daily practice in South Africa.

1.5.4 To establish a relationship between participants' demographics and their attitudes and feasibility regarding the use of technology for rehabilitation in South Africa

1.6 Significance of the Study

To contribute to South African research on telerehabilitation, with a focus on the attitudes and opinions of physiotherapists. Due to the current situation in South Africa (lack of resources and financial standing), telerehabilitation is not a priority in our health care system. However, with the devastating impact of Covid-19, the utilization of telerehabilitation has become important to limit the spread of disease while still providing therapy. The wider use of telerehabilitation will also improve the provision of therapeutic intervention to greater populations. This study is proposed to gain an understanding of the attitudes and opinions of physiotherapists and raise awareness of the possibilities of telerehabilitation both specifically for healthcare professionals, as well as the broader healthcare system. This study will contribute to the basis of literature in South Africa on telerehabilitation and promote further research and intervention to take place. Further research will raise awareness for clinicians and researchers to promote their skill development, practice in their daily therapeutic care, and allow for more advances in medical research.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

The purpose of this paper is to explain what telehealth is, how it may be delivered, and the use thereof both globally and locally, within South Africa. The growth within the international telehealth realm has demonstrated significant benefits to patients with varying health conditions, traditionally treated by physiotherapists. From virtual consultations, wearable sensors, smartphone applications, and more; patients have gained improved access to healthcare services; increased awareness and responsibility for their wellbeing, and have shown positive outcomes from the therapeutic interventions. As versatile and effective as telerehabilitation is, there are limitations and challenges such as lack of physical touch, differences in objective assessments, no hands-on therapy as well as the concern for privacy and confidentiality.

Physiotherapists have reported positive attitudes towards the use of telerehabilitation towards the assessment and treatment of patients overseas. However, no studies have reported the efficacy of telerehabilitation on the South African population and very few studies have investigated the attitudes and adoptive behaviour of physiotherapists practicing telerehabilitation in South Africa. It is observed that there is much advancement needed within South Africa's health system, before the success as not much literature has been published regarding the effectiveness of telerehabilitation on the South African population. The main challenges affecting the implementation of telerehabilitation will be outlined and what needs to be done for telerehabilitation to be feasible in South Africa.

To investigate the attitudes of physiotherapists in South Africa regarding telerehabilitation; the Modified Telerehabilitation Questionnaire (MTQ) was created and adapted from two previously validated questionnaires; the Technology Acceptance Model (TAM) and the Physiotherapy Mobile Acceptance Questionnaire (PTMAQ). All of these questionnaires assess the adoptive behaviour to new technology, with the focus on telerehabilitation for the MTQ and PTMAQ.

Search engines, such as PubMed and National Center for Biotechnology Information Search database, were sought through using keywords such as: "telerehabilitation", "telerehabilitation

in South Africa", "physiotherapy telerehabilitation" and "physiotherapy telehealth" to conduct the literature review.

2.2 Telehealth

Telehealth is considered an all-inclusive term that describes any form of remote therapy that encompasses telemedicine, telepsychology, telerehabilitation, and more. Telehealth encompasses preventative, curative, and promotional aspects of care, and is provided by numerous healthcare professionals (Cottrell and Russel, 2020). This remote therapy involves the use of telephonic and/or virtual platforms of consultation. Telehealth aims to provide health care services by improving access to the public while overcoming barriers such as travel, costs, Covid-19, and more (Cottrell and Russel, 2020).

Telehealth can be delivered synchronously and/or asynchronously in practice. Synchronous telehealth involves telephonic interaction via audio-only or audio and visual media and is a real-time interaction between the therapist and the patient, and/or a caregiver for the patient (Mechanic and Kimball, 2020). Asynchronous telehealth includes the sharing of information between the therapist and patient without live intervention; perhaps through WhatsApp/SMS/email discussions or telephone calls (Mechanic and Kimball, 2020). Hybrid telehealth (Cole, Pickard, and Stredler-Brown, 2019) includes both synchronous and asynchronous forms. Telerehabilitation is the delivery of rehabilitation services remotely to provide assessment, treatment, and education to promote health care and prevent further disability.

2.3 Use of telerehabilitation globally

Different modes of telerehabilitation have been employed for years all over the world to promote health and well-being. Heart rate monitors have been used since 1977 whereby Polar Electro created the first wireless electrocardiogram ECG heart rate monitor to assist the Finnish National Cross Country Ski Team with their training (Polar, 2017). Intensity training became more popular, and scales of personal wireless heart rate monitors were given to the public by 1983 (Polar, 2017). This has progressed to state-of-the-art fitness trackers that can track your steps, monitor your sleep patterns, and wirelessly connect to your smartphone. This enables one to access phone calls and SMSs as well. This ease of access to different measurements

increases one's self-awareness by monitoring different aspects of their health and motivates one to reach his/her fitness goal. If used in conjunction with physiotherapy; the physiotherapist may be granted access to the information and will therefore be able to continuously monitor the objectives and continue setting goals and further therapeutic interventions (Polar, 2017).

Ummels et al (2019) investigated the views of 29 participants who were patients under the treatment of a physiotherapist, diagnosed with chronic disease in the Netherlands. Chronic diseases included cardiovascular disease, chronic obstructive pulmonary disease (COPD), diabetes mellitus (DM), chronic pain (Lina et al., 2020), cancer, and osteoarthritis. The participants were recruited through purposive sampling from two physiotherapy practices and a rehabilitation center (Ummels et al., 2019). They wore an activity tracker for two to eight weeks while adhering to their physiotherapy program. It was shown that healthy adults (Maher, Ryan, Ambrosi and Edney, 2017) and the elderly (Fausset et al., 2013), were open to using activity trackers but they had expressed concerns regarding their technical skills and user experiences. If these concerns were addressed; the sustainability and feasibility of using the activity trackers could be improved. Participants also stated that they had perceived activity trackers to be expensive and required clear instructions on how to use them along with a clear prescription from their treating physiotherapist should be provided. The validity and reliability of the activity trackers were varied, and some activities completed by the participants were not measured, whereas other activities were picked up incorrectly by the trackers.

Wearable sensors have become affordable, portable, and effective in monitoring a wide variety of orthopaedic, neuromuscular, neurological conditions, and more (Porciuncula et al., 2018). These sensors allow for precise, objective measurements of movement disorders (Porciuncula et al., 2018), and due to them being portable and non-obtrusive; they can be worn in different environments while completing varied activities. This provides real-time data that can be accessed by the physiotherapist both synchronously and asynchronously for careful examination and the provision of continuous care. These objective measures include body orientation, motion, direction, and physiological state during movements (Hadjidj et al., 2013) that may guide rehabilitative activities for enhanced recovery.

A big focus in rehabilitation is enabling patients to walk after injury and disability. Gait is assessed in specific phases; therefore, force-based sensors can be installed into the patients' footwear to measure the interaction between their body and the surface they walk on (Rueterbories et al., 2010) as well as provide biofeedback to the patient during gait training (Owaki et al., 2016). This biofeedback has been clinically proven to improve balance, mobility, strength, and range of motion (Byl et al., 2015) under the guidance of the physiotherapist. Inertial measurement units (IMUs) can track neurological symptoms such as tremors (Delrobaei et al., 2018), dyskinesia, and bradykinesia (French et al., 2015), as well as disease progression (Mancini et al., 2015). The IMUs are self-contained devices that are made up of gyroscopes, accelerometers, and magnetometers, all combined to optimally measure different forces (Porciuncula et al., 2018).

Wearable sensors have tracked the physical movement of adults with knee osteoarthritis, and it was found that only 12.9% of men and 7.7% of women met the aerobic physical activity guidelines (Pondrom, 2011). A study included males and females, aged 45-79 years old with or at high risk of developing knee OA. They were a subcohort from the Osteoarthritis Initiative (OAI) (Dunlop et al., 2014). Individuals were excluded if they had rheumatoid or inflammatory arthritis; were concerned with their knees; were unable to undergo magnetic resonance imaging (MRI); or if they were pregnant (Dunlop et al., 2011). Other exclusions were if individuals were unable to provide a blood sample;were using an ambulatory aid for more than 50% of the time during ambulation; or had any comorbid conditions that might interfere with the ability to participate in the 4-year study (Dunlop et al., 2011).

Increased medial compartment loading has been shown to further the progression of medial tibiofemoral osteoarthritis (Bennell et al., 2011), and hence to reduce this; wearable sensors have been used to reduce the knee adduction moment during walking. A mean reduction of 14.2% of knee adduction moment was achieved using this biofeedback system (Dowling, Fisher, and Andriacchi, 2010). Audible signals can be set when abnormal gait patterns are measured and can hence cue the patient to adapt their movements accordingly (Porciuncula et al., 2018).

The use of technology in rehabilitation is meant to enhance the level of care provided by the physiotherapist; not replace it. The transmission of patients' clinical data to physiotherapists and feedback can reduce the amount of time and travel costs needed for follow-up appointments and hence patients can have improved access to physiotherapy services (Porciuncula et al., 2018). This is evident in Canada, where the goal of telerehabilitation is to increase geographical accessibility and quality of care for the older population (Marzano, Lubkina, and Stafeckis, 2016), and in Finland, telerehabilitation has improved economic barriers by reducing travel costs and time (Nyika, 2013).

Several services provided in Africa using telemedicine are being offered to patients ranging from neonatal, maternal and child healthcare, occupational health care, intensive care, and e-pharmacy, all the way to geriatric care (Chinye-Nwoko, Effiong, and Ani, 2020). These services have assisted in filling the void by bridging the gap of over 400 million people having little or no access to healthcare, whereby half of them living in rural areas have only a quarter of the number of doctors serving them (Chinye-Nwoko, Effiong, and Ani, 2020). Due to the poorly maintained roads and infrastructure in Africa, there is a high risk of motor vehicle accidents. In 2009, the overall road traffic injury rate in Nigeria was 41 per 1000 population, and mortality from road traffic injuries was 1.6 per 1000 population (Labinjo et al, 2009), which may be reduced using telehealth sessions in the comfort of their homes. Unfortunately, there are limitations in Africa that affect the delivery of telerehabilitation services, such as poor cellular networks and internet coverage, as well as unreliable electric supply (Chinye-Nwoko, Effiong, and Ani, 2020).

Telerehabilitation consultations are affordable to those in the middle and upper classes of the African population but are not for the other 40% of people in the lower financial class that are unable to access these services (Chinye-Nwoko, Effiong, and Ani, 2020). Another concern is that there is currently no regulatory body to oversee telehealth practice in Nigeria, including governmental bodies putting in place any policies or framework thereof (Chinye-Nwoko, Effiong, and Ani, 2020). There is a call for community leaders and health professionals to assist through a continuous learning approach (Chinye-Nwoko, Effiong, and Ani, 2020) to alter the negative perceptions of the patients in Nigeria to receive telerehabilitation services, as an adjunct to the typical face-to-face provision of healthcare services. Policies and legislation need to be developed to guide the provision of telehealth services in Africa and promote ethical and

evidence-based practice. There is a need for a union between the public and private sectors to combine and utilize resources for the delivery of telehealth.

2.4 Use of telerehabilitation in South Africa

Professor Mars conducted a literature review determining the extent and nature of telerehabilitation in South Africa and sub-Saharan Africa (Mars, 2011). Mars searched for all papers relating to telerehabilitation/ telemedicine and found 481 papers relating to telemedicine/ telerehabilitation in physiotherapy, occupational therapy, and speech therapy (Mars, 2011). Searches on Africa returned one paper, which was not relevant (Mars, 2011). After reviewing the papers, 101 papers met the inclusion criteria and of these none related to Africa (Mars, 2011). There was very little literature on telemedicine and telerehabilitation, which may have been due to researchers having difficulty publishing their work, or that telemedicine/telerehabilitation was not commonly practiced (Mars, 2011).

