Framework to Enhance the Uptake of Sustainable Telehealth Services across the DHBs in New Zealand

A Thesis

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by

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Abstract

Background

The healthcare sector today, across many countries, including New Zealand, faces many challenges, including a shortage of, and an uneven distribution of, health workers, an ageing population, and the prevalence of non-communicable diseases. Technological advances in telecommunications offer new applications for telehealth to enable fast, efficient, and effective patient care to address some of these challenges. The New Zealand Telehealth Forum and Resource Centre defined telehealth as an enabling technology to underpin changes to improve healthcare services delivery across New Zealand. The telehealth stocktake in 2014 by District Health Boards (DHBs) reported on telehealth services and affirmed that the uptake of telehealth in ongoing and routine operations of healthcare is slow, uneven, and fragmented. The onset of the COVID-19 pandemic in 2020 highlighted these issues in an already stressed system and providers quickly adopted telehealth services facilitate access to health services and thus prevent the spread of the virus. Despite the positive benefits, the uptake of telehealth services could not be sustained, and many providers reverted to in-person care amid decreasing COVID-19 risk in the community. Existing studies have suggested that telehealth technology's success increases when a suitable framework supports its implementation. No framework has been designed to implement and uptake telehealth services across the DHBs in New Zealand, and frameworks available elsewhere are country-specific and may not apply in the New Zealand context.

Objective

This study develops an applicable framework to enhance the uptake of telehealth services across DHBs in New Zealand. The study's main objective is to describe the status of telehealth services and identify factors at the organisational level that influence the uptake of telehealth services across DHBs in New Zealand and develop a framework.

Methods

A mixed-method research with concurrent triangulation was conducted to answer the research objectives in three phases. Phase 01 was a literature review identifying the factors at the organisational level that influence the uptake of telehealth services. A qualitative thematic analysis was performed in Phase 01 to develop the initial version of the framework underpinned by the non-adoption, abandonment, scale-up, spread, and sustainability (NASSS) framework. Phase 02 was a survey to investigate the status of telehealth across DHBs in New Zealand. Phase 03 was a semi-structured interview to identify factors at the organisational level that influence the uptake of telehealth across DHBs in New Zealand.

Results

In Phase 01 of the study, 51 studies were identified and analysed thematically to develop the initial version of the framework. The developed framework identified factors at the organisational level across five major domains: namely, the extent of technology integration, human resources, technology infrastructure, financial support, and factors in the external environment. Results of Phase 02 confirmed that all 20 DHBs use telehealth services, with variable uptake across regions and clinical specialities. The use of video conferencing, a widely used telehealth technology, differed significantly across DHBs. Results showed an increased demand for video conferencing and reported insufficient infrastructure, with patients not having access to devices as the biggest challenges to uptake telehealth services. Survey findings indicated a shift in telehealth service focus, from clinical-related to patient-related telehealth interactions, which involved ensuring that patients can use telehealth services closer to home. In Phase 03 of the study, factors at the organisational level that influence the uptake of telehealth across DHBs were identified. Phases 02 and 03 were used to refine the framework developed so that it was specific to DHBs in New Zealand.

Discussion and conclusion

The Framework developed in this study identifies the factors at the organisational level that influence the uptake of telehealth services to support stakeholders across DHBs in the uptake of telehealth services. The data collection reported on the study was completed before the 2020 Covid-19 pandemic in New Zealand. The onset of the pandemic caused a rapidly changing, unpredictable environment that increased the demand for telehealth services across the country. The study recommends a follow-up assessment to indicate any changes in influencing factors that emerged during the pandemic across the DHBs and this could be used to update the developed framework. Moreover, the framework developed from this study can be extended to a national framework to promote telehealth services across primary and non-governmental organisations. The revised, extended framework can inform the Health New Zealand to develop a systematic approach to implement and promote nationwide equitable telehealth services benefiting New Zealanders.

Dedication

To my parents and

my wife

for their love, sacrifices, and continued support

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Publications

The preliminary results of the study have been presented at the following conferences and published in conference proceedings:

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Selwyn (Selwyn-Jebaraj), S. (2018). Framework to assess and enhance the scalability of telehealth services in the District Health Boards of New Zealand: a research proposal. *In Proceedings of the 2018 Health Informatics New Zealand (HiNZ) Conference*, HiNZ 2018 Wellington, New Zealand. https://ebooks.hinz.nz/view/564876691/16/

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List of Abbreviations

Coronavirus disease (COVID-19)

Diffusion of Innovation (DOI)

District Health Boards (DHBs)

General Practitioners (GPs)

Gross Domestic Product (GDP)

Hospital Information System (HIS)

Human Ethics Committee (HEC)

Human-Technology Organisation Environment (HTOE)

Information and Communication Technologies (ICTs)

Information Technology (IT)

International Medical Graduates (IMGs)

MDM (Multi-Disciplinary Meetings)

Ministry of Health (MOH)

National Health Service National (NHS)

New Zealand Telehealth Forum and Resource Center (NZTFRC)

New Zealand Telehealth Leadership Group Support (NZTLG)

Nonadoption, Abandonment, Scale-up, Spread, and Sustainability (NASSS)

Non-Government Organisations (NGOs)

Normalisation Process Theory (NPT)

Organisation for Economic Co-operation and Development (OECD)

Primary Health Organisations (PHOs)

Statistical Package for the Social Sciences (SPSS)

Technology Acceptance Model (TAM),

Technology Organisation and Environment (TOE)

Video Conferencing (VC)

Working to Add Value Through E-Information (WAVE)

World Health Organisation (WHO)

Chapter 1 Introduction

1.1 Global Challenges in the Healthcare Sector

The healthcare sector faces many challenges and these are likely to shape its future. These include health worker shortages, an ageing population, and an increase in non-communicable diseases. The competitive demand for health workers is growing globally. Crisp and Chen (2014) note that the saying, “no health without a workforce”, is increasingly acknowledged as a universal truth. The World Health Organization (WHO) predicted that the health worker shortage would reach 12.9 million by 2035, up from 7.2 million in 2013. It is also the assessment of the WHO that 40% of nurses in developed countries will quit their nursing jobs within the next ten years due to high work demands or little incentive to stay (Thomas et al., 2013). The health workforce across the Organisation for Economic Co-operation and Development (OECD) countries are reliant on migrant health workers. Between 2006 and 2016, the number of foreign-trained doctors across the OCED countries increased by fifty per cent (OECD, 2019).

Under-investment in the training and education of healthcare workers results in continuous shortages (WHO, 2020). As well as health worker availability, the unequal distribution of health workers creates inequalities in healthcare access, and this is compounded by the deployment of health workers to rural and remote areas (Liu et al., 2017). Rural, remote, and impoverished regions often fail to attract or retain healthcare professionals, and health experts are generally more available in urban or more developed regions (Crisp & Chen, 2014). Furthermore, globally, both the wider population and health workers are increasingly ageing. An ageing population is linked to an increased likelihood of comorbidities and this increases the demand for healthcare workers (Crisp & Chen, 2014). The most common diseases associated with ageing are chronic and associated with impairment and permanent disability rather than infectious or acute disorders.

Epidemiologically, non-communicable diseases are rising, leading to increased impairment, disability and chronic disease, which all require more extended and resource-intensive care (Crisp & Chen, 2014).

Although this research was conducted prior to the pandemic, the onset of the coronavirus pandemic (COVID-19) starting in 2020 has worsened the growing shortage of health workers across OECD countries (Ministry of Health, 2021c; OECD, 2020). The long term impact of the pandemic on health workers shortages remains unpredictable with the border closures and travel restrictions (Ministry of Health, 2021c) and these affect the ability of health systems to respond (WHO, 2020). Health workers are a central component of the pandemic response to deliver essential healthcare services (WHO, 2020), and the onset of the pandemic led healthcare providers to work differently to use telehealth services (NZ Telehealth Forum and Resource Centre, 2020). During the pandemic, many countries, including New Zealand, started using telehealth as a key tool to prevent the spread of the virus while providing healthcare services (Association of Salaried Medical Specialists, 2020).

1.2 Challenges in New Zealand's Healthcare Sector

New Zealand was one of the first countries to establish national health services to integrate primary and hospital-based services and provide equal healthcare access (Goodyear-Smith & Ashton, 2019). The healthcare sector in New Zealand is organised around public, private, and Non-Government Organisations (NGOs). Public health care is mostly government-funded and comprises District Health Boards (DHBs) and Primary Health Organisations (PHOs). DHBs are the nucleus of the New Zealand healthcare system and aim to provide affordable and quality healthcare to a widely geographically distributed population. The 20 DHBs are required to focus on addressing the health inequalities among their geographical population and prioritise healthcare services according to their budgets (Quin, 2009). DHBs are governed by a board of members and are accountable for what happens in their own defined geographical regions (Ministry of Health, 2020b). The current complex and fragmented health system creates duplications and gaps across the 20 DHBs, contributing to inequity and inefficiency (Goodyear-Smith & Ashton, 2019). A report in 2020, released by the Health and Disability Systems Review, recommended system-level changes across the DHBs be implemented in 2022, with the hope that this leads to better and more equitable outcomes for New Zealanders (Ministry of Health, 2020b).

The DHB plans, manages, provides, and funds healthcare services for its district population and ensures the services are provided effectively and efficiently. Each DHB provides healthcare services to the population within its defined geographical area (Ministry of Health, 2021b; The Treasury, 2014). The DHB structure aims to provide high-quality care and helps to address any potential problems regarding healthcare service access and utilisation, particularly for rural or remote regions. (Ministry of Health, 2016b, 2021b). The availability of healthcare services at the local level overcomes challenges that lead to inequalities in healthcare delivery. Even so, various challenges exist around the issues surrounding access, equity, funding, and workforce shortages

1.2.1 Access to Health care

Access to health care is a key driver to improve health outcomes and support health equity (Shi, 2012). A survey in 2012 found that 27% of adults could not access primary healthcare when they needed it (Ministry of Health, 2013b). This unmet need is likely increased among people living in more deprived and rural areas. Large proportions of Māori live in high deprived rural areas and have poorer health (Ministry of Health, 2020b). The unmet healthcare needs are reported more among Māori when compared to non-Māori populations (Health Quality & Safety Commission, 2019). Over half of the Māori population live in the most deprived areas in New Zealand (Health Quality & Safety Commission, 2019). Māori who are living in the deprived communities are more likely (1.4 times) to experience unmet needs than non-Māori (Ministry of Health, 2019a). Māori receive less access to appropriate healthcare services, despite experiencing a high level of healthcare need (Medical Council of New Zealand, 2019). Māori reported that a lack of transport is a barrier to access health services 2.6 times more often in comparison to non-Māori; Pasifika people reported this 2.2 times more than non-Pasifika people (Ministry of Health, 2019a).

People living in rural areas need to travel long distances to obtain essential specialist healthcare services. They also face challenges in receiving the same level of clinical care as people living in urban areas (Ministry of Health, 2020b; Sarah, 2021). Rural communities are likely to have high unmet health needs due to challenges to universal, equitable health coverage (Ministry of Health, 2020b; Sarah, 2021). In addition, the burden of communicable and non-communicable diseases is often higher among Māori populations (Health Quality & Safety Commission, 2019). Socioeconomic deprivation is strongly linked with poor health outcomes and further increases the burden on publicly funded healthcare systems (National Health Committee, 2010).

