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Impact of Telemedicine, Telehealth and Virtual Online Consulting in the Nephrology Paradigm in South Africa

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Impact of Telemedicine, Telehealth and Virtual Online Consulting in the Nephrology Paradigm in South Africa

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A research proposal submitted to the Faculty of Commerce, Law and Management, University of the Witwatersrand, in partial fulfilment of the requirements for the degree of Master of Business Administration

Johannesburg, 2024

DECLARATION

I, Naeema Ayoob, declare that this Applied Research Project is my own work, except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration in the Graduate School of Business Administration, University of the Witwatersrand, Johannesburg. This study has not been submitted before for any degree or examination at Wits or any other university.

Naeema Ayoob …….. ……

Name of Candidate Signature

Signed at Johannesburg
On the 16th day of March 2024

DEDICATION

First and foremost, I would like to express my deepest gratitude to my Creator, the first and the last, and most praiseworthy, without whom, nothing would be possible.

To my late beloved mother Khadija Mangera, without whom I would not have been the person I am today. “When days are dark and I feel inadequate, isolated, and unworthy, I remember whose daughter I am, and I straighten my crown”.

To my daughter, Rumaanah, and my son, Talhah, who assisted me selflessly, knowing there was nothing for them to gain.

To my spouse, Mahommed Sauhabe Ayob, for his tolerance, patience, love and encouragement.

In the name of Allah, The Most Gracious, The Most Merciful.

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To Dr. Jacques Totowa, for your perseverance, kindness and authenticity. Your humour has made this stressful journey less daunting.

To all participants that completed the survey and made this research possible.

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NOMENCLATURE

BP	Blood pressure
CI	Confidence interval
CKD	Chronic kidney disease
COVID-19	Coronavirus SARS CoV-2
CVD	Cardiovascular disease
CVT	Clinical video telehealth
e-Consult	Electronic clinician-to-clinician communications
F2F	Face to face
HIV	Human Immunodeficiency Virus
HREC (Med)	Human Research Ethics Committee Medical
KRT	Kidney replacement therapy
NHI	National Health Insurance
NHS	National Health Service
PHR	Personal health records
pmp	Per million population
REDCap	Research electronic data capturing
SD	Standard deviation
SSRR	South African Renal Registry
VC	Virtual consults

CHAPTER 1: INTRODUCTION & BACKGROUND

1.1 Background of the study

The study is aimed at assessing the impact of telemedicine and telehealth, particularly the use of virtual consults with dialysis patients. The uniqueness of this study is that it allows clinicians the opportunity to provide nephrology care to patients at distant areas from various sites nationwide and globally.

This research is not intended to set out the ideal or best practices for the chronic kidney disease (CKD) setting or to recommend the code of conduct to adhere to, but rather to contribute towards the current literature and adapting behaviors that facilitate excellent health outcomes. In this way, the research project seeks to care for the health profession in South Africa through adopting and incorporating new innovations and technologies into everyday processes and practices.

Chronic kidney disease patients on dialysis require frequent and regular attention from the clinician; however, nephrologists are limited globally; particularly in South Africa. Thus, clinicians find it difficult to attend to multiple dialysis units simultaneously.

The use of telenephrology will transform the dynamics of renal care globally as this allows for one doctor to attend to multiple units and liaise with peers. This study assesses the impact of telenephrology, via multifaceted and innovative modalities that will revolutionize the care and outcome of CKD and kidney replacement therapy (KRT).

The study seeks to create awareness on the importance of telenephrology in the treatment of kidney disease. In order to achieve the main objective. The study will evaluate clinicians and patients' perception to use and reuse the technology and its' influences on patient confidence in treatment.

1.2 Context of the Study

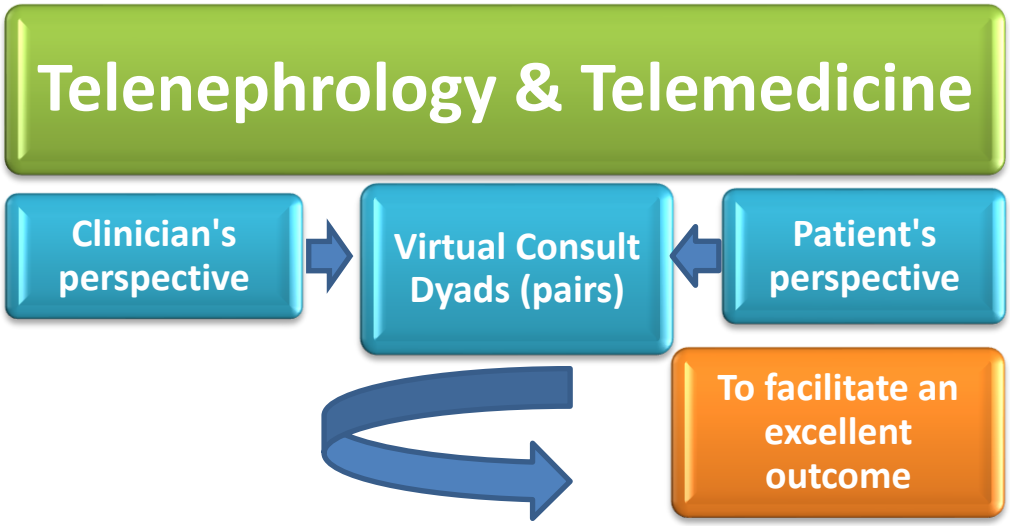


Figure 1-1: The conceptual framework of the study.
(Source: Developed by the researcher 2021)

The pillars in telemedicine are reflected in Figure 1.1. This study will focus will be on patients' perspectives with regards to the perception to use and reuse the technology and the influence of technology in their confidence of treatments.

Telemedicine, a video-based healthcare technology to deliver patient consultations, has the ability to attenuate disparities in the different patient groups, although it has been used in multiple chronic illness care management, including cardiac failure, chronic obstructive pulmonary disease and diabetes mellitus (Belcher, 2020). Telemedicine is a valuable opportunity for the follow-up of remote chronic kidney disease patients on haemodialysis, allowing patients to be treated close to home while ensuring optimal quality of care (Snoswell, et al., 2021).

Although telemedicine is not appropriate for all kidney related encounters, nephrology is, in many ways, particularly suited for telemedicine (Belcher, 2020). The longitudinal CKD patient follow-up is profoundly dependent on repeat laboratory biochemical evaluations and detailed history taking, lab evaluation appraisal and diet history, and questions regarding weight, swelling or oedema is critical; nonetheless, the majority of visits are not centred around extensive physical examinations; hypertension management is focussed around blood pressure (BP) logs and office vital signs; furthermore this can be conducted in concert with a dedicated clinical technologist or nurse or other telemedicine healthcare provider who is in direct contact with the patient, therefore management of these nephrology conditions often does not require an in-patient face-to-face physician visit (Belcher,

2020). The role and application of telemedicine for the care of kidney replacement therapy (KRT) patients can be adapted and fine-tuned.

According to Murphy (2021), the new virtual reality requires a new form of management, a virtual management, because management concepts, techniques and structures as expressed by "Taylor, Weber and Fayol" are proving to be less effective in today's progressively connected wired world. Furthermore, organisations find that the traditional management tools which were devised in a closed equilibrium system "thinking" era occurred when business was stable, customers loyal, competitors few and financial results were predictable – now fails to suffice with the realities of a complex-based new era (Murphy, 2021), mainly due to the discontinuous change and hypercompetition as defined by D'Aveni (1994). Digitalisation has produced radical developments in healthcare by offering several alternatives to in-person and face-to-face meetings between patient and physician (Björndell & Premberg, 2021). Teleconferencing and videoconferencing technologies, such as Zoom, Skype, Attend Anywhere, and Microsoft Teams have been received with enthusiasm by healthcare policy makers because they offer a platform to improve access to healthcare (Gilbert, et al., 2021). The technological instruments are also seen as a significant contributor to health and wealth as well as proficiency and efficiency gain strategies (Gilbert et al., 2021).

Telemedicine takes on a variety of forms, and using website-based platforms and other versatile digital applications, primary care physicians can be remotely connected to specialists with the use of videoconferencing for consultation, furthermore, nephrologist situated at specialised care centres may remotely see patients in primary care facilities, where web-based monitoring and devices can be utilised to collect physiological data and patients may have the option of a virtual visit directly from the patient's home (Belcher, 2020). Initiatives for a speciality access network allows for the provision of educational sessions for primary care providers and caregivers especially in rural or remote areas (Belcher, 2020).

Telehealth, it's now and forever

At the inflection of the new decade, the United Kingdom recorded its first case of the Novel Coronavirus SARS-CoV-2 (COVID-19) and the epidemic placed the National Health Service (NHS) under substantial strain which required the implementation of social distancing measures in March 2020, and virtual consultations (VC) were identified as a potential alternative to face-to-face consultations; simultaneously organisations were coerced to rapidly implement VC during the COVID-19 pandemic (Gilbert*et al*., 2021). VC have been rapidly deployed since the onset of COVID-19 pandemic, however without clear guidance and consensus on many essential and decisive issues

(legal, safeguarding, safety and security) and it is imperative to address these issues and develop local and national guidelines, protocols and frameworks to facilitate ongoing virtual practice safety beyond the COVID-19 pandemic (Gilbert, et al., 2021). Careful consideration must be given to research conducted and published prior to COVID-19 and whether it is appropriate for the post COVID-19 policy (Gilbert, et al., 2021). Irrespective of the means or mode by which patients are consulted, compliance regulations require implementation of appropriate safeguards for the protection of patients' health information and records (Belcher, 2020).

Clarke, et al (2020), demonstrates mandatory personal health records (PHR) could increase the digital division among vulnerable populations because the elderly and those with low reported computer self-efficiency, perceive technology as a barrier, whereas young adults have a high affinity for digitalisation and electronics, and middle age adults have mixed opinions and do not trust technology and select to interact with humans rather than technology. Senior citizens are eager and willing to technological instruments that is familiar to them and patients of different ages have different prefernces to the form of communication and technological instrument as well as interaction preferences (Clarke, et al., 2020).

1.2.1 The Nephrology Paradigm

Nephrology is the clinical speciality that spans from the basic clinical skills through to highly technological aspects of medicine linked and associated with kidneys (Pascoe & Halkett, 2003). CKD is a common illness across societies, affecting an estimated 13% of the population globally and the prevalence of CKD is increasing due to a combination of an ageing population and increased comorbidities such as obesity, hypertension and diabetes which contribute to its pathogenesis (Belcher, 2020). Early referral to a nephrologist may improve the outcome in CKD patients, however many patients only receive nephrology care at a late stage in their disease progression (Bekker, 2020).

Although the physiochemical process of dialysis was described by Graham in the 19th century, the first successful human dialysis was only achieved by Dr W Kolff in Holland in year of 1945, and this successful attempt was preceded by 15 failed attempts, it was only the 16th renal failure patient that went on to successful recovery (Pascoe & Halkett, 2003).

Dialysis technology has evolved significantly since 1945 and it is now possible to treat patients with renal failure in the acute setting even the haemodynamically unstable ones, however the availability of treatment for chronic renal failure is limited by financial factors to carefully selected patients in the state sector and those in the private sector with available funding (Pascoe & Halkett, 2003).

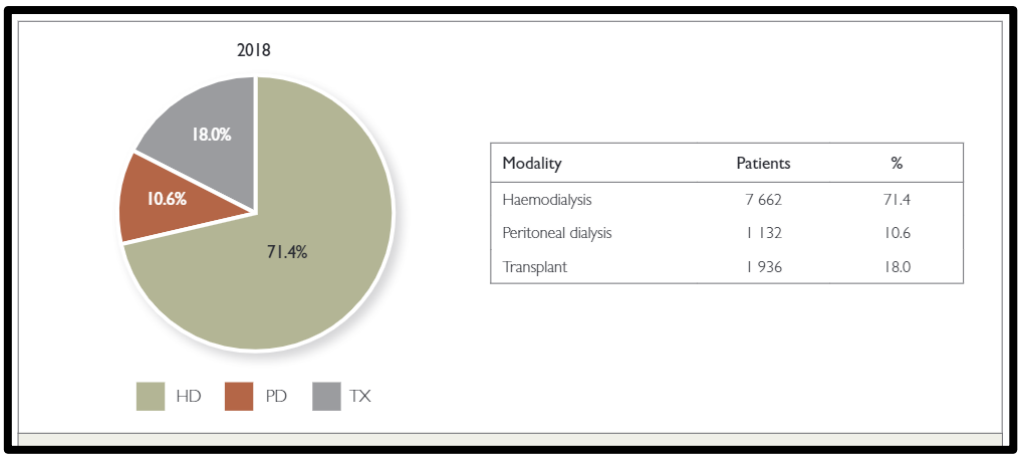
Dialysis and kidney transplantation remain costly and inaccessible to most South Africans, despite been available as a treatment modality since the 1950s (Davids et al., 2020). Nonetheless, it is crucial to put this into context by outlining the current situation for the management of end-stage chronic kidney disease (CKD) in our dichotomous healthcare system (Mistry et al., 2020).

The valuable resource, the South African Renal Registry (SSRR), documents the state of renal replacement therapy, and from the seventh annual report which summarises the 2018 data on KRT, it was found 10 730 patients were receiving chronic dialysis or had a functional renal transplant, and considering the fact that the population in South Africa was 57.78 million in 2018, then this represents a prevalence of 186 KRT patients being treated per million population (pmp) (South African Renal Registry Annual Report 2018; Davids et al, 2020). By comparison, the United States of America has a far higher prevalence of over 2 034 pmp of patients on renal treatment, even though the major aetiological factors (diabetes, hypertension, familial) for CKD are just as prevalent as in South Africa, furthermore South Africa is challenged with a greater proportional human immunodeficiency virus (HIV) burden compared to high-income countries (Mistry et al., 2020; Davids et al., 2020).

Information from the SSRR confirms that most end stage chronic kidney disease patients are treated with haemodialysis in the private healthcare sector, where the prevalence was 839 pmp; whereas, in the public sector, which serves 85% of the South African population, the prevalence of KRT (67 pmp) remained below the level reported for 1994 (Davids et al., 2020). The province with the highest patient load was Gauteng followed by Western Cape and KwaZulu-Natal, whereas the province with the highest prevalence was the Western Cape, followed by Gauteng and the Free State (Davids et al., 2020). There were 927 patients who started KRT in 2018, an incidence of 16 pmp and most of these patients (81%) received KRT in private centres (Davids et al., 2020). Limpopo and Mpumalanga remain the most under-served provinces and Africans remain the most under-served population group (Davids et al., 2020). The Western Cape province had the highest public sector treatment rates by a large margin and was also where most of the country's public sector kidney transplants were performed (Davids et al., 2020). The number of treatment centres for dialysis and transplantation centres contributing data to the SSRR was 301; of which 269 centre of these (89.4%) are privately owned. Several provinces have increased access for their public sector renal patients by utilising spare capacity at certain private haemodialysis centres on a fee-per-treatment basis (Davids et al., 2020).

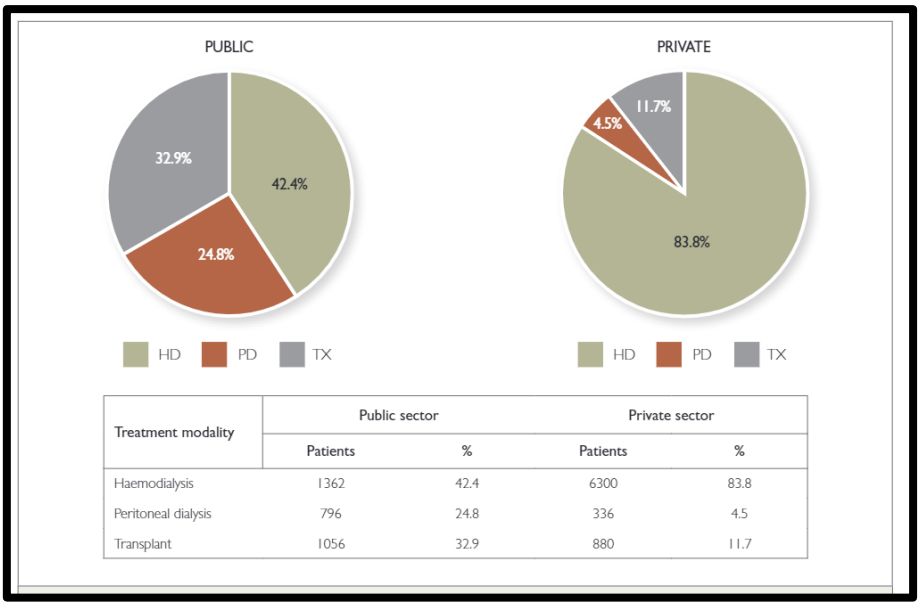
The distribution of KRT patients by type of renal treatment modality (Figure 1.2), illustrates that the prevalence of patients on haemodialysis is 7662, peritoneal dialysis is 1132, and functional transplants is 1936 (Davids et al., 2020). On further assessment (Figure 1.3), it can be seen that in the private

sector 83.8% of chronic kidney disease patients are on haemodialysis versus 42.4% in the public sector. It must also be noted that peritoneal dialysis and transplantations are more prevalent in the state sector (Davids et al., 2020).