Mars (2011) simultaneously surveyed 21 heads of physiotherapy, occupational therapy, and speech therapy at eight universities in South Africa to determine the telerehabilitation activities in their departments (Mars, 2011). The survey contained 15 questions looking at the knowledge of telerehabilitation and considered the use of telephone, internet, fax, email, Skype, videoconferencing, computer program, robotics, and virtual reality (Mars, 2011). Six of the medical schools responded, constituting nine heads of the departments. The use of telephones for patient follow-ups and providing support to community service therapists were reported by four departments. One department supported patients via telephone, fax, and email (Mars, 2011). Skype was used to support research and communicate with community service therapists (Mars, 2011), and video conferencing supported staff and students. Reminders for group therapy were sent via SMS. None of the heads of departments reported internet-based instant messaging or chat, specialized computer software, computer games, specialized devices, robotics, or virtual reality for rehabilitation at a distance (Mars, 2011). There was a poor response from the heads of departments which limited the information gathered in Mars' study. Mars' survey demonstrated that there was very little telerehabilitation being practiced at the universities and showed that it was limited to telephone, fax, or email (Mars, 2011). Skype and videoconferencing were used between therapists. Mars did not question awareness in his survey but reported that awareness of telerehabilitation was key for successful implementation at the university level (Mars, 2011).

Rowe and Sauls (2020) conducted a cross-sectional, descriptive study on the use of mobile applications among 270 South African physiotherapists belonging to the Neuromusculoskeletal Physiotherapists Group (NMSPG), a special interest group of the South African Society of Physiotherapy (SASP) (Rowe and Sauls, 2020). They used a self-administered questionnaire with closed-ended questions to gather information on the use of applications currently used in South Africa and open-ended questions exploring their experiences using them. About 60% of the physiotherapists reported using mobile applications in their clinical setting for administrative tasks: the highest at 70% for retrieving information; 65% for setting reminders; 56% and 49% for communication with colleagues and clients, respectively (Rowe and Sauls, 2020). Only 38% had prescribed health-related applications mainly for exercise (Rowe and Sauls, 2020).

Applications used by physiotherapists for patients were investigated. The use of goniometer applications was found to be more reliable (Rowe and Sauls, 2020) than the actual goniometer (Milanese et al., 2014). However, there were setbacks such as the high price of smartphones needed to use these applications as well as the limitations that the application had regarding the expected anatomical landmarks hence the accuracy could be affected. Ninety-four out of the 270 participants were not prescribing applications due to the quality of applications as their usefulness and suitability for their patients were a concern (Rowe and Sauls, 2020). The physiotherapists also were not prescribing applications because they lacked the knowledge of which applications were appropriate for their patients and required further guidance thereof. The last outstanding reason for non-prescription regarded the need for the legislature for the physiotherapist and patient safety in the event of injury or harm to the patient (Rowe and Sauls, 2020).

Regulations and guidelines are lacking on how to use applications for physiotherapists and physiotherapy students hence the need for improved skills and awareness regarding health-related and medical applications are so important for the future of service provision. Concerns about patient privacy regarding the exchange of personal information have also been reported, and hence physiotherapists need to use password-protected applications or applications whereby data is encrypted. Without regulation and legislation on telerehabilitation; patients and physiotherapists may be at risk of being taken advantage of. Telerehabilitation software

and applications need to be physiotherapy-specific, evidence-based, relevant, and suitable for patient use.

Experiences reported by physiotherapists currently prescribing mobile applications explained how useful the applications were for their patients and that they improved patient compliance as well as goal setting (Rowe and Sauls, 2020). Younger patients and those more technologically inclined were reported as more receptive and excited to using applications as an adjunct to therapy but the need for a review of applications before prescribing them to patients is important. It is also noted that the physiotherapists felt that older patients may not be as open and as knowledgeable about using mobile applications, yet text reminders are beneficial for keeping appointments and completing their exercise programm (Lilje et al., 2017). Clinical applications may also be costly for the practitioner and hence when choosing appropriate applications, they need to be cost-effective as well. Raveneck and Alvarez (2016) have identified the need for an increased understanding of applications and mobile technology and that it should be taught in the undergraduate curriculums (Rowe and Sauls, 2020).

2.5 Telerehabilitation in Physiotherapy

2.5.1 Benefits of Telerehabilitation in Physiotherapy

Telerehabilitation has been spearheaded as a means of controlling the spread of Covid-19 and other infectious diseases in South Africa. It has been effective in doing so as there is no direct contact between health professionals and their patients. The patients attend virtual remote sessions in the comfort of their homes, limiting the amount of time and money spent on traveling to their health facility, hence making therapy more accessible (Dannhauser, 2020). The physiotherapist saves on time and travel as they conduct their sessions in their clinical settings or homes. Telerehabilitation enables the patient (and their caregiver) to be more proactive in their therapy as well as more accountable for the state of their condition. The patients in effect, treat themselves with the guidance of the physiotherapist, and hence this increases their self-awareness and self-efficacy. It is empowering and allows the patient to feel more involved in treating their symptoms. As the patient will be in their own home: the therapist may gain a better understanding of the facilitators and the barriers that the patient faces at home. It also allows for the therapist to educate the patient on how to use their space and objects at home to facilitate their healing (Rogan and Rogan, 2020).

Physiotherapists can conduct full subjective assessments via telehealth. A lot of the information gathered by the physiotherapists from patients guides the objective assessment and outcome-based tests needed to confirm the patient's condition and the treatment needed to address it. The communication between the physiotherapist and the patient must be clear and conducive to the goals of assessment and treatment. Physiotherapists can assess the patients' quality of movement, rate their pain, and deduce the contributing factors to the patients' condition. As the therapy will be virtual, there will be no hands-on assessment which does hinder the physiotherapists' judgment for palpation, as well as results in no hands-on treatment. Telehealth sessions are different and are an adjunct to face-to-face sessions; the treatments are more cost-effective and hence are more affordable to the public (Rogan and Rogan, 2020).

Various therapies can be administered online to patients via telerehabilitation. McKenzie exercises (McKenzie International, 2021) is an approach that allows for assessment and treatment of the axial and appendicular systems. It is also known as the Mechanical Diagnosis and Therapy (MDT) approach and is endorsed globally by practitioners and their patients. The physiotherapist prescribes and guides specific exercises to their patients to improve their well-being of the patient. Douglas Heel developed the "Be Activated System" that promotes an improved understanding and awareness of fascial lines and reflex points in the body. Physiotherapists can utilize this therapy program in all age groups as well as varying levels of fitness. This enables the patient to have better control of their body and change compensatory patterns (Physio, 2019). Brian Mulligan created self-mobilization techniques to treat back, neck, and other joint pain (Mulligan, 1994), which can be done safely and effectively by patients in the comfort of their homes. Clear and effective instructions from the physiotherapist are key for patients completing all these exercises and techniques safely and effectively.

Cryotherapy assists in reducing swelling, bruises, and painfully acute injuries. The physiotherapist can guide further on protecting and compressing the affected area, as well as demonstrating how to optimally elevate the joint to promote blood flow and reduce swelling (Bleakley, 2009). Thermotherapy provided by hot water bottles, bean bags, and other heat sources can be done at home to reduce neuromusculoskeletal pain with the guidance and precautions provided by the physiotherapist to prevent burns (Hurley and Bearne, 2008). Education is a vital component in therapy, both in normal face-to-face sessions, as well as

telerehabilitation sessions (Sluijs, 1991). An educational program is a good way to teach patients on different topics such as their condition, what was established on assessment, and what is required from their treatments to improve patients' efficacy as well as improve adherence to therapy.

A home exercise program (Jack et al., 2010) is important for the patient to do in between telerehabilitation sessions to promote the continuation of therapy and reduction of symptoms. Some barriers that affect the patient from adhering to exercise programs are low self-efficacy, low levels of physical activity, anxiety and/ or depression, stress, and most often pain (Jack et al., 2010). There are non-adherence rates as high as 50-70% in patients with lower back pain (Beinart et al., 2013). Introducing telerehabilitation and aids such as smartphone applications have shown to increase this adherence through means of motivation, reminders, as well as increasing accountability and goal setting (Gaikwad et al., 2016).

2.5.2 Barriers of Telerehabilitation in Physiotherapy

As beneficial as telerehabilitation is, there are limitations to using it in clinical settings. A big concern among physiotherapists is the omission of physical hands-on assessment and treatment due to the distance between the therapist and the patient. All information obtained during the assessment and treatment is dependent on the patient or caregiver's subjective feedback and the physiotherapist will be limited in their objective assessment.

There are technological limitations such as data and internet issues (Dannhauser, 2020). Data is costly and not everyone has access to a stable internet connection. A poor, unstable internet connection will interfere with both audio and video calls. Only secure, data-encrypted applications must be used for telerehabilitation sessions as this is meant to maintain privacy and confidentiality between the patient and physiotherapist.

The physiotherapist and the patient and/or caregiver should be the only participants present during the session to further promote privacy and confidentiality. The poor quality of the camera lens used on the technological device may hinder the clarity of the consultation. Smartphone devices and technological devices which enable video calling are pricey and not every patient has the means to purchase them. Ethical considerations should be adhered to;

therefore, informed consent should be granted at the beginning of each session (Health Professions Council of South Africa, 2014). Another limitation is regarding the lack of confidence physiotherapists report in their knowledge and skills in running telerehabilitation sessions, and which applications could be safely used (Rowe and Sauls, 2020). It is suggested that due to technological advances being made worldwide, in the field of healthcare, telehealth should be implemented and taught in the undergraduate syllabus at universities to equip future practicing physiotherapists (Rowe and Sauls, 2020).

2.6 Attitudes of health care professionals and patients

In Saudi Arabia, 347 physiotherapists participated in a study assessing their current knowledge, attitude, and barriers toward the implementation of telerehabilitation-based physiotherapy at various hospitals and centers (Aloyuni et al., 2020). Among 347 participants, 204 (58.8%) knew what telerehabilitation was, but only 110 (31.7%) reported that their clinical setting was equipped for telerehabilitation (Aloyuni et al., 2020). However, only 69 (19.9%) participants used telerehabilitation at their workplace. About 270 (80.7%) and 272 (78.4%) participants reported that telerehabilitation is reliable and valid in clinical settings respectively. Furthermore, 320 (92.2%) participants agreed that the implementation of telerehabilitation will improve the quality of health care.

Additionally, the number of participants using image-based telerehabilitation was the highest (10%), followed by sensor-based telerehabilitation (8.4%) and the least usage was virtual reality telerehabilitation (3%) (Aloyuni et al., 2020). The participants in the study scored highest in the general knowledge domain and more than 50% of them reported that telerehabilitation can be used at every stage of patient rehabilitation (Aloyuni et al., 2020). The participants reported utilizing telerehabilitation in assessment (17%), diagnosis (3%), prognosis (4%), intervention (6%), and follow-up (20%) (Aloyuni et al., 2020). The main barriers to the implementation of telerehabilitation in physiotherapy settings were technical issues (24%), staff skill issues (23%), high cost (22%) provider willingness (20%), and location of the health care institute (10%) (Aloyuni et al., 2020). In addition to these limitations, participants named the attitudes of policymakers, whereas very few participants thought that the lack of skilled healthcare staff and patient compliance factors hindered the use of telerehabilitation services (Aloyuni et al., 2020). The study found that most physiotherapists are knowledgeable about telerehabilitation (Aloyuni et al., 2020). They have a positive attitude

toward telerehabilitation and more than 50% of physiotherapists report telerehabilitation can be used for assessment, diagnosis, prognosis, treatment as well as follow-up (Aloyuni et al., 2020). They do, however, report that the usage and facilities are limited in achieving effective implementation of telerehabilitation (Aloyuni et al., 2020).

Attitudes of both physiotherapists and patients, towards telerehabilitation, were investigated in two descriptive survey studies in the United States of America (Saaei and Klappa, 2021). A questionnaire using both quantitative and qualitative questions was created to explore the extent of adoption of telerehabilitation, the applications and devices being used, and the challenges faced by physiotherapists (Saaei and Klappa, 2021). Of the 228 physiotherapists who responded, over 70% increased their use of telerehabilitation during the Covid-19 pandemic (Saaei and Klappa, 2021). Almost half of the participants reported the use of applications in their clinical setting and only 17% of the youngest participants (aged 20-25 years) reported using applications in their practice (Saaei and Klappa, 2021). Physiotherapists with 5-10 years of experience reported the highest frequency (60%) of using applications (Saaei and Klappa, 2021). Almost all participants gave their patients home exercises via applications (39%) and software (56%) (Saaei and Klappa, 2021). About 97% of physiotherapists incorporated virtual visits either daily or weekly, and 20% reported giving educational content to their patients. On reporting challenges with telerehabilitation, participants reported technology illiteracy of patients and the sharing of patient education and exercises (Saaei and Klappa, 2021).