1.2.2 Funding Arrangements

Currently, DHBs are spending more money each year than they receive, leading to increasing funding shortfalls (Rosenberg, 2018). According to Keene et al. (2016), the government's funding of health as a proportion of Gross Domestic Product (GDP) is falling. For example, 6.32% of the GDP was allocated to public health in 2009/10, decreasing to 5.95% in 2014/15 (Keene et al., 2016). The decreasing rate reflects reduced spending on healthcare, which may have significant consequences for citizens. Advanced treatments and modern technologies also increase the cost of healthcare (Monitor, 2013). DHBs received the biggest boost in the 2020 Budget, but this still failed to compensate for the underfunding over previous years (Kiernan, 2020). The *Health and Disability Systems Review* recommended providing additional funding to rebalance the system and cover the underfunding over the past decade (Ministry of Health, 2020b). DHBs spending continues to increase with the population growth and ageing (Ministry of Health, 2020b).

1.2.3 Ageing Population

As in other countries, New Zealanders are living longer, and a 30% increase in adults aged over 80 years in New Zealand is predicted by 2031 (Cornwall et al., 2003; Nana et al., 2013). An ageing population is of concern because many people do not experience good health in their later years (WHO, 2021). The ageing process is associated with an increased likelihood of disability, a decline in functional capacity, chronic diseases, as well as a range of chronic physical, sensory, and cognitive impairments. These create an enormous demand for healthcare services, ongoing chronic illness care, and long-term care (Cornwall et al., 2003; Ministry of Health, 2020b). In addition to an ageing population, health workers are increasingly ageing in New Zealand (Ministry of Health, 2016a).

The average age of health workers in the DHB system in 2014 was 45.7 years, an increase from 44.9 years in 2009 (Medical Council of New Zealand, 2016). Around 40.1% of doctors were 50 years old or above in 2015, an increase from 35.3% in 2003. Between 2000 and 2013, the proportion of doctors who were 55 years, or above, increased from 27% to 36%, reflecting the increasing ageing healthcare workforce (Ministry of Health, 2016a). The average age of the specialist workforce in 2014 was 45–54.9 years, and this is still increasing (Medical Council of New Zealand, 2016). A survey of the rural General Practitioner (GP) workforce conducted in 2018 reported a severe shortage of rural-based medical practitioners and that 36% of current rural GPs intended to retire in the next five years (Sarah, 2021). The shortage of health workers provides a challenge to DHBs to address the growing needs of the ageing population (Ministry of Health, 2020b). In addition, uneven distribution and prolonged medical workforce shortages may have important impacts on health workers' workloads, wellbeing, and productivity (Medical Council of New Zealand, 2016). Uneven geographical distribution and shortages of health workers hinder people in rural areas from receiving equitable access to care.

1.2.4 Shortage and Distribution of Health Workers

Healthcare delivery to rural communities is challenging because a higher concentration of medical experts, particularly doctors and consultants, is found in urban areas. Similarly, the distribution of healthcare workers across geographic areas is not even, with a higher concentration of doctors in urban areas and cities. Urban areas have 378 doctors per 100,000 population, compared to 139 doctors per 100,000 in rural areas (Medical Council of New Zealand, 2016). Geographical misdistribution of the medical workforce is a significant challenge, with most rural hospitals struggling to recruit and retain specialists. Primary care facilities and hospitals sometimes struggle to attract, recruit, and retain medical professionals to live and work in rural and provincial areas (Ministry of Health, 2016a).

The workforce shortage between different health specialities is also a significant challenge (Ministry of Health, 2016a). Some hospitals in rural areas currently rely on GPs, and vacancies for GPs in rural practices increased from 35% in 2017 to 39% in 2018 (Sarah, 2021). The Medical Council's Medical Workforce Survey of 2014 showed that overseas-trained practitioners comprised 56% of the medical workforce working in rural and remote areas, compared to 39% in urban areas (Association of Salaried Medical Specialists, 2017; Medical Council of New Zealand, 2016). New Zealand's health workforce is increasingly dependent on migrant health workers (OECD, 2020) and has the second-highest proportion of International Medical Graduates (often referred to as IMGs) across the OECD countries (Association of Salaried Medical Specialists, 2017). The migrant medical professional workforce grew from 35% of specialists in 2000 to 43% in 2014 (Association of Salaried Medical Specialists, 2017). Retention of International Medical Graduates in New Zealand is poor and this is unlikely to change. The retention rate for overseas-trained doctors is around

30% four years after registration. The turnover of International Medical Graduates is high, at an average of 575 doctors and 240 specialists in each year from 2010 to 2015 (Association of Salaried Medical Specialists, 2017; Medical Council of New Zealand, 2016).

Some rural communities face challenges in recruiting and retaining health workers, even more so with the travel restrictions and limited international mobility as a result of the global pandemic (Ministry of Health, 2021c). The COVID-19 pandemic has thus resulted in a greater increased workload, and working overtime during the pandemic could lead to burnout of health workers and affect long-term staff retention. Early during the onset of the pandemic in March 2020, providers across New Zealand moved quickly to use telehealth services. For example, nearly 65% of the outpatients' departments at the Manukau SuperClinic used telehealth services for half of their regular consultations (Association of Salaried Medical Specialists, 2020). Until the pandemic, telehealth was not used frequently across primary care, but it became the most practical option for consultation during the national lockdowns in 2020 (Day et al., 2021).

1.2.5 The Need for Telehealth Services

Policymakers can leverage the benefits of technology to overcome some of the challenges in providing cost-effective healthcare to the New Zealand population (New Zealand Health IT, 2020). Like other computer-based technologies, telehealth services can reach many people over a large geographical area at a (relatively) minimal cost. Studies have shown that telehealth can help address shortages and uneven distribution of health workers in rural and urban areas (Ebad, 2013; Mars, 2013). Patients can be provided with clinical consultations and treated over a distance when access to specialist care is not possible locally (Ekeland et al., 2010). A few healthcare professionals from a single location can consult many patients across the country. The technology is particularly useful in rural and remote areas, where specialists may not reach their work location on time for acute situations.

Telehealth removes most of the need to travel and much of the financial cost, and can, therefore, play an important opportunity in ensuring that health care is accessible to communities that may be difficult to reach (Dawson et al., 2020). Access to telehealth services would be significantly cheaper than accessing care from a physical hospital and enables timely and efficient services (Ministry of Health, 2020b; WHO Global Observatory for eHealth, 2010). Telehealth services implemented in the COVID-19 context have had a positive reception (Association of Salaried Medical Specialists, 2020), and the successful embedding of telehealth services across DHBs could be a solution to reduce some of the major healthcare challenges in New Zealand.

1.3 About Telehealth

1.3.1 Defining Telehealth and Telemedicine

The terms “telehealth” and “telemedicine” are often used interchangeably (Fatehi & Wootton, 2012). Although *telemedicine* is the more commonly used term in the international academic literature (Fatehi & Wootton, 2012), in New Zealand *telehealth* is the preferred term. The New Zealand Medical Council defines *telehealth* as “the use of information or communication technology to deliver medical care when patients and doctors are not in the same physical location. This includes the use of digital technologies like video conferencing and telephone conferencing” (Medical Council of New Zealand, 2020a, p. 1). Video consultations are conducted between a doctor and a patient, either accompanied by a health practitioner or without medical support, and neither parties are physically present in the same consultation room (Medical Council of New Zealand, 2016). This thesis focuses on the video conferencing aspects of telehealth, and *telehealth* will be the preferred term except when citing or referring to authors who designate the term as *telemedicine*.

The term *telemedicine* was coined by the American Thomas Bird in the 1970s, from the Greek *tele* meaning “at a distance”, to mean quite literally *healing at a distance* (Craig & Petterson, 2005). The definition of telehealth has changed over time, and recognising no definitive definition of telehealth, WHO adopted a broad description to define telehealth:

> the delivery of healthcare services, where distance is a critical factor, by all healthcare professionals using information and communication technologies for the exchange of valid information for the diagnosis, treatment, and prevention of disease and injuries, research and evaluation, and for the continuing education of healthcare providers, all in the interests of advancing the health of individuals and their communities. (WHO Global Observatory for eHealth, 2010, p. 9)

Telehealth that refers to a broader scope of remote healthcare services, is an open and continually evolving science, incorporating modern technology advancements as well as adapting to the changing health needs and contexts of societies (Sood et al., 2007; Strehle & Shabde, 2006; WHO Global Observatory for eHealth, 2010). The technology allows the delivery of healthcare and sharing of healthcare information across distances (Strehle & Shabde, 2006). In addition, the technology modifies how people communicate, transfer, and exchange information to enrich their lives (WHO Global Observatory for eHealth, 2010). Electronic information and telecommunication are centrepieces in telehealth to enable long-distance clinical and patient care and education by healthcare professionals. Furthermore, telehealth helps to connect healthcare providers with patients and consulting clinicians across long distances (Greenspun et al., 2016).

In this thesis, I have adopted the following definition used, by the New Zealand Telehealth Leadership Group (NZTLG), which defines telehealth as "the use of information and communication technologies to deliver health services when patients and care providers are not in the same physical location." (NZ Telehealth Forum and Resource Centre, 2019, p. 5).

1.3.2 History of Telehealth

Telehealth technology can be traced back to 1897, where the telephone enabled the diagnosis of a child with croup (Ryu, 2010). In 1906, the first telegraphically transmitted electrocardiogram was undertaken. In 1928, Australia's Royal Flying Doctor Service conducted teleconsultations using Morse code and then later by voice radio. They successfully created novel solutions to distribute healthcare across the nation through this technology (Raison et al., 2015). The development of national postal services in the mid-19th century facilitated more personal healthcare delivery at a distance and connected clinicians who provided and planned this care. National postal services established telegraphy and were widely used in the American Civil War (Craig & Petterson, 2005). In the late 1930s, radios were used in healthcare facilities to provide services to seafarers (Ryu, 2010). The International Radio Medical Centre (Centro Internazionale Radio Medico), based in Rome, was established in 1935 and provided medical care to over 42,000 patients in its first 60 years (Craig & Petterson, 2005). In 1950, a prominent radiologist used fax to send x-ray images (Raison et al., 2015). The first live interactive videoconferencing technology began in 1959 at the University of Nebraska for monitoring and consulting psychiatric patients (Shore, 2015).

The modern form of telehealth that emerged in the early 1960s was mainly driven by the National Aeronautics and Space Administration (NASA). The use of television to facilitate consultation between specialists and GPs, education and training at distant sites was an early technological milestone (Craig & Petterson, 2005). In 1962, a knowledge-based teleconference demonstrated the first aortic valve replacement, and in the mid-1980s, telesurgery became available (Raison et al., 2015).

Despite its fascinating history and early projects, telehealth had a low uptake due to the high cost of technology and low quality of images (Cason, 2014; Wade et al., 2014). Considerable technical improvements in digital communications and technology-enabled organisations to adopt telehealth (Cason, 2014). New possibilities were increased by advancements in digital and satellite communications, low-cost computing, and mobile phones. The rise of digital methods of communication has enabled healthcare organisations to establish new and efficient care delivery systems. Some early milestones in mobile telehealth included satellite-mediated video consultations in Alaska that assessed the viability of improving village healthcare and distance education established by the Newfoundland programme of Memorial University in 1977 (Craig & Petterson, 2005). Recent advances and the increasing availability and use of Information and Communication Technologies (ICTs) by the general population are the drivers of telehealth services. The transition from analogue to digital methods of communication, combined with rapidly decreasing ICT costs, has created new possibilities for healthcare services and delivery. Healthcare professionals have shown more interest in telehealth applications, and organisations envision implementing new and more efficient ways of providing care (WHO Global Observatory for eHealth, 2010). The pace of ICT advancement has been further accelerated by the introduction and popularisation of the internet. Web-based (such as email and video conferencing) and multimedia applications (such as digital and video) have expanded the scope of telehealth services (WHO Global Observatory for eHealth, 2010). Despite the technological drivers, the onset of the COVID-19 pandemic was the biggest driver to use telehealth services globally (Agency for Healthcare Research and Quality, 2021; Denadai, 2020).

