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The adoption of telemedicine by healthcare practitioners in South Africa

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Orientation: Telemedicine plays an important role in patient-centred healthcare, diagnosing and treating diseases and developing treatment plans. It includes both provider-to-provider and provider-to-patient communication, which can be synchronous (telephone and video) or asynchronous (messaging and electronic consultations).

Research purpose: The coronavirus disease 2019 pandemic sparked interest and awareness of telemedicine; however, there is a need to explore the adoption of telemedicine in the context of South Africa. This study examined South African healthcare practitioners' adoption of telemedicine using the Unified Theory of Acceptance and Use of Technology (UTAUT) model.

Motivation for the study: The adoption of telemedicine by healthcare practitioners in South Africa has not been extensively researched.

Research design, approach and method: A positivistic approach using quantitative methods of analysis was adopted. The target population was registered healthcare practitioners practising in South Africa and 96 healthcare practitioners participated in the study.

Main findings: The study established that the independent factors of Performance Expectancy, Facilitating Conditions, Social Media Technology and Attitude all have a significant positive relationship with the dependent factor, Behavioural Intention to adopt telemedicine.

Practical and/or managerial implications: The need for healthcare practitioners to be trained in telemedicine technology is an essential prerequisite for its adoption.

Contribution and/or value-add: Gender significantly influenced the dependent factor, behavioural intention to adopt telemedicine. Males rated the behavioural intention more positively than females. The theoretical contribution of the study is the extension of the UTAUT model for telemedicine adoption.

Keywords: healthcare; practitioners; telemedicine; UTAUT model; telemedicine adoption.

Introduction

The advancement of telecommunication technology combined with declining costs has fuelled a steady growth in telemedicine, which has been boosted by the isolation periods during coronavirus disease 2019 (COVID-19) (Mandal et al. 2024). As a result of the decline in face-to-face consultations, the use of telemedicine has increased exponentially (Bhaskar et al. 2020). Telemedicine includes healthcare services provided by using audio and video technology (Gajarawala & Pelkowski 2021). Healthcare services are provided, and information is exchanged by healthcare professionals with participants who are separated by geographical distance (Haimi 2023).

The practice of telemedicine, defined as healing from a distance, can be traced back to ancient Egypt. Hieroglyphics and scrolls were used to transmit information regarding health epidemics and diseases (Hurst 2016; Kichloo et al. 2020). Breakthrough inventions, such as the telephone and the typewriter, created a new form of information exchange between patients and medical professionals in the 19th century. The telegraph and telephone were used in wars to inform authorities of casualties and medical care. Telepsychiatry, using videoconferencing, was introduced in America with the introduction of television in 1950 (Zundel 1996).

The National Aeronautics and Space Administration (NASA) played a major role in the use and development of telemedicine (Hurst 2016). Astronauts in space and during spaceflight were medically monitored by physicians using telemedicine services (Banda 2021). Indian Health

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Services (IHS) used communication technologies to provide telemedicine services to a rural Native American tribe (Chen 2017; Shafi, Fortson & Iyer 2021).

National Aeronautics and Space Administration was part of many government-funded projects and provided medical support to many rural communities in America (Chen 2017). The introduction of the Internet in the 1990s changed the trajectory of telemedicine and made it more accessible worldwide (Haroon et al. 2022; Hurst 2016).

Sharing of medical images or scans, vital signs, video conferencing and audio became possible through the use of the Internet (Banda 2021). By the end of the 20th century, telemedicine services had expanded to include various specialities, such as anaesthesia, emergency medicine and surgery. The increasing adoption and proliferation of mobile and electronic technologies have led to the Internet becoming a critical component of healthcare delivery (Haroon et al. 2022). Electronic medical records allow medical history to be stored and accessed by both medical staff and the patient. This allows the patient to view results, reorder medications and consult directly with a physician. Advances in information technology (IT), digital technology and mobile technology have enabled the adoption and use of asynchronous and synchronous telemedicine (Banda 2021).

Telemedicine is an umbrella term that encompasses any medical activity involving an element of distance (Wootton 2001).

Problem statement

Telemedicine plays an important role in patient-centred healthcare in the diagnosis and treatment of diseases and the prevention and development of treatment plans. It includes both provider-to-provider and provider-to-patient communication, which can be synchronous (telephone and video) or asynchronous (messaging, electronic consultations), as well as virtual chatbots and wearable digital devices (Banda 2021). The WHO (World Health Organization 2010) supports the implementation of electronic health (e-health) services, health monitoring, research and education and considers it a cost-effective use of ICT technology (Albarrak et al. 2021). Nittari et al. (2022) noted that telemedicine is a potential solution to some of Africa's health needs; however, there are few successful and sustainable telemedicine operations on the continent.

Rahi (2021) claims that notwithstanding the recent surge in technology adoption studies and the benefits of telemedicine, researchers and healthcare practitioners have paid less attention to the adoption of telemedicine, which results in the problem statement for this study – the adoption of telemedicine among health practitioners in South Africa has not been investigated.

Research objectives

This article examines South African healthcare practitioners' adoption of telemedicine using the Unified Theory of Acceptance and Use of Technology (UTAUT) model, which was developed by Venkatesh et al. (2003). The objective of this article is to use the UTAUT model to examine the factors that influence the adoption of telemedicine by healthcare practitioners in a South African context.

The remainder of this article is structured as follows. Firstly, the introduction, problem statement and objectives are discussed. Secondly, a literature review of the factors that influence the adoption of telemedicine is presented. Thirdly, the research methodology is outlined. Fourthly, the survey results are presented and fifthly, managerial implications are elaborated. Sixthly, conclusions, recommendations from this study, the theoretical contribution to the UTAUT model and suggestions for future research are discussed.

Literature review

The definition of telemedicine is healing from a distance (Pereira 2022). The Greek word *tele* means distance and *mederi* is the Latin word for heal (Mahitha & Shamsuddeen 2021). Telemedicine refers to a spectrum of activities that provide healthcare at a distance. It can be defined as the use of technological resources and digital devices to access a patient and his or her health data and information to perform assessment, diagnosis, monitoring and initiate communication between healthcare providers and patients (Mbunge, Muchemwa & Batani 2022).

The use of telehealth and digital health platforms increased during the COVID-19 pandemic because of the implementation of physical distancing measures and restrictions (Bouabida, Lebouché & Pomey 2022). The pandemic accelerated the swift adoption and expansion of telehealth (Valencia-Arias et al. 2024). The development and advancement of information and communication technology (ICT) have changed the way people seek and consume healthcare information (Chen, Zhao & Wang 2020). The acceleration of artificial intelligence (AI), the fourth industrial revolution and the ongoing global pandemic have led to the advancement of telemedicine, which is necessary and has become an integral part of healthcare systems around the world (Schmitz, Díaz-Martín & Yagüe Guillén 2022).

The advantages of telemedicine include convenience, greater accessibility of care, reduced transportation barriers and costs, reduced wages and lost work time and patient empowerment (Powell et al. 2017). Barriers to telemedicine include technology and infrastructure, which depend on broadband access, mobile device use and knowledge of basic digital skills (Bhaskar et al. 2020). The lack of understanding and recognition of these factors can exacerbate digital inequality and disadvantage those who could benefit. These factors can be overcome through training, switching between in-person and online guidance, policy and regulatory changes, and addressing local and cultural differences in management strategies (Bhaskar et al. 2020; Stoltzfus et al. 2023).