Modality	Patients	%
Haemodialysis	7 662	71.4
Peritoneal dialysis	1 132	10.6
Transplant	1 936	18.0

Figure 1-2: Distribution of chronic kidney disease patients by type of renal treatment modality. (Adapted from the South African Renal Registry (Davids et al., 2020).

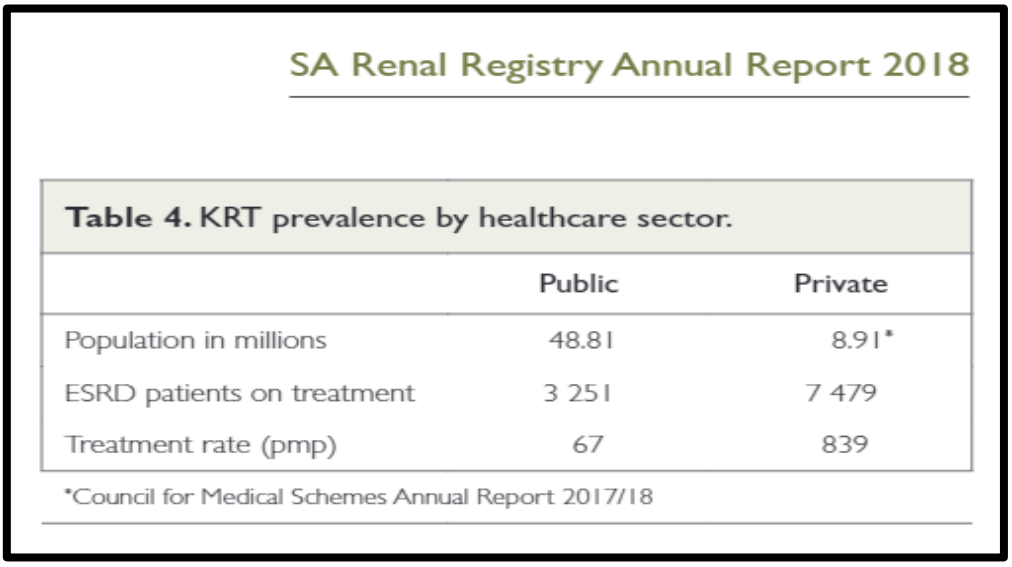


Treatment modality	Public sector		Private sector	
	Patients	%	Patients	%
Haemodialysis	1362	42.4	6300	83.8
Peritoneal dialysis	796	24.8	336	4.5
Transplant	1056	32.9	880	11.7

Figure 1-3: Kidney Replacement Therapy (KRT) modality by sector. (Adapted from the South African Renal Registry (Davids et al., 2020).

The private sector serves 8.91 million people and supports 7 479 dialysis patients (839 pmp) whereas the public sector serves 48.81 million people and can support 3 251 patients (67pmp) (Figure 1.4) (Davids et al., 2020). This emphasises and highlights the poor availability of KRT and dialysis service in the public sector (Mistry*et al.*, 2020). In addition, there is wide inter-provincial variations and ethic

differences in accessing dialysis as illustrated in Figure 1.5 and 1.6 (Mistry et al., 2020). The technological improvement adds to the cost of therapy and regrettably there are many areas that have no access to basic equipment. The challenges include making the technology affordable and improving patient outcome (Pascoe & Halkett, 2003).



SA Renal Registry Annual Report 2018

Table 4. KRT prevalence by healthcare sector.

	Public	Private
Population in millions	48.81	8.91*
ESRD patients on treatment	3 251	7 479
Treatment rate (pmp)	67	839

*Council for Medical Schemes Annual Report 2017/18

Figure 1-4: Kidney Replacement Therapy (KRT) by healthcare sector.
(Adapted from the South African Renal Registry (Davids et al., 2020).

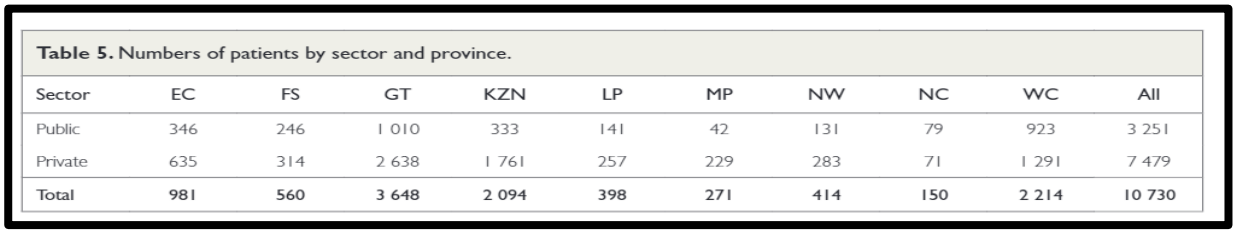


Table 5. Numbers of patients by sector and province.

Sector	EC	FS	GT	KZN	LP	MP	NW	NC	WC	All
Public	346	246	1 010	333	141	42	131	79	923	3 251
Private	635	314	2 638	1 761	257	229	283	71	1 291	7 479
Total	981	560	3 648	2 094	398	271	414	150	2 214	10 730

Figure 1-5: Number of KRT patients by sector and province
(Adapted from the South African Renal Registry (Davids et al., 2020).

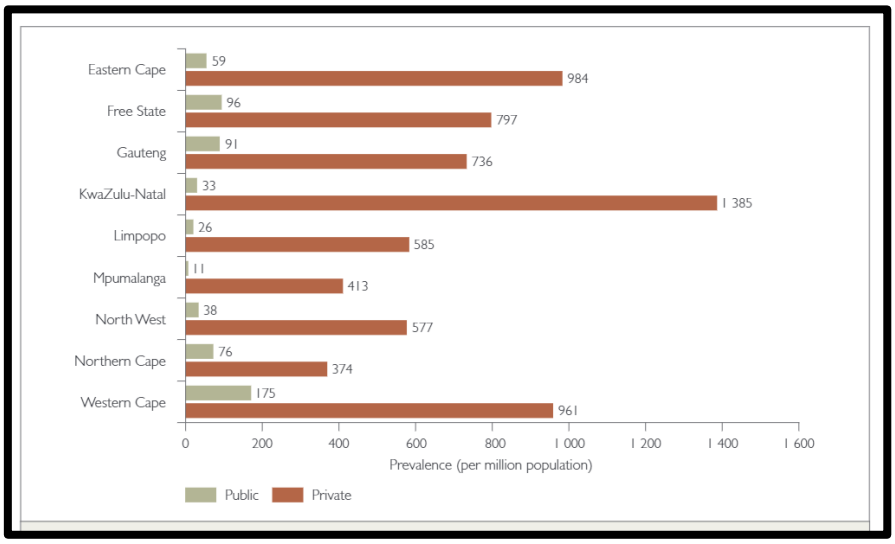


Figure 1-6: Prevalence of KRT by province and sector.
(Adapted from the South African Renal Registry (Davids et al., 2020).

Despite the well-recognised increasing prevalence of CKD and the accompanying renal failure, the focus has been primarily on increasing resources and adopting different treatment strategies for these patients. One of the most significantly neglected areas is linked to the ethical issues surrounding withholding and withdrawing dialysis treatment (Mistry et al., 2020). Patients with end-stage CKD are more likely to die on dialysis treatment and in a hospital setting in comparison to other patients where end-of-life care is managed in a palliative care setting (Mistry et al., 2020). This is mainly attributable to the fact that a substantial number of nephrologists and facilities lack the necessary skills for terminally ill patients and there is a need to provide palliative care for renal patients with advanced kidney disease which is associated with a high comorbidity score (Mistry et al., 2020). It is highly recommended that the palliative care specialist be part of the renal care team ab initio and da capo (Mistry et al., 2020).

1.3 Research Problem

End-stage renal disease is a major public health concern and chronic kidney disease (CKD) is a highly prevalent illness across societies, affecting approximated 13% of the population worldwide (Hill, et al., 2016). CKD constitutes a major burden to the healthcare system globally and the prevalence rates highlights the relevance to health care providers and national health programs with finite resources with which to address this epidemic (Hill, et al., 2016).

The high prevalence and the existing evidence that intervention is effective in reducing cardiovascular disease (CVD) events demonstrates a dire need for local and national initiatives to slow down the

disease progression and reduce cardiovascular-related events in CKD patients (Hill, et al., 2016). Further studies and research are mandatory to evaluate intervention strategies deliverable at scale to delay CKD progression and improve CVD outcomes and evaluation on the intervention roles and accompanying costs must be undertaken, as well as detailed disease definition and population demographics and other relevant findings must be researched (Hill, et al., 2016).

Studies suggest that early referral to nephrologists would most likely improve CKD outcome, however patient tend to only see the nephrologist late in their course of renal disease (Belcher, 2020). Barriers to early referral is mostly attributable to the geographic location where patients live in remote areas far away from renal centres or have difficulty travelling due to the burden of having other comorbidities (Belcher, 2020). Patients from rural areas have been found to have poorer quality-of-care markers in comparison to urban CKD patients, such as infrequent albuminuria tests, lack of appropriate use of preventative medication, greater risk of hospitalisation, and sustain all-cause mortality (Belcher, 2020).

The main research problem is to articulate the perspectives of the clinician and the patient in the nephrology setting in South Africa. The lack of human capital (nephrologists) together with a scarcity of resources and new medical procedures required to improve treatments affects the patient and clinician relationship. Clinicians are limited by time constraints and distance to reach all the patients that are under their care. Patients receive haemodialysis for four hours thrice weekly and would like to see a clinician at least once weekly. Currently more consultation time is required to address pressing issues. Clinicians need to adequately meet patients' expectations.

This gap can be improved with the use of telehealth, telemedicine, remote monitoring, and virtual consults. Telehealth aims to improve services in the nephrology field by offering convenience, quick diagnoses, funding, mobility, limited human capital, and the new trends in advancing treatment in a positive way. However, the lack of knowledge and insufficient adoption in the approach/resource inequalities in the context of South Africa places certain individuals at a disadvantage. Thus, the study is set out to determine the current attitudes and perceptions of patients and clinicians towards telehealth.

1.4 Aim of the study

To assess, knowledge, attitudes and perceptions that influence patients and clinicians, from the perspective of patients and clinicians, for virtual consultations in a nephrology setting.

1.5 Research Questions

The following research questions frame this study:

Question 1: What are patients' perceptions to use and reuse the digital solution in kidney treatment?

Question 2: Are clinicians' able and willing to adapt to the new technology?

Question 3: Will patients be satisfied with the new technology?

Question 4: What are the strategies for optimal synergies between clinicians and patients.?

1.6 Research objectives

The primary objective of this study is to determine the adoption of virtual consults digital technology solution in the treatment of kidney disease. To achieve the primary objective, the following sub objectives were investigated:

1. To describe the use of telehealth/telemedicine among healthcare professionals working in renal healthcare units.
2. To describe predictors of telehealth/telemedicine use among healthcare professionals working in renal care units.
3. To describe the use of telehealth/telemedicine among patients attending renal healthcare units.
4. To describe predictors of telehealth/telemedicine use among patients attending renal care units.
5. To determine patients' and healthcare professionals' knowledge, attitudes, and perceptions of the current forms of telemedicine and telehealth.

1.7 Justification / Rationale of the Study

The utilisation of telemedicine was sluggish prior to COVID-19, but due to extraordinary circumstances telemedicine has become a prominent practice and solution for healthcare delivery and continuity, with a possible impact on clinical practice post-pandemic (Alwabili et al, 2021). During the lockdown, majority of patients consider teleconsultation to be as good and effective as face to face (F2F) visits and patients acknowledge the positive effect on quality of communication and report to have felt listened, understood, and experienced respect and emotional support from the clinician (Kludacz-Alessandri, et al., 2021).

Virtual consults can be rapidly instituted in adaptation to a crisis situation with an accompanying high level of patient satisfaction and willingness of future engagement in the virtual health paradigm despite the service and experience being relatively new, however, additional efforts will be needed to maintain that the support is appropriate, acceptable and in combination with in-person visits (Alwabili

et al, 2021). Virtual consults and telehealth are deemed effective interventions for most nephrology conditions. Telehealth can support goal setting and enhance patient awareness.

1.8 Delimitations of the Study

These contributions are valuable, essential, and timely for the effective and efficient use of telehealth, particularly in resource-constrained healthcare organizations including rural areas and remote areas that continue to be digitally excluded due to lack of resources, resource constraints, lack of human capital and lack of capacity.

1.9 Structure of the Dissertation

This paper is structured as follows: In chapter two a critical review of the literature is undertaken with the goal of identifying and justifying the research gaps in telehealth and telenephrology. The critical review of literature will also review and provide a rationale for the theoretical underpinnings based on dynamic capabilities as the basis for the research hypotheses and propositions of this paper. The rationale for the theoretical framework will be followed by a motivation for the research methodology, which is approached from a critical realist research paradigm. This will be followed by the study methodology in chapter three. The results of the study will then be presented followed by a discussion and interpretation of the results (chapters 4 and 5). The concluding section will synthesize the findings in terms of the key insights from the research followed by the implications of the study to management, policy, and practice. A reflection on the limitations of the study, as well as recommendations for future research will also be mentioned.

CHAPTER 2:LITERATURE REVIEW

2.1 Introduction

This chapter explores telehealth, telemedicine, telenephrology and virtual consulting. The inputs required and the potential outcomes of the various processes, and factors that influence the selection and adoption of its use, and the perspectives that facilitate the excellent outcomes. In this way the researcher provides answers to the research questions that framed this study:

2.2 Definition of the topic: Telenephrology

One of the greatest triumphs of the 21st century is the potential to safely harness the power and potential of technology and to meet the challenges of improving health and providing better, safer, sustainable care for all (Greenhalgh, et al., 2016). There is growing evidence that the incorporation of smart apps helps support self-management in CKD patients (Jain, et al., 2020). The health-related patient apps provide record keeping, health data tracking, BP logs, vitals monitoring, medication reminders, and educational material for disease awareness and educational tools; and as telemedicine grows, the use of artificial intelligence and chatbots will likely increase, and potentially narrow the patient and clinician gap by the use of learning algorithms, particularly if utilised in a strategic way (Jain et al., 2020).

Videoconferencing technologies are utilised across many healthcare fields and can be advantageous to patients (Gilbert et al., 2021). Greenhalgh et al. (2018), conducted a multilevel mixed method study of Skype consultations and found that VC were convenient, safe and effective for patients when considered to be appropriate by the clinician, however the reality of establishing VCs in the outpatient setting was far more cumbersome and complex than anticipated (Greenhalgh, et al., 2018). The complexity and perplexity of telemedicine and telecare system is a longstanding problem (Gilbert et al., 2021). Video consultations are suitable in some situations, but accessibility was problematic in terms of medical prioritisation in healthcare (Björndell & Premberg, 2021).