1.3.3 Classification of Telehealth Applications

Telehealth is widely applied in the healthcare industry and is most prevalent in diagnostic services, particularly radiology and pathology. The primary types of telehealth applications are real-time (synchronous) and store-and-forward (asynchronous) applications. The classification is based on the information transmission time and the interactions between healthcare professionals (Ebad, 2013; WHO Global Observatory for eHealth, 2010). Both are commonly used in New Zealand (NZ Telehealth Forum and Resource Centre, 2017a).

Real-time applications involve live interaction where participants are available online at the same time in different locations. These include real-time diagnosis, consultation between patients and healthcare professionals, and even consultation between medical professionals (for example, between a GP and a specialist). Real-time applications involve the exchange of video and audio media between the participants and access to patient-related data and records. Teleconsultation is an excellent example used in a wide range of medical specialities (Ebad, 2013; Kim, 2010; WHO Global Observatory for eHealth, 2010). An adequate teleconsultation can result in timely access to correct medical information, improved diagnostics and treatment quality, increased clinician trust, and significantly improved patient care (Deldar et al., 2016; Nerlich et al., 2002). Consultations can be scheduled when both parties can book the time, location, and equipment in advance. It can also be unscheduled for emergency department triage. A range of consultations such as follow-up visits, discharge planning meetings, multidisciplinary team meetings, and ward rounds could be possible by video conferencing. The intended outcome of the consultation could determine discussions and available resources (NZ Telehealth Forum and Resource Centre, 2017b).

Store-and-forward applications are asynchronous applications mostly used in non-emergency services. They involve transmitting health information such as radiology images offline to healthcare professionals in other locations. These applications do not disrupt routine clinical workflows because no live interaction occurs between the participants. They are, therefore, more straightforward to implement than real-time applications (Ebad, 2013; Kim, 2010; WHO Global Observatory for eHealth, 2010).

1.3.4 Potential Benefits of Telehealth Applications

Miller (2006) categorised four potential benefits of telehealth services as follows:

1. Patient benefits include reduced travel, easy access to specialist services and reduced appointment cancellations due to weather or travel conditions. Telehealth also enables real-time opinions from clinicians that reduce the time required for diagnosis and treatment.

2. Practitioner benefits include increasing access and providing continuing care to patients in rural and remote areas.

3. Primary care institutions could benefit from specialist services from regional hospitals. The healthcare team could provide continuous healthcare services to remote locations by increasing their productivity and efficiency.

4. The costs of transferring patients and travel for healthcare professionals could be reduced. Telehealth enables increased productivity, high-quality care, and facilitates communication between healthcare facilities at a lower cost (Miller, 2006).

An adequately established teleconsultation enables timely access to correct medical information and improves diagnostic and treatment quality. Telehealth facilitates access to expert opinions, particularly specialists, and can be useful for patients who do not have access to these in their area of residence. It also enables GPs to consult specialists, and specialists to consult other specialists or engage in group discussions, to refer, consult, seek another opinion, or chart the diagnostic or treatment path for a patient (Deldar et al., 2016; Nerlich et al., 2002). Telehealth services may also involve sending radiology images, videos, or clinical pictures to aid decision-making and reduce unnecessary patient travel and associated costs (Deldar et al., 2016).

Telehealth is a convenient and flexible way for both the patient and the health provider to access healthcare. It can improve the effectiveness and accessibility of healthcare services and reduce costs (WHO Global Observatory for eHealth, 2010). Telehealth services improve healthcare access and utilisation for everyone, particularly in regions without access to specialists (Association of Salaried Medical Specialists, 2020). Patients can also access doctors and specialists beyond their locality or country. In addition, providers can better access continuing medical education sessions, lowering their professional isolation, and increasing their training hours. Telehealth technologies can also overcome the challenges of clinical staff shortages (Ebad, 2013; Kim, 2010; WHO Global Observatory for eHealth, 2010). Thoughtfully applied telehealth services in the right clinical situations enable better and cost-effective care for patients and provide better outcomes than traditional face-to-face care (OECD, 2021).

1.4 Health Information Technology Policy Context in New Zealand

Information and Communication Technologies in the New Zealand health sector is widespread and advanced by international standards (McKenna, 2010). This is partly due to various government actions to promote the development and use of technology in healthcare delivery. The *Health Information Strategy,* first published in 1991, was the Ministry of Health policy initiative that sought to guide information technology and management in the delivery of healthcare services. It was updated in 1996 to the *Health Information Strategy for the Year 2000* (Ministry of Health, 1996). In 2000 the Health Knowledge Strategy was drafted to establish a programme of activity, the Working to Add Value Through E-Information (WAVE) programme. The WAVE project sought ways to improve health outcomes and decrease costs using health information (Ministry of Health, 2001). *The WAVE Report,* published in 2001, gave 79 recommendations to the Ministry of Health on how to ensure better value from the use of health information. These included developing standards for security, privacy, and authentication. The implementation of the WAVE Report was investigated by the Office of Controller and Auditor-General, who prepared the report *Progress with Priorities for Health Information Management and Information Technology* (Controller and Auditor-General, 2006).

The *Health Information Strategy for New Zealand* (2005) aimed to advance some of the WAVE recommendations (Health Information Strategy Steering Committee, 2005). It also addressed some of the challenges associated with information use, such as sharing, collection and data sets, gaining insights into particular populations, promoting healthier lifestyles, and improving health outcomes (Health Information Strategy Steering Committee, 2005). The strategy recognised telehealth as a global trend to provide healthcare services remotely and acknowledged the need to extending services to geographically isolated areas in New Zealand. The strategy proposed a national connectivity initiative to provide secure broadband across the country, advising that it could facilitate telehealth, which could link specialist teams and patients, particularly in rural areas (Health Information Strategy Steering Committee, 2005).

The *National Health IT Plan* was followed in 2010 (National Health IT Board, 2010), updated in 2013–2014 (Ministry of Health, 2013a). It sought to guide stakeholders in investing in ICTs both regionally and nationally through integration and consolidation of health information, the introduction of shared plans and platforms, and decision support (National Health IT Board, 2010). The updated plan prioritised electronic medication management, information platforms in the different regions, integrated care at the community level, and clinical solutions at the national level. It identified telehealth as part of the national and regional investments to facilitate integrated care. Indeed, telehealth was one of the initiatives that the updated plan sought to support and maximise the benefits of the government's broadband programme (Ministry of Health, 2013a). The *Digital Health 2020* initiative updated the *National Health IT Plan* to guide strategic digital investments between 2016 and 2020 (Ministry of Health, 2017). The initiative comprises five major components: electronic health records, health and wellness dataset, preventive health IT capability, digital hospitals, and regional IT foundations. *Electronic health records* ensure that all New Zealanders, including patients, decision-makers, and carers, have easy access to health information. The *health and wellness dataset* aims to ensure health data access to support decision-making at all levels, including by the government and healthcare organisations. *Preventive health IT capability* seeks to support public health initiatives such as screening and immunisation. The *digital hospitals* initiative aims to ensure that hospitals are digitised and integrated (Ministry of Health, 2017). *Regional IT foundational technologies* being implemented to digitise hospitals include: digital medical imaging systems, medical prescriptions, and administration systems. The *Digital Strategy 2020* thus supports and maximises the potential of telehealth services in New Zealand (Ministry of Health, 2017).

1.4.1 Telehealth Context in New Zealand

Telehealth is also one of the government's digital health initiatives (Ministry of Health, 2017). The *New Zealand Health Strategy* (2016) theme *closer to home* involves providing healthcare to people close to where they live, work, learn, or play. This theme is mainly targeted for managing long-term and chronic health conditions and preventing chronic disorders by promoting wellbeing early in life. The theme *smart systems* revolve around finding new ways to share innovations in healthcare across the system by using emerging technologies. It involves developing smart methods that can help in sharing information and improving the management of patient reporting and clinical audits (Ministry of Health, 2016b). One example where both themes are being implemented efficiently to enhance healthcare accessibility is the Waikato DHB, which became the first centre in New Zealand to launch a virtual health service (National Health IT Board, 2016).

The National Health IT Board described telehealth as an enabling technology to underpin the changes required in providing healthcare services across New Zealand. Telehealth also assists people in rural areas with transport limitations to access speciality care when needed. These communities could be connected via technology and receive timely healthcare services from a broad range of specialists. Appropriate care ultimately improves complex health conditions, decreases hospital admissions, and reduces travel costs, saving on the cost of treatment to the individuals (National Health IT Board, 2015). The New Zealand Telehealth Forum and Resource Center (NZTFRC), funded by the Ministry of Health (MOH), plays a key role in promoting telehealth services. The forum is led by a leadership group that include telehealth industry experts, policymakers, consumers, clinicians, IT experts, and planning and funding managers (NZ Telehealth Forum and Resource Centre, 2021).

According to the NZTFRC, telehealth services are used in many parts of the country. For example, the Waikato DHB renal unit has a video conferencing unit to reduce the distance a patient travels and their time to reach specialists. Similar is the Northland DHB Telestroke service and renal unit (NZ Telehealth Forum and Resource Centre, 2018b). Telestroke aims to reduce inequalities among Māori and Pasifika communities living in rural areas, who only have access to small district hospitals by providing better access to time-critical therapies. The Northland renal unit provides specialist support using video conferencing to diagnose, treat, and monitor patients' health conditions without the need for the patient to leave home (NZ Telehealth Forum and Resource Centre, 2018b). The two dialysis satellite units in Kaitaia and Kawakawa use video conferencing to connect with the Whangarei Hospital renal unit and a renal specialist in Auckland City Hospital. Video conferencing enables specialists to jointly plan the best care for patients and to clarify any clinical issues. The technology also benefits patients by providing timely access and reducing their travel time to see specialists (NZ Telehealth Forum and Resource Centre, 2018b).

Since the emergence of COVID-19, telehealth has played a key role in preventing the spread of the virus and protecting health workers while delivering care to patients. During national and regional lockdowns early in the 2020 pandemic, DHBs used telehealth services to reduce in-person consultations to minimise the potential spread of the virus and demonstrated an exponential increase in the use of telehealth services (Ministry of Health, 2021c). During the early pandemic, the telehealth experience in New Zealand was received positively by both clinicians and patients. The positive benefits and increased utilisation of telehealth during the early pandemic reported several challenges to the use of telehealth services (Association of Salaried Medical Specialists, 2020). Even so, a huge amount of work is needed to implement telehealth services to overcome the challenges of the implementation of telehealth services. Establishing processes, evidence-based guidelines, and clinical information for clinicians requires major changes in roles, routines, and processes (Gogia et al., 2016). Technology insufficiencies and low digital literacy regarding technology use, must be overcome to ensure equitable provision of care using telehealth (Wilson et al., 2021). The interoperability of systems increases the complexity to user interface and adds resistance of staff to use telehealth for clinical consultations (Gogia et al., 2016). Widespread implementation of telehealth services without an equity-based approach may increase health disparities (Wilson et al., 2021).

1.5 Introduction to Thesis

Introducing and implementing technology to healthcare systems is not easy and has not always been successful (Ruiz Morilla et al., 2017). These technologies in healthcare systems have failed in many countries. Australia, the United Kingdom, the United States of America, South Africa, and Malaysia have adopted various healthcare information systems with varying degrees of success. In Australia, the *My Health Record* was launched in July 2012 to enable patients to share their health information with other health practitioners to whom they can allow access (Pearce & Bainbridge, 2014); however, only 21% of Australians had signed up for the service by August 2017 (Walsh et al., 2017). Walsh et al. (2017) noted that usability issues resulted in the low uptake of this technology. The National Health Service National (NHS) Programme for IT in the United Kingdom was also unsuccessful due to design and implementation problems. Later, it was closed, costing taxpayers billions of Euros (Justinia, 2017).