There were 62 patients, from the outpatient population, who completed the survey regarding their experiences with telerehabilitation. From the results, 75% of participants usually felt heard and understood when speaking to their caregiver virtually (Saaei and Klappa, 2021). When looking at concerns regarding telerehabilitation, quality of care was reported to be more pertinent, followed by privacy, and friendly user experiences (Saaei and Klappa, 2021). The use of laptops was most preferred for telerehabilitation (65%). As challenging as it is for both physiotherapists and patients, using telerehabilitation, populations in the United States have been reported to have more positive attitudes toward telerehabilitation as well as the adoption thereof (Saaei and Klappa, 2021).

In contrast, a study was conducted on two hundred physiotherapy students from Obafemi Awolowo University in Nigeria who answered a self-administered questionnaire that assessed awareness, attitude, and expectations about telerehabilitation (Mbada et al., 2021). The majority of students were aware of telerehabilitation platforms (76.5%) due to school (61.4%) and lectures, workshops, and seminars (26.1%) being the main sources of awareness about telerehabilitation (Mbada et al., 2021). There was a significant association between the level of awareness of telerehabilitation and age ($X 2 = 22.312$; $p = 0.001$), but not with gender and class level (Mbada et al., 2021). One hundred and forty-three (71.5%) students reported that they felt comfortable with telerehabilitation applications. One hundred and forty-three (71.5%) students believed that telerehabilitation should be implemented in all hospitals, and 79% of the students believed that they could be more productive using telerehabilitation (Mbada et al., 2021).

However, many students (60.5%) reported that they will have a positive attitude towards telerehabilitation after witnessing reports of patients being treated by it, and one hundred and thirty-three students (66.5%) believed telerehabilitation can never replace face-to-face consultation (Mbada et al., 2021). Attitudes of students were grouped into positive and negative towards telerehabilitation. Many students (61%) reported negative attitudes toward telerehabilitation when compared with other modalities of treatment (Mbada et al., 2021). There was no significant association between the attitude towards the use of telerehabilitation and age and sex (Mbada et al., 2021). There was, however, a significant association between attitude to use telerehabilitation and the level of study of students. One hundred and sixty-six (83%) students reported that telerehabilitation should be included in the university curriculum and various academic platforms such as workshops, seminars, etc (Mbada et al., 2021). Nigerian physiotherapy students were reported to have moderate awareness and high expectations for future telerehabilitation applications. However, a larger number of them hold a negative attitude towards its use (Mbada et al., 2021).

Very little literature has been published regarding the attitudes of physiotherapists about telerehabilitation in South Africa. However, many of the participants belonging to the Neuromusculoskeletal Physiotherapists Group (NMSPG) (Rowe and Sauls, 2020) did not feel comfortable suggesting applications to patients to be used at home (Rowe and Sauls, 2020). This demonstrates the use of telerehabilitation is limited to administrative purposes and not

therapeutic use (Rowe and Sauls, 2020). On the other hand, participants who had educated their patients regarding relevant applications to patients found them to be useful as they stated that their patients were more compliant when setting goals or reminders (Rowe and Sauls, 2020). Concerns about the quality and personalization of the applications, as well as patient safety were factors considered for participants not prescribing applications for patients. Lack of knowledge about applications was also a contributing factor (Rowe and Sauls, 2020).

2.7 Feasibility of telerehabilitation in South Africa

On the 5th of March 2020, the first case of Coronavirus disease (Covid-19) was announced and had risen to 61 within the proceeding two weeks (Sekyere et al., 2020). A national state of disaster was then declared by South African president, Cyril Ramaphosa, and several measures were undertaken to contain the spread of the virus. Several governance structures were quickly put in place to manage the spread of this disease, including an inter-ministerial committee on Covid-19, an Emergency Operations Center, and a National Command Council chaired by the president himself (Sekyere et al., 2020). Unfortunately, the number of reported cases had still risen, leading the president, in collaboration with the National Command Council, to declare a 21-day national lockdown from 26 March 2020 to control the spread of the disease and its effects on South Africa's population (Sekyere et al., 2020). Hence, restricting the movement of people, practicing social distancing, and tracing all those who have been in contact with an infected person (all of which were being practiced globally to varying degrees) appeared to be effective ways of controlling the spread of the disease (Sekyere et al., 2020).

Several coronavirus helplines were established for an immediate response from the police, health service, rapid response to crime, fire service, and other service delivery needs of society. The Covid-19 pandemic has several diverse implications and impacts on South African society, including in the social, economic, health, environmental, and technological realms (Sekyere et al., 2020). There was an international travel ban and the denial of visas for anyone traveling from high-risk countries such as China, Italy, the United States of America, and others. Schools were closed nationally from Wednesday, 18 March 2020 to 18 April 2020 (Sekyere et al., 2020). There was a prohibition of large gatherings of people and increased testing of South African citizens coming from high-risk countries.

Equipment and facilities to test and isolate had to be increased as well as the demand for intensive care beds and equipment became greater. There was immense pressure on hospitals and clinics as the beds accommodated those infected with Covid-19, and the facilities had to be adapted to restrict entry and isolate those infected. Unfortunately, there were greater concerns in South Africa, such as the lack of water and sanitation facilities in a lot of areas which hinder many South Africans from following hygienic practices and drinking enough water. Many locations and rural areas do not have proper housing and are overpopulated in small, condensed areas which further affects the social distancing rule (Sekyere et al., 2020). Businesses in different sectors permitted their employees to work remotely instead of go into the workplace. Online learning at schools and higher education facilities were employed to continue academic progress. Universities had worked with data providers to enable students to learn from home and live stream classes, as well as submit work online.

On 26 March 2020, the Health Professions Council of South Africa encouraged the use of telemedicine and telehealth whereby health professionals could provide care to patients who have been previously assessed and treated face-to-face (Kwinda, 2020). Telemedicine and telerehabilitation including the use of applications and questionnaires, as well as performing a consultation without a doctor being present with the patient, were previously forbidden in South Africa, according to the HPCSA guidelines (Barit, 2019). This was because treatment provided by a health professional at a distance was not deemed an acceptable standard of care (Health Professions Council of South Africa, 2014). Health professionals now had the opportunity to use telehealth and telerehabilitation services for therapy, but no formal guidance, applications, or software was advised.

Health professionals had no prior formal training on how to conduct telehealth sessions therefore, their knowledge and skills on how to deliver effective care were limited. They were faced with an ethical dilemma of how to contribute to the national guidelines of self-isolation and social distancing and continue to be accessible to their patients (Kwinda, 2020). According to the HPCSA telemedicine guidelines (Kwinda, 2020), telepsychology is permissible without an established psychologist-patient relationship, whereas telehealth in other aspects of healthcare is only permissible where the practitioner and patients have established a face-to-face relationship. This limited health professionals as new patient assessments would still need to be face-to-face and due to the political and healthy climate, this was not advisable.

As different specialists and health professionals provide different forms of care; appropriate guidelines should be developed through the relevant professional organizations and associations (Mars and Jack, 2010). This will allow for specific standards to be created to stipulate the clear scope of practice, guidelines for assessment and therapy, ethical practices, and guidelines. As telehealth is a recent practice of care in South Africa, medical aids have had to realign their payment schedules accordingly and some are not covering telehealth sessions. There is no formal training at universities for telerehabilitation (Govender and Mars, 2018) and hence health professionals look to online courses and applications for guidance. South Africa's health system is suffering due to a lack of human and medical resources, poor infrastructure, a lack of funding, and a burden of disease. Telemedicine and telehealth could assist in reducing this impact on the health system and improve the accessibility of health care for the South African population; but advancement in this sector needs to take place with assistance from different shareholders.

For telehealth to form part of everyday practice, in various clinical settings; the feasibility thereof needs to be determined. This applies to both healthcare providers as well as their patients. The infrastructure for telecommunication needs to be in place and maintained for providing stable and strong signals so that telehealth sessions can occur seamlessly. Eskom (n.d.) provides electricity to South Africa and as a means of controlling the country from unplanned events that may lead to a total blackout, scheduled "load shedding" is done, which leaves areas without electricity for several hours. In addition, unfortunate events such as cable theft or tampered electrical equipment leads, ultimately affect the feasibility of telerehabilitation sessions being conducted.

In 1998, the South African Government launched Phase One of the National Telemedicine Project whereby teleradiology, tele-ultrasonography, telepathology, and teleophthalmology were involved (Gulube & Wynchank, 2002). It soon failed due to limited or no budgeting by the provincial Departments of Health, a lack of buy-in, limited bandwidth, and poor management (Mars, 2011). The project never progressed to the second and third phases due to poor funding and implementation. Regardless, there have been telemedicine projects implemented in several provinces through their departments of health and university medical

schools (Mars, 2011). In KwaZulu-Natal, teleophthalmology, teledermatology, telepsychiatry and tele-orthopedics are provided (Mars, 2011).

2.8 Tools used to assess the attitudes of physiotherapists

One of the factors contributing to the limited use of telerehabilitation in South Africa is the attitudes of physiotherapists towards the use of telerehabilitation in their daily practice. In the pre-implementation stage of telerehabilitation, it is important to understand what the physiotherapists' potential attitudes are regarding the use thereof and whether telerehabilitation will benefit or hinder their provision of services to patients residing in different parts of South Africa. This led to the focus on user acceptance of technology (Davis, 1989).

Davis (1989) looked at perceived usefulness (PU), perceived ease of use (PEOU), and user acceptance (UA) of information technology. To do this, an outcome measure was created to assess user acceptance using two six-item scales exhibiting a high convergent, discriminant, and factorial validity. Variables such as perceived usefulness and perceived ease of use were noted as fundamental determinants of user acceptance (Davis, 1989). Perceived usefulness (PU) is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989). Perceived ease of use (PEOU) is defined as "the degree to which a person believes that using a particular system would be free of effort" Davis (1989). PU is significantly correlated with both self-reported current usage and self-predicted future usage. PEOU is also significantly correlated with current and future usage. PU of information technology had a significantly greater correlation with user acceptance than PEOU (Davis, 1989).

Blumenthal, Wilkinson, and Chignell (2018) built on this Technology Acceptance Model (TAM) and adapted it to assess the attitudes of physiotherapists and physiotherapy students (Blumenthal, Wilkinson, and Chignell, 2018) regarding the use of mobile wearable technology (mHealth) in their practice (Blumenthal, Wilkinson, and Chignell, 2018). They aimed to explore this using a modified technology acceptance model questionnaire (Blumenthal, Wilkinson, and Chignell, 2018), called the Physiotherapy Mobile Acceptance Questionnaire (PTMAQ), which was administered online. About 76 participants were recruited in Toronto using snowball and convenience sampling (Blumenthal, Wilkinson, and Chignell, 2018). Blumenthal, Wilkinson, and Chignell (2018) found that perceived usefulness (Blumenthal,

Wilkinson, and Chignell, 2018) (PU) and perceived ease of use (Blumenthal, Wilkinson, and Chignell, 2018) (PEU) were related to early adoptive behaviour and there was no information suggesting that the demographic profile of the participants influenced the early adoptive behaviour. Ultimately, the participants' attitudes were positive about using mHealth in daily clinical practice. They also found that there was a gap in discerning the factors influencing the willingness to use technology in clinical practice.

The Physiotherapy Mobile Acceptance Questionnaire (PTMAQ) was developed using the Venkatesh and Davis version of the Technology Acceptance Model (TAM) and adapted it to suit the context of the use of mHealth in physiotherapy. A panel of experts in relevant fields assessed the questionnaire for face validity and comprehensibility (Blumenthal, Wilkinson, and Chignell, 2018). The questionnaire was then piloted on 12 physiotherapists from the same clinical facility in Toronto. The final version of the questionnaire, the PTMAQ, consisted of a set of demographic questions regarding the use of personal technology, along with 30 questions developed using the previously described method (Blumenthal, Wilkinson, and Chignell, 2018). The 30 questions consisted of 12 modified TAM items and 18 items relating to clinical variables for which mHealth technology could be recommended (Blumenthal, Wilkinson, and Chignell, 2018).