Connecting with a patient using video technology could be smooth and straightforward or deficient which can be attributable to the communication mode and the patient's ailment and condition (Björndell & Premberg, 2021). A constellation of good communication skills, clinical experience, patient involvement throughout the consultation process and medical examination is crucial for VC where patients are required to perform self-examination (Björndell & Premberg, 2021). Combining virtual care with traditional general practice has the potential to reduce the physician's workload and ensure medical competence in virtual primary care (Björndell & Premberg, 2021). In certain patients,

VCs are suitable for primary care visits, however the physician experience is rarely studied, and the following factors must be considered: clinical experience, consultation skills, flexibility, healthcare prioritisation and physician connection to patients' regular health profile(Björndell & Premberg, 2021).

Traditional organizational management methods and structures are failing to adequately accommodate a complexity-based world view, which is characterized by discontinuous change, hyper competition, and the exponential explosion of information science. Virtual organizational management is the needed change in the management paradigm (Murphy, 2021).

2.3 Management models and theories used to explain acceptance of telemedicine

- Technology Acceptance Model
- Technology Acceptance Model 2
- Unified Theory of Acceptance and Use of Technology
- Diffusion of Innovations Theory
- Theory of Reasoned Action
- Theory of Planned Behaviour
- Theory of Interpersonal Behaviour
- Social Cognitive Theory
- Health Belief Model
- Dual Factor Model
- Technology Readiness
- Protection Motivation Theory (Harst, Lantzsch, & Scheibe, 2019)
- Strong structuration theory meets actor-network theory (Greenhalgh & Stones, 2010)

2.4 Telehealth and clinical video telehealth

Telehealth encompasses a large scope of patient communication aspects, and the term telehealth is used interchangeably with telemedicine; however, telemedicine forms a subset of telehealth (Tuckson, et al, 2017). Telehealth is the use of medical information that is exchanged or shared from one site to another, using electronic modes of communication to improve patient's health and medical outcome (Tuckson et al., 2017).

Telemedicine is the delivery of health-related services by utilising information and communication strategies for the exchange of valid data for the purpose of diagnosis and treatment of disease in a way to advance patient health and outcome, and particularly in remote areas (Lea & Tannenbaum,

2020). Within the broader context of telemedicine, telehealth refers to the direct provision of remote healthcare, which can involve synchronous encounters, such as phone calls or interactive videoconferencing, as well as asynchronous systems, such as text messaging, advice platforms and website-based electronic consultations (Belcher, 2020).

Telenephrology uses these technologies in the renal setting (Lea & Tannenbaum, 2020). Asynchronous telehealth whereby medical data are transmitted between participants for assessment for convenience and often utilises remote monitoring devices and monitors, and this store-and-carry-forward telehealth method in the form of electronic clinician-to-clinician communications (e-consults) has been the most frequently used form of tele-nephrology in the ambulatory setting and has the potential to overcome limited availability of specialist, travel distance, and other barrier fields to obtain speciality care for rural patients (Lea & Tannenbaum, 2020).

However, there is limited experience with telemedicine for patients with nephrology disorders in rural hospitals utilising real-time synchronous videoconferencing and virtual physical examination, though there is experience in home dialysis sphere; and furthermore, there are services such as tele-stroke and tele-ICU that uses real-time synchronous monitoring which has been implemented in hospital settings with favourable outcomes (Lea & Tannenbaum, 2020).
The quadruple aim of telehealth is to address socially desirable goals in the health care system by improving the experience of patient care and providing care as well as improving health of the population, together with reduced health care costs (Tuckson et al., 2017). The services and tools derived from telehealth technologies (Figure 2.1), are forming the fundamental component of the health care sector (Tuckson et al., 2017).

Clinical video telehealth (CVT) is the most common modality and form of telehealth, it is the most readily adoptable introduction to telehealth, and frequently takes the form of specialist physicians consulting patients located in other offices for real-time, interactive, video teleconferencing (Belcher, 2020). Although patients are not seen F2F by their primary provider, the mere act of going to a medical or office facility and interacting with medical staff can be familiar, reassuring and comforting, and this assists to allay concerns that the new technology will disrupt the doctor-patient relationship (Belcher, 2020). From a health provider's perspective, initiating telenephrology through an office -based model provides reassurance that patients will still be seen in an orderly and timely manner in a medical staff surrounding (Belcher, 2020).

A videoconference monitor is situated in the physician's office and another monitor enhanced by accompaniments, such as high resolution digital video camera, ultrasound probe, and stethoscope is located remotely in the patient examination room; and alongside the patient there is a healthcare technician or nurse trained in telenephrology, who is available to measure the vital signs and assist the physician with remote physical examination as required per patient (Belcher, 2020). The quality of communication during teleconsultation is mainly influenced by technical and behavioural aspects of the system, therefore successful communication requires good technical conditions, security, and privacy, feeling of comfort and mutual trust between the patient and the clinician (Kludacz-Alessandri, et al., 2021).

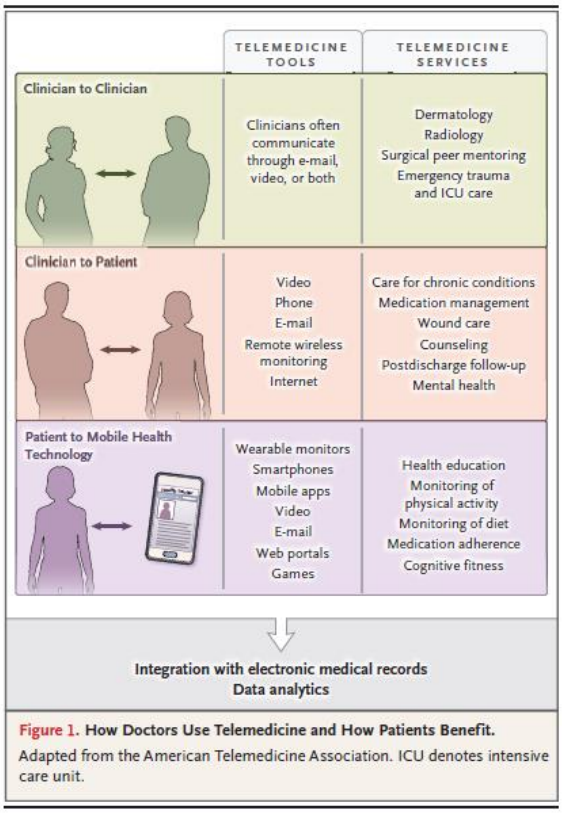


Figure 2-1: Uses and benefits of telemedicine (Tuckson et al., 2017)

The growth of telehealth care delivery is influenced and determined by five key trends: continuous innovation in the consumer technology market which attract financial capital for product development; continuous advancement in electronic health records and clinical-decision support systems which integrates telehealth making it more efficient; projected shortages in the health professional workforce will increase the need to provide primary and speciality care access for rural and underserved urban communities; reorganisation in the delivery and financing of medical care due to initiatives and incentives to lower costs outside traditional hospital facilities; growth of

consumerism in health care with increasing consumer expectations for convenient and real time access to health services, personal medical records, prescription refills, and interventions analogous to the other sectors in economy (Tuckson et al., 2017).

Telenephrology, the time is now.

Spurred by changes and challenges wrought by COVID-19, telehealth has expanded and found a permanent role in many nephrology practices; nevertheless, several hurdles and hiccups do exist to the widespread adaptation that must be overcome before favourable integration and implementation of telehealth into clinical practice (Belcher, 2020). Population isolation and consequences arising from the pandemic have affected the regular provided care for non-COVID-19 patients, necessitating urgent reorganisation of practices and as a result healthcare systems across the globe have placed increased reliance on telemedicine, particularly on video consultation, in order to facilitate accessibility to health care and maintain the patient follow up and regular-routine care while minimising the risk of virus spread in hospitals and in communities (Alwabili et al., 2021). There is a commensurate need for telehealth incorporation and telehealth must not be seen as an "alternative" form of health care, instead it should become integrated within the training curricula for both health professionals and social practitioners (Fisk et al., 2020).

Inadequate CKD patient awareness and dialysis modality education, and inconsistent detection of CKD by physicians remain major gaps in advanced patient care, therefore web-based learning, text-based outreach, virtual support groups, online group classes and health apps for CKD and dialysis education offer a complimentary solution to many care gaps (Jain et al, 2020).

Telemedicine was initiated during the lockdown and should continue to be applied in the post-pandemic normal era (Kludacz-Alessandri, et al., 2021). The COVID-19 pandemic forced changes that helped to establish telehealth more firmly after its aftermath and some changes may not be long-lasting, however, the momentum will propel telehealth to find a stronger place within the health care service framework and to have increased the acceptance amongst patients and health care providers (Fisk et al., 2020). The advantages and challenges of Telenephrology are listed in Table 2.1 (Belcher, 2020).

Table 2.1: Advantages and challenges to telenephrology (Belcher, 2020)

Advantages and Disadvantages	
Advantages to telenephrology	**Challenges with telenephrology**
Improved access to specialized care in remote and rural areas	Alterations to doctor-patient relationship
Improved access to care for patients with transport barriers and limited mobility	Limitations to performing physical examination
Time saving and reduced expenses due to reduced travel expenses	Lack of standardisation, facility licensing and credentialing
Reduced requirements for limited clinic space and this allows for increased health providers and decreased waiting times for scheduling of visits.	Incomplete coding options for dedicated telemedicine
Reduction in patient no-show rates	Legal frameworks and uncertain malpractice
Ability and capability to maintain continuity of care during COVID-19 pandemic and other environmental disasters.	Data security and synchronous communications
Mobile applications offer increased and improved patient engagement and ownership with individual healthcare	Compatibility issues due to challenging situations in patients with audio-visual impairment
Opportunity for educational awareness and strategies and professional engagement with PCPs via SCAN-ECHO	Initiation and maintenance costs for telenephrology set-up
	Time required to acquire and train on equipment needed
	COVID-19, coronavirus disease 2019; PCPs, primary care providers; SCAN-ECHO, Specialty Care Access Network-Extension for Community Healthcare Outcomes

According to Belcher (2020), barriers can be subdivided into three categories as follows:

a) Societal and clinical barriers
b) Security, privacy, and legal barriers
c) Reimbursement barriers

Ethics in Telehealth

The current health care paradigm focuses on establishing interactions across providers, patients, and settings in different contexts with ethical connotations (Kuziemsky, et al., 2020). Unintended consequences occur due to complexities of remote care delivery, the communication, the remote monitoring service, and mobile applications (Kuziemsky, et al., 2020).

The four aspects relating to the perspectives of telehealth consist of the following:

a) The impact of cultural and regional differences
b) The ethical implications using artificial intelligence and Big Data generated by telemedicine services.
c) The ways in which ethics of telehealth differs from F2F medical practice.
d) The ethical issues related to health care of the elderly (Kuziemsky, et al., 2020).

The implications of telehealth

There is substantial evidence to indicate that patients, caregivers, and clinicians are generally satisfied with telehealth (Orlando, et al., 2019). Telehealth supports rural and remote patient care and the benefits from travel expense benefits as well as the avoidance of inconvenience complements the various stakeholders. However, telehealth does not replace F2F appointments, it offers alternate mode of service delivery in an integrated network of health care, and aligning the health care service with patients' needs and expectations can lead to overall user satisfaction, furthermore, future research must focus on accurate measures of satisfaction and follow up research to establish sustained satisfaction over the long term (Orlando, et al., 2019).

Telehealth transformation

The various telehealth encounters are depicted in Table 2.3 (Wosik, et al., 2020). The three phases relating to the telehealth service transformation is illustrated graphically in Figure 2.2 and 2.3.

Table 2.2: Classification of telehealth encounters (Wosik, et al., 2020)

Platform	Use Case(s)	Opportunities	Limitations
E-consult: Asynchronous clinician-to-clinician communication based on record review (inpatient and outpatient)	During and after initial surge: Assist frontline clinicians with triage of urgent patient referrals Assist frontline clinicians with management of low complexity patients where there is limited capacity among specialists	Time efficient for specialists, consolidates care for patients New inpatient clinician-to-clinician billing codes available Patient-initiated second opinion requests are possible	Potentially shifts work to frontline clinicians Lack of physical exam or direct communication with patients
Remote patient monitoring:Gather patient outside traditional healthcare setting via connected device or patient reported outcomes (synchronous or asynchronous)	All phases: efficient method of patient care, especially those with chronic conditions	Respond to clinical data outside of regular clinic visits Recordings can be automatically sent to clinicians Payers support remote patient monitoring activities	Requires staffing infrastructure Data ideally is integrated into EHR for sustainable workflow
Patient-initiated messaging: Synchronous chats with automated or live agents Asynchronous patient portal messaging	All phases: time-efficient handling of straightforward issues.	Patient initiates communication when convenient Able to get FAQs and use self-service tools Live or autonomous text-based options	Requires technology infrastructure and staffing Potential lack of context, requires tight integration with the EHR to be optimally useful
Telephone visit: Synchronous patient-clinician communication by phone	During and after initial surge: replace some face-to-face visits	Universally accessible, even in the most ill/low socioeconomic status patients	Currently devalued by most payers, inability to conduct a physical exam, loss of nonverbal cues
Video visit: Synchronous patient-clinician communication with both audio and video, with possible ancillary and telemetry equipment	During COVID-19 surge: replaces face-to-face visit After initial surge: expansion of virtual interactions across all sectors of the healthcare system; unbundling of services through technology	Slight improvement in clinical care (nonverbal communication, physical exam depending on bedside facilitator and peripherals) More favorable reimbursement by payers	Technology requirements: Outpatient requires broadband Internet, computer/smart device; may need digital peripherals (eg, stethoscope, otoscope) Most complex/sickest patients may be least able to participate/access care Inpatient requires mobile/zoomable camera with microphone and speaker Need infection prevention/sanitization protocol for devices

COVID-19: coronavirus disease 2019; EHR: electronic health record.

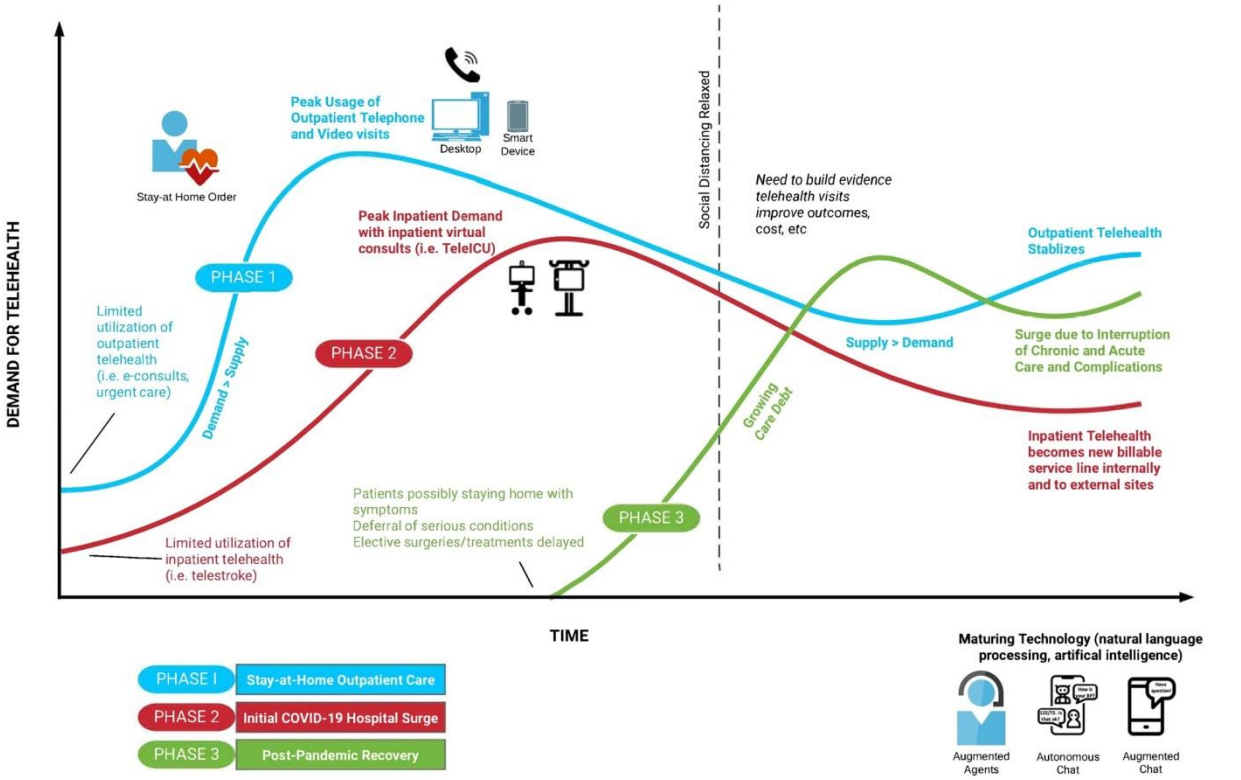


Figure 2-2: Three phases of coronavirus disease 19 (COVID-19) pandemic and demand for telehealth services (Wosik, et al., 2020)

Table 2.3: Rapidly developing and deploying a Tele-ICU service during a crisis (Wosik, et al., 2020)

People affected by the new approach	Physicians—pulmonary/intensivist
	Advance practice providers—ICUs
	Respiratory therapists, bedside nurses
	Leadership (command center, ICU medical directors, nurse/respiratory therapists managers, project managers)
	Information technology department (hardware, software, security)
	Potential vendors
	Telehealth support individuals
	Medical students / trainees
Processes/policieschanged to accomplish the new approach	Clinician and/or staff in other part of hospital or at home can assess patient virtually and assist in clinical care with bedside facilitator
	Pulmonary/intensivist ventilator consults responded in person or virtually as appropriate
	Cleaned after each use (Tru-D, Sani-Cloth wipes)
	In-service trainings, multiple educational/training sessions
Technologies implemented for the new approach	Video camera (1080p) with microphone and speaker (loud enough to hear at 10 feet)
	HIPAA-compliant, secure, and easy to use video platform on desktop and mobile device (tablet, smartphone)
	Mounts, poles to allow to modify camera angle (toward patient, ventilator, vitals, family, etc.)
	Easily cleaned with protective/durable cases
	Specific hospital computers for consultants with cameras/mics and video platform installed
	Entire system available within 5- to 7-d delivery

HIPAA: Health Insurance Portability and Accountability Act; ICU: intensive care unit.