NHS *Connecting for Health*, its replacement, was also closed after running between 2005 and 2013. The National Department of Health in South Africa, recognise the potential of telehealth, but also acknowledge their initial failure in 2012 to implement a national telehealth system (Van Dyk, 2014). The Malaysian Ministry of Health initiated a telehealth system in 1997 in response to increasing demand to improve its healthcare system; however, it remains underutilised, and most of the projects failed to take off (Zailani et al., 2014). In New Zealand, two major healthcare information system projects failed. These were *Health Waikato* (NZD17 million) and *Capital Coast Health* (NZD26 million). These were abandoned and showed the realities of implementing ICTs projects in New Zealand and around the world (Gauld et al., 2006). To increase its chance of success implementation of telehealth must be carefully planned before a rollout. Most technologies may be successfully developed, adopted, and diffused, but efficient and effective scaling to larger populations is often challenging, which may lead to project failure (Alaboudi, 2017). Abandoned and failed projects show the need for extensive research, particularly in the health setting during and after implementation, before introducing telehealth technologies.

1.5.1 Research Philosophy

In research, *epistemology* describes the form and nature of knowledge, whereas *ontology* is concerned with reality or what is (Knight & Cross, 2012). Together with methodology and methods, these comprise the research paradigm. The research philosophy explains the philosophical beliefs and assumptions chosen and adapted by researchers to understand and analyse their data and how it is developed to create new knowledge from their research (Knight & Cross, 2012). The four main philosophical paradigms used by researchers are positivism, realism, interpretivism, and pragmatism (Johnson & Onwuegbuzie, 2004; Knight & Cross, 2012; Morgan, 2007; Scott & Briggs, 2009). Each is based on its own ontological and epistemological assumptions. *Positivism* is based on an ontological assumption of realism, which explains that only one single and intangible reality exists independent of the researcher (Scotland, 2012). *Realism* focuses on reality and beliefs in certain environments and exists independently of the researcher (Scotland, 2012). The epistemology assumption of positivism is objectivism, which means that the research is not part of the research process (is objective), and the role of the researcher is to explore or discover phenomena in an object. Methodology refers to the plan of action, which describes how, why, when, where, and what data are collected and analysed (Scotland, 2012). Methodology in positivist approaches uses factual, raw data to explain relationships and identify causes. Examples of positivist data collection methods include closed-ended questionnaires, standardised tests and observation tools (Scotland, 2012).

In contrast, *interpretivism* is based on the ontological assumptions that multiple realities exist as constructed by people, and therefore, reality can only be limited by time, individual, space, or group (Scotland, 2012). This is also known as relativism, and it explains that reality is subjective. The epistemological assumption of interpretivism is subjectivism, which explains that the world is not independent of our knowledge (Scotland, 2012). The researcher, therefore, is part of the research process, and this is the only way to understand the social world. Methodologies in the interpretive approach include case studies, phenomenology, and ethnography, all of which aim to understand an area of interest from an individual's perspective. Methods include open-ended interviews, questions, observations and focus groups (Scotland, 2012).

The researcher's philosophy aims to make the study both theoretically and practically useful. The post-positivist basis of the present study holds that reality exists but can only be apprehended by the insights and construction of meanings of individuals. The epistemology that best fits this is *pragmatism*, which assumes that all knowledge is realistic and perception is interpretive (Scott & Briggs, 2009). Moreover, this approach facilitates gathering socially useful knowledge that could be employed as grounds for action. This approach directly aligns with the overarching research questions of what is needed to achieve the goals of improving the healthcare system.

In the healthcare field, particularly in healthcare information management applications, a pragmatic approach is required to build a holistic understanding. Moreover, stakeholders in clinical practices widely adopt research that follows a pragmatic philosophy. Various researchers have also argued that this is the most appropriate philosophical stance in health informatics research (Johnson & Onwuegbuzie, 2004; Scott & Briggs, 2009).

Thus, this study adopted the philosophy of pragmatism, which states that any proposition, innovation, idea or ideology is considered true only with empirical, reliable, and credible evidence (Johnson & Onwuegbuzie, 2004; Knight & Cross, 2012; Morgan, 2007; Scott & Briggs, 2009). The study was based on the existing empirical, reliable, and credible evidence, and the chosen methodology was compatible with pragmatism. This methodology and philosophy ensured the credibility of the findings towards developing a framework to enhance the uptake of telehealth services across the DHBs in New Zealand.

1.5.2 Research Gap and Scope

As discussed earlier in this chapter, New Zealand's challenges in delivering high-quality public health services sit within the context of a constantly changing healthcare environment and the need to limit healthcare expenditure growth. The use of telehealth is well recognised internationally and has increased significantly over time (Barnett et al., 2018). The potential of telehealth to improve the quality of care while being cost-effective is yet to be realised in New Zealand. The country has a reliable healthcare system and infrastructure and it also has well-established telecommunication networks, facilitating effective implementation and adoption (Al-Qirim, 2005). Implementing telehealth services in everyday healthcare operations across DHBs could enable better and more cost-effective care, contributing to greater efficiency in the overall system (Ministry of Health, 2020a; Wilson et al., 2021). Despite the potential of this technology, the integration of telehealth into every day operations across the DHBs in New Zealand has been slow, uneven, and fragmented (NZ Telehealth Forum and Resource Centre, 2014). However, more needs to be done to reap the benefits of telehealth. While DHBs want to enhance the uptake of telehealth, the challenge exists in understanding the factors that influence the implementation of sustainable telehealth services (National Health IT Board, 2015; NZ Telehealth Forum and Resource Centre, 2014).

In 2014, the NZ Telehealth Leadership Group (NZTLG) undertook a stocktake to monitor telehealth activity in New Zealand (NZ Telehealth Forum and Resource Centre, 2014). It reported that all DHBs had used telehealth technologies to some degree; however, the full potential of telehealth services is yet to be met, and only four DHBs indicated that their capacity matched demand. In addition, the scale at which telehealth services were implemented in New Zealand was relatively small (National Health IT Board, 2015). This is only more so with the onset of the COVID-19 pandemic and the exponential increase in telehealth services by the 20 DHBs during the early 2020 national and regional COVID-19 lockdowns, but this increase in telehealth service delivery was not sustained post lockdown (Ministry of Health, 2020a, 2021c). Despite the uptake of telehealth services during the onset of the pandemic in 2020, most of the services reverted to in-person care with decreasing COVID-19 risk in the community (Ministry of Health, 2020a). The phenomenal rates of increase in the uptake of telehealth services reported during the pandemic presented many challenges for DHBs, but it also allowed DHBs to assess and re-evaluate their capability for sustainable telehealth services (Ministry of Health, 2021c). The complexity of the implementation of telehealth is often underestimated, and numerous factors influence its success (Van Dyk, 2014).

Factors ranging from technological challenges to infrastructure, legislation, governance, change management, and financial business models impact the successful implementation of sustainable telehealth services (Van Dyk, 2014). Most of the successful telehealth pilot projects could not be sustained (Zanaboni & Wootton, 2012) because they failed to identify the factors that influence the wider implementation of telehealth services (Van Dyk, 2014). In addition, because telehealth services are delivered over distance, the implementation of telehealth services span more than one organisation. These organisations involve multidisciplinary health workers who often exhibit conflicting organisational cultures, incompatible business processes that influence the implementation of telehealth services (Van Dyk, 2014). Existing literature states that only a few studies have explored the factors that influence the uptake of widespread implementation of video consultations (James et al., 2021). Successful implementation of telehealth across the DHBs in New Zealand requires identifying the factors that influence the uptake and need a sustained resolution of all these factors concurrently (Kho et al., 2020).

Existing studies revealed a few existing organisational frameworks that identified the factors to guide the stakeholders on implementing telehealth systems (Singh et al., 2010; Whittaker et al., 2004). For example, Leon et al. (2012) applied a framework to assess the benefits and challenges of scaling up a technology (mHealth) in South Africa (Leon et al., 2012). They identified issues related to the everyday use and availability of information technology in primary care, organisational culture, technological challenges and capacity. Issues of financing, interoperability of systems, and privacy of information for a large-scale implementation also existed (Leon et al., 2012). Gagnon et al. (2006) reviewed the factors for success when implementing telehealth services in rural and remote Canada using a framework (telehealth care normalisation) (Gagnon et al., 2006). The researchers reported various individual, professional, organisational, technological, ethical and sociopolitical factors that influenced scalability. Concerns also existed about the use of telehealth services resulting in fewer doctors' willingness to travel to rural areas. In addition, the issue of readiness for telehealth services emerged. Individuals and communities will take up the technology if they can use it and are ready for it. According to Whitten and Adams (2003), cultural factors must be considered when implementing telehealth services in rural areas (Whitten & Adams, 2003).

Research can identify the setting and context most appropriate for scaling up, and many studies have explained the need for a framework to guide implementing a successful project (Ahmadi et al., 2017; Baker, 2012; Hasanain, 2015; Khoja et al., 2013; Leon et al., 2012; Tsiknakis & Kouroubali, 2009; Van Dyk, 2014; Wade et al., 2017). Existing literature suggests that the success of implementing telehealth technology increases when a suitable framework is available to assist its implementation (Alaboudi, 2017; Cresswell et al., 2013; Hasanain, 2015; Simon et al., 2013). A framework incorporates identifying various factors that could determine the success of the project and ensures that they are duly considered during adoption or implementation. Frameworks depend on the discipline, context, and setting and are therefore not always transferrable (Ahmadi et al., 2015). In every context or setting, factors that affect the success of implementation include technological challenges, human resources, governance, financial business models, legislation, and infrastructure (Kamal et al., 2015).

The existing telehealth frameworks, however, had limited applicability because they were developed either to implement all ICT innovations in a generic way or developed to focus on implementing a specific ICT innovation within a country or organisation (Ammenwerth et al., 2003; Baker, 2012; Bouwman et al., 2005; Cresswell et al., 2013; Gilson & Raphaely, 2008; Healy, 2008; Kaplan, 2001; Westbrook et al., 2007; Yu, 2010). As is discussed in Chapter 2, due to limitations in the applicability of existing frameworks, the researcher argues that the available frameworks are neither suitable nor effective for identifying the factors that influence the implementation of telehealth services across the DHBs in New Zealand. No known studies have identified the factors at the organisational level that influence the implementation and scale-up of telehealth across the DHBs in New Zealand, and those that are available elsewhere are country-specific and may not apply. This study develops a framework specifically to guide telehealth implementation teams across the DHBs to identify and address the factors at the organisational level that will lead to increased uptake of sustainable telehealth services in New Zealand. The focus in the study is on video conferencing aspects of the implementation of telehealth across the DHBs because clinicians perceive video conferencing to be equivalent to traditional face to face visits (OECD, 2021; Taylor, Coates, Wessels, et al., 2015; Wilson et al., 2021). Moreover, video conferencing is the dominant telehealth technology used for patient interactions and clinical networks in New Zealand (National Health IT Board, 2015). It could, therefore, play a more critical role in the implementation of telehealth than other technologies in New Zealand.

1.5.3 Aims

This research aimed to explore, first, the status of telehealth services currently provided by the DHBs and, second, the organisational level factors that influence the implementation of telehealth; and finally, to develop a framework that can guide DHBs to enhance the uptake of sustainable telehealth services.