The African continent has seen a sharp increase in the number of mobile phone users (Aworh 2021). The mobile sector in sub-Saharan Africa has been critical during the pandemic, keeping people and businesses connected. Since the onset of the pandemic, mobile phone penetration and use have increased on the continent (GSMA Intelligence 2019). Omboni et al. (2022) found that African countries had poor IT and poor communication technology infrastructure, resulting in social media and communication platforms (Skype, WhatsApp, Zoom, Teams, email, mobile phones and telephone) being the most commonly used methods to deliver healthcare services during COVID-19. These social media and communication platforms are emerging as a driving force for cutting-edge telemedicine that will revolutionise the healthcare industry and the way it operates (Mccool et al. 2022).

Advantages of telemedicine adoption

It is evident that COVID-19 accelerated the use of telemedicine platforms and was a lifeline during the pandemic, enabling healthcare practitioners to diagnose, care for and treat patients from all socioeconomic backgrounds worldwide (Sagaro et al. 2020). Research has shown that convenience and safety were the most important factors for telemedicine use during the pandemic (Bakshi & Tandon 2022). Reduced diagnosis time, shorter waiting times and lower costs were cited by researchers as factors influencing telemedicine adoption (Albarrak et al. 2021; Bhaskar et al. 2020). Telemedicine services can improve healthcare quality, save time and make it more affordable for people in need (Albarrak et al. 2021; Kaium et al. 2020). Social media and communication platforms such as Skype, WhatsApp and Zoom were frequently used by healthcare practitioners as a medium to consult with patients and colleagues (Montemurro & Perrini 2022; Omboni et al. 2022).

Challenges with telemedicine adoption

Because of the system's complexity, healthcare practitioners and patients feel challenged and are, hence, hesitant to use telemedicine services (Liu et al. 2020). Key challenges are discussed in this section.

Limited knowledge and awareness

The main challenges impacting telemedicine adoption are the lack of patients' awareness of telemedicine access, services offered and cost (Kichloo et al. 2020). The growth of telemedicine depends on how stakeholders, such as policymakers, healthcare professionals and patients perceive its importance. Stakeholders need to be adequately informed about telemedicine solutions and services to promote adoption (David et al. 2020). Dorsey and Topol (2016) not only confirmed these findings but also pointed out that many people who lack access to traditional healthcare services are elderly or lack education and may have difficulty adopting telemedicine solutions.

Infrastructural and technological challenges

The availability of certain technologies, such as the Internet, ICT infrastructure and constant power supply, is critical to the successful implementation of telemedicine. Critical disadvantages and challenges in telemedicine platforms are poor technological infrastructure, connectivity issues, unreliable power supply and access to the Internet (Thomas et al. 2022; Zobair, Sanzogni & Sandhu 2020). Mbunge et al. (2022) address the challenges they face, such as the high cost of telecommunication equipment, infrastructure and technological issues that hinder the adoption of telemedicine.

Organisational challenges

The ability to use and the simplicity of the technology are important aspects of this research. Telemedicine can be used as a strategic and useful tool in healthcare; however, it is highly dependent on the digital knowledge and skills of practitioners and patients (Mishra 2020; Vidal-Alaball et al. 2020). The lack of telemedicine education, digital literacy and training impacts the adoption of telemedicine (Bhaskar et al. 2020; Kichloo et al. 2020). Other organisational challenges include a lack of senior management commitment to telemedicine solutions, a lack of competency among medical professionals and ineffective planning (Luciano et al. 2020).

Insufficient funding

The Internet, ICT technologies and infrastructures are needed to enable telemedicine. Kruse et al. (2018) noted that start-up requirements for virtual healthcare solutions can become costly and some resource-limited facilities may not be able to afford and sustain virtual healthcare systems. Telemedicine may require the use of specialised equipment, which may be difficult to procure because of a lack of funding (Kumar et al. 2022). Ranganathan and Balaji (2020) supported these findings by examining the key predictors of telemedicine adoption. The authors concluded that telemedicine adoption is lower when expensive equipment is required.

Legal, ethical and regulatory challenges

Adepoju (2020) points out that there is a lack of active telemedicine and regulatory frameworks worldwide, which has exacerbated the lack of policies and regulations to support telemedicine applications. Kaliyadan et al. (2020) confirmed these challenges in their study, highlighting that regulatory frameworks, such as security, privacy and confidentiality were lacking or lacked clear guidelines. Winata and Dira (2022) support these findings, pointing out that inconsistent ethical guidelines and a lack of frameworks and guidelines for telemedicine hinder its adoption.

The adoption of telemedicine in South Africa

Telemedicine has existed in South Africa since 1991 and in 1998, the first advancement in teleradiology was made by the Department of Health (DOH) (Ewing & Holmes 2022). Although telemedicine has a long history in South Africa, its adoption by the healthcare system has been limited (Report 2020). A national telemedicine system and task force were developed by the DOH to support primary care in rural areas of the country (Ewing & Holmes 2022). The current healthcare system in South Africa can be described as a pluralistic

system that includes a government-funded healthcare system with salaried doctors and a private sector fee-for-service healthcare system (Ndlanzi 2021). The government-funded public health sector serves three-quarters of the population, while the private health sector is funded by individual contributions to medical assistance or insurance schemes (Nittari et al. 2022).

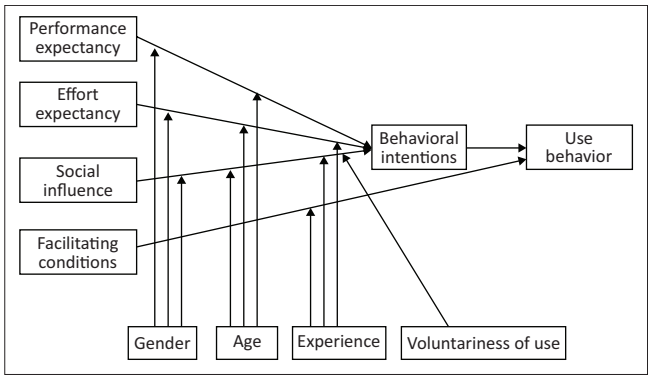
Telemedicine in South Africa is governed by the General Ethical Guidelines for Good Practice in Telemedicine, which is controlled by the Health Professions Council of South Africa (HPCSA) (Rabe 2022).

The HPCSA is the current statutory body created to oversee the education, training and registration of healthcare professionals. The council can also protect patients from malpractice and provide guidelines for healthcare providers (Report 2020). Prior to COVID-19, telemedicine was limited to clinical and educational services (Nittari et al. 2022). As a result, South Africans did not enjoy the full benefits of telemedicine, which include improved access to quality healthcare and greater equity (Report 2020). Telemedicine was introduced in the private sector during COVID-19 as a triage method (Nittari et al. 2022), because of partial relaxation of the telemedicine guidelines by HPCSA, which allowed virtual consults without a prior doctor–patient relationship (Townsend, Mars & Scott 2020).

Theoretical base

This study is based on the UTAUT model developed by Venkatesh et al. (2003). The UTAUT model is based on eight different existing acceptance models and theories that form a comprehensive acceptance model, which helps in predicting the usage, the intentions to adopt and use new technologies (Figure 1) (Al-Azzam, Alazzam & Khalid Al-Manasra 2019). Venkatesh et al. (2003) found four main factors that determine behavioural intention to use and adopt technology. These are performance expectancy (PE), effort expectancy (EE), facilitating conditions (FC) and social influence (SI).