Figure 2-3: Tele-ICU (Wosik, et al., 2020)

CHAPTER 3: METHODOLOGY

3.1 Research Methodology

This chapter provides an overview of the methodology and research design used for the study. Research methodology to answer the research questions and address the primary and secondary objectives of this study will be employed.

The study design will use descriptive cross-sectional design involving convenient sampling. Cross-sectional study design uses quantitative methods derived from hypothetico-deductive model which is aligned to positivism research paradigm. The survey will be completed by two categories of participants i.e., the one category will be healthcare professionals such as, clinicians and clinical staff and the other category will be patients and caregivers. The survey will explore the knowledge, attitude, perceptions, awareness of both categories of participants using two four-tiered self-administered surveys. The surveys will consist of a questionnaire, accessible online through Research Electronic Data Capture (REDCap) tool.

The following section highlights and explains the study site, study design including instrumentation, sampling and population, identification of the study population, study scope, study setting, inclusion and exclusion criteria, data collection and analysis and ethical considerations. External and internal validity as well as reliability will be reviewed. The research instruments, material and theoretical framework will be deliberated. Processes that will be considered for data collection, data verification, and data analysis will be outlined. Privacy and confidentiality will be maintained.

3.2 Study Design

This study was a cross-sectional analysis of the knowledge, attitudes and perceptions of healthcare professionals and patients regarding telehealth, telemedicine, and virtual consults. Cross-sectional study design uses quantitative methods derived from hypotheticodeductive model which is aligned to positivism research paradigm. Data was collected using two self-administered questionnaires, one distributed to healthcare professionals and the other distributed to patients.

The healthcare professional's questionnaire consisted of four parts. The first part consisted of demographic information such as, age, gender, ethnicity, field of practice, province of practice, sector (public vs private) and years of experience. The second part consisted of current patient practices, and focussed on number of patients seen per day, and current use of electronic and telemedicine software, and ten statements describing the attitudes towards electronic consults in general. An

additional seven statements assessed the overall computer and smart phone use amongst healthcare professionals using seven statements. The third part assessed knowledge of virtual consults and telemedicine using eleven statements and were given the opportunity to list current ways implemented in their practice, if any. The fourth part assessed the attitudes and perceptions towards virtual consults and consisted of three subdivisions, namely, perceived usefulness, patient service and improvement to professional practice and perceived ease of use of telehealth and telemedicine software, using general statements. The questionnaire was ended off with open-ended questions on their outlook of virtual consulting in their practice as well as their concerns.

The patients' questionnaire consisted of four parts. The first part comprised of demographic information such as, age, gender, ethnicity, province, sector (public vs. private), province, level of education, current dialysis mode (haemodialysis vs. peritoneal dialysis), number of years diagnosed with CKD and whether transplanted. The first part ended off with ten general statements regarding their current practices, in terms of consults, use of electronic devices, co-morbidities, and medication use. The second part consisted of seven general statements relating to attitudes towards computers and electronic devices. The third part consisted of ten general statements assessing the current knowledge of virtual consults and telemedicine. Participants were given the opportunity to list ways in which they have already used telemedicine or received a virtual consult. The fourth part assessed the attitudes and perceptions of towards virtual consults and consisted of three subdivisions, namely, perceived usefulness, improvement to patient service and perceived use of ease of telemedicine software, using general statements. Participants were then asked open-ended questions on possible challenges as well as positives in the health setting.

The general statements of both questionnaires required participants to grade their level of agreement using a 5-point Likert-scale (strongly agree, agree, neutral, disagree, strongly disagree)

3.3 Study Population & Sample Size

It is often not possible to calculate the exact proportion of individuals that form a population. The proportion within the sample should be an adequate substitute for the proportion within the whole population.

The sample size was calculated using probability proportional to size sampling and was based on the approximate numbers of dialysis patients and healthcare practitioners practicing in the nephrology sector. Assuming a margin or error of 5%, a confidence interval (CI) of 95% and a response

distribution of 50%, a sample size of a minimum of 100 patients and 100 patients was calculated to adequately power this study.

3.4 Inclusion & Exclusion Criteria

The study population included all consenting participants ≥ 18 years of age. Participants who were practicing as health professionals and were exposed to CKD patients were included. These included nephrologists, vascular surgeons, general practitioners, renal nurses, registered nurses, clinical technologists, pharmacists, and medical students. Renal patients and their caregivers were included.

3.5 Data Collection

The knowledge, attitudes and perceptions of telemedicine, telehealth and virtual consulting amongst healthcare professionals and patients was conducted using a self-administered survey captured on the Research Electronic Data Capture (REDCap) Version 12.3.3 data capture tool. The link to the study questionnaire, which included, information about the study, details of the researcher and matters pertaining to informed consent was sent to potential participants. Participants accessed the questionnaire through the electronic link and submitted and submitted their responses electronically. The questionnaire was disseminated to potential participants as follows: 1) by the administration of practitioner bodies including, the Johannesburg Doctors, Islamic Medical Association, Dialysis Association of South Africa, Steve Biko Medical Registrar Group and University of the Witwatersrand Medical Registrar groups and others; 2) by clinical managers at facilities (state and private); 3) by the researcher directly inviting eligible individuals to participate in the study or extend the invitation to other colleagues. Data collection took place from October 2023 to March 2024. Data responses were recorded automatically to an online database and was manually exported and recorded to a Microsoft Excel spreadsheet.

3.5.1 Quality Control and Data Verification

The data collection process was closely monitored throughout the study to prevent potential errors. A variety of control measures were put into place before and during the survey to ensure that data collection and data recording was based on high data quality and acceptable standards. The data verification process included programmed range checks to identify ant outlying values, missing values, and inconsistencies.

3.6 Data Analysis

Data was analysed quantitatively using descriptive statistics and inferential statistics. The electronic data was analysed using Microsoft Excel and the statistical software STATA 18. Numerical variables

were presented as medians with interquartile range (IQR), and categorical variables were presented as frequency and percentages (%). Pearsons Chi-squared tests were used to test for any statistical association amongst the variables. Cronbach Alpha was used to test the internal validity of the questionnaire. Univariate and multivariate logistic regression models were used to explore the relationship between demographic factors to determine predictors of telehealth use and were reported as an odds ratio (OR) with a 95% confidence interval (CI). A value of $p < 0.05$ was considered statistically significant.

3.7 Ethical Considerations

Ethical clearance was obtained from the University of the Witwatersrand's Human Research Ethics Committee Medical (HREC-Med); Clearance certificate number: M230344. Ethical clearance was obtained prior to the commencement of data collection.

3.7.1 Informed Consent

All participants were asked to provide consent before participating in the survey. Owing to the nature of data collection, it was understood that written consent could not be obtained from each participant. A participant information sheet with relevant information regarding consent for study participation was distributed electronically along with the questionnaire, which made participants aware that tacit consent to participate was implied once an individual accessed the questionnaire and began the survey. Participants were informed that they had the option of not continuing the study at any point or opting to not submit their responses. Additionally, participants were not obligated to answer every question. All potential participants were informed that their participation was strictly voluntary, and they are free to withdraw from the study at any time without facing any penalty.

3.7.2 Privacy and Confidentiality

Privacy and Confidentiality was maintained throughout the study. Participants were not asked any identifying information. Confidentiality was maintained by ensuring that participants data was kept under lock and key and password protected, ensuring that only the researcher and supervisor has access to the data, and will be kept for a period of five years.

3.8 Validity and Reliability

Reliability is a measure of consistently producing the same results under the same conditions repeatedly and validity is a measure of precision employed in a quantitative study (Heale & Twycross, 2015). All data employed in this research was handled by the researcher alone. No alteration was made to the data obtained. The same variables were collected throughout the study. The data obtained

in the objectives were entered correctly and were compared as comprehensively as possible to current data found in existing literature to ensure that data was interpreted as realistically as possible. The reliability and interpretation of data was also validated by my supervisor to ensure that there was no bias. The questionnaires used in this study were validated by conducting a pilot study before commencement, to ensure that they were reliable and valid.

Statistical experts were consulted to test the tools for validity. The 5-point Likert-scale questionnaire was developed, and experts rated the face validity and content validity of the tools. Consistency, stability, and repeatability were tested using the Cronbach's Alpha coefficients to test the internal reliability estimates of the measuring tool. A Cronbach Alpha coefficient of 0.70 and above was considered acceptable. The researcher also checked whether the items in a similar multi-item set fitted together, were appropriate and consistent.

CHAPTER 4: RESULTS

4.1 Introduction

This chapter depicts findings of the results obtained from both the quantitative surveys (healthcare professionals and patients/caregivers) in accordance with the study objectives and provides an in-depth analysis and discussion of the results obtained.

The results of this study are divided into knowledge, attitudes, and perceptions of healthcare professionals, followed by patients. The benefits of conducting a survey to determine the knowledge, attitudes, and perceptions of both healthcare professionals as well as patients include identifying knowledge gaps, cultural beliefs, and behavioural patterns of both groups of participants. This information may assist to identify the needs, problems and barriers which will assist in future planning and implementation. The information obtained from this study may assist with the understanding of baseline levels.

A total of 244 participants consented to participate in this study, however only 216 surveys were completed and were analysed (81% response rate). The results are divided into two parts: part 1 describes healthcare professionals and part 2 describes patients and caregivers. The following section highlights and explains participants demographics, their knowledge, perceptions and attitudes towards telemedicine, telehealth, and virtual consults.

4.2 Part 1: Healthcare professionals

4.2.1 Demographics of Healthcare professionals

The demographic portion of the survey aimed to identify gender, ethnicity, profession, years of experience, province, sector, and geographical area. A total of 111 healthcare professionals consented to participate in the survey. Of these, 101 in were completed surveys and were used in the analysis, indicating a response rate of 91%. Both the mean and median age of the participants was 45 (SD 10.6), ranging from 22 to 77 years old. The gender ratio was 1:1.6 in favour of females, with almost 61% of the respondents were female. Clinical technologists (23%) and nephrologists (18%) were the most prevalent professions, with experience ranging from less than 5 years to more than 20 years and 42% of the study population had more than 20 years of experience in healthcare (Table 4.1).

Indians (40%) followed by Africans (39%) represented the largest ethnic group within the study population. Majority of the participants were from the Gauteng province (48%), and almost three

quarters of participants working in the private sector (72%) and 67% working in Sub-urban areas (Table 4.1).

Table 4.1: Demographic Characteristics of Healthcare Professionals

Variable (n=101)	**n (%)**	**Use of Telehealth**		
		Yes	**No**	**p-value**
Age (years); Median (IQR)	**45 (35,55)**	45 (37, 57)	41.5 (32, 54)	0.251
Age categories (years), n(%)				0.748
<35 Years	24 (24)	9 (38)	15 (63)	
35-44 Years	25 (25)	12 (48)	13 (52)	
45-54 Years	23 (23)	12 (52)	11 (48)	
≥55 Years	27 (27)	13 (50)	13 (50)	
Gender (Sex)				0.638
Female	62 (61)	28 (45)	34 (55)	
Male	29 (29)	15 (52)	14 (48)	
Ethnicity				0.357
Africans	39 (39)	14 (36)	25 (64)	
Coloured	6 (6)	3 (50)	3 (50)	
Indian	40 (40)	21 (54)	18 (46)	
White	16 (16)	9 (56)	7 (44)	
Profession				0.020
Clinical Technologist	23 (23)	10 (44)	13 (57)	
Nephrologist	18 (18)	15 (83)	3 (17)	
General Practitioner	12 (12)	6 (50)	6 (50)	
Nephrology Trained Nurse	12 (12)	2 (17)	10 (83)	
Registered Staff Nurse	13 (13)	5 (39)	8 (62)	
Specialist Physician	17 (17)	7 (44)	9 (56)	
Other (Medical Students, Pharmacists, Clinical Engineers)	6 (6)	2 (33)	4 (67)	
Province				
Gauteng	48 (48)			
Limpopo	7 (7)			
Mpumalanga	9 (9)			
Western Cape	9 (9)			

Variable (n=101)	n (%)	Use of Telehealth		
		Yes	No	p-value
Free State	6 (6)			
North West	11 (11)			
Eastern Cape	7 (7)			
Northern Cape	3 (3)			
KwaZulu Natal	9 (9)			
Sector				0.301
Public	13 (13)	4 (31)	9 (69)	
Private	72 (72)	37 (52)	34 (48)	
Both	15 (15)	6 (40)	9 (60)	
Geographical Area				
Urban	47 (47)			
Sub-urban	67 (66)			
Rural	32 (32)			
Number of years of experience in healthcare				0.533
≤10 Years	29 (30%)	12 (41)	17 (59)	
11-20 Years	30 (30%)	13 (43)	17 (57)	
>20 Years	42 (42)	22 (54)	19 (46)	

Almost two-thirds (57%) of healthcare professionals attested to consulting high patient loads (i.e. greater than 20 patients a day) and 63% working in more than one dialysis unit due to a high demand for the service. More than two-thirds of the participants preferred digital applications to capture patient notes (79%) and electronic prescriptions (84%), with 68% already using some form of electronic database for patient information, for easy accessibility. Around 51% preferred handwritten patient notes and prescriptions, possibly due to the adjustment of technological systems. Being a specialist nephrologist was shown to be more associated with increased use of telehealth ($p = 0.020$) (Table 4.2).

More than three-quarters of participants (77%) of participants regularly communicated with healthcare workers for patients notes and prescriptions, and 90% of the participants (50%) agreed to patients forgetting the names of their chronic medication (Table 4.2).