Numerous physiotherapists working in academia were consulted, leading to (1) overall activity level, (2) balance, (3) gait speed, (4) gait quality, (5) cognitive status, and (6) pain level, being used in their study (Blumenthal, Wilkinson, and Chignell, 2018). Each clinical variable had three variants: one covering measurements at a single point in time; one covering longitudinal measurements; and one dealing with practice items carried out by patients (Blumenthal, Wilkinson, and Chignell, 2018). In the final PTMAQ (Blumenthal, Wilkinson, and Chignell, 2018), the 12 modified TAM items in the questionnaire were simplified to investigate the effect of perceived usefulness and perceived ease (Davis and Davis, 1989) on use on early adoption (EA) and the effect of perceived ease of use (Davis and Davis, 1989) on perceived usefulness (Blumenthal, Wilkinson, and Chignell, 2018).

Blumenthal, Wilkinson, and Chignell (2018) framed their perceived use and intention to use questions in their questionnaire positively, as did Venkatesh and Davis (1989) with their TAM.

However, the perceived ease of use questions were viewed negatively to collect a conservative estimate of how usable their participants would find mobile or wearable technology (Blumenthal, Wilkinson, and Chignell, 2018).

Besides the demographic information, all other questions were answered using a five-point Likert scale; 1 strongly disagree, 2 disagree, 3 neutral, 4 agree, and 5 strongly agree (Blumenthal, Wilkinson, and Chignell, 2018). R statistical software) (R Foundation for Statistical Computing, Vienna, Austria) was used to assess all data (Blumenthal, Wilkinson, and Chignell, 2018). Partial least-squares path modeling (PLS-PM) was used to examine the appropriateness of the modified TAM model (Blumenthal, Wilkinson, and Chignell, 2018). Using the PTMAQ, observations were collected on the latent constructs of interest (Blumenthal, Wilkinson, and Chignell, 2018). Factor analysis was then used to create a revised set of constructs based on the correlations among the question items that were observed in their sample (Blumenthal, Wilkinson, and Chignell, 2018). The significance of path coefficients was assessed using two-tailed t-tests, and associated p-values were reported along with b-values (Blumenthal, Wilkinson, and Chignell, 2018).

Demographic information was not a predictor of early adoptive behaviour which went against the idea that the acceptance and use of new technology were much higher among the younger generation, who have grown up with the internet and smarter technology (Blumenthal, Wilkinson, and Chignell, 2018). Even though they had a greater proportion of students in their sample, it was found that there were no significant differences between the students and non-students, in the measured constructs or personal technology use (Blumenthal, Wilkinson, and Chignell, 2018). Perceived usage was found to be the strongest determinant of behavioural intention, whereas the PEOU indirectly impacted behavioural intention (Blumenthal, Wilkinson, and Chignell, 2018). PEU and PU both explained the variability in EA behaviour. Behavioural intention to use (BI) was significantly related to willingness to recommend (Blumenthal, Wilkinson, and Chignell, 2018) mobile or wearable technology (MWT) in the context of gait speed and in the context of gait quality and balance. But, the relationship betweem BI to pain and cognitive status was weaker (Blumenthal, Wilkinson, and Chignell, 2018). Physiotherapists regarded communication as an important aspect of their use of mHealth and that they have a positive attitude towards possible future use of mHealth in their clinical setting (Blumenthal, Wilkinson, and Chignell, 2018). The low rating of perceived use of

mHealth was noted and hence relevant training was to be initiated for physiotherapists to promote the use of mHealth (Blumenthal, Wilkinson, and Chignell, 2018).

There is no standardized tool to investigate the attitudes of physiotherapists about telerehabilitation in South Africa. Therefore, the researcher used literature and borrowed questions from existing tools to compile a questionnaire for this study. The finalized tool for this study adopted and modified questions from the previously validated Physiotherapy Mobile Acceptance Questionnaire (PTMAQ) (Blumenthal, Wilkinson, and Chignell, 2018) and Technology Acceptance Model (TAM) by Davis and Venkatech (2000) to suit the objectives of this study.

2.9 Conclusion

This literature is not intended to report on all the forms of technology used in telerehabilitation but to demonstrate the advances thereof and their benefits. There are limitations and barriers to the implementation of telerehabilitation in South Africa, including but not limited to, electricity outages and load shedding, lack of infrastructure, and internet access. There is a knowledge and skills shortage among physiotherapists as well as limited guidelines and legislature protecting health professionals and their patients regarding the use of telerehabilitation. Formal teaching is suggested in universities and improved regulation. Physiotherapists are successfully utilizing telerehabilitation globally and the positive outcomes of patients' conditions are evident. There is a need for telerehabilitation in South Africa; however, strategic plans need to be in place to improve the shortfalls preventing the implementation of telerehabilitation. The Modified Telerehabilitation Questionnaire created for this study aimed to get a better understanding of the attitudes of physiotherapists regarding the use of telerehabilitation in South Africa and the feasibility thereof.

CHAPTER 3: METHODOLOGY

3.1 Type of Study

The study was quantitative and cross-sectional. The researcher observed the exposure and outcomes of physiotherapists using telerehabilitation at one point in time. This type of research was used to describe the demographic profile of a group of physiotherapists practicing in South Africa and therefore, made inferences about possible relationships between them and their attitudes on telerehabilitation.

3.2 Participants

3.2.1 Source of Participants

The participants were sought by convenience sampling through the South African Society of Physiotherapy (SASP), both in the public and private sector via the SASP email. The SASP is an organisation that physiotherapists can voluntarily join. Even though not all physiotherapists practicing in South Africa are members of the SASP, the physiotherapists work in various settings all over South Africa. This would demonstrate a fair distribution of responses needed for the study. Each member of the SASP was emailed with the information about the questionnaire and was able to voluntarily answer the questionnaire through the link provided. Currently, there are 4291 physiotherapists registered with SASP (World Confederation for Physical Therapy, 2019).

Inclusion Criteria

- Physiotherapists from both public and private health sectors currently working in South Africa.
- Physiotherapists registered with the Health Professions Council of South Africa (HPCSA).
- Physiotherapists belonging to the SASP.

Exclusion Criteria

- Retired physiotherapists.

3.2.2 Sample Selection

A sample of convenience was used to recruit participants to the study. A Raosoft Statistical tool was used to calculate the sample size (Raosoft.com, 2016). According to the World Confederation for Physical Therapy country profile (2019), 4 291 physiotherapists belong to the SASP. The number of 353 physiotherapists needed to be included in the study as the study sample was estimated for SASP (Appendix A) with a 5% margin of error and 95% confidence level.

3.3 Instrumentation and outcome measures

3.3.1 Online questionnaire

Currently, there is no standardized tool to investigate the attitudes of physiotherapists about telerehabilitation in South Africa. Therefore, the researcher used the current literature and borrowed questions from an existing tool to compile a questionnaire for this study. The finalized tool for this study adopted and modified questions from the previously validated Physiotherapy Mobile Acceptance Questionnaire (PTMAQ) (Blumenthal, Wilkinson, and Chignell, 2018) to suit the objectives of this study. The PTMAQ was created to understand the attitudes of physiotherapists toward mHealth (Blumenthal, Wilkinson, and Chignell, 2018) and to use technology in their practice (Blumenthal, Wilkinson, and Chignell, 2018). The questionnaire was assessed for face and content validity (Blumenthal, Wilkinson, and Chignell, 2018), and comprehensibility by a panel of experts and later piloted among physiotherapists at a facility in Toronto, Canada. The questionnaire was built on the previously validated Venkatesh and Davis version of the Technology Acceptance Model (Venkatesh and Davis, 2000) which is a generic framework used across occupations. The PTMAQ consisted of 30 questions and used the following clinical variables: overall activity level, balance, gait speed and, quality; cognitive status, and pain level. Blumenthal, Wilkinson, and Chignell (2018) found that there are promising prospects for the adoption of mHealth in physiotherapy practice, but barriers remain.

The tool developed for this study, The Modified Telerehabilitation Questionnaire (MTQ) (Appendix B), had three sections: Section A consisted of four short questions based on the participants' demographic information. Section B consisted of 13 questions to assess the perceived usefulness (PU), Perceived Ease of Use (PEOU), and intention to use physiotherapists with telerehabilitation in the treatment of their patients. Each question was

rated on a Likert scale of "strongly disagree, disagree, neutral, agree, strongly agree". Section C investigated the feasibility of telerehabilitation in South Africa using three yes/no questions and the last question required a selection from the options provided.

After compiling the questionnaire, the researcher sent the tool to a panel of five experts in the field of physiotherapy to test for face- and content validity as well as comprehensibility. Once validated, the questionnaire was then piloted among 10 participants of the sample population.

3.4 Procedure

3.4.1 Pilot Study

Succeeding the creation of the questionnaire and its review by the experts, a pilot study was completed among 10 participants, to test the content and face validity of the questionnaire. Content validity refers to whether a tool completely represents the aims that it wishes to measure (Middleton, 2020). For the criteria of content, and validity to be met, these items needed to be validated. Similarly, face validity looks at the suitability of the content of the tool to its aims (Middleton, 2020). This testing was done to make sure there was no ambiguity in the questionnaire. The questionnaire was sent to the physiotherapists online via email and answered on the RedCap (Research Electronic Data Capture) tool hosted at the University of the Witwatersrand (Harris et al., 2009). The RedCap (Research Electronic Data Capture) tool is a secure web application for creating and managing online surveys (Harris et al., 2009). This pilot study followed the same data collection procedure as in the main study in 3.4.2 below. After data collection, the researcher analyzed the data as described below and included it in the main study.

3.4.2 Main Study

Before data collection commenced, the research protocol was sent to the Wits Faculty of Health Sciences Human Research Ethics Committee for ethical clearance (Appendix C). Once ethical clearance was received (M200946), the questionnaire was distributed via email by the SASP administrator to all its members. All participants were provided with the study information sheet detailing the purpose, objectives, and methods of the study (Appendix B). Participants consented to completing the questionnaire and participating in the study by going ahead and answering the questionnaire.

All participants were physiotherapists who answered the self-administered questionnaire through the RedCap tool, which was hosted at the University of the Witwatersrand (Harris et al., 2009). The raw data from the questionnaires were collected and tabulated using Microsoft Excel (Excel-easy.com, 2017).

Descriptive and inferential statistics were conducted to describe the participants' demographic profile, their attitudes to telerehabilitation, and the feasibility of telerehabilitation in their clinical settings. The raw data from the questionnaires were collected and tabulated using Microsoft Excel (Excel-easy.com, 2017). Thereafter, it was analyzed by the researcher on IBM SPSS Statistics for Windows, Version 21.0., with the assistance of the statistician. The following table outlines how the data were analyzed (as per the objectives):

Table 3.4.2.1: Data Analysis

Objectives	**Variables**	**Type of data**	**Analysis**
To describe the demographic profile of physiotherapists working in South Africa.	Independent: age, number of years in profession area of specialization, primary clinical setting	Nominal	Frequencies and percentages
To determine the attitudes of physiotherapists about the use of technology for rehabilitation in South Africa.	Dependent: perceived usefulness, perceived ease of use, willingness to use	Ordinal	Frequencies and percentages
To determine the feasibility of using technology for rehabilitation in their daily practice in South Africa.	Dependent: knowledge, awareness,	Nominal	Frequencies and percentages

	capacity, limitations		
To establish a relationship between participants' demographics and their attitudes and feasibility regarding the use of technology for rehabilitation in South Africa	Dependent: perceived usefulness, perceived ease of use, willingness to use, and knowledge, awareness, capacity, limitations	Nominal and Ordinal	One-Way ANOVA (analyses of variance)

3.5 Ethical Considerations

- This protocol was sent for ethical clearance to the Wits Faculty of Health Sciences Human Research Ethics Committee.
- Permission was gained from SASP as they distributed the questionnaire via their email.
- Informed consent was received from participants via the REDCap questionnaire after reading through the aims, objectives, and methods of the study and being accepted to participate in the study by completing the questionnaire.
- Autonomy: All participants suitable for the study participated voluntarily in the study. It was their choice to continue or stop participating at any stage without enduring any consequences or providing a reason for leaving. All participants fulfilling the inclusion criteria participated voluntarily. When answering the questionnaires, participants had the choice to choose the answers most applicable to them. The participant was welcome to withdraw from the study with no proceeding consequences. If the participant withdrew from the study prior to the completion of data collection, their data was removed and destroyed.
- Confidentiality: All participants' information was kept confidential and was only made available to the investigators. There were no identifying names of participants used in the study at any stage. Electronic data was password protected.