Almegbel and Aloud (2021) reported that the UTAUT model has a greater descriptive capacity and explains 69% of technology adoption, while other theoretical models, such as the Theory of Planned Behaviour, Theory of Reasoned Action, Personal Computer Use Model and Social Cognitive Theory explained approximately 40%. The original UTAUT theory has been widely used in the study of user acceptance of health technologies and therefore formed the theoretical base for this study.



Source: Marikyan, D. & Papagiannidis, S., 2023, 'Unified theory of acceptance and use of technology: A review', in S. Papagiannidis (ed.), TheoryHub Book, viewed n.d., from https://open.ncl.ac.uk

FIGURE 1: Unified theory of acceptance and use of technology model.

The main factors (Figure 1) are key determinants of behavioural intentions to adopt telemedicine. These independent factors are discussed in the next sub-section.

Performance expectancy

Performance expectancy was defined by Venkatesh et al. (2003:447) as the 'degree to which an individual believes that using the system will help attain gains in job performance'. The authors pointed out that PE is the strongest predictor of intention, regardless of whether the setting is voluntary or mandatory and remains significant at all measurement intervals. Research by Alam et al. (2020) found a positive relationship between PE and behavioural intention to adopt mHealth services. Performance expectancy has been identified as an important factor in telemedicine adoption.

Effort expectancy

According to Venkatesh et al. (2003:450), EE is theorised as 'the degree of ease associated with the use of the system'. The Technology Acceptance Model, Model of PC Utilisation and Innovation Diffusion Theory were the three existing models used to formulate EE (Adenuga, Iahad & Miskon 2017). Effort expectancy represents user perceptions that telemedicine will be easy and effortless, suggesting that EE is significantly related to behavioural intention (Napitupulu, Yacub & Putra 2021). The work of Schmitz et al. (2022) highlights that EE is an important factor in the context of healthcare that directly influences intention. The lower the expectation of EE, the higher the intention to use it, which is related to the effort that would be required to complete an online consultation.

Researchers have found a positive impact of EE on technology adoption and see it as playing a key role in user intention to use telemedicine (Rahi 2021). The perceived ease of use and perceived benefits of telemedicine for both healthcare providers and patients have led to a positive move towards adoption (Anderson et al. 2022). Effort expectancy has been identified as an important factor in adopting telemedicine.

Facilitating conditions

Facilitating conditions can be defined as 'the degree to which an individual believes that an organisational and technical infrastructure exists to support use of the system' and has been hypothesised to be directly related to actual usage behaviour (Venkatesh et al. 2003:453). Blok et al. (2020) recognise that FC reduce perceived barriers to technology adoption such as support and assistance. Blok et al. (2020) also suggest that increased perceptions of access, availability of resources, knowledge and support increase adoption of new technology use. If technology users have access to a variety of help and

support services, the impact of FC is likely to increase (Venkatesh et al. 2003). Facilitating conditions were identified as an important factor in telemedicine adoption.

Social influence

The level at which a person perceives others important to them, such as family, friends or co-workers, when it comes to using IT is called SI (Siripipatthanakul et al. 2022). Social influence as explained by Venkatesh et al. (2003:451) is 'the degree to which an individual perceives that important others believe he or she should use the new system'. Almegbel and Aloud (2021) imply that social circles surrounding the user can contribute to user engagement and adoption of the new technology through the sharing of information and encouragement. Gu et al. (2021) and Shiferaw and Zolfo (2012) suggest that SI plays a significant role in the intention to adopt telemedicine. Social influence has been identified as an important factor in the adoption of telemedicine.

Social media technology

The availability of affordable mobile technology and cheaper data costs has increased access to Social Media Technology (SMT) in developing countries (Aworh 2021). Social Media Technology can be used for health education, disease control and monitoring and low-cost communication with healthcare providers and patients. They can have a greater impact on individuals and decision-makers than traditional media (Maitra & Rowley 2021). Commonly used social media and communication platforms for telemedicine consultations include FaceTime, Google Hangouts, Skype and Zoom, which provide an easily accessible and cost-effective option (Shafi et al. 2021). Maitra and Rowley (2021) concluded that WhatsApp can be used to promote health information and influence adoption.

The African continent has seen an exponential increase in the number of mobile phone users since the pandemic (GSMA Intelligence 2019). Mobile phones are considered more affordable and easier to use and therefore, it was important to add SMT as an extension to the UTAUT model. This was accomplished to contribute to the global adoption of telemedicine but from a South African context. Social Media Technology was identified as an important factor in telemedicine adoption.

Technology anxiety

Napitupulu et al. (2021) described technology anxiety (TA) as a person's fearful or emotional reactions when it comes to using technology. It reflects users' understanding of their capabilities and their eagerness to use telemedicine. Research by Aggelidis and Chatzoglou (2009) examined the relationship between anxiety and EE. They concluded that TA has a significant impact on behavioural intention to adopt telemedicine. The study conducted by Aggelidis and Chatzoglou (2009) suggests that increased anxiety leads to lower perceptions of telemedicine usability. It is important to investigate how users embraced telemedicine during the COVID-19 pandemic.

Previous studies (Dorsey & Topol 2016; Tsai et al. 2019) using the UTAUT model only provided reasons for end users to use a telemedicine system or device, without providing any context of the healthcare practitioners' knowledge and abilities when using technology. Therefore, in this study, TA was added as an extension to the UTAUT model to strengthen the model in a telemedicine context. Technology anxiety has been identified as an important factor in telemedicine adoption.

Attitude

Attitude (AT) can be defined as 'an intellectual and emotional unit that shows how people think, perceive and are inclined to act in relation to an event or object' (Shiferaw & Zolfo 2012:5). Their research also found that AT towards technology use had a positive significant impact on behavioural intention to adopt telemedicine. Zayyad and Toycan's (2018) research concluded that healthcare professionals' AT influences their intention to adopt and use virtual technologies in healthcare. This is consistent with the findings of Almegbel and Aloud (2021), Andriani and Berlianto (2022), Garavand et al. (2022) and Napitupulu et al. (2021), who identified AT as an important factor influencing telemedicine adoption.

Shiferaw and Zolfo (2012) noted that studies carried out in lower-income settings identified AT as a factor that influences the adoption of technology in the healthcare sector. Therefore, in this study, AT was added as an extension to the UTAUT model to strengthen the model from a South African context. Attitude was identified as an important factor in telemedicine adoption.

Demographics

Three demographic variables were tested in this study.

Age

In both the UTAUT and UTAUT-2 models, age is an important moderating variable when assessing the acceptance and adoption of new technologies (Venkatesh et al. 2003). Older people rely more on automatic information processing, which suppresses new learning (Venkatesh, Thong & Xu 2016). This means that as people age, their ability to learn and handle new technologies decreases (Schmitz et al. 2022). Research conducted by Zhao, Ni and Zhou (2018) on the factors influencing virtual health platforms has shown that age acts as a moderating variable in the healthcare environment.

Zhao et al. (2018) indicate that older people prefer easy-to-use technologies and find complex technologies difficult to use. The opposite was found to be true for younger people, who easily adopt and learn new technologies. Older users preferred the traditional form of face-to-face consultations during the COVID-19 pandemic and were unwilling to adopt alternative forms of healthcare (Pang et al. 2022).