1.5.4 Research Questions

Research questions assist in framing the research and determining the best methodology to provide scientific explanations (Knight & Cross, 2012).

Three specific research questions are posed to answer the aim of the study:

- What is the status of the telehealth environment across the DHBs in New Zealand?
- What factors, at the organisational level, influence the uptake of sustainable telehealth services across the DHBs in New Zealand?

- What framework, specific to the context and needs of DHBs, will enhance the uptake of sustainable telehealth services?

The research questions were addressed in three phases, using a mixed-methods approach. The following specific objectives of this research are identified to address the research question to achieve the aim of the study:

Phase 01: To conduct a review of the literature:

- To identify the factors at the organisational level that influence the uptake of sustainable telehealth services.
- To develop the initial framework, underpinned by a theoretical framework, to enhance the uptake of sustainable telehealth services.

Phases 02 and 03 are conducted to refine the developed framework specific to DHBs in New Zealand.

- Phase 02: To conduct a survey to understand the status of telehealth across the DHBs in New Zealand
- Phase 03: To conduct semi-structured interviews to understand the organisational level factors across the DHBs that influence the uptake of sustainable telehealth services

Findings from the three phases of the research were integrated to bring together the final framework appropriate to the context and the needs of the implementing telehealth services across the DHBs in New Zealand. The framework developed from this research can guide DHBs for the uptake of sustainable telehealth services in New Zealand.

1.6 Thesis Outline

Chapter 1 provides a background to telehealth, the context, and the focus of this thesis.

The remainder of this thesis is structured as follows

Chapter 2 provides a context for the relevant theories, models and frameworks and discusses the Nonadoption, Abandonment, Scale-up, Spread, and Sustainability (NASSS) framework, which is the theoretical foundation of this research (Greenhalgh et al., 2017).

Chapter 3 presents the methods used for this research study, including the data collection and analysis procedures.

Chapter 4 presents the findings from all three phases of the study, the literature review, the survey conducted across the DHBs, and the semi-structured interviews with telehealth users from the DHBs.

Chapter 5 integrates the findings from the three phases of the research to bring together the final framework and provides suggestions for future research.

Chapter 2 Review of Literature

The thesis has two literature reviews. The first literature review was conducted to inform Chapters 1 and 2. The second literature review was undertaken to inform the development of the initial framework, detailed in chapter 3, section 3.4 of the thesis. The first literature review was initiated using the search strategy explained in Appendix A. The search was limited to literature published in the English language from 2005 to May 2018 that included the sources from journal articles, theses and dissertations. Additionally, electronic and manual searchers examined published reports from governmental and non-governmental agencies and the websites of professional bodies and ICT organisations realted to the search parameters. The purpose of the review was to understand the telehealth context and the relevant theories pertinent to telehealth research.

Research should demonstrate an understanding of theories and concepts relevant to the research topic about the broader aspects of knowledge (Wade et al., 2017). It is, therefore, important to explore the theories and concepts in telehealth research because it helps to understand the key concepts and assist in establishing an applicable and theoretically sound foundation to determine the best fit within the purpose of the research (Wade et al., 2017). For this reason, suitable theories, models, and frameworks were considered while planning this research. By exploring the suitable theories, models, and frameworks, the researcher understood the specific concepts and tools to conceptualise the interaction between people, technology, and the organisations in which they are implemented. In addition, as explained in Chapter 1, this chapter provides the context relating to the frameworks, scalability, and limitations in the applicability of the existing frameworks. Finally, this chapter discusses the theoretical framework chosen to be the theoretical foundation and structured guide for developing the framework to enhance the uptake of sustainable telehealth services across the DHBs in New Zealand.

Several theoretical frameworks have been applied in telehealth research, those reported by Gammon et al. (2008) and Wade et al. (2017) were taken as a starting point and discussed in the following sections

2.1 Theory in Telehealth Research

A theory forms a foundational component of the research by underpinning the design, methodology, analysis, and interpretation of the research project. A *theory* is explanatory and descriptive about specific relationships from the initial research idea until the final presentation and discussion of any research (Labaree, 2017; Swanson & Chermack, 2013).

Telehealth studies are conducted in a wide variety of fields, including medical practices, behavioural sciences, health information technology, economic sociology, and business management. Such studies bring together different theories and approaches that influence the research questions and outcome measures. Literature relating to differing approaches to theory in telehealth are limited. Gammon et al. (2008) reported that only 5% of studies had a theory or a paradigmatic approach while analysing the theories employed in telehealth studies. Most of these studies did not test the theory; instead just enumerated a theory (Gammon et al., 2008; Whitten et al., 2007). A further review conducted in 2014 also suggested no substantial increase in the use of theory in telehealth research studies (Wade et al., 2017). Wade et al. (2017) indicated that some studies argue for not considering a theory because telehealth is not a separate field of scientific enquiry, and it is acceptable to merely adopt the perspective of the individual researcher rather than consider an approach underpinned by theory to structure their research. Others disagree and view telehealth research as a “distinct method of health service delivery” to have a strong tradition of involving multiple clinical specialities (Gammon et al., 2008; Wade et al., 2017). Authors also argue that the research in telehealth is informed by both health systems and services as well as the relationships between technology and people who use the technology. Wade et al.

(2017) reports the above-combined characteristics have contributed to the development of a specific domain of inquiry in telehealth research (Gammon et al., 2008).

Over the past decade, healthcare research started focusing on the adoption of ICTs. There is extensive research in the areas of digital technology adoption (Gammon et al., 2008). Approaches to theory in social psychology and other scientific fields could be adapted and applied to study ICT adoption in health care (Gagnon et al., 2006). The adoption process follows the organisational application adoption decision, to an individual application adoption decision and finally to the post-adoption area (Jasperson et al., 2005). Literature contributes to considerable research in the pre-adoption and the implementation of information technology. Influential factors seen from both the organisational and individual levels are different in pre-adoption and post-adoption contexts and there is a demand for a more specific understanding of the factors that influence the post-adoption and implementation of digital technology (Jasperson et al., 2005; Kane & Labianca, 2011; Zhu & Kraemer, 2005).

As mentioned earlier, there is still a gap in the theory that underpins research into telehealth and theory in the telehealth domain accounts for only 5% out of 1615 articles from 1999 to 2005 (Gammon et al., 2008; Wade et al., 2017). Most of these authors of the telehealth papers published between 1999-2005 adopted an existing theory from multiple disciplines.

The *Diffusion of Innovation Theory* examined telehealth diffusion at the organisational level (DeLone & McLean, 1992; Rogers, 2004). Another set of theories, namely the *Actor-network theory* (Latour, 1999), *Giddens's Structuration theory* (Giddens, 1984), and the *Institutional theory* (Scott, 2005), explained how science and technology are socially embedded to influence technology adoption. Authors also highlighted many adoption problems relating to the lack of fit between these different contexts, namely the human, technology, organisational and environmental (Marques et al., 2011; Tsiknakis & Kouroubali, 2009).

The major theories that have been cited in telehealth research are described in the following subsections.

2.1.1 Positivism

Studies relating to positivism in telehealth have focused on patient health outcomes. Positivism is a deductive scientific method to develop and test a hypothesis during the research process. It involves proposing a hypothesis where quantitative measurements are subjected to statistical significance testing to determine the likelihood of accepting or rejecting the hypothesis. Research using this methodology typically does not clearly explain the theory underpinning the approach because it is assumed to be obvious (Kifle Gelan, 2006; McDowell et al., 2015).

2.1.2 Diffusion of Innovation Theory

One of the widely adopted theories by many studies of ICT adoption in healthcare is the Diffusion of Innovation (DOI) theory (Rogers, 1995). The most frequently mentioned theory in the telehealth studies (11% of the total) was this theory (Gammon et al., 2008; Wade et al., 2017). *Diffusion* is a "process of communication and influence whereby potential users become informed about the availability of new technology and are persuaded to adopt, through communication with prior users" (Attewell, 1992). The Diffusion of Innovation theory describes the sources that influence the adoption and diffusion of innovation. It explains how, why, and at what rate the innovations spread (Chan et al., 2016). It focuses mainly on the ICT adoption at the individual decision-making level by classifying individuals as innovators, early adopters, early majority, late majority, or laggards (Rogers, 1995). The Diffusion of Innovation theory outlines the five characteristics from the perspective of decision-makers, namely: relative advantage, compatibility, trialability, observability and complexity. The adoption of innovation comprises five stages: knowledge, persuasion, decision, implementation, and confirmation. Studies show that this theory has dominated the field of knowledge translation in healthcare ICT adoption and hence is the most common theory cited in telehealth research (Estabrooks et al., 2008; Whitten et al., 2007). It is mainly used to explain the factors affecting the uptake of telehealth projects and ehealth projects. It also focuses on the factors that cause a delay in the adoption of telehealth and ehealth applications (Menachemi et al., 2004; Zanaboni & Wootton, 2012). Some drawbacks of this theory are that it lacks specificity and pays more attention to individual challenges within the organisation (Baker, 2012; Korpelainen, 2011; Oliveira & Martins, 2011).

2.1.3 Normalisation Process Theory

Normalisation Process Theory (NPT) was developed as a response to multiple failures in implementing innovations in the complex healthcare setting (May et al., 2001). It is a sociobehavioural theory focused on the social organisation of work, making practices common elements of everyday life and sustaining embedded practices in their social contexts. It consists of four constructs that describe the action or work performed and proposed a complex intervention to become routine everyday practice. The following mechanisms need to be considered, namely: coherence (what is the work), cognitive participation (who does the work), collective action (how does the work get done) and reflexive monitoring (how is the work understood) (McEvoy et al., 2014). It is mainly concerned with the work individuals and groups have to perform with modern technology or practice to become embedded and sustained in routine practices. It also explains and focuses on the process evaluation of the complex intervention to identify the contextual factors associated with new practices and mainly explores the unique perspectives of service users. Although this theory explains implementation, it focuses on, and explains the post-implementation, and the ways in which practices could be embedded into routine practice and integrated into the social context.

Though NPT was developed specifically in the telehealth field, it does not include a wider societal influence and has a very narrow focus to describe how new practises are integrated and embedded into routine practices (Green, 2020). Moreover, some authors make the criticism that a significant effort is required to develop each construct within the complexity of current organisational practice (Bouamrane et al., 2011; Morrison, 2014).

2.1.4 Systems and Complexity Theories

This group of theories were mainly used to understand better the complex behaviours of adaptive non-linear systems that are difficult to differentiate in causal relationships. These theories explained how innovations in healthcare succeed when they are used slowly, led by locally self-organising groups and they permit the most effective solution to emerge from a range of alternatives. To handle the escalating complexity of health care, one should accept the unpredictability, respect and utilise creativity, and respond flexibly to the emerging patterns and opportunities (Plsek & Greenhalgh, 2001). These theories describe how telehealth could be adopted within the complex healthcare system. The more complex the system, the less likely a single external solution will be effective in health care. It explains how best telehealth could be adopted by changing the existing complex systems in healthcare (Coiera, 2013; Jean et al., 2015; Lehoux et al., 2002; Plsek & Greenhalgh, 2001).