Table 4.2: General Attitudes regarding handwritten or electronic records amongst Healthcare Professionals

n= 101; *n (%)*	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
I experience large patient volumes per day	18 (18)	39 (39)	22 (22)	19 (19)	3 (3)
I work at more than one dialysis unit	13 (13)	50 (50)	6 (6)	22 (22)	9 (9)
I prefer handwritten patient notes	11 (11)	40 (40)	21 (21)	27 (27)	2 (2)
I prefer using digital apps to capture patient notes	10 (10)	69 (68)	15 (15)	8 (8)	0 (0)
I prefer handwritten prescriptions	5 (5)	47 (47)	21 (21)	24 (24)	4 (4)
I prefer electronic prescriptions	9 (9)	75 (74)	6 (6)	8 (8)	3 (3)
I have electronic data base records	7 (7)	61 (60)	10 (10)	15 (15)	8 (8)
Healthcare workers contact me regularly for confirmation and clarification regarding patient history and medication records	14 (13)	63 (62)	14 (14)	5 (5)	4 (4)
I can track my patient's current timeline and medication records	7 (7)	65 (64)	19 (19)	5 (5)	5 (5)
My patients often don't remember their chronic medication names	38 (38)	56 (55)	2 (2)	4 (4)	1 (1)

4.2.2 Knowledge and Attitudes towards telemedicine and virtual consulting amongst healthcare professionals

Majority of the study participants (93%) were familiar and comfortable with the use of technology and electronic applications, as well as the use of computers both personally and professionally (96%). Nine-in-ten participants (90%) leaned towards using their smartphones to check and monitor laboratory results. Almost all the participants are intrigued by the use of digital technology and would be interested to learn more (Table 4.3).

Approximately 66% of healthcare professionals had knowledge of virtual consulting and telemedicine, with only 47% having used a video call to assist and consult with a patient, with 36% not feeling comfortable with video-calls and 71% preferring to see the patient during the video consult. More than two-thirds 69% of healthcare professionals were familiar with electronic prescriptions and only 21% were aware of the cost factor associated with setting up virtual consulting rooms and 18% of healthcare professionals had previous experience with virtual consulting, were aware of the concept of an advanced clinical video health check and only 10% had knowledge of the existing laws on virtual consults (Table 4.3).

Table 4.3: Healthcare professionals' knowledge and attitudes towards telemedicine and virtual consults

n=101; *n (%)*	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
Attitudes towards telemedicine and virtual consulting					
I am familiar and comfortable with the use of computers and digital technology	33 (33)	60 (59)	4 (4)	3 (3)	0 (0)
I use computers/ laptops for professional & personal use	36 (36)	60 (59)	3 (3)	2 (2)	0 (0)
I regularly use computers at home	36 (36)	57 (56)	4 (4)	3 (3)	0 (0)
I regularly use computers at work/ my practice/ the hospital	33 (33)	58 (57)	3 (3)	4 (4)	2 (2)
I am familiar and comfortable with the use of smart apps on my mobile device	32 (32)	59 (58)	9 (9)	1 (1)	0 (0)
I tend to use my smartphone for checking laboratory results	38 (38)	56 (55)	3 (3)	2 (2)	1 (1)
I am intrigued to learn more digital technology knowledge	52 (51)	47 (47)	2 (2)	0 (0)	0 (0)
Knowledge of telemedicine and virtual consulting					
I am familiar with the idea of virtual consults	6 (6)	60 (59)	19 (19)	11 (11)	5 (5)
I have utilised a form of video call to assist and consult with a patient	5 (5)	42 (42)	12 (12)	27 (27)	14 (14)
I am comfortable with video-conference calls	5 (5)	31 (31)	20 (20)	33 (33)	12 (12)
I prefer to have access to view the patient while consulting with the patient	7 (7)	64 (63)	25 (25)	1 (1)	4 (4)
I am familiar with the electronic prescription/ e-prescription	8 (8)	61 (60)	18 (18)	13 (13)	0 (0)
I understand the cost factor in setting up virtual consulting rooms	5 (5)	16 (16)	12 (12)	45 (45)	22 (22)
I have had experience with previous virtual consulting software	4 (4)	14 (14)	14 (14)	39 (39)	18 (18)
I know about the existing laws surrounding virtual consults	0 (0)	9 (9)	12 (12)	40 (40)	40 (40)
I know the current virtual consulting software available	0 (0)	10 (10)	11 (11)	42 (42)	38 (38)
I am aware of what an advanced health check is	0 (0)	10 (10)	11 (11)	32 (32)	48 (48)

4.2.3 Perception of telemedicine and virtual consulting amongst healthcare professionals

4.2.3.1 Perceived Usefulness

More than three quarters of participants perceive that the use of virtual consults will save time (80%), will mitigate a long waiting period (82%), mobility or distance barriers (93%), poor patient compliance and adherence to medication (85%); with only 42% perceiving telemedicine being more

beneficial for routine follow-ups and 92% believe that telemedicine will allow for achievement of early intervention, as the ability to send an e-prescription is helpful. Approximately 52% believe that virtual consults will be beneficial to all practices regardless of a high patient load (Table 4.4).

4.2.3.2 Patient Service and Improvement to Professional Practice

Almost three-quarters of the participants (73%) believe that virtual consults compromise patient confidentiality. Majority of participants (95%) attest that patient medical history provided by e-consulting software is beneficial to the prescribing and dispensing process, provides a new opportunity for growth (90%), will promote health related research, will reduce the long-term health care costs (92%) and will be beneficial tool in the National Health Insurance (NHI) programme (79%). Around 95% of participants find the alerts for drug-drug and drug-disease interactions useful (Table 4.4).

4.2.3.3 Perceived Use of Ease of Telehealth (virtual consulting) software

Almost all the participants (90%) felt that virtual consulting software will ease workflow and only 72% feel that it will improve patient satisfaction; with 84% of participants preferring digital applications for patients and making patient follow-up easier (88%). Although 88% of participants feel that virtual consulting will make patient follow-up easier, 74% feel that virtual consulting through software is complicated and 65% would prefer to see patients in person to assess them; and 45% believe that it may allow for unauthorized access to patient records. Only 18% of participants are in agreement with the current forms of telehealth and 92% feel that training is required to be fully competent, and the software will require regular maintenance (96%) and technical which will result in time wastage (77%).

Table 4.4: Perceptions of Virtual Consults amongst Healthcare Professionals

n=101; *n (%)*	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
Perceived Usefulness					
My practice will save time with the use of virtual consults	7 (7)	75 (74)	14 (14)	5 (5)	0 (0)
Virtual consults will mitigate a long waiting time	10 (10)	72 (71)	17 (17)	2 (2)	0 (0)
Virtual consults will mitigate difficulty getting to the practice due to mobility or distance	19 (19)	74 (73)	7 (7)	1 (1)	0 (0)
Virtual consults will mitigate poor patient compliance and adherence to medication	14 (14)	71 (70)	8 (8)	7 (7)	1 (1)

n=101; *n (%)*	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
Laboratory results can be discussed sooner with patients	20 (19)	75 (74)	5 (5)	1 (1)	0 (0)
Early intervention can be achieved	22 (22)	72 (71)	5 (5)	2 (2)	0 (0)
Virtual consulting is ideal only for a practice with a high patient load	4 (4)	18 (18)	26 (26)	40 (40)	12 (12)
Having the capability to send a e-prescription or referral is helpful	20 (20)	76 (75)	4 (4)	1 (1)	0 (0)
Compared to outpatient follow-up, virtual consults will be more beneficial	9 (9)	33 (32)	32 (32)	19 (18)	8 (8)
Patient Service and Improvement to Professional Practice					
Virtual consults may compromise patient confidentiality as more information is stored and available in databases	6 (6)	67 (66)	13 (13)	13 (13)	2 (2)
Virtual consults is a new opportunity for my practice to grow in terms of a service profile	10 (10)	80 (79)	11 (11)	0 (0)	0 (0)
Patient medication history provided by e-consulting software is beneficial to the prescribing/ dispensing process	13 (13)	82 (81)	5 (5)	1 (1)	0 (0)
e-consulting software will enable clinicians to view patient medication history thereby facilitating rational prescribing	11 (11)	84 (83)	5 (5)	0 (0)	0 (0)
Virtual consulting software promotes health-related research through reliable patient information collection	10 (10)	82 (81)	9 (9)	0 (0)	0 (0)
Virtual consulting reduces overall costs for the healthcare system in the long run	8 (8)	71 (70)	18 (18)	4 (4)	0 (0)
Virtual consulting will be a useful tool on the National Health Insurance (NHI) programme	13 (13)	77 (76)	9 (9)	1 (1)	1 (1)
Virtual consulting clinical decision support tools are beneficial in my practice	13 (13)	73 (72)	13 (13)	2 (2)	0 (0)
I am concerned about the privacy control imposed over my practice	6 (6)	78 (77)	10 (10)	6 (6)	1 (1)
Clinical decision support tools are beneficial in my practice	15 (15)	74 (73)	11 (11)	1 (1)	0 (0)
I find warnings, alerts and drug-drug or drug-disease interaction alerts useful	37 (37)	58 (57)	5 (5)	1 (1)	0 (0)
Perceived Use of Ease of Telehealth (virtual consulting) software					
Virtual consulting software will ease my workflow	9 (9)	81 (80)	7 (7)	3 (3)	0 (0)
Virtual consulting improves patient satisfaction	9 (9)	63 (63)	22 (22)	6 (6)	1 (1)
I prefer digital apps for patient records	12 (12)	72 (71)	14 (14)	2 (2)	0 (0)
It will be easier to follow up patients	10 (10)	78 (77)	12 (12)	1 (1)	0 (0)

n=101; *n (%)*	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I prefer to see patients in person and assess them rather than remotely	13 (13)	61 (60)	19 (19)	7 (7)	0 (0)
Virtual consulting through software is complicated	5 (5)	60 (59)	24 (24)	12 (12)	0
Virtual consulting through software is secure and prevents unauthorised access	2 (2)	30 (30)	24 (24)	37 (37)	8 (8)
I agree with the functionality of current forms of telehealth	3 (3)	15 (15)	42 (42)	35 (35)	5 (5)
Clinicians will require additional training to be competent in virtual consulting	40 (40)	53 (52)	3 (3)	2 (2)	1 (1)
Virtual consulting will require regular maintenance and technical support	33 (33)	63 (62)	4 (4)	0 (0)	0 (0)
Such technical support will cause time wastage	22 (22)	55 (54)	13 (13)	10 (10)	0 (0)

4.2.4 Predictors of the use of Telemedicine amongst healthcare professionals

The evaluation of the relationship between demographic characteristics and use of telemedicine/telehealth amongst healthcare professionals showed that there was an association between profession and the use of telemedicine. Nephrologists were more likely to use telemedicine compared to other healthcare professionals. On univariate and multivariate analysis, nephrologists were ten times and twelve times more likely to use telehealth respectively ($p = 0.032$; $p = 0.044$) (Table 4.5).

Although not statistically significant, middle-aged participants (45 to 54 years) ($p = 0.314$; $p = 0.367$), participants with more years of computer experience ($p = 0.280$) and participants practicing in the private sector ($p = 0.397$) were two times more likely to use telehealth on univariate and multivariate analysis.

Table 4.5: Univariate and Multivariate logistic regression models for use of telehealth amongst healthcare professionals

		Use of Telehealth, OR (95% CI)					
N = 101	Used	**Univariate Analysis**			**Multivariate Analysis**		
Variable	Telehealth	**Crude OR**	**95% CI**	**p-value**	**Adjusted OR**	**95% CI**	**p-value**
Age group, years							
<35 Years	9 (37.5%)	1	Reference	Reference	1	Reference	Reference
35-44 Years	12 (48.0%)	1.54	0.49 - 4.81	0.459	2.10	0.49 - 9.03	0.318
45-54 Years	12 (52.2%)	1.82	0.57 - 5.82	0.314	1.98	0.45 - 8.70	0.367
≥55 Years	13 (50.0%)	1.67	0.54 - 5.15	0.375	0.70	0.15 - 3.34	0.655
Gender							
Female	28 (45.2%)	1	Reference	Reference	1	Reference	Reference
Male	19 (50.0%)	1.21	0.54 - 2.73	0.638	-	-	-
Race							
Black	14 (35.9%)	1	Reference	Reference	1	Reference	Reference
Coloured	3 (50.0%)	1.79	0.32 - 10.06	0.511	3.90	0.57 - 26.76	0.167
Indian	21 (53.9%)	2.08	0.84 - 5.17	0.113	2.87	0.69 - 12.02	0.148
White	9 (56.3%)	2.30	0.70 - 7.51	0.169	2.81	0.63 - 12.44	0.174
Profession							
Other	2 (33.3%)	1	Reference	Reference	1	Reference	Reference
Clinical Technologist	10 (43.5%)	1.53	0.23 - 10.15	0.655	1.25	0.16 - 9.57	0.833
General Practitioner	6 (50.0%)	2.00	0.26 - 15.38	0.505	1.14	0.13 - 10.13	0.908
Nephrologist	15 (83.3%)	10.00	**1.22 - 81.90**	**0.032**	**11.77**	**1.07 - 129.42**	**0.044**

Nephrology Trained Nurse	2 (16.7%)	0.40	0.04 - 3.90	0.430	0.39	0.03 - 6.07	0.503
Registered Staff Nurse	5 (38.5%)	1.25	0.16 - 9.54	0.830	1.13	0.10 - 12.59	0.921
Specialist Physician	7 (43.8%)	1.56	0.22 - 11.09	0.656	1.16	0.14 - 9.94	0.892
Sector							
Both	6 (40.0%)	1	Reference	Reference	1	Reference	Reference
Private	37 (52.1%)	1.63	0.53 - 5.07	0.397	-	-	-
Public	4 (30.8%)	0.67	0.14 - 3.19	0.612	-	-	-
Years of experience							
≤10 Years	12 (41.4%)	1	Reference	Reference	1	Reference	Reference
11-20 Years	13 (43.3%)	1.51	0.59 - 3.91	0.391	-	-	-
>20 Years	22 (53.7%)	0.92	0.33 - 2.59	0.879	-	-	-
Computer use							
≤10 Years	6 (40.0%)	1	Reference	Reference	1	Reference	Reference
11-20 Years	12 (35.3%)	0.82	0.23 - 2.85	0.753	-	-	-
>20 Years	28 (56.0%)	1.91	0.59 - 6.18	0.280	-	-	-

P < 0.05; statistically significant. OR: Odds Ratio. CI: Confidence Interval

4.3 Part 2: Patients/Caregivers

4.3.1 Demographics of Patients/ Caregivers

A total of 133 participants consented to participate in this survey, however 18 survey responses were excluded as these surveys were incomplete, indicating a response rate of 86% among patients/caregivers. Both the mean and median age of participants were 49, with ages ranging from 22 to 77 years old. Males outnumbered females, as almost two-thirds of participants were male (58%). Africans represented the largest ethnic group of the study population (43%), with majority of participants being patients (72%), residing in the Gauteng province (40%) followed by Eastern Cape (31%). The treatment modality of most participants (87%) was hemodialysis and treatment was carried out at private dialysis units (92%) (Table 4.6).