- Beneficence/ non-maleficence: There were no known risks to completing the questionnaire. The research study did not interfere with the treatment provided by participants. If a problem was detected during the questionnaires, it was reported to the health authorities. There were no costs incurred by the participants, although a stable internet connection was necessary to access the online questionnaire. There was no financial reimbursement to the participants. The study could have potentially benefited the participants in realizing their level of understanding of telerehabilitation and perhaps promoted further knowledge and skills courses for them to undertake on their own accord. Furthering their knowledge and skills would improve the treatment provided to their patients, hence improving the health outcomes of the greater society attending Physiotherapy.
- Justice: Every physiotherapist eligible and who consented to participate in the study was recruited. The above points were explicitly expressed in the informed consent form. Additionally, the participants were asked to verify that they understood the above points at the end of the informed consent form proceeding with the questionnaire.
- The participants may have access to a copy of the report upon request once the study was complete.

The above information agrees with the Declaration of Helsinki (World Medical Association, 2013).

CHAPTER 4: RESULTS

4.1 Introduction

All 356 participants completed the online questionnaires (100% response rate). Descriptive and inferential statistics were conducted to describe the participants' demographic profile, their attitudes on telerehabilitation, and the feasibility of telerehabilitation in their clinical settings.

4.2 Demographic profile

This study included 356 participants who completed the questionnaires. As indicated in Table 4.1, most participants were between the ages of 25-35 (170, 47.8%), working more than 20 years (101, 28.4%), mostly in orthopaedic manipulative therapy (137, 38.5%) and in outpatient practice (199, 55.9%).

Table 4.1: Demographic profile of physiotherapists in South Africa (*n* = 356).

Demographics	Categories	Frequency (n)	Percentage (%)
Age	18-24	40	11.2
	25-35	170	47.8
	36-55	103	28.9
	>55	43	12.1
Number of years in the profession	< 12 months	6	1.7
	1 - 4 years	96	27.0
	5 - 10 years	83	23.3
	11 - 20 years	70	19.7
	>20 years	101	28.4
Area of specialization	Neurology	45	12.6
	Orthopaedic Manipulative Therapy	137	38.5
	Paediatrics	28	7.9
	Sports	34	9.6
	Cardiopulmonary	40	11.2
	Other	72	20.2
Primary setting of clinical practice	Private hospital	71	19.9
	Outpatient practice	199	55.9
	Rehabilitation centre	27	7.6

	Public school	3	0.8
	Other	56	15.7

4.3 Attitudes of physiotherapists about telerehabilitation

Most participants agreed that telerehabilitation would encourage patients' participation in their rehabilitation programmes (197, 55.3%); would improve communication (179, 50.3%), and would be useful for monitoring patients' home programme and progress (236, 66.3%). There was an agreement among participants that telerehabilitation would improve access to treatment (205, 57.6) and improve health promotion 232(65.2). Less than half the participants believed that telerehabilitation would take a lot of extra time (163, 45.8%) and that they would require significant training before being comfortable with using it (135, 37.9%). Just about half of the participants indicated that telerehabilitation would limit their ability to assess their patients (175, 49.2%), as well as it will be difficult to teach patients how to use telerehabilitation (152, 42.7%). More than half believe that their treatment would be limited (196, 55.1%).

It was noted that 65 (18.3%) participants used telerehabilitation in their clinical settings. Only 148 (41.6%) participants agree and 18 (5.1%) strongly agree that they would be willing to use telerehabilitation in their clinical setting. Evidently, only 37.3% of participants thought that the South African population would be receptive to telerehabilitation.

Table 4.2: Attitudes of physiotherapists about telerehabilitation (*n* = 356)

Attitudes	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
	n (%)	n (%)	n (%)	n (%)	n (%)
Telerehabilitation would encourage patients' participation in their rehabilitation programmes.	3 (.8)	46(12.9)	81(22.8)	197(55.3)	129(8.1)
Telerehabilitation would improve communication between a physiotherapist and a patient.	5(1.4)	61(17.1)	76(21.3)	179(50.3)	35(9.8)
I would find telerehabilitation useful for monitoring patients' home programme and progress.	5(1.4)	19(5.3)	37(10.4)	236(66.3)	59(16.6)

Telerehabilitation would improve patient's access to treatment.	10(2.8)	26(7.3)	59(16.6)	205(57.6)	56(15.7)
Telerehabilitation would improve health promotion through home education.	3(.8)	16(4.5)	37(10.4)	232(65.2)	68(19.1)
I believe doing telerehabilitation in my clinical setting would take a lot of extra time to do my work.	3(.8)	75(21.1)	71(19.9)	163(45.8)	44(12.4)
I believe doing telerehabilitation would take significant additional training before I am comfortable with it.	18(5.1)	107(30.1)	68(19.1)	135(37.9)	28(7.9)
I expect that I will be limited in my assessment of patients using telerehabilitation.	5(1.4)	19(5.3)	24(6.7)	175(49.2)	133(37.4)
I expect that I will be limited in my treatment of patients using telerehabilitation.	1(.3)	26(7.3)	34(9.6)	196(55.1)	99(27.8)
I expect that it would be difficult to teach or coach my patients on the use of telerehabilitation.	3(.8)	82(23.0)	77(21.6)	152(42.7)	42(11.8)
I am currently using telerehabilitation in my clinical setting.	129(36.2)	125(35.1)	37(10.4)	52(14.6)	13(3.7)
I would be willing to try out the use of telerehabilitation in my clinical setting.	11(3.1)	40(11.2)	73(20.5)	148(41.6)	18(5.1)
I think the South African population would be receptive to telerehabilitation services.	19(5.3)	92(25.8)	116(32.6)	117(32.9)	12(3.4)

4.4 Telerehabilitation feasibility

Most participants thought that there was not enough knowledge (308, 86.5%) and awareness (262, 73.6%) about telerehabilitation but do have the capacity and resources to conduct telerehabilitation sessions in their clinical settings (227, 63.8%) (Table 4.3).

Table 4.3: Telerehabilitation feasibility (n = 356)

Knowledge, awareness, and resources in the clinical setting	Yes	No
	n (%)	n (%)
Do you think there is enough knowledge of telerehabilitation amongst physiotherapists in your clinical setting?	48(13.5)	308(86.5)
Do you think there is enough awareness of telerehabilitation amongst physiotherapists in your clinical setting?	94(26.4)	262(73.6)
Do you think that physiotherapists in your clinical setting have the capacity and resources to do telerehabilitation?	227(63.8)	129(36.2)

The five main limitations of telerehabilitation were: difficult assessment/treatment (256, 71.9%), technical issues (183, 51.4%), lack of telerehabilitation guidelines/standards (171, 48.0%), lack of knowledge and skill to conduct telerehabilitation services (168, 47.2%), and limited internet access (147, 41.3%).

Table 4.4: Limitations to telerehabilitation in the clinical setting (n = 356)

Limitations	n (%)
Lack of knowledge and skill to conduct telerehabilitation	168(47.2)
Lack of telerehabilitation guidelines/standards	171(48.0)
Lack of willingness to implement	127(35.7)
Limited access to the internet	147(41.3)
Limited access to electricity	82(23.0)
Limited access to technology	118(33.1)
Difficult assessment/treatment	256(71.9)
High cost to the clinical setting	57(16.0)
Technical issues	183(51.4)
Safety issues	96(27.0)
Maintenance and sustainability of technology	108(30.3)

4.5 Relationship demographics and attitudes

One-way ANOVA tests were done to investigate the possible differences in attitudes of the demographic profile of participants regarding the perceived usefulness, perceived ease of use, willingness to use, and knowledge, awareness, capacity, and limitations. The Bonferroni post hoc tests attempt to prevent data from incorrectly appearing to be statistically significant by making adjustments during the demographic profile comparisons.

In Table 4.5, the one-way ANOVA tests demonstrated significant differences between all specialisations regarding the expectation that it would be difficult teaching patients on the use of telerehabilitation ($F_{3,41}$ = 2,406; p = 0.037) as well as their current use of telerehabilitation in their clinical setting ($F_{3,41}$ = 2,238; p = 0.050). A significant difference was found between participants in the orthopaedic manipulative therapy (OMT) and neurology (p = 0.016) specializations. Table 4.7 shows that participants in the OMT disagreed that it would be difficult teaching their patients on the use of telerehabilitation and neurology specialization agreed that it would be. Participants in OMT had a more favourable attitude toward telerehabilitation.

Regarding clinical settings, shown in Table 4.8, there was a significant difference between participants working in outpatient practice and private hospitals in needing additional training before being comfortable with telerehabilitation (p = 0.05), teaching patients on the use of telerehabilitation (p = 0.009), and the current use of telerehabilitation in their clinical setting (p = 0.000). There were significant differences between all clinical settings regarding the training needed to comfortably use telerehabilitation ($F_{3,41}$ = 2,502; p = 0.042) and if it would be difficult teaching their patient on the use of telerehabilitation ($F_{3,41}$ = 5, 396; p = 0.000). There were significant differences between clinical settings currently using telerehabilitation ($F_{3,41}$ = 5,530; p = 0.000) as well as willingness to use telerehabilitation ($F_{3,41}$ = 2,503; p = 0.043).

When looking at the usefulness of telerehabilitation to monitor patients' home exercises and progress; Table 4.6 demonstrated a significant difference between participants practicing less than 1 year and more than 20 years (p= 0,029), as well as between 1-4 years and less than 20 years (p = 0,021). There was a significant difference between 1-4 years and 11-20 years (p= 0,021) considering the significant training needed before using telerehabilitation. Overall, there was a significant difference between all groups in training needed for telerehabilitation ($F_{3,41}$ = 4,162; p = 0.003), and monitoring home progress ($F_{3,41}$ = 2,784; p = 0.027). No significant effects of age were found.

Table 4.5: One-Way ANOVA of Demographic Profile of Participants

ANOVA

			Sum of Squares	df	Mean Square	F	Sig.
Years of Practice	I would find telerehabilitation useful for monitoring patients' home programme and progress.	Between Groups	9.705	4	2.426	4.162	0.003
		Within Groups	204.595	351	0.583		
		Total	214.301	355			
	I believe doing telerehabilitation would take significant additional training before I am comfortable with it.	Between Groups	12.900	4	3.225	2.784	0.027
		Within Groups	406.628	351	1.158		
		Total	419.528	355			
Specializations	I expect that it would be difficult to teach or coach my patients on the use of telerehabilitation.	Between Groups	11.711	5	2.342	2.406	0.037
		Within Groups	340.761	350	0.974		
		Total	352.472	355			
Clinical Setting	I am currently using telerehabilitation in my clinical setting.	Between Groups	14.987	5	2.997	2.238	0.050
		Within Groups	468.707	350	1.339		
		Total	483.694	355			
	I believe doing telerehabilitation would take significant additional training before I am comfortable with it.	Between Groups	11.631	4	2.908	2.502	0.042
		Within Groups	407.897	351	1.162		
		Total	419.528	355			
	I expect that it would be difficult to teach or coach my patients on the use of telerehabilitation.	Between Groups	20.418	4	5.105	5.396	0.000
		Within Groups	332.054	351	0.946		
		Total	352.472	355			
	I am currently using telerehabilitation in my clinical setting.	Between Groups	28.674	4	7.169	5.530	0.000
		Within Groups	455.020	351	1.296		

		Total	483.694	355			
	I would be willing to try out the use of telerehabilitation in my clinical setting.	Between Groups	8.576	4	2.144	2.503	0.043
		Within Groups	244.100	285	0.856		
		Total	252.676	289			

Table 4.6: Multiple Comparisons between Number of Years in the Profession

Multiple Comparisons between Number of Years in the Profession

Bonferroni

Dependent Variable	(I) 2. Number of years in the profession	(J) 2. Number of years in the profession	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
I would find telerehabilitation useful for monitoring patients home programme and progress.	<1 year	1-4 years	0.646	0.321	0.452	-0.26	1.55
		5-10 years	0.763	0.323	0.186	-0.15	1.67
		11-20 years	0.652	0.325	0.453	-0.27	1.57
		>20 years	0.964*	0.321	0.029	0.06	1.87
	1-4 years	<1 year	-0.646	0.321	0.452	-1.55	0.26
		5-10 years	0.0117	0.114	1.000	-0.21	0.44
		11-20 years	0.007	0.120	1.000	-0.33	0.35
		>20 years	0.318*	0.109	0.037	0.01	0.63
	>20 years	<1 year	-0.964*	0.321	0.029	-1.87	-0.06
		1-4 years	-0.318*	0.109	0.037	-0.63	-0.01
		5-10 years	-0.201	0.113	0.770	-0.52	0.12
		11-20 years	-0.311	0.119	0.091	-0.65	0.02
I believe doing telerehabilitation would take significant additional training before I am comfortable with it.	1-4 years	<1 year	-0.396	0.453	1.000	-1.68	0.88
		5-10 years	-0.203	0.161	1.000	-0.66	0.25
		11-20 years	-0.524*	0.169	0.021	-1.00	-0.05

		>20 years	-0.366	0.153	0.175	-0.80	0.07
	11-20 years	<1 year	0.129	0.458	1.000	-1.16	1.42
		1-4 years	0.524*	0.169	0.021	0.05	1.00
		5-10 years	0.321	0.175	0.666	-0.17	0.81
		>20 years	0.158	0.167	1.000	-0.31	0.63

*. The mean difference is significant at the 0.05 level.