2.1.5 Sociotechnical theories

Sociotechnical theories are considered to explain human-technology relationships. These theories describe how humans use technology, namely the tools and workstations in their immediate environment. Studies relating to these sociotechnical theories are used in teledermatology and telerehabilitation applications. They elaborate on the notion that social context is a key factor in change. This approach also covers a broader aspect of the community, organisational and regulatory interaction with the technology (Charness et al., 2012; Demiris et al., 2010; Sittig & Ash, 2011). In addition, studies that considered sociotechnical theories explain why on the job training and ongoing helpdesk support are key for successful implementation (Greenhalgh et al., 2004)

2.1.6 Process Theories

These theories explain the relationships between the agents that influence the adoption of innovative technology. These theories have a common feature in focusing on the communications, relationship, and action between the agents that influence the adoption. This explains why in telehealth, some activities could be successfully embedded into everyday practices and why others are more challenging to integrate into current ways of functioning (Kairy et al., 2014). One of the most commonly used theories is the structuration theory; it explains how routine organisational activities are developed in a social system and concludes that an effective implementation of a telehealth application needs to be compatible with the organisation's existing routine activities. Other process theories used are activity theory and agency theory. Activity theory identifies the key critical factors that affect the sustainability of the newly developed services in healthcare settings (Lin & Hsieh, 2014). Agency theory explains the relationship between parties in economic transactions adopting telehealth applications (Leukel et al., 2012).

2.1.7 Organisational Change Management Theories Change management theories are concerned with "How"- how the change could be organised for effectiveness and how the target groups will be influenced (Rufo, 2012). The change management process explained by Kurt Lewin's field theory (1951) is based on the idea that there is a current state and a desired future state. This theory begins with Lewin's three-stage model of unfreezing, system change, and refreezing. It was originally proposed as a theory of organisational change but also has an application to individual behavioural change. Because of its simplicity, this theory was the prototype for models that incorporate a "stage of change" approach (Prochaska & Velicer, 1997). It proposes that individuals and groups pass through various stages in their motivation and their readiness to change and intervention needs to be tailored specifically at each stage (Broens et al., 2007; Connolly, 2013; Hendy et al., 2012). Although this theory is widely discussed in the literature, the effectiveness of the theory has been questioned. Broens et al., (2007) described the various sets of factors that need to be considered in a different stage of implementing telehealth applications (Broens et al., 2007). To date, no effective nor generalisable strategies have been elucidated for the constantly changing organisation culture (Parmelli et al., 2011). Impact theories focus on the behaviour of the individuals, their choices, decisions and how that decision could be influenced (Grol et al., 2007). They are categorised as educational, social, and organisational with overlapping factors. The distinction between the change management process and impact theories is often unclear, and they often overlap (Grol et al., 2007).

2.1.8 Behavioural Theories

Cognitive theories of change management focus on rational decision-making processes. These theories propose that changes to professional practices could be made using educational approaches. This approach is consistent with the constructivist approach that defines learning as "What people do when they construct meaning from their experiences" (Slotnick & Shershneva, 2002). Behavioural theories focus on individual motivation and action for their behavioural change. Some of the theories of planned behaviour, interpersonal behaviour, self-efficacy, and adult learning are used to explain why some health professionals are more likely to adopt telehealth than others (Gagnon et al., 2003; Graham et al., 2014; Kelders et al., 2012). These theories are also used more commonly to design telehealth interventions that promote and manage lifestyle and chronic diseases for patients (Riley et al., 2011; Suter et al., 2011).

A range of the above theories were explored to understand the different factors that affect the implementation of sustainable telehealth services. Though DOI was one of the commonly used theories in telehealth research to identify the barriers in telehealth implementation, it does not focus on the organisational decisions regarding implementing a new ICT innovation but on the context of the implementation processes (why and at what rate) itself (Marques et al., 2011; Rogers, 2003; Venkatraman et al., 2015). In addition, DOI explains the characteristics of adopters and the spread of innovation but does not consider external factors and is mainly centred on the technology that may influence adoption, particularly on a large scale (Green, 2020). Furthermore, DOI pays too much attention to individual challenges within an organisation in the diffusion of a new ICT innovation within the organisation (Korpelainen, 2011; Marques et al., 2011; Rogers, 2003; Venkatraman et al., 2015). In addition, NPT does not consider the wider external environment, and sociotechnical theories are technology-centric focused and have no clear mechanisms for adaption (Green, 2020). The next section explains the models in telehealth research.

2.2 Models used in Telehealth Research

A *model* is descriptive and closely related to a theory with a narrowly defined explanation scope (Nilsen, 2015).

2.2.1 Technology Acceptance Model

The technology acceptance model helps to understand the user acceptance of information technology. It was developed based on the theory of reasoned action (Davis, 1989). It is based on the two main concepts, ease of use and perceived usefulness (King et al., 2007). It considers the intention of the individuals as a direct determinant of the behaviour, while the attitude and social norms as the predictors of intention (Davis, 1989). In most telehealth research, the two main concepts of ease of use and perceived usefulness correlate with an intention (Kowitlawakul, 2011; Orruño et al., 2011). Some of the criticisms of this model in healthcare settings are that they do not consider the external factors which influence the technology adoption and does not include the interaction between the user and the task

(Ammenwerth et al., 2006; Yarbrough & Smith, 2007). The terms *adoption* and *acceptance* are often used interchangeably and need much room for improvement in the healthcare industry is addressed by the model discussed next.

2.2.2 Unified Theory of Acceptance and Use of Technology (UTAUT) Model

The Technology Acceptance Model was expanded by a unified theory of acceptance and use of technology (UTAUT) model to address the limitations on lack of standardisation and to be adaptable to healthcare environments (Holden & Karsh, 2010). The UTAUT model is a new promising model and used only by few studies in the field of information systems. Some criticism of this approach involves that this model focuses on the micro/individual level and its lack of meso-level formulation (Holden & Karsh, 2010; Venkatesh et al., 2016; Williams et al., 2011). UTAUT provides a holistic tool to measure the technology acceptance and use but fails to explain the behavioural intention such as culture, technology readiness in different settings (Marikyan, 2003)

2.2.3 Models Relating to Health Economics

Studies based on the health economics models focus on the efficiency and effective allocation of scarce resources (Wade et al., 2017). They share differing variations of cost-effectiveness models, namely the cost analysis, cost-effectiveness analysis, cost-benefit analysis, and cost-utility analysis aiming to attain the position of steadiness for the system (Gammon et al., 2008). The physical and human resource cost in healthcare is measured in terms of health outcomes. One of the main arguments for using this approach in telehealth research is that these technologies reduce healthcare costs to enable cost-effective resource allocation (Bergmo, 2009; Jódar-Sánchez et al., 2013). Some of the large-scale economic evaluations of telehealth projects are seen in the United Kingdom and the United States of America (Darkins et al., 2015; Henderson et al., 2013). All these studies use one of the above four analysis (cost analysis, cost-effectiveness analysis, cost-benefit analysis, and cost-utility analysis) as a base and statistical or economic modelling to analyse respectively the cost or the outcome or both. Some of the health economics models used are the Markov Decision Model (referred to elsewhere as MDM), Transaction Cost Theory (TCT), Disability-Adjusted Life Years (DALYs) and Quality Adjusted Life Years (QALYs) (Aoki et al., 2004; Bergmo, 2014; Henderson et al., 2013; Räsänen et al., 2006; Theodore et al., 2015). Some authors use these models to make extensive use of modelling to predict future cost-effectiveness or cost-savings across a country by implementing telehealth applications (Cusack et al., 2008). However, these models compare the financial costs of telehealth with other models of care it does not consider the organisational or wider aspects of the implementation of telehealth services (Green, 2020).

2.2.4 Telemedicine Service Maturity Model (TSMM)

The framework was developed specifically to identify, measure and manage the maturity of telehealth implementation in the South African healthcare system (Alaboudi, 2017). The maturity indicators developed from this model contain five domains to provide a holistic view of the factors influencing telehealth implementation within the South Africa healthcare system. The five domains discussed in the model were *Man* (community users), *Machine* (Technology infrastructure), *Materia*l (required data), *Method* (processes, guidelines, strategies, and national policies), *Money* (funding). This model has an applicability limitation as it was developed especially for the implementation of telehealth in the South Africa healthcare system. In addition, Alaboudi (2017) argued the model was not supported by rigorous conceptualisation and validation methods.

2.2.5 The Model for Assessment of Telemedicine (MAST)

The European Commission initiated to development of The Model for Assessment of Telemedicine (MAST) to assist decision-makers in choosing the most efficient and cost-effective technologies (Kidholm et al., 2012). The model was developed and validated in the context of Europe by consulting users and stakeholders who use telehealth services in Europe. The model focuses on seven important aspects of implementing telehealth services, namely clinical effectiveness, description of the health problem (application to be used), the economic aspects, patient perception, organisational aspects (workflow, processes between providers), safety (data safety and network problems), and ethical aspects (legal obligations) (Kidholm et al., 2012). The drawback of this model is the applicability limitations (designed specifically to assist decision makers within Europe) and does not include user's dimension (healthcare workers) and their acceptance to use the technology (Alaboudi, 2017).

In summary, TAM was one of the prominent models used in telehealth research but failed to address the above human and wider context interaction. The use of IT is often complicated and multi-dimensional, depending on multiple factors at both the individual and organisational levels (Kukafka et al., 2003). In addition, TAM neglects the social and psychological factors does not explore the interdisciplinary, nondeterministic recursive relationship between the people's action and the wider organisational and system context (Greenhalgh et al., 2017). Health economics do not necessarily capture the benefits other than patients, for example, families of patients and healthcare professionals. In addition, some of the economic model's evaluations are poor in quality and do not consider the interactions of the human element or the wider context in which they operate. TSMM and MAST are specifically developed in the context of South Africa healthcare and the European region and has applicability limitation as explained in the following section 2.3.5.

2.3 Frameworks in Telehealth Research

A *framework* is the structure to support the theoretical foundation of a research study and describes why the research problem under study exists (Labaree, 2017; Swanson & Chermack, 2013). Change management frameworks are commonly used in telehealth projects, whether for adoption, implementation, or scaling up. Most frameworks are discipline-specific and may target innovations, end-users, or settings (Moullin et al., 2015). Implementation frameworks are constructed with varying levels of influence, barriers and facilitators, as well as strategies and stages of implementation. Because of this, they differ in terminology, classification, context, basis, and theory. However, as well as being discipline-specific, frameworks can be context-specific in that their successful application depends on a combination of factors specific to the setting, such as the users, organisation, and region (Moullin et al., 2015). In their systematic review, Moullin et al. (2015) found that frameworks tend to be particular to the type of innovation, and overall, they were more explanatory than predictive.

2.3.1 The Technology Organisation and Environment Framework (TOE)

The Technology Organisation and Environment Framework (TOE) was developed by Tornatzky and Fleischer (1990). It proposes a generic set of factors to explain and predict the likelihood of innovation/technology adoption. This framework serves as a starting point to understanding the factors that influence the post-adoption phase of digital innovation technology (Lin & Lin, 2008; Zhu & Kraemer, 2005). The TOE framework identifies three main aspects that influence the process of an organisation’s adoption of digital technology innovation, namely technology, organisational, and environmental context. The technology context explains the availability of technologies relevant to the organisation both internally and externally. These include the existing technologies currently available in the organisation and the technologies acquired in the market. The organisational context describes the organisation’s characteristics, such as scope, size, organisational structure, and complexity of the managerial structure. The environmental context reflects the arena where the organisation conducts its business, suppliers, competitors, and dealings with government politics and regulations. This framework has been used in many empirical studies on various information system domains, and findings from these authors confirm the framework as a valuable tool in understanding the adoption of digital technology innovation (Lin & Lin, 2008; Zhu & Kraemer, 2005). Though TOE was widely used to understand the readiness of the organisation to adopt new technology innovations, TOE was not originally developed for the healthcare industry. In addition, implementing telehealth services need to look beyond the mere readiness and implementation phase after the adoption phase (Pumplun et al., 2021). The framework, which was primarily developed for the healthcare context to address scalability and sustainability, is discussed in the next section.