Gender

Gender is used as a moderating variable in the original UTAUT and UTAUT-2 models (Venkatesh et al. 2003, 2016). The variable

is extensively studied in technology acceptance models; however, it can lead to contradictory results. Some researchers believe that differences between men and women are not because of a specific gender, but rather develop because of societal pressures and peer pressure. Schmitz et al. (2022) suggest that gender differences do exist and they impact the intention to adopt telemedicine. Mobile health usage in China was studied by Guo et al. (2015), who indicated that threat assessment (how a person views the seriousness of the situation) was related to gender and age while coping assessment (how a person responds to a situation) was better among men. A study by Zhang et al. (2014) concluded that men have a greater affinity for technology compared to women, as evidenced by higher adoption of telemedicine. Understanding the gender variable in healthcare in the digital age is critical to understanding how it is adopted (Zhang et al. 2014).

Profession

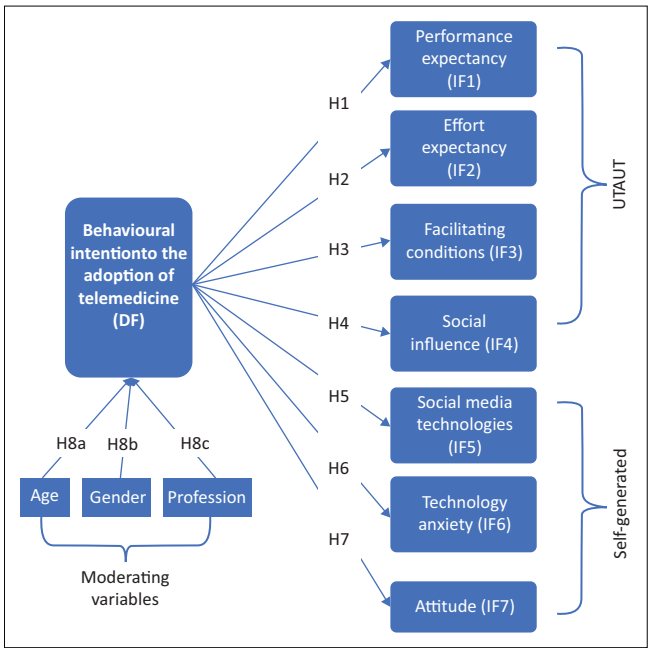
Profession, in this study, refers to the medical category of healthcare practitioner, because the healthcare sector has various specialities (Adenuga et al. 2017). The adoption of telemedicine was studied by Adenuga et al. (2017) who surveyed 252 healthcare workers in Nigeria and found that profession was a significant variable for EE, FC and SI. It is important to distinguish which professions or specialities are more likely to adopt telemedicine. The work of Garavand et al. (2022) noted that there are various types of telemedicine and each type has its own patients and certain factors that may influence its use. Telepsychiatry and telesurgery are very different and may require different infrastructure, tools and equipment. These differences can alter influencing factors (Garavand et al. 2022).

Demographic variables such as gender, age, profession, experience and voluntariness of use were used to enhance the effect of the seven primary key factors on behavioural intention (Venkatesh et al. 2003). The UTAUT 2 model was proposed by Venkatesh et al. (2016) and included some modifications to the existing UTAUT model and focussed mainly on customer adoption of technology.

In healthcare, several researchers (Pang et al. 2022; Rouidi, Elouadi & Hamdouneal 2022) have used the original UTAUT model. Research that includes TA, SMT and AT as independent factors for intention to adopt telemedicine in a South African context is limited, which is the reason for including these three factors in the proposed model to strengthen the novelty of the research and incorporate a UTAUT model for the healthcare sector. The hypothesised model, consisting of seven independent factors and three demographical variables that influence behavioural intention to adopt telemedicine, is presented in Figure 2.

Hypotheses and conceptual model

The following hypotheses were identified in this study that will be used to determine the independent factors that influence adoption of telemedicine:



Source: Adapted from Venkatesh, V., Morris, M.G., Davis, G.B. & Davis, F.D., 2003, 'User acceptance of information technology: Toward a unified view', *MIS Quarterly* 27(3), 425–478. https://doi.org/10.2307/30036540

UTAUT, Unified theory of acceptance and use of technology.

FIGURE 2: A hypothesised model of the factors that influence behavioural intention to adopt telemedicine.

H_1: *Performance expectancy* has a significant positive effect on the *behavioural intention to adopt telemedicine.*

H_2: *Effort expectancy* has a significant positive effect on the *behavioural intention to adopt telemedicine.*

H_3: *Facilitating conditions* have a significant positive effect on the *behavioural intention to adopt telemedicine.*

H_4: *Social influence* has a significant positive effect on the *behavioural intention to adopt telemedicine.*

H_5: *Social media technology* has a significant positive effect on the *behavioural intention to adopt telemedicine.*

H_6: *Technology anxiety* has a significant positive effect on the *behavioural intention to adopt telemedicine.*

H_7: *Attitude* has a significant positive effect on the *behavioural intention to adopt telemedicine.*

H_{8a}: *Age* has a significant positive relationship with the *behavioural intention to adopt telemedicine.*

H_{8b}: *Gender* has a significant positive relationship with the *behavioural intention to adopt telemedicine.*

H_{8c}: *Profession* has a significant positive relationship with the *behavioural intention to adopt telemedicine.*

Research methodology

A quantitative methodological paradigm and a positivistic philosophical framework were used to conduct this research. The target population for this study included registered healthcare professionals practising in South Africa. According to the HPCSA, at the time of the study, the were 28 000 registered healthcare practitioners in South Africa (Businesstech 2022). The researchers used the non-probability convenience sampling technique to recruit the respondents from the population.

An online survey was created using QuestionPro. The questionnaire was operationalised from the literature. Respondents had to select a specific option for each statement. The questionnaire was constructed as follows:

- Section 1: Demographics.

  This section asked for the respondent's demographic data, namely age, gender, profession or speciality and the healthcare sector in which the respondent currently works.
- Section 2: Measuring.
  It contained items used to measure the dependent and independent factors. A five-point Likert scale was used, which is an ordinal measure of respondents' opinions on various items. The Likert-scale, in this research, provided the following options for participants to choose from: 'strongly disagree' (1), 'disagree' (2), 'neutral' (3), 'agree' (4) and 'strongly agree' (5).

Respondents were informed that participation in the survey was voluntary and that no personal information was required. All responses were treated confidentially, and anonymity was assured. The uniform resource locator (URL) link was distributed to participants along with a cover letter indicating the nature and aim of this study. Participants were also informed that their information would be anonymous and confidential. The questionnaire was distributed through various social media platforms such as Facebook, LinkedIn and WhatsApp. The researchers used their networks to distribute the questionnaire. Printed copies of the questionnaire were left at various hospital canteens. A sealed and locked box was placed in the canteen with a compartment for participants to deposit their completed questionnaires, ensuring the anonymity of all participants.

The data were analysed by the university statistical consultant using descriptive and inferential statistics. The exploratory factor analysis (EFA) was further conducted and Table 6 shows the factors and items after EFA.

Ethical considerations

An application for full ethical approval was made to the Nelson Mandela University, Faculty Research Ethics Committee (Human) and ethics consent was received on 23 May 2022. The ethics approval number is H22-BES-BUS-046.