Table 4.7: Multiple Comparisons between Area of Specializations

Multiple Comparisons between Area of Specializations

Bonferroni

Dependent Variable	(I) 3. Area of Specialization	(J) 3. Area of Specialization	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
I expect that it would be difficult to teach or coach my patients on the use of telerehabilitation.	Neurology	Orthopaedic Manipulative Therapy	-0.559*	0.170	.016	-1.06	-0.06
		Paediatrics	-0.407	0.238	1.000	-1.11	0.29
		Sports	-0.271	0.224	1.000	-0.93	0.39
		Cardiopulmonary	-0.425	0.214	.724	-1.06	0.21
		Other	-0.314	0.188	1.000	-0.87	0.24
	Orthopaedic Manipulative Therapy	Neurology	0.559*	0.170	.016	0.06	1.06
		Paediatrics	0.152	0.205	1.000	-0.45	0.76
		Sports	0.289	0.189	1.000	-0.27	0.85
		Cardiopulmonary	0.134	0.177	1.000	-0.39	0.66
		Other	0.245	0.144	1.000	-0.18	0.67

*. The mean difference is significant at the 0.05 level.

Table 4.8: Multiple Comparisons between Clinical Settings

Multiple Comparisons between Clinical Settings							
Bonferroni							
Dependent Variable	(I) 4. Primary setting of clinical practice	(J) 4. Primary setting of clinical practice	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
I expect that it would be difficult to teach or coach my patients on the use of telerehabilitation.	Outpatient practice	Private hospital	0.356	0.134	0.084	-0.02	0.74
		Rehabilitation centre	0.668*	0.199	0.009	0.10	1.23
		Public school	1.112	0.566	0.501	-0.49	2.71
		Other	0.404	0.147	0.064	-0.01	0.82
	Rehabilitation centre	Private hospital	-0.311	0.220	1.000	-0.93	0.31
		Outpatient practice	-0.668*	0.199	0.009	-1.23	-0.10
		Public school	0.444	0.592	1.000	-1.23	2.12
		Other	-0.264	0.228	1.000	-0.91	0.38
I am currently using telerehabilitation in my clinical setting.	Private hospital	Outpatient practice	-0.672*	0.157	0.000	-1.12	-0.23
		Rehabilitation centre	-0.088	0.257	1.000	-0.81	0.64
		Public school	-0.977	0.671	1.000	-2.87	0.92
		Other	-0.399	0.203	0.506	-0.97	0.18
	Outpatient practice	Private hospital	0.672*	0.157	0.000	0.23	1.12
		Rehabilitation centre	0.584	0.234	0.128	-0.08	1.24
		Public school	-0.305	0.662	1.000	-2.18	1.57
		Other	0.273	0.172	1.000	-0.21	0.76

*. The mean difference is significant at the 0.05 level.

CHAPTER 5: DISCUSSION

Due to the lack of studies investigating the use and feasibility of telerehabilitation in South Africa; this study focused on the attitudes of physiotherapists regarding their understanding and willingness to use telerehabilitation in their clinical settings. There are strides to be made in the pre-implementation stage of conducting telerehabilitation before telerehabilitation can become a standardized, holistic and common practice among physiotherapists in South Africa. The mixed reviews established by the participants indicate that much is needed to improve their perceived usefulness, perceived ease of use, and willingness to use telerehabilitation. The clinical settings in which the participants practice, have a great influence on their willingness to conduct telerehabilitation and whether it will be feasible for them. Improved knowledge and awareness among physiotherapists and their patients, clear guidelines for standardized practice, and better infrastructure would prove effective in rolling out telerehabilitation among physiotherapy settings in South Africa.

Times are changing globally, and with the increased utilization of technology, the health sector needs to upgrade its infrastructure, daily practices, and therapeutic devices used, to keep up with patient demands. The first wave of Covid-19 proved to change every single person's life and precautionary measures had to be put in place to limit the spread of the virus. President Cyril Ramaposa in association with the South African government, released regulations regarding the alert levels (South African Government, 2020) governing the population's movement. However, both the private and public sectors in South Africa were still affected by the burden of disease; hospitals were understaffed; did not have enough beds and equipment to accommodate all patients. All unessential operations were ceased and many health professionals had to close down practices due to patients not being willing to attend face-to-face sessions.

Patients suffered as they were unable to attend their regular therapy sessions and therapists had no way of continuing healthcare services. The Health Professions Council of South Africa was aware of this and hence released statements permitting the provision of telehealth services, in instances where face-to-face sessions were already established (Kwinda, 2020). This was a step in the right direction with increasing access to therapy for patients. However, no information or set guidelines were released to assist healthcare providers on how to navigate through the telerehabilitation sessions. No specific applications were suggested for telehealth where both

the patient and healthcare provider would be protected, in terms of confidentiality and privacy. Not all healthcare settings are equipped with internet and suitable devices, as well as skilled professionals with good computer literacy, which, therefore, puts them at a disadvantage in providing healthcare at a distance. It is at each health professional's discretion whether to use telehealth, how they would provide it (video sessions, smartphone applications, etc), and whether it was suitable for their patient base. This results in a lack of standardized telehealth practices and affects the willingness to continue the conduction of telehealth.

In Kuwait, similar circumstances occurred that pushed the need to explore telerehabilitation as an adjunct to continuing the provision of therapy. Barriers to implementing telehealth also included inadequate infrastructure, the lack of telecommunication devices, the lack of computer literacy, patient safety, and privacy, and the lack of regulations (Albahrouh and Buabbas, 2021). Albahrouh and Buabbas (2021) investigated the perceptions and willingness to use telerehabilitation of 273 physiotherapists in Kuwait during the Covid-19 pandemic (Albahrouh and Buabbas, 2021). They further explored the barriers hindering the effective implementation of telerehabilitation among physiotherapists (Albahrouh and Buabbas, 2021). Their cross-sectional study also employed a questionnaire but also included face-to-face interviews. Their questionnaire looked at the demographic profile of the physiotherapists, their technological background, their perception of telerehabilitation, their comfort with using it, their willingness to conduct telerehabilitation, as well as the barriers affecting the use of telerehabilitation (Albahrouh and Buabbas, 2021). These sections are similar to the variables focused on in the MTQ. The face-to-face interviews investigated the use of telerehabilitation in the departments, how it was used, the barriers and facilitators in the use of telerehabilitation, and what they thought was required to implement successful telerehabilitation sessions (Albahrouh and Buabbas, 2021).

There have not been any standardized questionnaires assessing the attitudes of physiotherapists on the use of telerehabilitation in South Africa and hence a previously validated questionnaire was used and modified to be suitable for this. The variables "perceived usefulness", "perceived ease of use" and "willingness to use" telerehabilitation, were used to determine whether the participants' attitudes were positive or negative. The responses specifically from the "perceived usefulness of telerehabilitation", demonstrated positive attitudes among physiotherapists practicing in South Africa, demonstrating that there is a place for telerehabilitation in the care of patients. Most participants agreed that telerehabilitation would encourage patients'

participation in their rehabilitation; be useful for monitoring their home program and progress, as well as improve communication between physiotherapists and their patients. It was evident that the participants believed that telerehabilitation would not take a lot of extra time to use, nor would they require significant training before conducting telerehabilitation. Telerehabilitation would increase patients' access to therapy. However, there were concerns that the assessment and treatment of patients would be limited. The limitations of assessment and treatment of patients using telerehabilitation is a global concern as almost half the participants indicated limitations with their assessments and more than half of the sample believed that their treatment would be limited in Toronto, Canada (Blumenthal et al., 2018).

According to the responses from the MTQ, most participants fell into the 25-35 age group, followed by the 36-55 age group; then the above 55 age group, and lastly the 18-24 age group. The study conducted by Blumenthal et al. (2018) included a smaller sample of 76 participants where most of them were aged older than 25 years old, followed by the 25-34 age group. The study had only 10 participants below the 45 age group which formed the least amount of participants. This indicates that most participants in both studies were more of/less similar ages. Whereas, in Kuwait, most of the participants were of an older age group; between 35-50 years old (Albahrouh and Buabbas, 2021).

When looking at the number of years in practice; most of the participants were practicing for more than 20 years, followed by 1-4 years and 5-10 years. Students from Toronto, Canada formed most of the sample included by Blumenthal et al. (2018) followed by physiotherapists practicing for more than 20 years. This study focused on the attitudes of physiotherapists currently practicing, which differs from Blumenthal et al. (2018) who based their study on the attitudes of physiotherapy students as well as qualified physiotherapists. The highest level of education among the students was a master's degree, followed closely by an undergraduate degree (Blumenthal et al., 2018). Another big difference between the findings was the primary clinical setting. In South Africa, most of the participants were working in outpatient practice, followed by private hospitals and rehabilitation centers. In Toronto, Canada, most of the participants were students so they could not account for their clinical setting. However, the closest second was the rehabilitation hospital (Blumenthal et al., 2018). Most participants worked in rehabilitation hospitals, followed by general hospitals, in Kuwait (Albahrouh and Buabbas, 2021). In the MTQ, the orthopedic manipulative therapy specialization took precedence over other specializations, specifically in the outpatient practice setting.

Because Blumenthal et al. (2018) were investigating the PU, PEOU, and willingness to use mHealth, there was important of the participants own a smartphone, wearown a wearable tracking device, and if so, which type of mHealth device. Besides one participant, the rest of the participants owned a smartphone and most wore wearable tracking devices, with it being a watch or a band (Blumenthal et al., 2018). This indicated that almost all participants knew how to use a device that could be used for mHealth with patients in Toronto, Canada. In Kuwait, similar questions were asked to gauge whether participants used a computer at work or if they used the internet and email (Albahrouh and Buabbas, 2021). The results showed much fewer physiotherapists are using technology at work: less than a third of the participants used the computer; very few used the internet and email at work (Albahrouh and Buabbas, 2021).

A very low proportion of physiotherapists are currently utilizing telerehabilitation in their daily practice as well as willing to use it in the future; therefore, receptiveness to telerehabilitation among physiotherapists in South Africa was rated poorly. These outcomes were opposite to the willingness to use telerehabilitation reported in Kuwait, whereby most of the participants were happy to use telerehabilitation to deliver physiotherapy (Albahrouh and Buabbas, 2021).