2.3.2 NASSS (Nonadoption, Abandonment, Scale-up, Spread and Sustainability) Framework

Many encouraging technological improvements in social and health care are categorised by abandonment or non-adoption by individuals or by unsuccessful efforts to uptake locally, spread distantly, or long-term sustainability at the system or organisation level (Greenhalgh et al., 2017). The framework was developed by Greenhalgh and colleagues (2017) to evaluate the challenges, non-adoption, and abandonment to the spread, sustainability, and scale-up of technologies in health and care services (Greenhalgh et al., 2017). According to Greenhalgh and colleagues (2017), many health and social care technologies were abandoned, were not adopted, or failed to scale up, spread, or become sustainable in the long-term at both the system and organisation level. The authors conducted secondary research and empirical case studies to develop a framework to predict and evaluate the success of health and social care technological innovations (Greenhalgh et al., 2017). The NASSS framework comprises seven domains; the value proposition, the condition or illness, the adopter system, the organisation, the technology, the broader context, and the interaction and mutual adaptation of these domains over time which are explained below in section 2.3.6.

2.3.3 Implementation Frameworks

A review of frameworks for the implementation of telehealth services conducted by Van Dyk (2014) reported implementation frameworks to guide new technology or innovation in healthcare to ensure success and effectiveness. Frameworks that are not based on a particular theory are the seven core principles for the successful development of telehealth systems, lessons in telehealth service innovation, and the framework for assessing the health system challenges to scaling up mHealth, which is based on ICT for health in developing countries (Van Dyk, 2014). In addition, the comprehensive model for the evaluation of telehealth is based on transactional economics theories. The *Khoja–Durrani–Scott (KDS) Evaluation Framework* is based on the systems development lifecycle processes (Van Dyk, 2014). Despite their differences, all implementation frameworks recommend a systematic introduction of the innovation and a pre-planned strategy in line with determinants involved in the innovation process (De Veer et al., 2011). In addition, they include issues surrounding technology, functionality, and application (De Veer et al., 2011; Van Dyk, 2014). Such frameworks have made the initial adoption and implementation of innovations successful because they identify and address relevant user, as well as targeted technical and organisational factors (De Veer et al., 2011; Van Dyk, 2014). However, initial adoption and implementation are not enough to ensure change's continued success and effectiveness, particularly in the long term. Although the adoption and use of technology are vital during implementation, scalability remains critical in the implementation process, without which the project does not last.

2.3.4 Scalability in Telehealth Research

Scalability describes the ability of a project, innovation, or technology to be used in larger populations or at larger scales and in real-world situations beyond the controlled conditions or the small scale where it was first initiated (Milat et al., 2012). Factors such as cost-effectiveness, adequate resources (human, technical, and financial), the effectiveness of the innovation, political acceptability, and feasibility may influence the ability of a technology to scale up (Milat et al., 2015; Milat et al., 2012). Researchers have investigated the importance of frameworks in assessing the scalability of a project before carrying out the scaling up (Milat et al., 2012). A survey of experts on scalability noted that effectiveness, reach (size of the population) and adoption were recognised as essential for successful scalability (Milat et al., 2012). The experts were governmental and non-governmental policymakers with extensive experience in implementing large-scale health programmes and researchers who had been chief investigators in intervention research in Australia and globally. They were selected through purposive sampling, ensuring that individuals with the most knowledge of the research issues were selected (Milat et al., 2012).

Milat et al. (2012) identified effectiveness and reach as key aspects of scalability as they facilitate monitoring and reporting any advantageous and unintended effects, which can help modify or change behaviour for widespread adoption. Monitoring and evaluation play a critical role in scalability because they facilitate a constant feedback loop so that programmes can be dynamically modified, added, or removed (Milat et al., 2012). The reach of an innovation or technology across target groups and settings, including varied socioeconomic settings, can also influence scalability (Milat et al., 2015; Milat et al., 2012). Implementation of telehealth ability or inability to reach certain groups can determine the difficulty of scaling up of technology or innovation.

Another set of factors that influence whether a technology or innovation is scalable is the resources required, including workforce, organisation, and technical resources (Milat et al., 2012). These are related to the infrastructure and expertise needed to scale up, and if they are missing or inadequate, scaling up may not be possible. Another relevant factor is cost, without which scalability is affected. Contextual elements, a set of factors that include political acceptability, compatibility with other policies, acceptability to the community and alignment with government and agency policies, also influence scalability (Milat et al., 2012). Lastly, Milat et al. (2012) acknowledged that relevant research and evaluation strategies are critical when scaling up. These facilitate capturing real-world qualities to enable planning before scaling up, along with evaluation and a constant feedback loop to help correct, modify, and adapt to the real world (Milat et al., 2012). Other researchers have also reported similar expert sentiments (Glasgow et al., 2003).

Studies have shown that the success of telehealth projects during the initial pilot phase does not always translate to sustainable and scalable options in the long term (Broens et al., 2007). For example, Alaboudi (2017) developed a framework to uptake telehealth services in Saudi Arabia and reported on the study that 75% of telehealth projects failed to expand or scale-up services. Berg (1999) reported that around 75% of telehealth services failed during the operational phase. Sundin et al. (2016) reported that telehealth operational failures result from financial, technological, organisational, and contextual challenges, and gives as an example that operating costs may be too high to be sustainable. Human resource challenges, such as staff turnover and training, may also affect operations in the real world. Hailey and Crowe (2003) reported similar findings and added that reliability of equipment software, vendors, technical support, communications, as well as national, regional, and economic issues are likely to affect telehealth services. If stakeholders are not involved, they may not feel a sense of ownership and acceptance of the technology (Hailey & Crowe, 2003).

Acceptability of the technology and a readiness to adopt it are critical in the large-scale adoption of telehealth service technology because those factors determine scalability. The ability to scale up telehealth services to operate long-term requires three distinct but interrelated concepts: continued functioning, normalisation, and widespread uptake. *Continued functioning* refers to the ability of any services to continue functioning into the future with fewer or no foreseeable threats. *Normalisation* is defined as embedding services into daily operations and everyday clinical practice. *Widespread uptake* refers to the phase of innovation where a majority have adopted the new technology or practice (May et al., 2003; Rogers, 2004). Therefore, before deciding to scale up, it is necessary to investigate whether these and other factors are likely to play a role in the real world, even though they may not have featured in the controlled conditions. Assessing scalability before expanding assesses the real world and determines whether the system as it is can continue to perform as expected after a large-scale implementation.

2.3.5 Limitation in Applicability of Existing Frameworks

A framework can help identify the aforementioned factors before scaling up a project or technology to avoid failure. According to Milat et al. (2015), a significant scale-up should be based on evidence and data obtained from monitoring during implementation. For example, the Human-Technology Organisation Environment (HTOE) framework was developed as a general framework to guide the decision-makers in adopting all the Hospital Information System (HIS) innovations within Malaysian public hospitals (Ahmadi et al., 2015). Baker (2012) argued that when a framework is generic for implementing all ICT innovations, it fails to cover all the context-specific factors of success and failure of each technology. Thus, details might be missed. Conversely, the technology-specific Telemedicine Service Maturity Model (TMSMM) framework was developed specifically to identify factors to implement telehealth within the South African healthcare system (Van Dyk, 2014). Studies have argued that no single framework exists for implementing either different ICT innovations within a country or organisation, or a specific ICT innovation for all countries or organisations (Ammenwerth et al., 2003; Baker, 2012; Cresswell & Sheikh, 2013; Healy, 2008; Kaplan, 2001). A framework successful in identifying influencing factors to implement an ICT technology in a given country or organisation may not be suitable for implementing another technology in the same country or the same technology in a different country or organisation (Cresswell & Sheikh, 2013; Gilson & Raphaely, 2008; Westbrook et al., 2007; Yu, 2010). This is because each organisation faces unique challenges and barriers, reflected and driven by their business priorities (Baker, 2012; Bouwman et al., 2005; Gilson & Raphaely, 2008; Healy, 2008). For example, the characteristics of the country or organisation:

1. related to their environment and context might include culture, structure, micro-economy, social, and political influences.

2. related to their implementation strategies for ICT innovations include their project plan, processes, and resources.

3. related to the acceptance and attitude of the potential users of the ICT innovations.

4. related to implementation include the availability and requirements for implementing the ICT innovations.

The ultimate success for implementing a specific ICT innovation lies in developing a framework tailored to the characteristics of both the technology and also the country or organisation (Campbell et al., 2001; Perednia & Allen, 1995). The existing telehealth frameworks, however, had limited applicability because they were developed either to implement all ICT innovations in a generic way or developed to focus on implementing a specific ICT innovation within a country or organisation. Due to limitations in the applicability of existing frameworks, the researcher argues that the available frameworks are neither suitable nor effective for identifying the factors that influence the implementation of telehealth services across the DHBs in New Zealand.

2.3.6 Theoretical Framework Chosen in this Study

In summary, the theories, models and frameworks discussed above were a small percentage of the overall body of telehealth research from the literature, with the remainder being limited in their applicability to this research. Some of the prominent approaches in telehealth research that aid in understanding telehealth adoption and uptake are Diffusion of Innovation theory (DOI), Technology Acceptance Model (TAM), Actor-network theory (ANT) and Technology-Organisational- Environment Model (TOE). Each of the approaches discussed above offers advantages, and a few researchers analysed the course of technology implementation; however, they hardly ever studied scale-up, spread, and sustainability (Greenhalgh et al., 2017). Only a few research works considered the managerial aspect. In case investigators considered actual execution at all, they emphasised small-scale demonstration projects, but they did not examine why these plans failed to spread out more remotely (spread), locally (scale-up), or remain longstanding (sustainability) (Greenhalgh et al., 2017). For these reasons, designing a framework specific to the type of innovation and the healthcare field is ideal. Selecting a framework, therefore, requires careful consideration because some may not cover all aspects of the innovation, and when they do, they may not cover these in the same depth as the innovation (Moullin et al., 2015). Fortunately, in the last decade or so, research has been initiated to fill these significant information gaps, and there is currently enough empirical evidence in the literature to support a new framework for understanding the non-adoption and abandonment of technologies by individuals (staff and patients) and problems with scale-up, spread, and sustainability encompasses in NASSS (Nonadoption, Abandonment, Scale-up, Spread and Sustainability) framework (Greenhalgh et al., 2017). The NASSS framework was selected as an overall framework for this research because it best fits the research to identify the factors that influence the sustainable implementation of telehealth services at both the system and organisational levels. In addition, the NASSS framework was the preferred theoretical framework to guide this research and provide the basis from which the framework for the New Zealand context will be developed as the endpoint of this research project. The framework helps to identify the factors at the micro-level (individual), meso-level (organisational), and macro-level (policy and regulatory) challenges to enable scalable and sustainable telehealth services. The NASSS framework comprises seven domains; the value proposition, the condition or illness, the adopter system, the organisation, the technology, the broader context, and the interaction and mutual adaptation of these domains over time. The challenges were identified and classified as simple, complicated, or complex. Table 1 outlines the seven domains of the NASSS framework, and the domains are discussed in the following sections.