Results and discussion of the findings

The demographic profile of the respondents is illustrated in Table 1, and it shows that 79% of the responses (n = 75) were from KwaZulu-Natal (KZN). This is because the primary researcher resides in KZN (Durban) and has her own network in the medical field. The public (32%, n = 31) and private sectors (61%, n = 58) were well represented, with the private sector being more prevalent because of the accessibility of available telemedicine technologies and platforms. The different age groups were well represented, with most respondents (n = 62, 65%) belonging to the 26–35 and 36–45 age groups.

TABLE 1: Demographic profiles of respondents (N = 96).

Variable	*n*	%
Region (provinces)		
Gauteng	12	12
Kwazulu-Natal	75	79
Eastern Cape	3	3
Western Cape	6	6
Healthcare section		
Public	31	32
Private	58	61
Public and Private	7	7
Age (years)		
18–28	4	4
26–35	29	30
36–45	33	35
46–55	22	23
55–65	7	7
> 65	1	1
Selected professions		
General practitioner	16	17
Nursing	15	16
Optometry	12	13
Pharmacy	6	6
Psychology	8	8
Radiology	5	5

KZN, KwaZulu-Natal.

Telemedicine is better adopted and understood by younger age groups because they can learn to use the technology more easily than older age groups (Pang et al. 2022). Older age groups prefer the traditional form of consultations and are more resistant to change (Schmitz et al. 2022). The results show that both genders were well represented, with more females responding to the questionnaire (62%, n = 60). This is because of the large number of responses from the nursing and optometry profession. The nursing and optometry profession is a female-dominated field and this is indicated by the increased female responses received (Akella & Seay 2022).

Figure 3 shows the frequency of responses per profession or speciality within the healthcare industry. There was more than one respondent in general medicine, nursing, optometry, pharmacy, psychology and radiology.

Table 2 shows the frequency distribution for each social media application used for telemedicine. WhatsApp, Zoom, Facebook and Skype were the most used applications (Table 2).

Based on Cronbach's alpha, the reliability of each factor was determined. The measuring instrument proved to be valid and seven of the eight factors indicated excellent reliability and one indicated good reliability (Table 3).

Table 4 shows how high (positive) or low (negative) the respondents' answers were for each factor. The categories are based on the 5-point Likert scale, which was reduced

to a 3-point scale for reporting purposes. Performance expectancy and AT were the factors with the highest positive response rate. Both had a positive response rate of 85% (n = 82). Effort expectancy had the highest frequency of negative responses at 70% (n = 67). This indicates that the majority of users believe that telemedicine is not easy to use and requires more effort. The highest neutral responses for any factor were for SI.

Statistical analysis shows that there are four independent factors that influence Behavioural intention to adopt telemedicine and one moderating variable. Performance expectancy, FC, SMT and AT have a significant positive effect on the behavioural intention to adopt telemedicine. Furthermore, Pearson moment correlations indicate that these factors are all positively correlated with behavioural intention to adopt telemedicine. These factors have a statistical significance level of 0.05 (where $p < 0.0005$) and large Cramer's V values, which proves practical significance (Table 5).

Performance expectancy

The study showed that PE has a significant positive effect ($p < 0.05$, $V = 0.50$) and is positively correlated ($|r| = 0.726$) with behavioural intention to adopt telemedicine. This aligns with research carried out by Al-Azzam et al. (2019), Almegbel and Aloud (2021) and Schmitz et al. (2022). These findings showed that respondents will consider using telemedicine systems if they have a clear understanding of its importance and benefits for clinical diagnosis and management (Adenuga et al. 2017). Previous research in telemedicine adoption has shown a positive and significant relationship between PE and behavioural intention (Alam et al. 2020).

The positive and significant relationship that PE had on the behavioural intention to adopt telemedicine, indicates that healthcare practitioners, in this study, recognise that telemedicine is an important tool that can be used to carry out healthcare services (Ateriya et al. 2018). Management in healthcare facilities or institutions should start incorporating telemedicine frameworks and strategies to increase telemedicine adoption (Mbunge et al. 2022).

Facilitating conditions

The study showed that FC have a significant positive effect ($p < 0.05$, $V = 0.44$) and are positively correlated ($|r| = 0.471$) with behavioural intention to adopt telemedicine. The finding is consistent with Blok et al. (2020) and Napitupulu et al. (2021). These findings indicated that the role of FC was affirmed by respondents, suggesting that technical and IT support, adequate infrastructure and training programmes may be instrumental in influencing healthcare practitioners to adopt telemedicine (Hossain, Quaresma & Rahman 2019).

A study conducted by Rouidi et al. (2022) noted that FC had a significant influence on healthcare practitioners using

TABLE 2: Social media applications used for telemedicine (N = 96).

Application	*n*	%
WhatsApp	88	92
Zoom	39	41
Facebook	23	24
Skype	22	23
Instagram	18	19
Vula	5	5
Twitter	4	4
Teams	3	3
Viber	2	2
WeChat	1	1
Other	0	0

TABLE 3: Cronbach's alpha coefficients for the factors (N = 96).

Factor	Coefficient	Reliability
Performance expectancy	0.92	Excellent
Effort expectancy	0.87	Excellent
Social influence	0.84	Excellent
Facilitating conditions	0.88	Excellent
Social media technology	0.80	Excellent
Technology anxiety	0.75	Good
Attitude	0.94	Excellent
Behavioural intention	0.88	Excellent

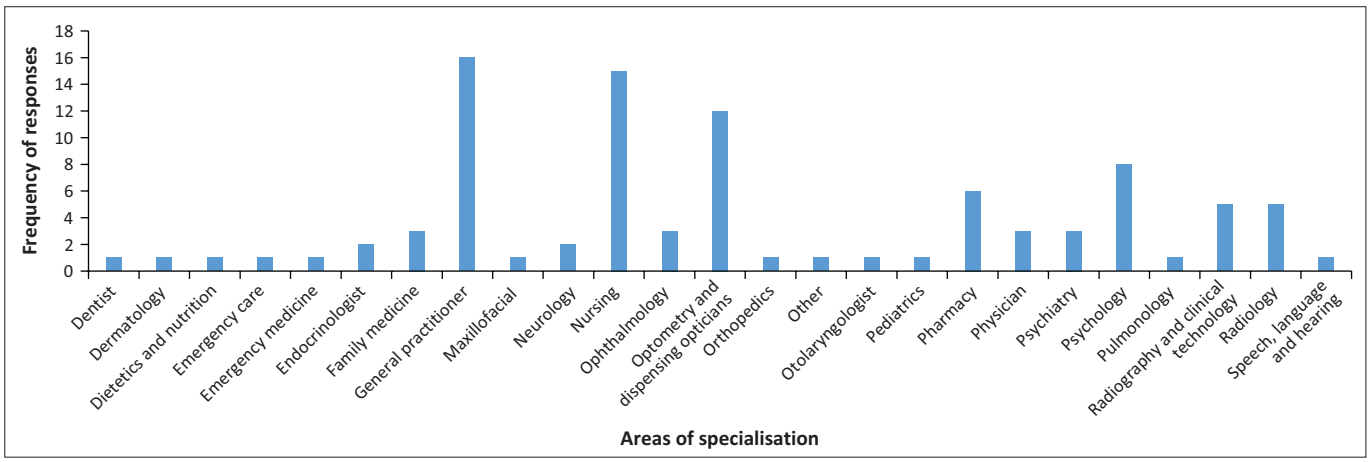


FIGURE 3: Frequency of responses per profession (N = 96).

telemedicine applications in Belgium. This was substantiated by Adenuga et al. (2017), who identified that Nigerian healthcare practitioners agree that organisational and technical support influence telemedicine adoption. Napitupulu et al. (2021) highlight that independent technical support will be essential in guiding healthcare practitioners when deciding to adopt telemedicine.