Significant differences were observed between all specializations, in South Africa, regarding the expectation that it would be difficult to teach patients about the use of telerehabilitation as well as their current use of telerehabilitation in their clinical settings. Participants in the OMT specialization disagreed that it would be difficult teaching their patients about the use of telerehabilitation, and the neurology specialization agreed that it would be. Participants in OMT had a more favorable attitude toward telerehabilitation.

Regarding clinical settings, there was a significant difference between participants working in outpatient practice and private hospitals in needing additional training before being comfortable with telerehabilitation, teaching patients about the use of telerehabilitation, and the current use of telerehabilitation in their clinical setting. There were significant differences between all clinical settings regarding the training needed to comfortably use telerehabilitation and if it would be difficult teaching their patients about the use of telerehabilitation. There were significant differences between clinical settings currently using telerehabilitation as well as willingness to use telerehabilitation.

When looking at the usefulness of telerehabilitation to monitor patients' home exercises and progress; there was a significant difference between participants practicing for less than 1 year and more than 20 years, as well as between 1-4 years and less than 20 years. There was a significant difference between 1-4 years and 11-20 years considering the significant training needed before using telerehabilitation. Overall, there was a significant difference between all groups in training needed for telerehabilitation and monitoring home progress. There were no significant effects of age found. Interestingly, Blumenthal et al. (2018) found that age, gender, years of experience, and clinical setting did not affect the early adoption of telerehabilitation among physiotherapists in Toronto, Canada.

Contrary to both South Africa and Canada, in Kuwait, a significant association was shown between age and willingness to use telerehabilitation (Albahrouh and Buabbas, 2021). Physiotherapists aged between 35–50 years old were more willing to use telerehabilitation than those who were less than 35 years old and those who were older than 50 years old (Albahrouh and Buabbas, 2021). There was also a significant association between professional rank and willingness to use telerehabilitation systems: the higher-ranked, senior physiotherapists were more willing to use telerehabilitation (Albahrouh and Buabbas, 2021). There were no associations found between willingness to use telerehabilitation and gender and nationality (Albahrouh and Buabbas, 2021). A significant association was also found between the use of technology and willingness to use telerehabilitation; whereby the more physiotherapists used the internet and email, the more comfortable they were with technology, and ultimately the more willing they were to use telerehabilitation (Albahrouh and Buabbas, 2021).

The lack of knowledge and awareness of telerehabilitation among South African physiotherapists calls for the integration of different governmental, and private stakeholders and teaching facilities to provide suitable courses to improve this so that more physiotherapists are knowledgeable about telerehabilitation, its uses, and its benefits thereof. More than half of the physiotherapists stated that they do have the capacity and resources to conduct telerehabilitation sessions in their various clinical settings; hence telerehabilitation would be feasible.

A further look at the feasibility of telerehabilitation in South Africa demonstrated five main limitations of telerehabilitation; difficulty with assessment and/or treatment, as previously mentioned, under perceived ease of use, and technical issues of the software or hardware used.

There is a lack of guidelines governing the practice of telerehabilitation and a lack of knowledge and skill to conduct telerehabilitation services. There are no accredited courses at the South African universities educating physiotherapy students and practicing physiotherapists at the postgraduate level about telerehabilitation, which would ultimately improve their comfortability with conducting telerehabilitation sessions. Limited internet access which would prevent telerehabilitation sessions from occurring, does constitute the fifth main concern regarding the limitations of conducting telerehabilitation. This concern would be addressed at the management level of the clinical settings as different internet options would be explored and utilized for the implementation of telerehabilitation. Similar barriers to the implementation of telerehabilitation were noted in Kuwait, ranking the top five being lack of connection between ICT experts and clinicians; lack of user-friendly software; lack of suitable training to practice, patient privacy and confidentiality of their data; and high cost of equipment (Albahrouh and Buabbas, 2021).

Overcoming the barriers to implementing feasible and effective telerehabilitation in South Africa is a great task, but it is possible. If therapists are feeling that their patient load is too great, schedules should be drawn up to separate patients seen face-to-face and those seen via telehealth. This will improve daily workflow and the efficiency of administration. A lot of therapists are not willing to conduct telehealth either due to a lack of knowledge and skill, or lack of belief in telehealth as an effective therapeutic modality; hence awareness and education are very important to dispel any doubts (Albahrouh and Buabbas, 2021). Regular educational sessions on the role of telehealth, how to use it, etc., should be conducted for the staff so that they could effectively educate their patients and thus utilize it. For patients that are elderly and not technologically inclined, awareness and education can be delivered during a therapy session and via bulletin boards and brochures in different health care settings (Albahrouh and Buabbas, 2021). Patients could also bring one of their loved ones or caregivers to be educated on telehealth and they could be present during the virtual sessions to assist them. Workshops on using technology in health care should be offered by physiotherapists to their patients to improve their digital literacy (Albahrouh and Buabbas, 2021).

If health professionals perceive telehealth to not be clinically useful, successful applications, websites and devices should be trialed to ensure their effectiveness and efficiency, and demonstrate their place in therapeutic care. In clinical settings where the infrastructure does not permit telerehabilitation, relationships with information connection technology (ICT)

experts should be established to set up suitable internet connection services and suitable devices. Relevant software or applications should be agreed upon between ICT and physiotherapists delivering telehealth with regular training sessions should occur to keep updated on the programs. Patient privacy and confidentiality are of utmost importance and should be prioritized with the type of software/ applications used, as well as who has access to it. The applications should be of high-quality security and user-friendly on compatible devices that physiotherapists and patients own (Albahrouh and Buabbas, 2021).

As there is a lack of guidelines, policies, and protocols for telehealth use among the broader healthcare system in South Africa, clinical settings and departments should draw up their own to manage and standardize the telehealth services they provide. The guidelines should protect both the telehealth provider and patients to ensure safe and effective therapy.

Telerehabilitation is not being widely used in South Africa but due to our current climate, other means of health delivery need to be implemented. It has been demonstrated that physiotherapists in outpatient practice, specializing in orthopedic manipulation are more willing to conduct telerehabilitation and have positive attitudes towards its usefulness and ease of use. If the barriers are reduced, and physiotherapists continue to become more aware and knowledgeable about telerehabilitation; their attitudes will improve and they will be more willing to conduct telerehabilitation and feel comfortable with conducting it.

Limitations of the Study

There are no validated telerehabilitation questionnaires in South Africa, hence the Modified Telerehabilitation Questionnaire (MTQ) was built from the Physiotherapy Mobile Acceptance Questionnaire (PTMAQ) (Blumenthal, Wilkinson and Chignell, 2018, and the validated Technology Acceptance Model (TAM) (Davis, 1989), with additional changes by the researcher. Using questionnaires that have not been validated causes bias in the responses; have no context or clearly defined purpose, and result in misleading and incorrect information. The questionnaire was not thoroughly tested for reliability. Therefore, it is not certain if the results would be reproduced if the research was repeated under the same conditions. The MTQ was assessed by a panel of five experts, each specializing in physiotherapy and research, which may have caused a bias in the quality of questions; hence therapists or specialists in telemedicine/ telerehabilitation should have been included as well. A recommendation for a validated and reliable readiness tool for a physiotherapist willing to conduct telerehabilitation should be

created to determine the possible limiting factors before implementation. The participants in this study were sourced from the SASP which caused a bias in the sample as most physiotherapists belong to the private healthcare sector. This limited the potential input from physiotherapists working in the public healthcare sector hence more input is needed from physiotherapists practicing in the public healthcare sector is needed to comment on their attitudes towards telerehabilitation. As the study was quantitative, there were no opportunities for further explanation or detail when participants answered the questions; therefore, future qualitative studies are suggested to gain a better understanding of the views on telerehabilitation.

Significance of this study

The adaptations made to the previously validated PTMAQ were suitable for investigating physiotherapists' attitudes to telerehabilitation in the South African context. This study contributes to South African literature on telerehabilitation and may act as a stepping stone for further investigation in the utilization of telerehabilitation in physiotherapy. This study has demonstrated the current use, willingness to use, and attitudes of physiotherapists on the use of telerehabilitation amongst a reasonable representation of physiotherapists practicing in South Africa. Serious consideration into the guidelines and policies governing telerehabilitation should be introduced to manage physiotherapy practices, physiotherapists, and patients. The inclusion of teaching formal telerehabilitation courses in South Africa would benefit physiotherapists and create standardization amongst telerehabilitation practices. Education would increase awareness, understanding, and ease of application amongst physiotherapists, as well as their patients, thus decreasing resistance to the use thereof in supplementation of face-to-face sessions. There is scarce literature on the use of telerehabilitation in South Africa. Research needs to be conducted on the feasibility of telerehabilitation in South Africa and the use thereof among the South African population.

CHAPTER 6: CONCLUSION

This study is one of the first to investigate the attitudes of physiotherapists on the use of telerehabilitation; however, further studies need to be conducted to examine the effectiveness of telerehabilitation in physiotherapy in South Africa. This study demonstrated that physiotherapists in South Africa do have a positive attitude towards telerehabilitation, but are not willing to conduct sessions due to the barriers previously outlined. Further training and legislation is necessary for physiotherapists to feel comfortable using it in their daily practice. Telerehabilitation is being widely utilized among physiotherapists globally; however, the same could not be said for physiotherapists in South Africa. Due to factors of physiotherapists, their clinical settings and their limitations, national issues, and non-specific legislation; the effective, efficient implementation of telerehabilitation may only be seen in years to come. The Covid-19 pandemic forced the Health Professions Council of South Africa to allow health professionals to conduct telerehabilitation sessions with patients as a means to continue therapy but maintain social distancing. Stakeholders in both the private and public sectors need to unite for the implementation of telerehabilitation to be successful and feasible long term. It is the hope that the awareness, knowledge, and skill to conduct telerehabilitation increase and increase therapists in South Africa so that use of telerehabilitation can become common practice.

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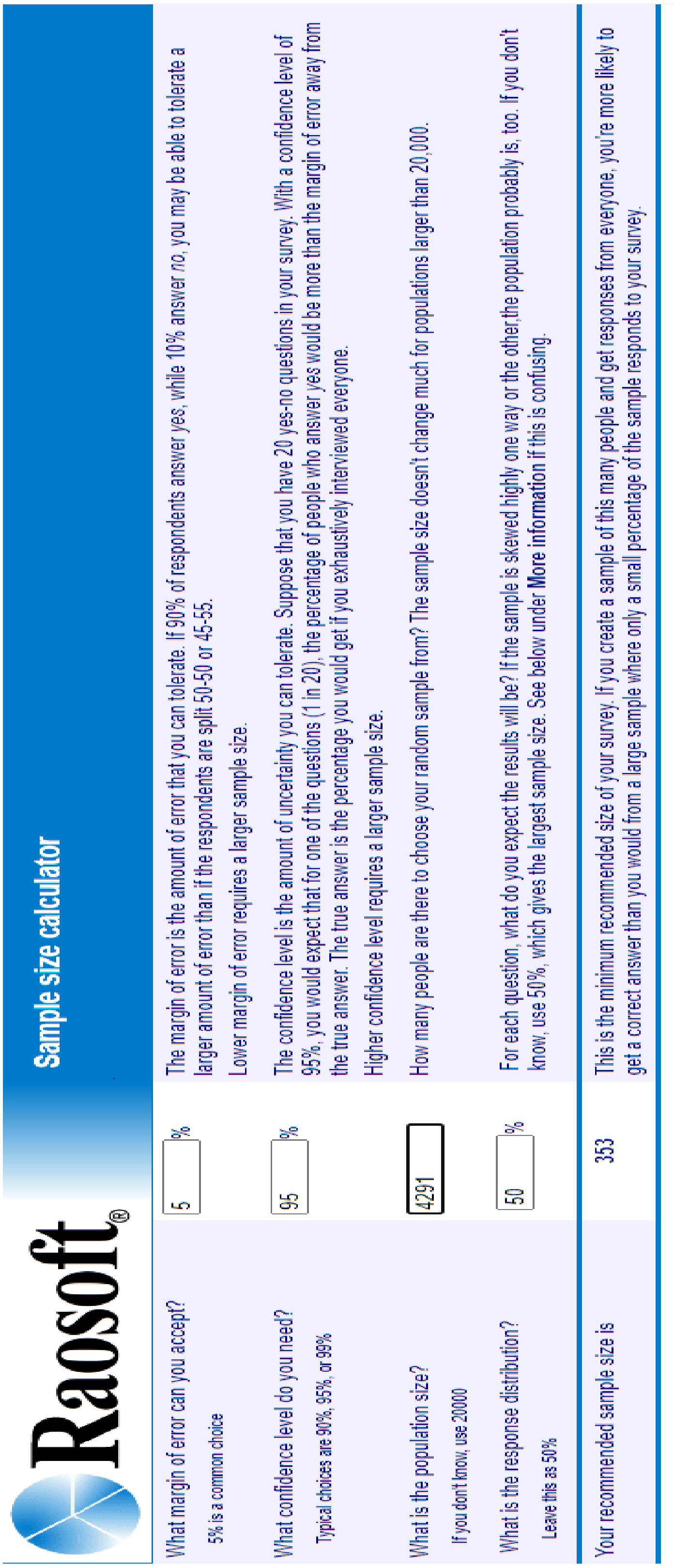
APPENDICES