Table 4.6: Demographic Characteristics of Patients

Variable (n=115)	**n (%)**	**Use of Telehealth**		
		Yes	**No**	**p-value**
Age (years); Median (IQR)	**49 (37.5, 58.5)**	**45 (35, 55)**	**50 (40, 59)**	**0.318**
Age Categories				0.617
<40 Years	33 (29)	15 (46)	18 (55)	
40-49 Years	25 (22)	7 (29)	17 (71)	
50-59 Years	28 (25)	8 (29)	20 (71)	
≥60 Years	26 (23)	8 (31)	18 (69)	
Gender (Sex)				0.152
Female	48 (42)	20 (42)	28 (58)	
Male	67 (58)	19 (29)	47 (71)	
Ethnicity				0.180
Africans	50 (44)	13 (27)	36 (74)	
Coloured	13 (11)	5 (39)	8 (62)	
Indian	26 (23)	8 (31)	18 (69)	
White	24 (21)	0 (0)	24 (100)	
Other	2 (1)	1 (50)	1 (50)	
Role				
Patient	83 (72)			
Caregiver	18 (16)			
Transplanted Patient	1 (1)			
Other	12 (10)			

Variable (n=115)	n (%)	Use of Telehealth		
		Yes	No	p-value
Province				0.028
Gauteng	46 (40)	12 (27)	33 (73)	
Limpopo	16 (14)	9 (56)	7 (44)	
Mpumalanga	5 (4)	2 (40)	3 (60)	
Western Cape	1 (1)	0 (0)	1 (100)	
Free State	5 (4)	5 (100)	0 (0)	
North West	2 (2)	0 (0)	2 (100)	
Eastern Cape	36 (32)	10 (28)	26 (72)	
Northern Cape	1 (1)	0 (0)	1 (100)	
KwaZulu Natal	2 (2)	1 (50)	1 (50)	
Sector				0.351
Private	106 (95)	37 (35)	68 (65)	
Public	6 (5)	1 (17)	5 (83)	
Geographical Area				0.242
Urban	73 (64)	28 (38)	45 (62)	
Sub-urban	37 (33)	11 (31)	25 (69)	
Rural	4 (4)	0 (0)	4 (100)	
Level of Education				0.927
Primary school education	7 (6)	3 (43)	4 (57)	
Secondary school education	52 (46)	18 (35)	34 (65)	
Diploma	40 (35)	14 (36)	25 (64)	
University degree or higher	14 (12)	4 (29)	10 (71)	
Number of years on dialysis				
< 1 year	12 (10)			
1 - 5 years	67 (58)			
6 - 10 years	24 (21)			
11 - 15 years	6 (5)			
16 - 20 years	1 (1)			
Kidney transplant recipient				
Yes	1 (1)			
No	112 (97)			

More than three quarters (78%) of patients preferred to have multiple consults (more than one monthly consult) and 83% generally dialyzed at more than one dialysis unit. This is due to the nature of CKD, where patients dialyze at the unit closest to them when travelling. Less than half of patients preferred handwritten notes and prescriptions (49%). Half of the patients (50%) preferred to use digital applications to communicate and 53% preferring electronic prescriptions. However, only 28% have an electronic database that they are aware of (Table 4.7).

Table 4.7: General Attitudes regarding handwritten or electronic records amongst patients

n= 115; *n (%)*	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
I prefer multiple consults (more than 1 monthly visit)	17 (15)	72 (63)	2 (2)	20 (17)	2 (2)
I generally dialyse at one dialysis or nephrology unit	17 (15)	78 (68)	13 (11)	1 (1)	3 (3)
I prefer handwritten patient notes, letters & reports	9 (8)	48 (42)	48 (42)	7 (6)	0 (0)
I prefer handwritten prescriptions	9 (8)	47 (41)	49 (43)	7 (6)	0 (0)
I prefer using digital apps to communicate	8 (7)	50 (43)	36 (31)	15 (13)	3 (3)
I prefer electronic prescriptions	8 (7)	53 (46)	33 (29)	16 (14)	2 (2)
I have an electronic data base records that I am aware of	6 (5)	26 (23)	49 (43)	26 (23)	4 (4)
I have multiple co-morbidities	9 (8)	25 (22)	44 (38)	31 (27)	1 (1)
I remember to take my medication regularly/ daily	21 (18)	63 (55)	20 (17)	6 (5)	1 (1)
I often don't remember my chronic medication names	1 (1)	17 (15)	32 (28)	46 (40)	15 (13)

4.3.2 Knowledge and Attitudes towards telemedicine and virtual consulting amongst patients

More than two-thirds of patients (68%) were familiar and comfortable with the use of computers and digital applications as well as the use of computers both personally and professionally (63%). Less than half (44%) of patients preferred to use their smartphones to check and monitor their health records, however 62% participants are intrigued by the use of digital technology and would be interested to learn more (Table 4.8).

Only 47% of patients had knowledge of virtual consulting and telemedicine, with only 42% being happy with a video consult instead of F2F consultation and only 33% having used a video call to

receive a consult from their clinician. Less than half patients (47%) are comfortable with video calls in general and 53% preferring to see their doctor during the video consultation (Table 4.8).

More than half (52%) of patients were familiar with electronic prescriptions, whereas only 23% know which software's are available to obtain a digital prescription and 21% were aware about the current laws regarding virtual consults and electronic prescribing. Only 27% were aware of the concept of an advanced clinical video health check (Table 4.8).

Table 4.8: Knowledge and attitudes towards telemedicine and virtual consults amongst patients

n=115	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
Attitudes towards telemedicine and virtual consulting					
I am familiar and comfortable with the use of computers	16 (14)	62 (54)	27 (23)	7 (6)	2 (2)
I use computers/ laptops for professional & personal purposes	18 (16)	54 (47)	27 (23)	11 (10)	3 (3)
I regularly use computers at home	16 (14)	43 (37)	38 (33)	13 (11)	3 (3)
I regularly use computers at workplace	18 (16)	50 (43)	27 (23)	12 (10)	6 (5)
I am familiar and comfortable with the use of smart apps on my mobile device	18 (16)	55 (48)	26 (23)	55 (47)	3 (3)
I tend to use my smartphone for checking my health record	10 (9)	40 (35)	38 (33)	21 (18)	6 (5)
I am intrigued to learn more digital technology knowledge	20 (17)	52 (45)	28 (24)	14 (12)	1 (1)
Knowledge of telemedicine and virtual consulting					
I am familiar with the idea of virtual consults/ video consults	10 (9)	44 (38)	33 (29)	25 (22)	3 (3)
I am happy to see my doctor over the computer or on the phone instead of going in	4 (3)	45 (39)	32 (28)	25 (22)	7 (6)
I have utilised a form of video call to receive a consult	4 (3)	35 (30)	32 (28)	32 (28)	11 (10)
I am comfortable with video-conference calls	8 (7)	46 (40)	31 (27)	24 (21)	5 (4)
I prefer to view the doctor while consulting	9 (10)	49 (43)	35 (30)	18 (16)	2 (2)
I am familiar with the electronic prescription/ e-prescription	13 (11)	47 (41)	28 (24)	21 (18)	4 (3)
I know about the existing laws surrounding virtual consults	6 (5)	18 (16)	46 (40)	30 (26)	12 (10)
I know the current virtual consulting software available	6 (5)	21 (18)	40 (35)	34 (30)	10 (9)
I am aware of what an advanced health check is	5 (4)	26 (23)	39 (34)	29 (25)	11 (10)

4.3.3 Perception of telemedicine and virtual consulting amongst healthcare professionals

4.3.3.1 Perceived Usefulness

More than two-thirds of participants (67%) perceive that the use of virtual consulting will save time will mitigate a long waiting period (66%), mobility or distance barriers (64%). Just less than two-thirds feel that virtual consults will improve patient compliance and adherence to medication (58%); with 62% perceiving telemedicine being more beneficial for routine follow-ups and 64% believe that telemedicine will allow for achievement of early intervention, as the ability to send an e-prescription is easy and convenient. Only 34 % believe that virtual consults will be only beneficial to practices with a high patient load and 52% feel that virtual consults will be beneficial (Table 4.9).

4.3.3.2 Patient Service and Improvement to Professional Practice

Only one-third (31%) of the patients feel that virtual consults will compromise patient confidentiality, with 24% being concerned about control imposed over their personal information, and more than half (52%) attest that patient medical history provided by e-consulting software is beneficial to the prescribing and dispensing process, with only 44% perceiving that it will provide a new opportunity for growth (90%). Virtual consulting was perceived to reduce the long-term healthcare costs by 56% of participants and 54% feel it will be beneficial for the National Health Insurance (NHI) programme. Around 54% of participants find the alerts for drug-drug and drug-disease interactions useful (Table 4.9).

4.3.3.3 Perceived Use of Ease of Telehealth (virtual consulting) software

More than two-thirds (67%) of patients feel that virtual consulting will make their lives easier and 60% feel that it will improve patient satisfaction; with 59% of participants preferring digital applications for patients and making patient follow-up easier (62%).

Although 62% of participants feel that virtual consulting will make patient follow-up easier, 28% feel that virtual consulting through software is complicated and 41% would prefer to see their doctor in person, with 41% feeling neutral and would be comfortable with either option. Only 47% of participants agree with the current forms of telehealth and 38% believe that it is secure and will prevent unauthorized access to patient records. Around 47% feel that training is required to be fully competent, as the software will require technical support (47%) and technical which will result in time wastage (21%) (Table 4.9).

Table 4.9: Perceptions of Virtual Consults amongst Patients

n=115; n (%)	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Perceived Usefulness					
Virtual consults will save patient's time	12 (10)	65 (57)	21 (18)	14 (12)	3 (3)
Virtual consults will eliminate or at least mitigate a long waiting time	14 (12)	62 (54)	20 (17)	12 (10)	4 (4)
Virtual consults will mitigate difficulty getting to the practice due to mobility or distance	15 (13)	59 (51)	24 (21)	12 (10)	4 (4)
Virtual consults will mitigate poor patient compliance and adherence to medication	14 (12)	53 (46)	28 (24)	15 (13)	5 (4)
Laboratory results can be discussed sooner with me	17 (15)	58 (50)	22 (19)	13 (11)	4 (4)
Early medical management steps can be achieved	16 (14)	58 (50)	22 (19)	13 (11)	4 (4)
Virtual consulting is ideal only for a practice with a high patient load	7 (6)	32 (28)	44 (38)	23 (20)	6 (5)
Obtaining e-prescription or referral is helpful	20 (17)	54 (47)	24 (21)	12 (10)	5 (4)
Compared to the outpatient routine follow-up, virtual consults will save time	20 (17)	52 (45)	22 (19)	12 (10)	5 (4)
Compared to regular dialysis patient face to face, virtual consults will be more beneficial	9 (8)	51 (44)	32 (28)	16 (14)	7 (6)
Patient Service and Improvement to Professional Practice					
Video consults may compromise patient confidentiality as more information is stored and available in databases	4 (3)	32 (28)	48 (42)	26 (23)	5 (4)
Virtual consults is a new opportunity for the dialysis practice to grow in terms of a service profile	10 (9)	40 (35)	45 (39)	15 (13)	5 (4)
Patient medication history provided by e-consulting software is beneficial	14 (12)	46 (40)	35 (30)	15 (13)	5 (4)
Doctors can view patient medication history thereby facilitating rational prescribing	13 (11)	54 (47)	30 (26)	13 (11)	5 (4)
Virtual consulting software promotes health-related research through reliable patient information collection	11 (10)	53 (46)	33 (29)	13 (11)	5 (4)
Virtual consulting reduces overall costs for the healthcare system in the long run	15 (13)	49 (43)	33 (29)	13 (11)	5 (4)
Virtual consulting will be a useful tool on the National Health Insurance (NHI) programme	13 (11)	50 (43)	33 (29)	13 (11)	5 (4)
I am concerned about the control imposed over my personal information	6 (5)	33 (29)	51 (44)	19 (17)	5 (4)
Clinical decision support tools are beneficial in my practice	12 (10)	52 (45)	30 (26)	14 (12)	5 (4)

n=115; n (%)	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I find the warnings and alerts useful	16 (14)	46 (40)	30 (26)	14 (12)	5 (4)
Perceived Use of Ease of Telehealth (virtual consulting) software					
Virtual consulting software will make life easier	13 (11)	64 (56)	20 (17)	13 (11)	5 (4)
Virtual consulting will improve patient satisfaction	13 (11)	56 (49)	27 (23)	14 (12)	5 (4)
I prefer digital apps to view my own records	11 (10)	56 (49)	25 (22)	17 (15)	5 (4)
Virtual consults make my follow-ups easier	13 (11)	59 (51)	23 (20)	14 (12)	5 (4)
I like to see my doctor in person (rather than remotely)	10 (9)	37 (32)	47 (41)	15 (13)	5 (4)
Virtual consulting is complicated	2 (2)	30 (26)	43 (37)	30 (26)	10 (9)
Virtual consulting is secure and prevents unauthorised access	8 (7)	36 (31)	48 (42)	16 (14)	6 (5)
I like/agree with the functionality of current forms of telehealth	10 (9)	44 (38)	41 (36)	14 (12)	5 (4)
I will require additional training to be competent in virtual consulting	11 (10)	38 (33)	42 (37)	18 (16)	6 (5)
I will require regular updates and technical support for virtual consulting	11 (10)	42 (37)	40 (35)	16 (14)	6 (5)
Such technical support will cause time wastage	3 (3)	21 (18)	43 (38)	21 (18)	11 (10)

4.3.4 Predictors of the use of Telemedicine amongst Patients/caregivers

The evaluation of the relationship between demographic characteristics and use of telemedicine/telehealth amongst patients showed that there was an association between ethnicity and province with the use of telemedicine. Although the univariate and multivariate analysis on patients and the use of telemedicine, was inconclusive, participants residing in Limpopo were five times more likely to use telemedicine compared to other provinces (p = 0.0.063) (Table 4.10).

Table 4.10: Univariate and Multivariate logistic regression models for use of telehealth among patients

		Use of Telehealth, OR (95% CI)					
N = 115	Used	**Univariate Analysis**			**Multivariate Analysis**		
Variable	Telehealth	**Crude OR**	**95% CI**	**p-value**	**Adjusted OR**	**95% CI**	**p-value**
Age group, years							
<40 Years	15 (45.5%)	1	Reference	Reference	1	Reference	Reference
40-49 Years	7 (29.2%)	0.49	0.16 - 1.51	0.215	0.74	0.21 - 2.61	0.645
50-59 Years	8 (28.6%)	0.48	0.16 - 1.40	0.178	0.27	0.06 - 1.16	0.079
≥60 Years	8 (30.8%)	0.53	0.18 - 1.57	0.253	0.33	0.08 - 1.39	0.130
Gender							
Female	20 (41.7%)	1	Reference	Reference	1	Reference	Reference
Male	19 (28.8%)	0.57	0.26 - 1.24	0.154	0.73	0.70 - 13.83	0.588
Race							
Black	13 (26.5%)	1	Reference	Reference	1	Reference	Reference
Coloured	5 (38.5%)	1.73	0.48 - 6.25	0.403	3.11	0.70 - 13.83	0.137
Indian	8 (30.8%)	1.23	0.43 - 3.51		1.52	0.40 - 5.74	0.536
White	0 (0.0%)	*	*	*	*	*	*
Other	4 (4.2%)	**3.27**	**1.18 - 9.10**	**0.023**	1.36	0.30 - 6.09	0.686
Level of Education							
Primary	3 (42.9%)	1	Reference	Reference	1	Reference	Reference
Secondary	18 (34.6%)	0.71	0.14 - 3.50	0.670	-	-	-
Diploma	14 (35.9%)	0.75	0.15 - 3.82	0.726	-	-	-

Degree or higher	4 (28.6%)	0.53	0.08 - 3.54	0.515	-	-	-
Province							
Eastern Cape	10 (27.8%)	1	Reference	Reference	1	Reference	Reference
Free State	5 (100.0%)	-	-	-	-	-	-
Gauteng	12 (26.7%)	0.95	0.35 - 2.53	0.911	0.71	0.18 - 2.85	0.626
KwaZulu Natal	1 (50.0%)	2.60	0.15 - 45.68	0.513	4.68	0.15 - 151.17	0.384
Limpopo	9 (56.3%)	3.34	1.00 - 11.41	0.054	**4.61**	**0.92 - 23.02**	**0.063**
Mpumalanga	2 (40.0%)	1.73	0.25 - 12.00	0.577	2.40	0.20 - 28.23	0.488
North West	0 (0.0%)	-	-	-	-	-	-
Northern Cape	0 (0.0%)	-	-	-	-	-	-
Western Cape	0 (0.0%)	-	-	-	-	-	-
Sector							
Private	37 (35.2%)	1	Reference	Reference	1	Reference	Reference
Public	1 (16.7%)	0.37	0.04 - 3.26	0.369	-	-	-
Geographical Area							
Rural	0 (0.0%)	1	Reference	Reference	1	Reference	Reference
Suburban	11 (30.6%)	*	*	*	-	-	-
Urban	28 (38.4%)	*	*	*	-	-	-

P < 0.05; statistically significant. OR: Odds Ratio. CI: Confidence Interval

4.4 Summary of results of Healthcare Professionals and Patients/Caregivers

Both healthcare professionals and patients preferred electronic prescriptions and using digital applications to capture notes. Most healthcare professionals had electronic databases already in use, however only some patients were aware of their electronic records. Majority of the patients preferred more than one consult per week and healthcare professionals experienced large patient volumes per day, therefore multiple consults were not always manageable. Although healthcare professionals felt that their patients did not remember the names of their chronic medication, patients disagreed (Figure 4.1).