Management in both the public and private sectors needs to prioritise the necessary facilities such as, IT support, adequate infrastructure, connectivity and staff training, which are needed for telemedicine adoption. Training can be individual or group training. Individual training needs to include customising telemedicine technology for each particular speciality to help the practitioner integrate the system into their medical practice (Paré et al. 2022). Adequate feedback mechanisms need to be set up, which allow practitioners to log or query a problem and receive prompt feedback and solutions (Chin et al. 2022).

Social media technology

The study showed that SMT has a significant positive effect ($p < 0.05$, $V = 0.49$) and is positively correlated ($|r| = 0.658$) with behavioural intention to adopt telemedicine. The factor SMT was added to the UTAUT model to strengthen the novelty of the study and provide insight from a South African and developing world context. Research carried out by Maitra and Rowley (2012) and Shafi et al. (2021) suggests that social media technologies can influence the adoption of telemedicine. Mobile phone access and penetration in low-income countries have exponentially increased and focussing on social media technologies can result in better success in implementing telemedicine in resource-scarce countries (Shiferaw & Zolfo 2012). Healthcare facilities and institutions need to ensure that they invest in the infrastructure needed to implement the use of social media technologies to perform telemedicine services.

Because of the affordability of mobile technology and data costs, management in both sectors needs to identify that there is a growing mHealth platform in South Africa (Almegbel & Aloud 2021). The preference for telemedicine modality can be based on sociodemographic and economic factors (Shiferaw & Zolfo 2012). The results of this study identified that the social media application WhatsApp was the most preferred modality of telemedicine. This is in line with research by Maitra and Rowley (2021), Morris, Scott and Mars (2022) and Omboni et al. (2022) who identified WhatsApp as the most common method used. This could be because of the availability of mobile phones and expanding mobile communications networks (Shiferaw & Zolfo 2012).

The results further indicate that many practitioners used WhatsApp to conduct telemedicine consults. The HPSCA must re-evaluate their current telemedicine guidelines to include the use of WhatsApp as it is a low-cost affordable option between patient and provider (Morris et al. 2022).

TABLE 4: Frequency distributions: Factors ($N = 96$).

Factors	Disagree		Neutral		Agree	
	n	%	*n*	%	*n*	%
Performance expectancy	2	2	12	13	82	85
Effort expectancy	67	70	25	26	4	4
Social influence	29	30	46	48	21	22
Facilitating conditions	9	9	18	19	69	72
Social media technology	3	3	14	15	79	82
Technology anxiety	56	56	38	40	4	4
Attitude	2	2	12	13	82	85
Behavioural intention	6	6	31	32	59	62

Attitude

The study showed that AT has a significant positive effect ($p < 0.05$, $V = 0.55$) and is positively correlated ($|r| = 0.808$) with behavioural intention to adopt telemedicine. According to Venkatesh et al. (2003), PE is the strongest predictor of behavioural intention; however, the results of the analysis reveal that AT has a more critical role than PE. This was supported by Elsaie et al. (2022) and Shiferaw and Zolfo (2012). The rapid transmission of the COVID-19 pandemic has amplified healthcare professionals' AT towards adopting telemedicine (Shiferaw & Zolfo 2012), which could indicate why the respondents in this study had a positive AT towards telemedicine.

TABLE 5: Hypothesis testing.

Hypothesis	Hypothesis description	Chi²	*p*	Cramer's *V*	Pearson's *r*	Accept or reject
H_1	Performance expectancy has a significant positive effect on the behavioural intention to adopt telemedicine	48.23	< 0.0005	0.50 Large	0.726	Accept
H_2	Effort expectancy has a significant positive effect on the behavioural intention to adopt telemedicine	31.79	< 0.0005	0.41 Large	-0.505	Reject
H_3	Facilitating conditions have a significant positive effect on the behavioural intention to adopt telemedicine	37.46	< 0.0005	0.44 Large	0.471	Accept
H_4	Social influence has a significant positive effect on the behavioural intention to adopt telemedicine	8.26	0.083	n/a	0.333	Reject
H_5	Social media technology has a significant positive effect on the behavioural intention to adopt telemedicine	46.98	< 0.0005	0.49 Large	0.658	Accept
H_6	Technology anxiety has a significant positive effect on the behavioural intention to adopt telemedicine	6.82	0.145	n/a	-0.136	Reject
H_7	Attitude has a significant positive effect on the behavioural intention to adopt telemedicine	57.50	< 0.0005	0.55 Large	0.808	Accept

Three of the seven hypotheses were rejected. The accepted hypotheses are discussed in this section.

Garavand et al. (2022) and Shiferaw and Zolfo (2012) noted that AT was the main determinant of behavioural intention to adopt telemedicine in lower-income countries. This could indicate why many respondents in this study had a positive AT towards telemedicine. The findings in this study also indicate a practical and statistical relationship between the independent factors, AT and PE ($p < 0.05$, $d = 0.34$). This suggests that healthcare facilities and institutions should invest in improving healthcare professionals' knowledge, skills and changing perceptions, which can result in an increased level of AT towards adopting telemedicine.

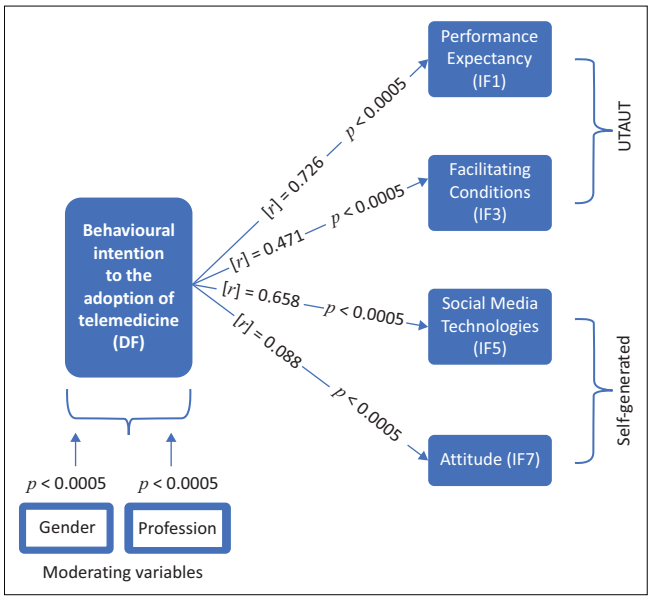
Demographical variables

Univariate ANOVA statistical analysis was performed to determine whether there was a relationship between respondents' demographics and factors related to behavioural intention to adopt telemedicine. The results show a statistical ($p = 0.020$) and a small practical significant difference (Cohen's $d = 0.41$) that the public sector ($\mu = 4.35$) estimates the PE in telemedicine higher than the private sector ($\mu = 4.04$). This could be because of the patient overload and lack of resources that the public sector is currently facing and it considers telemedicine as a tool for relief (Bhamjee et al. 2022).