Appendix A: Sample size calculation


Raosoft®

Sample size calculator

What margin of error can you accept? 5% is a common choice	5 %	The margin of error is the amount of error that you can tolerate. If 90% of respondents answer yes, while 10% answer no, you may be able to tolerate a larger amount of error than if the respondents are split 50-50 or 45-55. Lower margin of error requires a larger sample size.
What confidence level do you need? Typical choices are 90%, 95%, or 99%	95 %	The confidence level is the amount of uncertainty you can tolerate. Suppose that you have 20 yes-no questions in your survey. With a confidence level of 95%, you would expect that for one of the questions (1 in 20), the percentage of people who answer yes would be more than the margin of error away from the true answer. The true answer is the percentage you would get if you exhaustively interviewed everyone. Higher confidence level requires a larger sample size.
What is the population size? If you don't know, use 20000	4291	How many people are there to choose your random sample from? The sample size doesn't change much for populations larger than 20,000.
What is the response distribution? Leave this as 50%	50 %	For each question, what do you expect the results will be? If the sample is skewed highly one way or the other,the population probably is, too. If you don't know, use 50%, which gives the largest sample size. See below under **More information** if this is confusing.
Your recommended sample size is	353	This is the minimum recommended size of your survey. If you create a sample of this many people and get responses from everyone, you're more likely to get a correct answer than you would from a large sample where only a small percentage of the sample responds to your survey.

Appendix B: The Modified Telerehabilitation Questionnaire

Confidential

The Modified Telerehabilitation Questionnaire

Good day.

My name is Tylla Thomas. I am a Physiotherapy Master of Science student from the University of the Witwatersrand. I am inviting you to participate in this research project that will be supervised by Mr. Siyabonga Kunene.

I am conducting a study investigating the attitudes of physiotherapists currently practicing in both, public and private sector in South Africa on telerehabilitation. Telerehabilitation is the use of technological aids in the management of patients both in face- to-face sessions and remotely. It has been noted that telerehabilitation is not currently been widely utilized and hence this questionnaire aims to determine the attitudes of physiotherapists about telerehabilitation and to understand the opinions of physiotherapists about the feasibility of telerehabilitation in South Africa. The previously validated Physiotherapy Mobile Acceptance Questionnaire (PTMAQ) was created to understand the attitudes of physiotherapists toward mHealth and using technology in their practice in Toronto, Canada. It asks questions that assess the perceived usefulness (PU) of the technology, perceived ease of use (PEOU), behavioral intention to use (BI) and usage behavior of participants. The purpose of this study is to investigate the attitudes of physiotherapist on the use of telerehabilitation on daily practice in South Africa using a modified tool based on the PTMAQ, created by the researcher.

Your participation in this study is voluntary. You are consenting to participate in the study by proceeding to the questionnaire.

Please answer the following questionnaire which will take about 10-15 minutes to complete.

There are no known risks to you participating in this study. The study will not affect any treatment that you provide. If you wish to discontinue the questionnaire at any point, there will be no repercussions.

There will be no direct benefit to you however, I hope that the information obtained in this study may be used to decide if telerehabilitation in physiotherapy is feasible in the South African context. This study will determine whether physiotherapists in South Africa think that telerehabilitation can be used more widely among the physiotherapy specializations.

The responses to the questionnaires will remain anonymous. No identification of the participants will be on the questionnaire. The data gathered during the study will be saved in a password protected application that only the researcher have access to. The SASP will be mentioned in the study.

There will be no payment to the SASP nor the participants in this study.

If you have any questions at any time about the study, you may ask the researcher or Chairperson of the Human Research Ethics Committee (Medical) whose contact details are given below.

If you have any questions that we have not answered or if you have any problems with the study, please contact the investigator or Chairperson of the Human Research Ethics Committee (Medical): Ms. Tylla Thomas, Physiotherapy Master of Science Student at the University of Witwatersrand. Cell number: 0828577209 or by Email: 605990@students.wits.ac.za.
Professor CB Penny, Chairperson of the Human Research Ethics Committee (Medical) at the University of Witwatersrand, on telephone no. 011 717 2301, or by e-mail at Clement.Penny@wits.ac.za. Ms. Z Ndlovu or Mr Rhulani Mkansi, Committee Secretariat, telephone nos.: 011 717 2700 or 1234, or by e-mail at: Zanele.Ndlovu@wits.ac.za or Rhulani.Mkansi@wits.ac.za

Thank you!

Section A: Demographical Profile of Physiotherapist

1. Age	○ 18-24 ○ 25-35 ○ 36-55 ○ >55
2. Number of years in the profession	○ < 12 months ○ 1-4 years ○ 5-10 years ○ 11-20 years ○ >20 years
3. Area of Specialization	○ Neurology ○ Orthopaedic Manipulative Therapy ○ Paediatrics ○ Sports ○ Cardiopulmonary ○ Other
Please provide your area of specialization:	_____
4. Primary setting of clinical practice	○ Private hospital ○ Outpatient practice ○ Rehabilitation centre ○ Public school ○ Other
Please provide the clinical setting you work in:	_____

Section B: Physiotherapists' attitude towards telerehabilitation

Response scale: strongly disagree, disagree, neutral, agree, and strongly agree.

Perceived usefulness of telerehabilitation

1. Telerehabilitation would encourage patient's participation in their rehabilitation programmes.	○ Strongly Disagree ○ Disagree ○ Neutral ○ Agree ○ Strongly Agree
2. Telerehabilitation would improve communication between a physiotherapist and patient.	○ Strongly Disagree ○ Disagree ○ Neutral ○ Agree ○ Strongly Agree
3. I would find telerehabilitation useful for monitoring patient's home programme and progress.	○ Strongly Disagree ○ Disagree ○ Neutral ○ Agree ○ Strongly Agree

4. Telerehabilitaton would improve patient's access to treatment.	○ Strongly Disagree ○ Disagree ○ Neutral ○ Agree ○ Strongly Agree
5. Telerehabilitaton would improve health promotion through home education.	○ Strongly Disagree ○ Disagree ○ Neutral ○ Agree ○ Strongly Agree

Perceived ease of telerehabilitation use

6. I believe doing telerehabilitation in my clinical setting would take a lot of extra time to do my work.	○ Strongly Disagree ○ Disagree ○ Neutral ○ Agree ○ Strongly Agree
7. I believe doing telerehabilitation would take significant additional training before I am comfortable with it.	○ Strongly Disagree ○ Disagree ○ Neutral ○ Agree ○ Strongly Agree
8. I expect that I will be limited in my assessment of patients using telerehabilitation.	○ Strongly Disagree ○ Disagree ○ Neutral ○ Agree ○ Strongly Agree
9. I expect that I will be limited in my treatment of patients using telerehabilitation.	○ Strongly Disagree ○ Disagree ○ Neutral ○ Agree ○ Strongly Agree
10. I expect that it would be difficult to teach or coach my patients on the use of telerehabilitation.	○ Strongly Disagree ○ Disagree ○ Neutral ○ Agree ○ Strongly Agree

Willingness to use telerehabilitation

11. I am currently using telerehabilitation in my clinical setting.	○ Strongly Disagree ○ Disagree ○ Neutral ○ Agree ○ Strongly Agree
12. I would be willing to try out the use of telerehabilitation in my clinical setting.	○ Strongly Disagree ○ Disagree ○ Neutral ○ Agree ○ Strongly Agree

13. I think the South African population would be receptive to telerehabilitation services.	○ Strongly Disagree ○ Disagree ○ Neutral ○ Agree ○ Strongly Agree

Section C: Feasibility of telerehabilitation in South Africa

Response scale: yes/no

1. Do you think there is enough knowledge of telerehabilitation amongst physiotherapists in your clinical setting?	○ Yes ○ No
2. Do you think there is enough awareness of telerehabilitation amongst physiotherapists in your clinical setting?	○ Yes ○ No
3. Do you think that physiotherapists in your clinical setting have the capacity and resources to do telerehabilitation?	○ Yes ○ No

Please select the most applicable below. You may select more than one.

4. In your opinion, what could be the limitations to telerehabilitation in your clinical setting?	☐ A. Lack of knowledge and skill to conduct telerehabilitative services ☐ B. Lack of telerehabilitation guidelines/standards ☐ C. Lack of willingness to implement telerehabilitation in your clinical setting ☐ D. Limited access to internet ☐ E. Limited access to electricity ☐ F. Limited access to technology ☐ G. Difficult assessment/treatment ☐ H. High cost to clinical setting ☐ I. Technical issues ☐ J. Safety issues ☐ K. Maintenance and sustainability of technology

Appendix C: Ethical Approval

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

Office of the Deputy Vice-Chancellor (Research & Post Graduate Affairs)

TO: Ms T Thomas
School of Therapeutic Sciences
Department of Physiotherapy
Medical School
University

E-mail: tylathomas22@gmail.com

CC: Supervisor: Mr S Kunene <Siyabonga.Kunene@wits.ac.za>
and <HREC-Medical.ResearchOffice@wits.ac.za>

FROM: Iain Burns
Human Research Ethics Committee (Medical)
Tel: 011 717 1252

E-mail: Iain.Burns@wits.ac.za

DATE: 2020/11/02

REF: *R14/49*

PROTOCOL NO: **M200946** *(This is your ethics application study reference number. Please quote this reference number in all correspondence relating to this study)*

PROJECT TITLE: *Investigating the attitudes of physiotherapists to the use of telerehabilitation in South Africa*

Please find attached the Clearance Certificate for the above project. I hope it goes well and that an article in a recognized publication comes out of it. This will reflect well on your professional standing and contribute to the Government funding of the University.

M:\Word\2020\Iain\0007\Clearscan.wps

UNIVERSITY OF THE
WITWATERSRAND
JOHANNESBURG

R14/49 Ms T Thomas

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M200946

NAME: (Principal Investigator)	Ms T Thomas
DEPARTMENT:	School of Therapeutic Sciences Department of Physiotherapy Medical School University
PROJECT TITLE:	Investigating the attitudes of physiotherapists to the use of telerehabilitation in South Africa
DATE CONSIDERED:	2020/10/02
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Mr S Kunene
APPROVED BY:	Dr CB Penny, Chairperson, HREC (Medical)
DATE OF APPROVAL:	2020/11/02

This clearance certificate is valid for 5 years from the date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary on the 3rd Floor, Philip Tobias Building, Parktown, University of the Witwatersrand, Johannesburg.

I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to submit details to the Committee. **I agree to submit a yearly progress report.** When a funder requires annual re-certification, the application date will be one year after the date when the study was initially reviewed. In this case, the study was initially reviewed in **September** and will therefore reports and re-certification will be due early in the month of **September** each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature

4 November 2020
Date

Appendix D: SASP Approval

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NPO
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VAT No
4350268489

15 January 2021

Dear Miss Tylla Thomas

Thank you for your proposal " Investigating the attitudes of physiotherapists on the use of telerehabilitation in South Africa", protocol number: M200946 .

We grant permission to share your survey and we will do so via email to the SASP members on your behalf.

Regards;

Thamsanqa Ncube

National Operations Manager

Appendix E: Turnitin Report

Investigating the attitudes of physiotherapists about telerehabilitation and their opinions on its feasibility in South Africa by Tylla Thomas

ORIGINALITY REPORT

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