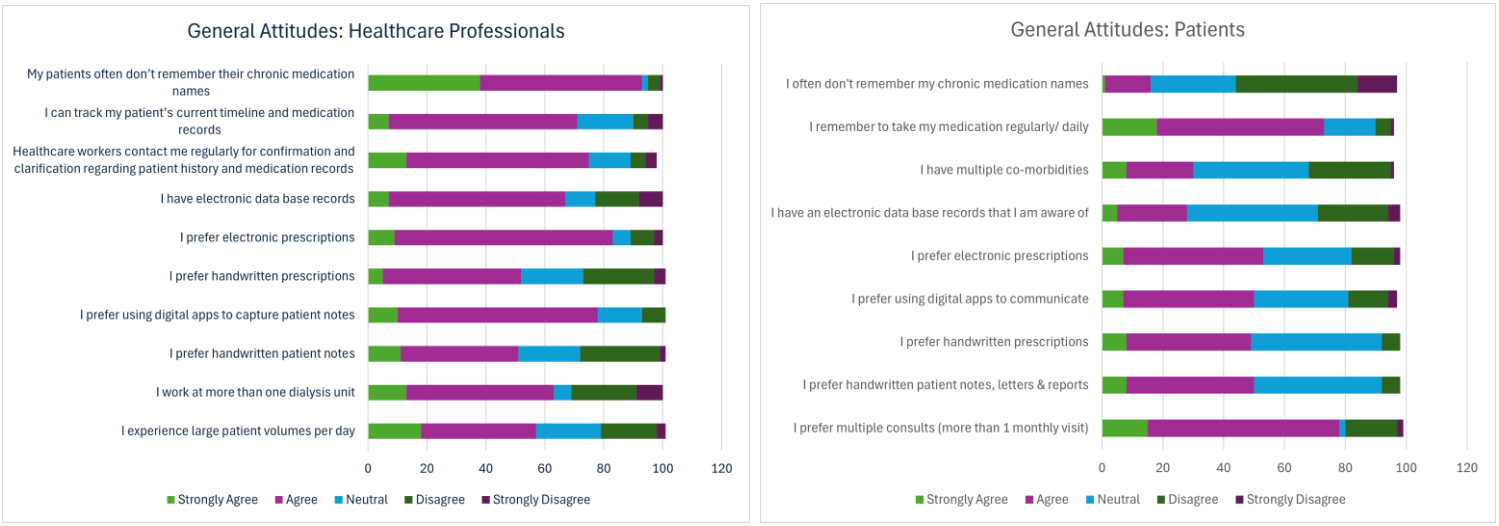


Figure 4-1: Likert-scale responses of healthcare professionals and patients' general attitudes towards telehealth.

Both healthcare professionals and patients were comfortable with the use of computers and digital technology, used computers/ laptops professionally or personally and were comfortable with the using of digital applications on their smartphones to monitor health records, such as blood results. Healthcare professionals were more familiar with digital applications on their smartphones compared to patients, possibly due to higher levels of education. Both healthcare professionals and patients preferred to view each other during the consultation, with patients feeling more comfortable with video calls compared to healthcare professionals (Figure 4.2).

Although both healthcare professionals and patients were familiar with the concept of virtual consulting, many patients were not familiar with virtual consulting. Healthcare professionals did not know of the current software available for virtual consulting, however patients were aware. This could possibly be due to patients assuming that messenger applications such as, WhatsApp. Facetime and zoom, were the main software used for virtual consulting and were unaware of the official software's

being utilized. Both healthcare professionals and patients were unaware of the laws and ethical considerations relating to virtual consulting (Figure 4.2).



Figure 4-2: Likert-scale responses of healthcare professionals and patients' knowledge & attitudes towards telehealth.

Both healthcare professionals and patients agreed that telehealth will save time, mitigate mobility and distance barriers, mitigate poor adherence to medication as well as allow for early intervention. Although healthcare professionals felt that virtual consults may compromise patient confidentiality, patients felt that it was safe, and confidentiality would be maintained. Patients felt that virtual consulting was complicated, however, healthcare professionals did not share the same feeling. Although virtual consulting has many perks, both patients and healthcare professionals prefer to have an in person, rather than remote consult (Figure 4.3).



Figure 4-3: Likert-scale responses of healthcare professionals and patients' perception of telehealth.

CHAPTER 5: DISCUSSION

This study explored clinicians and patients, knowledge, attitudes and perceptions of telehealth and telemedicine and the adoption of virtual consults and digital technology in the treatment of kidney disease. The basic purpose was to highlight the concerns and perceptions of both ends of the spectrum (patients and healthcare professionals), for the future. Telehealth, fuelled by an explosion of internet-connected devices, provides opportunities to increase access to healthcare and eliminate barriers for individuals with geographical, transportation or time constraints (Liaw, et al., 2019). The American Telemedicine Association has defined telemedicine as the use of medical information that is exchanged from one site to another through electronic communications and aims to improve patient health (American Telemedicine Association, 2023).

Telemedicine is an emerging tool in South Africa, where many patients live far away from healthcare facilities and have limited access to healthcare. With the advancing telecommunication tools, telemedicine has been established as a distinct entity for easy, affordable consultation without long waiting times, as it saves time for both the doctor and the patient, who will not have to travel long distances (Ahmed, et al., 2021). The goal of telemedicine is to improve the standards of medical care and the well-being of patients.

It was realised that beginning and ending the consultation with a click on a computer, as opposed to physical waiting rooms, was perceived to facilitate clinical focus and efficiency (Liaw, et al., 2019). Under optimal conditions, physicians tend to equate the contact during an in-person visit, using eye contact and facial expressions. Healthcare professionals and patients in this study preferred in person consults and only 7% and 17**%** preferring video consultations respectively. These findings were expected, given that an existing doctor-patient relationship is important for both the video consultation to be successful and for patients to be willing to use the service. Visual cues have been previously described as benefits of video consultation, favourably building rapport and communication (Mold, et al, 2019).

A patient-centred consultation, eliciting the patient's thoughts, concerns and requests is essential for the video consultation. The lack of an in-person consult may result in physicians missing certain visual cues and will be unable to conduct certain examinations. However, both patients and healthcare professionals in this study responded favourable to telemedicine and reported that using a telemedicine intervention, such as a video call, saves time; these findings are consistent with current literature (Liaw, et al., 2019). Telemedicine may be helpful in reducing the rush and administrative

issues in hospitals, saving consultants time, which can be utilised for improved care for their patients (Ahmed, et al., 2021). Some authors have queried whether video consultations may be less reliable, less safe and less cost-effective than traditional encounters; due to the online environment known to produce subtle alterations in the dynamics of human interaction, and a potential risk of certain clinical cues being missed (Greenhalgh et al , 2018). Although much can be obtained from home monitoring and clinical observation for breathing patterns, there is no standardization of the physical examination during virtual care (Raina, et al., 2021).

Healthcare professionals should remember to always be present during the virtual consultation, by maintaining eye-contact. Looking away from the screen may lead the patient to believe that the clinician is no longer listening or is disinterested. This could be mitigated by reviweing the patient chart before the consult (Raina, et al., 2021). This was confirmed in this study as most patients still preferred an in-person consult as it allowed for a stronger connection between patient and doctors.

Telemedicne allows for flexibility in scheduling visits. The ability to attend appointments requires significant time and bears a large cost factor burden for patients, particularly those with a lower income. Patients in this study felt that virtual consults will save time, mitigate long waiting times, mitigate the distance to the facilities and make their lives easier. A study showed that telemedicine visits significantly improved patient attendance to follow-ups (Raina, et al., 2021).

To ensure access to telehealth, the software's used for e-consulting will be required to share information with other healthcare professionals, such as primary care providers. Healthcare professionals in this study feared that electronic software and sharing of records will compromise patient confidentiality, however patients felt that it would be secure. Without adequate sharing, errors may occur, patients will receive conflicting advice and critical information will not be shared (Liaw, et al., 2019). Many telehealth companies are identifying ways to integrate virtual care with electronic health records (American Hospital Association, 2015).

In prospective studies carried out in Saudi Arabia by Alashamari, (2019), senior physicians had little interest in telemedicine and its technology, because of limited exposure to technology particularly, the digital software used in telehealth. In contrast, this study demonstrated that with the growing know-how of telemedicine, both healthcare professionals and patients were familiar and comfortable with the use of smartphones and healthcare professionals already preferred using digital applications to access patient information and monitor laboratory results. In addition, medical students are well aware of medical applications and majority of them have already installed health-related applications

on their smartphones (Ahmed, et al., 2021). Although the knowledge and attitudes relating to telehealth are good, there is a need to translate this knowledge into good practice.

In this study, both, healthcare professionals and patients believed that telemedicine would reduce and will be a suitable tool to use in the National Health Insurance (NHI) programme. To reduce costs, telemedicine may need to focus on patients that are responsible for the highest healthcare costs and telemedicine should be integrated with primary care (Stanton & Rutherford, 2005). Although telemedicine is mostly used to treat acute conditions, it is increasingly being used in the management of chronic conditions, such as CKD. Primary care physicians have already started managing complex patients with multiple co-morbidities, that require frequent visits and have limited physical mobility through virtual consults (Moore, et al., 2016).

Staff training has been shown to be important for the success of telemedicine to acclimate patients and healthcare professionals to the telemedicine system. The most effective methods include recorded videos and live webinars. Video training allows individuals to revisit the training multiple times and have their frequently asked questions addressed (Raina, et al., 2021). Both healthcare professionals and patients in this study acknowledged the need for training and felt that technical support will not cause time wastage. Majority of the participants were unfamiliar with the laws relating to virtual consulting and the electronic software's, indicating that training should include laws and regulations relating to telemedicine.

Within the study sample, we found that participants were more likely to be educated, urban based and receiving care from private facilities. Although the findings from this study confirm that video consults may have a place in healthcare and most of the study population possessed the precursors for adoption of telehealth due to internet access and technological competence, both healthcare professionals and patients preferred in person visits, for the personal touch associated with a F2F consult, in contrast, in the United Kingdom patients preferred to use virtual consultations when a F2F consultation was not warranted, even if the conditions were chronic conditions (Mold, et al, 2019), such as CKD. There is a growing mismatch between experimental trials and the variable experiences of teams who have introduced video consults in reality (Greenhalgh et al , 2018).

CHAPTER 6: FINAL OVERVIEW

6.1 Conclusion

Telehealth is an innovation worthy of further investigation as an integrated part of primary care for both acute and chronic conditions. The utility of telemedicine in the care of selected groups of patients, such as CKD patients is of tremendous value. Telehealth may allow patients to obtain care and for both the patient as well as their healthcare team to receive updates. Telehealth users are attracted to its convenience and telemedicine is a valuable instrument to improve patient care, however, to make it more promising, healthcare professionals need to be trained to ensure success of this rapidly acknowledged field of effective patient care.

There is a growing need to educate patients and healthcare professionals to make use of this commendable facility. The implementation of telehealth will result in improved patient care, less overcrowding in medical facilities and out-patient departments, satisfied patients and doctors and an improved overall healthcare system.

6.2 Limitations and future recommendations

There are limitations to consider when interpreting the findings of this study, beginning with their generalizability to all population groups. This study focussed primarily on patients with kidney disease and the healthcare team involved in their treatment and cannot be generalised to all patients. The bulk of the study sample consisted of healthcare practitioners and patients from sub-urban areas, consulting in the private sector, thus the study population was limited to those with access to healthcare. Due to electronic data collection, participants with poor computer skills may have been discouraged from partaking in the survey. There is a dearth of studies investigating telehealth and telemedicine, as such there is a need for further high-quality studies to fully evaluate the usefulness of telehealth and virtual consulting in patient care, particularly on the long-term impact of telehealth on the patient-doctor relationship.

6.2.1 Brief set of recommendations

Although South Africa plans to implement the National Health Insurance (NHI) programme, there us no system for telemedicine and virtual consulting formally in place allowing access to all patents and healthcare professionals. Telemedicine has great potential and with adequate training and information, healthcare professionals will be more willing to implement virtual consulting into practice. Guidelines regarding legalities and ethical considerations should be introduced by regulatory bodies.

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APPENDICES

Appendix A: Questionnaire (Healthcare Professionals/ Clinicians)

Self-administered questionnaire (Clinician or clinical staff)

Study Title: The Influence and Impact of Telemedicine, Telehealth and Virtual Online Consulting in the Nephrology Paradigm in South Africa

1. Demographic Questions:

Age: _____

Gender: ☐ Male

☐ Female

Ethnic Group ☐ Black

☐ Coloured

☐ Indian

☐ White

☐ Other, specify

Profession: ☐ Enrolled Nurse

☐ Registered Staff Nurse

☐ Nephrology trained Nurse

☐ Clinical Technologist

☐ General Practitioner

☐ Specialist Physician

☐ Nephrologist

☐ Other (Please specify): _____

Province(s) of dialysis centre

Province: ☐ Gauteng ☐ Limpopo ☐ Mpumalanga ☐ Western Cape

☐ Free State ☐ Northwest ☐ Eastern Cape ☐ Northern Cape

☐ KwaZulu Natal

Sector: ☐ Private

☐ Public

Both

Description of area where dialysis centre is situated:

☐ Urban

☐ Suburban

☐ Rural

Designation: _____

Highest Qualification: _____ put on pg 1

Years of experience in healthcare

☐ <1 year

☐ 1-5 years

☐ 6-10 years

☐ 11-15 years

☐ 16-20 years

☐ >20 years

2. Current Patient Practices

The average number of dialysis patients seen (or treated) per week/ day:

☐ Less than 20 patients per day (average day)

☐ 20 or more patients per day (average day)

Have you recently used / do you use any form electronic telemedicine software in the practice where you work?

Yes ☐ No ☐

If yes, please specify: _____

With the statements that follow, please circle the response that is most relevant to you using the following scale:

1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree

I experience large patient volumes (20 or more patients per day)	1	2	3	4	5
I work at more than one dialysis or nephrology unit.	1	2	3	4	5
I prefer handwritten patient notes	1	2	3	4	5
I prefer using digital apps to capture patient notes	1	2	3	4	5
I prefer handwritten prescriptions	1	2	3	4	5
I prefer electronic prescriptions	1	2	3	4	5
I have electronic data base records	1	2	3	4	5
Other health care workers contact me regularly for confirmation and clarification regarding patient history and medication records	1	2	3	4	5

I can track my patients current timeline and medication records	1	2	3	4	5
My patients often don't remember their chronic medication names	1	2	3	4	5

Computer Use –Personal experience

I have been using computers for
- ☐ <1 year
- ☐ 1-5 years
- ☐ 6-10 years
- ☐ 11-15 years
- ☐ 16-20 years
- ☐ >20 years

With the statements that follow, please circle the response that is most relevant to you using the following scale:

1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree

I am familiar and comfortable with the use of computers and digital technology	1	2	3	4	5
I use computers/ laptops for professional & personal purposes	1	2	3	4	5
I regularly use computers at home	1	2	3	4	5
I regularly use computers in at work /my practice / hospital	1	2	3	4	5
I am familiar and comfortable with the use of smart apps on my mobile device	1	2	3	4	5
I tend to use my smart phone for checking laboratory results	1	2	3	4	5
I am intrigued to learn more digital technology knowledge	1	2	3	4	5

3. Knowledge of virtual-consults and telemedicine:

With the statements that follow, please circle the response that is most relevant to you using the following scale: 1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree					
I am familiar with the idea of virtual consults	1	2	3	4	5
I have utilised a form of video call to assist and consult with a patient	1	2	3	4	5
I am comfortable with video-conference calls	1	2	3	4	5
I prefer to have access to view the patient while consulting with the patient	1	2	3	4	5
I prefer that the patient only views me at the start and end of the consultation	1	2	3	4	5
I am familiar with the electronic prescription/ e-Prescription	1	2	3	4	5
I understand the cost factor in setting up virtual consult rooms	1	2	3	4	5
I have had previous experience with virtual consulting software	1	2	3	4	5
I know about the existing laws surrounding virtual consults	1	2	3	4	5
I know the current virtual consults software available	1	2	3	4	5
I am aware of what an advanced clinical video health check is	1	2	3	4	5

a. List the current ways in which your practice has integrated telehealth concepts.