The post hoc results show a statistical ($p = 0.000$) and a large practical significant difference (Cohen's $d = 0.92$) that the public sector (μ: 3.41) scores more positively than the private sector (μ: 2.60) on SI. This is because of the fact that the public sector has started to adopt telemedicine solutions as a resource to improve workflow, patient education and access to healthcare (Morris et al. 2022). The post hoc results show a statistical ($p = 0.023$) and a medium practical significant difference (Cohen's $d = 0.55$) that the private sector (μ: 3.95) is more positive about the FC than the public sector (μ: 3.49). This is because the private sector has better access to the technologies, infrastructure and resources needed for telemedicine (Ndlanzi 2021).

The univariate results of ANOVA indicate that there is statistical and practical significance between gender and behavioural intention to adopt telemedicine with $p = 0.033$ and Cohen's $d = 0.54$. As a result of the strong evidence, it is concluded that gender has a significant positive influence on behavioural intention to adopt telemedicine. The post hoc results show a statistical ($p = 0.004$) and a medium practical significant difference (Cohen's $d = 0.51$) that males (μ: 4.26) rated SMT more positively than females (μ: 3.88). This could be because men have a greater affinity for technology compared with women (Zhang et al. 2014). Finally, regarding *Gender* and *behavioural intention*, the results show a statistical ($p = 0.033$) and a medium practical significant difference (Cohen's $d = 0.54$) that a higher number of males (μ: 4.14) rated *behavioural intention* more positively than females (μ: 3.64). The demographic factor of *Gender* was found to have a significant influence on the dependent factor, *behavioural intention*.

The model of factors influencing behavioural intention to adopt telemedicine is presented in Figure 4.



UTAUT, unified theory of acceptance and use of technology.

FIGURE 4: A model for behavioural intention to adopt telemedicine.

Exploratory factor analysis

Exploratory factor analysis has two main objectives, namely, to determine the number of factors influencing the factors and to measure the strength of the relationship between each observed factor (Auerswald & Moshagen 2019). Eigenvalues are a technique used to determine which items to retain (Shrestha 2021). The minimum factor loading deemed significant at the $p = 0.05$ level was 0.558 for the sample size ($n = 96$) in agreement with Hair et al. (2006). An Eigenvalue above 1 is used as a guide to determine the number of factors per construct.

Table 6 indicates a summary of the results after the EFA. The items that remained after EFA are presented in the table. The Cronbach alpha, Eigenvalues and the percentage variance explained are included in Table 6.

Managerial implications

The following managerial implications have been identified.

Set strategic directives and objectives

To establish strategic guidelines, the identification of bottlenecks experienced by the South African healthcare system during the COVID-19 pandemic should first be assessed. Telemedicine systems need to be re-evaluated rather than replicated on a virtual platform and healthcare infrastructure and systems need to be analysed to determine whether they can support a long-term telemedicine strategy. Management in healthcare facilities or institutions should start incorporating telemedicine frameworks and strategies to increase telemedicine adoption (Mbunge et al. 2022).

Technological recommendations

Developers of telemedicine applications and systems should design a simple, user-friendly and cost-effective system that

TABLE 6: Summary of results after exploratory factor analysis.

Factors and items	Factor loading	Cronbach alpha	Eigenvalue	Variance (%)
IF1: Performance expectancy	-	0.92	3.911	76.2
Using telemedicine increases my chances of meeting my needs	0.903	-	-	-
Using telemedicine increases the capability to manage health	0.885	-	-	-
Telemedicine increases my productivity	0.868	-	-	-
Telemedicine could enhance the level of convenience in accessing healthcare services	0.858	-	-	-
I find telemedicine a useful tool	0.850	-	-	-
IF2: Effort expectancy	-	0.87	3.732	62.2
Learning how to use telemedicine is easy for me	0.860	-	-	-
My interaction with telemedicine is clear	0.831	-	-	-
It is easy for me to become skillful using telemedicine services	0.819	-	-	-
I find using telemedicine simple	0.807	-	-	-
Telemedicine saves me time	0.718	-	-	-
I don't foresee any problems using telemedicine	0.683	-	-	-
IF3: Social influence	-	0.84	3.097	61.9
My family/friends think I should use telemedicine	0.831	-	-	-
My colleagues think I should use telemedicine services	0.820	-	-	-
People who use telemedicine are more prestigious than those who do not	0.782	-	-	-
I feel obligated to use telemedicine in order to comply with social expectations	0.767	-	-	-
Management think I should use telemedicine	0.732	-	-	-
IF4: Facilitating conditions	-	0.88	3.739	62.3
I have the required technical infrastructure and/or technology to use telemedicine	0.855	-	-	-
I have the required knowledge to use telemedicine	0.853	-	-	-
I have access to the internet and connectivity required to use telemedicine	0.813	-	-	-
I have the training necessary to use telemedicine	0.769	-	-	-
Telemedicine is compatible with other technologies I use	0.767	-	-	-
IF5: Social media technology	-	0.80	2.649	66.2
I believe social media technology is easy to use	0.863	-	-	-
I use social media technologies to provide telemedicine services.	0.837	-	-	-
I believe social media technology has made telemedicine easier	0.794	-	-	-
I have the required knowledge to use social media technologies	0.757	-	-	-
IF6: Technology anxiety	-	0.75	2.33	58.4
I use digital devices without hesitation caused by privacy concerns	0.851	-	-	-
I use digital devices without hesitation because I do not have fears about making mistakes	0.839	-	-	-
I am capable of using digital devices comfortably	0.763	-	-	-
If given the opportunity, I would like to learn more about the use of digital devices	0.573	-	-	-
IF7: Attitude	-	0.94	4.754	79.2
Telemedicine is helpful	0.928	-	-	
Telemedicine is important	0.912	-	-	-
Telemedicine provides a more convenient service	0.901	-	-	-
Using telemedicine is a good idea	0.882	-	-	-
Telemedicine enhances my service	0.869	-	-	-
Telemedicine will become an integral part of consulting	0.847	-	-	-
DF: Behavioural Intention to adopt TM	-	0.88	3.435	68.7
I will try to use telemedicine frequently	0.861	-	-	-
I intend to continue using telemedicine in the future	0.857	-	-	-
I have used telemedicine often in the past year	0.820	-	-	-
I like/would like to work/working with telemedicine	0.816	-	-	-
I spend most of my time at work using telemedicine	0.789	-	-	-

Table 6 continues →

TABLE 6 (Continues...): Summary of results after exploratory factor analysis.

can support patients and healthcare practitioners. The use of mobile technologies and social media applications for telemedicine has increased because of the cost-effectiveness and accessibility of mobile phones in South Africa. It is therefore recommended that mobile applications for telemedicine be developed to support the growing mHealth platform. Community ICT centres should be established in rural areas of South Africa to bridge the digital divide and improve access to telemedicine services. Many public sector hospitals in South Africa lack basic resources and have limited IT infrastructure, support and equipment, which are important technologies for telemedicine (Bhamjee et al. 2022) and have to be addressed.

Organisational recommendations

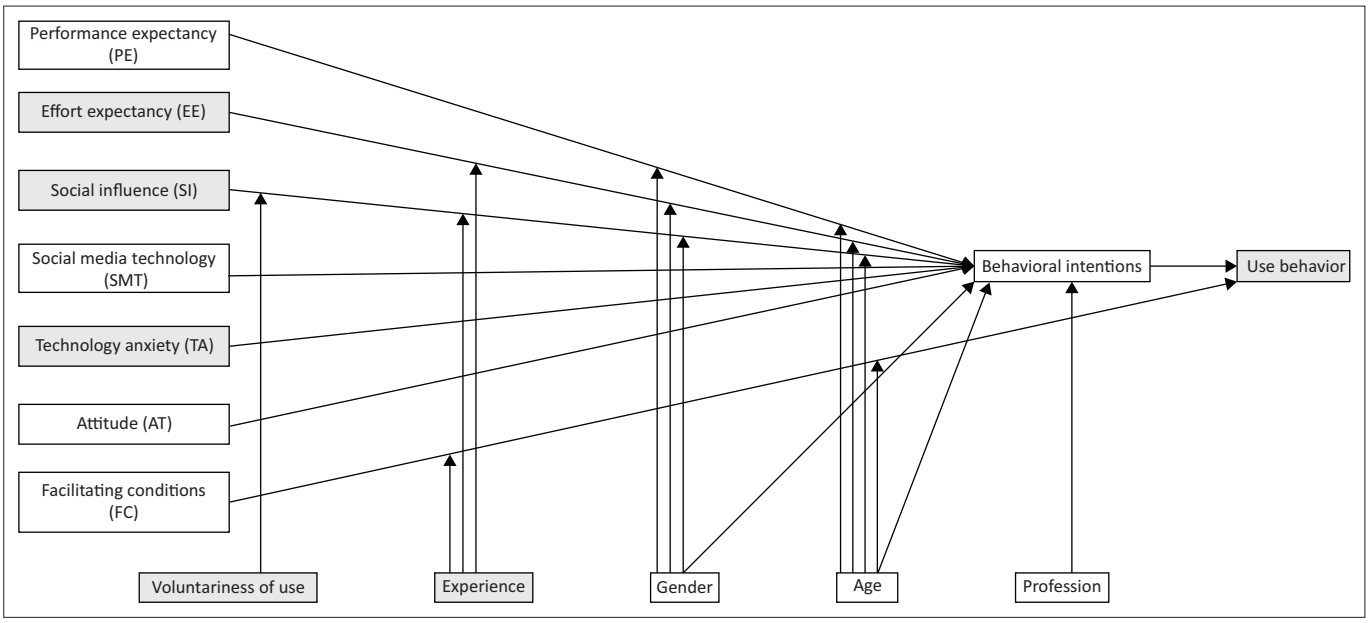
The need for training of healthcare practitioners on telemedicine technology is an essential prerequisite for its adoption (Haleem et al. 2021; Paré et al. 2022; Stovel et al. 2020). Frequent training needs to be provided by the South African government in the public sector and management services in the private sector can also facilitate this. Regular training strengthens the telemedicine knowledge and skills of healthcare practitioners so that they feel more confident in using this technology.

Legal and regulatory recommendations

The HPCSA and other medical associations need to re-evaluate their telemedicine policies to create a standard telemedicine policy or framework for implementing telemedicine services in South Africa. This is particularly important to address issues of security, confidentiality, privacy, liability, standards, ethics, accountability, governance and licensing of telemedicine software that slow the adoption of telemedicine. Creating an appropriate legal and policy environment will be beneficial for telemedicine adoption. The South African DOH should establish a Department of Telemedicine to coordinate telemedicine initiatives and ensure that they are appropriate to the local context, cost-effective, regularly re-evaluated and funded as part of the national healthcare service in South Africa (Ryu 2012).

Financial recommendations

Increased budgetary resources to support the adoption of telemedicine in the public healthcare sector are needed, as well



Source: Adapted from Marikyan, D. & Papagiannidis, S., 2023, 'Unified theory of acceptance and use of technology: A review', in S. Papagiannidis (ed.), TheoryHub Book, viewed n.d., from https://open.ncl.ac.uk

FIGURE 5: Unified theory of acceptance and use of technology (UTAUT) model for telemedicine adoption.

as expanded collaboration between the public and private healthcare sectors to expand funding sources for telemedicine solutions. Ranganathan and Balaji (2020) concluded that telemedicine adoption is lower when expensive equipment is required and funding is a problem. Telemedicine systems must be sustainable over the long term.

Reimbursement recommendations

A barrier to telemedicine adoption has been unclear reimbursement of telemedicine to healthcare professionals and patients (Bhaskar et al. 2020; Powell et al. 2017). It is recommended that healthcare professionals be reimbursed to ensure participation. It is also recommended that reimbursement for medical supplies should include telemedicine services.

Conclusions, limitations and future research

Telemedicine allows healthcare professionals to provide services to patients who are separated by geographical distance (Haimi 2023). Because of the increase in telemedicine solutions and technologies, telemedicine has transitioned to a paradigm that entails convenience, lowered costs, reduced waiting times and increased access to healthcare. These benefits may not be accessed until healthcare facilities or institutions in South Africa have the adequate infrastructure and resources required for telemedicine, the required training and knowledge for telemedicine, the required technical support, reviewed telemedicine guidelines and standardised protocols and reimbursement strategies. One of the pillars of the National Health Insurance (NHI) for South Africa is universal access (Passchier 2017). The adoption of telemedicine practices could assist in achieving that goal.

The findings indicated that South African healthcare institutions should invest in improving healthcare professionals' knowledge, skills and changing perceptions, which can result in an increased level of AT towards adopting telemedicine. The public sector (μ: 3.41) scored more positively ($p < 0.000$) than the private sector (μ: 2.60) on SI. The demographic variable, *Gender* was found to have a significant influence on the dependent factor, *Behavioural Intention to adopt telemedicine.* The results further indicate that many health practitioners use WhatsApp to conduct telemedicine consults.

The theoretical contribution of this study is the extension of the UTAUT model (Figure 1) for telemedicine (Figure 5). Three new constructs were added to the UTAUT model (Marikyan & Papagiannidis 2023), namely SMT, TA and AT. An additional moderating variable was further added, namely the Profession, which was deemed important when assessing the acceptance and adoption of new technologies in the health industry.

The findings indicated that SMT had a significant positive effect ($p < 0.05$, $V = 0.49$) and is positively correlated ($|r| = 0.658$) with behavioural intention to adopt telemedicine. Attitude was added as an extension to the UTAUT model to strengthen the model from a South African context. The study showed that AT has a significant positive effect ($p < 0.05$, $V = 0.55$) and is positively correlated ($|r| = 0.808$) with behavioural intention to adopt telemedicine. Hypothesis H_6, relating to TA was rejected ($p = 0.145$, $|r| = -0.136$); however, it is included in the UTAUT model (Figure 5) for future research, together with the independent factors of the UTAUT model, EE and SI. The variables of *Voluntariness of use* and *Experience* were not included and evaluated in this study.

Future research should include a qualitative study to enable the probing of data in areas where responses were neutral to provide a better understanding of the research problem. The final model (Figure 4) requires additional research to establish its validity and usability as an effective means to establish and monitor telemedicine adoption both locally and internationally. It is recommended that the same study should be repeated in South Africa with a larger sample size.

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Competing interests

The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

Authors' contributions

P.B. executed the research and contributed to writing this research article under supervision of M.C. and S.B., while A.C. assisted with the data analysis and the writing of this research article.

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Data availability

The authors confirm that the data supporting the findings of this study are available within the article.

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