_____

_____

4. Attitudes and Perceptions of virtual consults:

4.1 Perceived usefulness:

With the statements that follow, please circle the response that is most relevant to you using the following scale: 1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree					
My practice will save patients time with the use of virtual consults	1	2	3	4	5
Virtual consults will eliminate or at least mitigate the risks of the following issues					
• Long waiting time	1	2	3	4	5
• Difficulty getting to the practice due to mobility or distance	1	2	3	4	5
• Poor patient compliance and adherence to medication	1	2	3	4	5
Laboratory results can be discussed sooner with patients	1	2	3	4	5
Early intervention can be achieved	1	2	3	4	5
Virtual consulting is ideal only for a practice with a high patient load	1	2	3	4	5
Having the capability to send an e-prescription or referral is helpful	1	2	3	4	5
Compared to outpatient routine follow up, virtual consults will save time	1	2	3	4	5
Compared to regular dialysis patient F2F visit, virtual consults will be more beneficial	1	2	3	4	5

4.2 Patient Service and Improvement to Professional Practice

With the statements that follow, please circle the response that is most relevant to you using the following scale: 1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree					
Virtual consults may compromise patient confidentiality as more information is stored and available in databases.	1	2	3	4	5
Virtual consults is a new opportunity for my practice to grow in terms of a service profile	1	2	3	4	5
Patient medication history provided by e-consulting software is beneficial to the prescribing/ dispensing process	1	2	3	4	5
e-consulting software will enable clinicians to view patient medication history thereby facilitating rational prescribing	1	2	3	4	5
Virtual consulting software promotes health-related research through reliable patient information collection	1	2	3	4	5
Virtual consulting reduces overall costs for the health care system in the long run	1	2	3	4	5
Virtual consulting will be a useful tool in the National Health Insurance programme	1	2	3	4	5
Virtual consulting Clinical decision support tools are beneficial in my practice	1	2	3	4	5
I am concerned about the privacy control imposed over my practice	1	2	3	4	5
Clinical decision support tools are beneficial in my practice	1	2	3	4	5
I find the warnings, alerts, and drug-drug or drug-disease interaction alerts useful	1	2	3	4	5

4.3 Perceived ease of use of telehealth (Virtual consulting) software

With the statements that follow, please circle the response that is most relevant to you using the following scale: 1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree					
Virtual consulting software will ease my workflow	1	2	3	4	5
Virtual consulting improves patient satisfaction	1	2	3	4	5
I prefer digital apps for patient records	1	2	3	4	5
It will be easy to follow up patients	1	2	3	4	5
I like to see the patients in person and assess them rather than remotely	1	2	3	4	5
Virtual consulting through software is complicated	1	2	3	4	5
Virtual consulting software is secure and prevents unauthorised access	1	2	3	4	5
I agree with the functionality of current forms of telehealth	1	2	3	4	5
Clinicians will require additional training to be competent in virtual consulting	1	2	3	4	5
Virtual consulting will require regular maintenance and technical support	1	2	3	4	5
Such technical support will cause time wastage	1	2	3	4	5

a. Why do you think Virtual consulting does/does not belong in your practice / workplace?

_____

_____

_____

b. When would you consider implementing the use/acceptance of Virtual consulting software in your practice / workplace?

_____

_____

_____

c. Do you think that Virtual consulting should be linked and information transferred between clinicians?

YES☐ ***OR*** **NO☐**

Please explain why or why not:

_____

_____

_____

_____

e. What features do you believe are necessary for Virtual consulting software?

_____

_____

_____

_____

f. What challenges have you faced regarding Virtual consulting?

_____

_____

_____

g. Do you have any other thoughts relating to Virtual consulting that you would like the researcher to know?

_____

_____

_____

_____

Thank you for completing the survey.

Appendix B: Questionnaire (Patients/ Caregivers)

Self-administered questionnaire (Patients/ Caregivers)

Study Title: The Influence and Impact of Telemedicine, Telehealth and Virtual Online Consulting in the Nephrology Paradigm in South Africa

Age: _____

Gender: ☐ Male

☐ Female

Ethnic Group ☐ Black

☐ Coloured

☐ Indian

☐ White

☐ Other, specify

Profession: ☐ Patient

☐ Caregiver

☐ Transplanted patient

☐ Other (Please specify): _____

Province of dialysis centre

Province: ☐ Gauteng ☐ Limpopo ☐ Mpumalanga ☐ Western Cape

☐ Free State ☐ Northwest ☐ Eastern Cape ☐ Northern Cape

☐ KwaZulu Natal

Sector: ☐ Private

☐ Public

Description of area where dialysis centre is situated:

☐ Urban

- ☐ Suburban
- ☐ Rural

Highest level of education:

- ☐ Primary School Education
- ☐ Secondary School Education
- ☐ Diploma
- ☐ Degree
- ☐ Degree
- ☐ Honors or Masters or higher

2. Current Lifestyle

My current dialysis mode:

☐ Haemodialysis ☐ Peritoneal dialysis

Number of years since the start of diagnosis as a chronic kidney disease patient

- ☐ <1 year
- ☐ 1-5 years
- ☐ 6-10 years
- ☐ 11-15 years
- ☐ 16-20 years
- ☐ >20 years

Have you received a kidney transplant?

Yes ☐ No ☐

If yes, please specify: _____

With the statements that follow, please circle the response that is most relevant to you using the following scale:

1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree

I prefer multiple consults (more than 1 monthly visit)	1	2	3	4	5
I generally dialyse at more than one dialysis or nephrology unit.	1	2	3	4	5
I prefer handwritten patient notes letters & reports	1	2	3	4	5
I prefer handwritten prescriptions	1	2	3	4	5
I prefer using digital apps to communicate	1	2	3	4	5
I prefer electronic prescriptions	1	2	3	4	5

I have electronic data base records that I am aware of	1	2	3	4	5
I have multiple comorbidities	1	2	3	4	5
I remember to take my medication regularly / daily	1	2	3	4	5
I often don't remember my chronic medication names	1	2	3	4	5

Computer Use –Personal experience

I have been using computers for
- ☐ <1 year
- ☐ 1-5 years
- ☐ 6-10 years
- ☐ 11-15 years
- ☐ 16-20 years
- ☐ >20 years

With the statements that follow, please circle the response that is most relevant to you using the following scale:

1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree

I am familiar and comfortable with the use of computers	1	2	3	4	5
I use computers/ laptops for professional & personal purposes	1	2	3	4	5
I regularly use computers at home	1	2	3	4	5
I regularly use computers in my work place	1	2	3	4	5
I am familiar and comfortable with the use of smart apps on my mobile device	1	2	3	4	5
I tend to use my smart phone for checking my health record	1	2	3	4	5
I am intrigued to learn more digital technology knowledge	1	2	3	4	5

3. Knowledge of virtual-consults and telemedicine:

With the statements that follow, please circle the response that is most relevant to you using the following scale:

1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree

I am familiar with the idea of virtual consults/ video I am happy to see my doctor over the computer or on the fone instead of going in	1	2	3	4	5
I have utilised a form of video call to receive a consult	1	2	3	4	5
I am comfortable with video-conference calls	1	2	3	4	5
I prefer to view the clinician while consulting	1	2	3	4	5
I prefer that the clinician only views me at the start and end of the consultation	1	2	3	4	5
I am familiar with the electronic prescription/ e-Prescription	1	2	3	4	5
I know about the existing laws surrounding virtual consults	1	2	3	4	5
I know the current virtual consults software available	1	2	3	4	5
I am aware of what an advanced clinical video health check is	1	2	3	4	5

b. List the current ways in which you have used telehealth.

_____

_____

_____

4. Attitudes and Perceptions of virtual consults:

4.1 Perceived usefulness:

With the statements that follow, please circle the response that is most relevant to you using the following scale: 1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree					
Virtual consults will save patient's time	1	2	3	4	5
Virtual consults will eliminate or at least mitigate the risks of the following issues					
• Long waiting time	1	2	3	4	5
• Difficulty getting to the practice due to mobility or distance	1	2	3	4	5
• Poor patient compliance and adherence to medication	1	2	3	4	5
My Laboratory results can be discussed with me	1	2	3	4	5
Early medical management steps can be achieved	1	2	3	4	5
Virtual consulting is ideal only for a practice with a high patient load	1	2	3	4	5
Obtaining e-prescription or referral is helpful	1	2	3	4	5
Compared to outpatient routine follow up, virtual consults will save time	1	2	3	4	5
Compared to regular dialysis patient F2F visit, virtual consults will be more beneficial	1	2	3	4	5

4.2 Patient Service and Improvement to Professional Practice

With the statements that follow, please circle the response that is most relevant to you using the following scale: 1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree					
~~Virtual~~ Video consults may compromise patient confidentiality as more information is stored and available in databases.	1	2	3	4	5
Virtual consults is a new opportunity for the dialysis practice to grow in terms of a service profile.	1	2	3	4	5
Patient medication history provided by e-consulting software is beneficial.	1	2	3	4	5
Clinicians can view patient medication history thereby facilitating rational prescribing.	1	2	3	4	5
Virtual consulting software promotes health-related research through reliable patient information collection	1	2	3	4	5
Virtual consulting reduces overall costs for the health care system in the long run	1	2	3	4	5
Virtual consulting will be a useful tool in the National Health Insurance programme	1	2	3	4	5
I am concerned about the control imposed over my personal information	1	2	3	4	5
Clinical decision and support tools are beneficial.	1	2	3	4	5
I find the warnings and alerts useful.	1	2	3	4	5

4.3 Perceived ease of use of telehealth (Virtual consulting) software

With the statements that follow, please circle the response that is most relevant to you using the following scale: 1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree					
Virtual consulting software will make life easier.	1	2	3	4	5
Virtual consulting will improve patient satisfaction	1	2	3	4	5
I prefer digital apps to view my own records	1	2	3	4	5
Virtual consults make my follow up visits easier.	1	2	3	4	5
I like to see my doctor in person (rather than remotely)	1	2	3	4	5
Virtual consulting is complicated	1	2	3	4	5
Virtual consulting software is secure and prevents unauthorised access	1	2	3	4	5
I like /agree with the functionality of current forms of telehealth	1	2	3	4	5
I will require additional training to be competent in virtual consulting	1	2	3	4	5
I will require regular updates and technical support for virtual consulting	1	2	3	4	5
Such technical support will cause time wastage	1	2	3	4	5

d. Why do you think Virtual consulting does/does not belong in the dialysis centres?

_____

_____

_____

_____

e. Do you think that Virtual consulting should be linked and information transferred between clinicians?

YES☐ *OR* NO☐

Please explain why or why not:

---

h. What challenges do you think you will face regarding Virtual consulting?

_____

_____

i. Do you have any other thoughts relating to Virtual consulting that you would like the researcher to know?

_____

_____

Thank you for completing the survey.

Appendix C: Participant Information Sheet

The Influence and Impact of Telemedicine, Telehealth and Virtual Online Consulting in the Nephrology Paradigm in South Africa

Dear Sir/Madam

Introduction:

I, Naeema Ayoob, is conducting research relating to telehealth, telemedicine, virtual consults in South Africa. In this study, I would like to explore the knowledge, attitude and perceptions of telemedicine, telehealth, and virtual consults in the renal paradigm (setting) of patients, caregivers, clinical staff and clinicians and its role within the health care system. I would also like to explore feedback from the patients, caregivers, clinical staff and clinicians concerning what they would prefer in telenephrology.

Invitation to Participate:

I would like to invite you to participate in this research study.

What is involved in this study?

If you agree to partake in this study, you will be asked to complete a self-administered questionnaire consisting or a range of questions that explore your perception of telemedicine, telehealth, and virtual consults in the renal paradigm (setting). The survey is of intermediate length and should not take longer than 20-25 minutes to complete. The survey link has been provided in the email. All data will remain anonymous, and you will not be required to identify yourself in the survey.

Risks of being involved in this study

There are no risks associated with participating in this study.

Benefits of being involved in this study:

There are no direct benefits to participating in this study.

Participation is voluntary:

Participation is completely voluntary, and you may withdraw from participating in this study at any time with no negative consequences

Confidentiality:

All data will remain anonymous, and you will not be required to identify yourself in the survey. The data will be available to the researchers and supervisors only. All data collected in this study will be securely retained for five years, if a scientific publication arises from this study. Thereafter all data will be destroyed accordingly.

If you have any further queries, please do not hesitate to contact either myself or my supervisor. See contact details below:

	Name	Contact Number	Email Address
Researcher	Naeema Ayoob	082 966 3232	naeemapost@gmail.com
Supervisor	Dr. Ufuo Oro	011 717 3764 084 964 4518	Ufuo.Oro@wits.ac.za; ou58oro@yahoo.com; orooro72@gmail.com

Outputs:

The findings of the study or a summary of the findings may be requested after the study is completed.

Kind Regards

Naeema Ayoob

9000693X

Appendix D: Informed Consent Form

Study Title: The Influence and Impact of Telemedicine, Telehealth and Virtual Online Consulting in the Nephrology Paradigm in South Africa

I hereby confirm that I have accurately read and understood the information sheet provided by the researcher, and I understand that the following will be done:

- I understand that participation is voluntary.
- I shall participate in this study towards the researcher's MBA project.
- I understand that I may withdraw from the study at any time.
- I give the researcher permission to use the interview data
- I understand that I have the right to not answer any questions I do not feel comfortable answering.

I hereby agree that I have understood the requirements of this project and I am willing to participate in the study.
Completing and submitting the questionnaire is taken to mean you consent to participate. By clicking "I agree" below, you consent to the following:

- ✓ I am above the age of 18 years.
- ✓ I have read the information sheet.
- ✓ I understand that my data will be anonymous.

- I Agree
- I Do Not Agree

Appendix E: Ethics Clearance Certificate

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

R49 Dr N Ayoob

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M230344

NAME: (Principal Investigator)	Dr N Ayoob
DEPARTMENT:	Graduate School of Business Administration University
PROJECT TITLE:	*The influence and impact of telemedicine, telehealth and virtual online consulting in the Nephrology paradigm in South Africa*
DATE CONSIDERED:	2023/03/31
DECISION:	Approved unconditionally
CONDITIONS:	
NOTE:	If contact information regarding student study participants is required, please contact the Registrar's office - <Nicoleen.Potgieter@wits.ac.za>
SUPERVISOR:	Professor OU Oro
APPROVED BY:	Professor P Ruff, Chairperson, HREC (Medical)
DATE OF APPROVAL:	2023/08/14 **EXPIRY DATE:** 2028/08/13

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG
OFFICE OF THE DEPUTY VICE CHANCELLOR: RESEARCH
2023 -08- 24
RESEARCH OFFICE
HREC (Medical)
RECEIVED

This Clearance Certificate is valid for 5 years from the date of approval. An extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office secretariat on the 3rd floor, Phillip 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 **March** and therefore reports and re-certification will be due in the month of **March** each year. Unreported changes to the study may invalidate the clearance given by the HREC (Medical).

Signature of Principal Investigator

14 AUG 2023
Date

Appendix F: Protocol Approval Letter

UNIVERSITY OF THE
WITWATERSRAND,
JOHANNESBURG

Private Bag 3 Wits, 2050
Fax:
Tel:

Reference: Ms Jennifer Mgolodela
E-mail: jennifer.mgolodela@wits.ac.za

06 January 2023
Person No: 9000693X
PAG

Dr N Ayoob
PO BOX 2186
Lenasia
1820
South Africa

Dear Dr Naeema Ayoob

Master of Business Administration: Approval of Title

We have pleasure in advising that your proposal entitled *Impact of telemedicine, telehealth and virtual online consulting in nephrology within South Africa* has been approved. Please note that any amendments to this title have to be endorsed by the Faculty's higher degrees committee and formally approved.

Yours sincerely

Mrs Marike Bosman
Faculty Registrar
Faculty of Commerce, Law and Management