Table 1

NASSS (Nonadoption, Abandonment, Scale-up, Spread and Sustainability) Framework (Greenhalgh et al., 2017)

Domain	**Component**
Condition	• Nature of condition or illness • Comorbidities, sociocultural influences
Technology	• Material features • Type of data generated • Knowledge needed to use • Technology supply model
Value proposition	• Supply-side value • Demand-side value
Adopters	• Staff • Patient • Carers
Organisation	• Capacity to innovate • Readiness for this technology • Nature of adoption/Funding • The extent of change needed to routines • Work needed to implement change
Wider system	• Political • Regulatory • Professional • Sociocultural
	• Adaptation scope over time

Domain	Component
Embedding and adaption over time	• Organisational resilience

2.3.6.1 Domain 1: The Condition or Illness. The condition of illness domain describes the clinical, and sociocultural aspects of the condition. Not all conditions were suitable for telehealth technologies. The severity, level of risk, complexity of the disease, and predictableness of the condition were critical in determining whether the case could be resolved using telehealth technologies.

2.3.6.2 Domain 2: The Technology. This domain addresses the features of the technology and includes size, aesthetics, and sounds that impact the perceived and actual appropriateness and usability of the technologies. The technology dependability was addressed in terms of trustworthiness, the accuracy of the data, knowledge and the skills required to operate, troubleshoot and maintain the technology. Other issues in this domain include the interoperability of the technology, the ability to customise the technology, and other issues in the supply process.

2.3.6.3 Domain 3: The Value Proposition. This domain assesses whether the technology was worth its value. The needs should be matched between the demand-side value and supply-side value. The demand-side value was determined by positive results of efficacy, safety, and useful business practice tests. In contrast, the supply-side value was determined by technology appraisal, procurement, and reimbursement decisions as well as the evidence that the technology was beneficial to patients. If the organisation did not see the value in the technology, adoption and scaling-up might not be achieved.

2.3.6.4 Domain 4: The Adopter System. This domain explained the adoption of the technology by patients, staff, and caregivers. Failure of the staff to engage with the technology arises with the issues such as fear of job security, patient safety, or threats to the scope of practice. The disengagement of staff with technology can lead to non-adoption or abandonment of technology.

2.3.6.5 Domain 5: The Wider Context. This domain described the institutional and sociocultural context, which may explain the failure of an organisation to scale up its technologies. Aspects in the broader context of a relevant technology include health policy, fiscal policy, professional bodies, and legal and regulatory factors. Adoption of technology was brutal and impossible if these factors in the broader context were not permissive.

2.3.6.6 Domain 6: The Organisation. This domain addressed the capacity and readiness of the organisation to uptake the technology. It included decisions to allocate budgets supporting the technology, routines, and the effort and work required to implement the technology. A lack of capacity or readiness to uptake the technology results in difficulties in scaling-up and abandonment.

2.3.6.7 Domain 7: Interaction Between Domains and Adaptation Over Time. This domain explained the feasibility of the continued adaptation of the technology in the medium- and long term. It also included organisational resilience, which describes the ability and willingness of the organisation to take up the technology and continue using it over time. If constant adaptation were not feasible or the organisation was not resilient, the technology may be abandoned, or scaling-up may not be achieved.

2.4 Summary of Chapter

This chapter provides an understanding of the theoretical frameworks in telehealth research. A range of theories, models, and frameworks in telehealth was considered to gain knowledge in telehealth research and choose a suitable theoretical framework for this study. As discussed in this chapter, the increase in the likelihood of successfully implementing any ICT system increases when a suitable framework is available to assist it. In addition, frameworks have been shown to guide the implementation and scale up innovations and technologies, particularly those related to healthcare. The available frameworks are country or technology-specific and may not apply to the New Zealand context. No known specific framework has been developed to assess and enhance the scalability of telehealth services across DHBs in New Zealand. The framework developed from this study can identify factors at the organisational level that influence the uptake to ensure that telehealth projects do not fail and that the people of New Zealand can enjoy the benefits of telehealth services. The framework will evaluate the status of telehealth services and eventually enable the optimisation of telehealth services across the DHBs in New Zealand. As a consequence, this research contributes to developing a framework to guide the uptake of telehealth services across the DHBs in New Zealand. The next chapter explains the research design and the data collection methods and the different phases from this study.

Chapter 3 Methods

3.1 Introduction

The last chapter detailed a range of theories, models, and frameworks in telehealth and why the NASSS framework was chosen as a suitable theoretical framework for this study. This chapter describes the research design and the data collection methods used in this research. The last section of this chapter addresses the ethical procedures followed by the researcher in this study.

3.2 Research Objectives

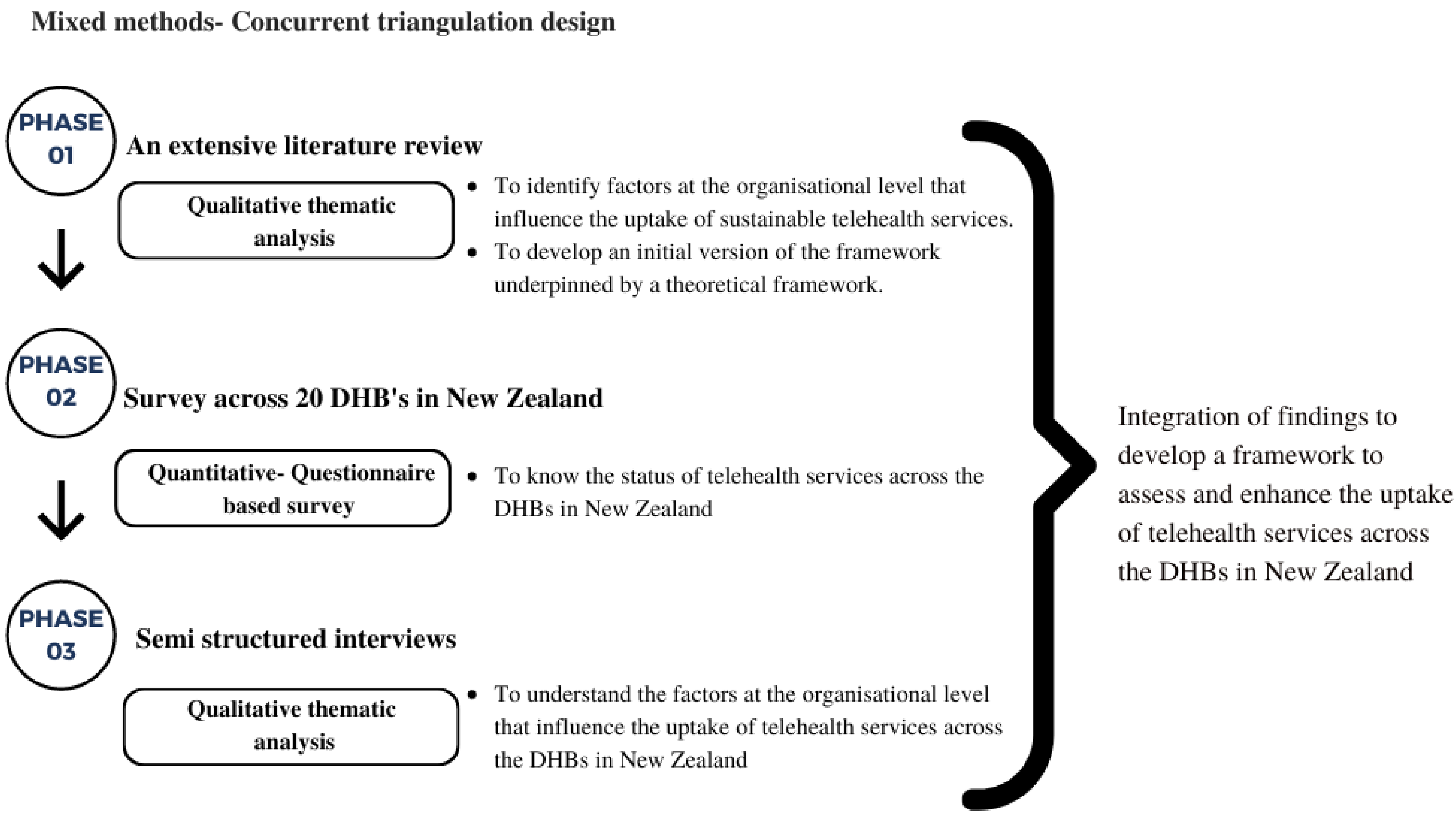
The first objective of this research was to explore the factors at the organisational level that influence the uptake of sustainable telehealth services. The aim is answered by conducting a literature review which will be explained in section 3.4. A qualitative thematic analysis was performed to develop an initial version of the framework underpinned by the NASSS framework which was identified in the previous chapter. Phase 02 and 03 refined the framework applicable for the context specific to the DHBs in New Zealand. Phase 02 surveyed the DHBs to understand the status of the telehealth environment in New Zealand. Phase 03 completed semi-structured interviews to understand organisational level factors that influence the uptake of telehealth services across the DHBs in New Zealand. In this way, the research objectives were answered in three phases, using a mixed-methods approach.

3.3 Overall Research Design

The objectives of this research were approached in three phases. As discussed in Chapter 1, the proposed study used a mixed-methods approach with a concurrent triangulation design. Concurrent triangulation helps integrate the findings from both the Quantitative and Qualitative phases of the study (Creswell and Clark 2017). The data was collected from the same participants from Phases 02 and 03 to understand better the telehealth status and the influential factors for sustainable telehealth uptake. The study findings were developed through three-sequential phases, described in (Figure 1).

Figure 1

The Three Phases of the Research (Mixed-Methods Approach, Concurrent Triangulation Design



3.4 Phase 01: Literature Review

The concept of developing a framework and particularly one for understanding the factors at the organisational level that influence the implementation of telehealth was a new concept across the DHBs in New Zealand. The outcome of the first phase is to identify the key factors at the organisational level that influence the uptake of sustainable telehealth services.

Phase 01 of the study used the information and knowledge from the existing theories to develop the initial version of the framework. The Non-adoption, Abandonment, Scale-up, Spread and Sustainability (NASSS) framework was the theoretical framework used to develop the initial framework, which was explained earlier in Chapter 2. The framework was developed by Greenhalgh and colleagues (2017) to theorise and evaluate the challenges, non-adoption and abandonment of the spread, sustainability and scale-up of technologies in health and care services (Greenhalgh et al., 2017). The material obtained from the literature review was analysed through the thematic analysis technique (Braun & Clarke, 2006). NVivo qualitative analysis software programme was used to analyse the literature in identifying the emerging themes. The analysed results were used to develop an initial framework underpinned by the NASSS framework to understand the key factors that influence the implementation of telehealth services.

3.4.1 Motivation and Aim of Phase 01

A literature review was carried out in Phase 01 to identify the factors at the organisational level that influenced sustainable telehealth services. A literature review was one of the most effective methods to explain and find the influential factors relating to a new topic (Hart, 1998; Webster & Watson, 2002). The literature review combines summaries and synthesis of critical materials including books, journals, articles and information from other sources such as websites to inform a subject area, topic, or research problem. By triangulating information from multiple sources, a researcher can trace the progression of the field of interest intellectually. In addition, triangulation can help combine varied interpretations of the subject area, develop an understanding of past research and so avoid re-inventing the wheel, and can then build on this earlier research (Labaree, 2009). In this study, the researcher aimed to understand the factors at the organisational level that influenced the implementation of sustainable telehealth services.

An extensive literature review provided knowledge and information about the processes of implementation and scaling-up. By summarising and synthesising the information available from multiple sources and locations, the researcher developed an initial version of the framework underpinned by the NASSS framework, which provided a context for the subsequent phases of the research. The literature search phase of the study was, therefore, critical to understanding background research and knowledge and forms the backbone for further research conducted in the other two phases.

The main research objectives for Phase 01 of the study were:

1. To identify the factors at the organisational level that influence sustainable telehealth services and
2. To develop an initial version of the framework in terms of its influential factors that enhance the sustainable telehealth services underpinned by the NASSS framework.

3.4.2 Literature Review Strategy

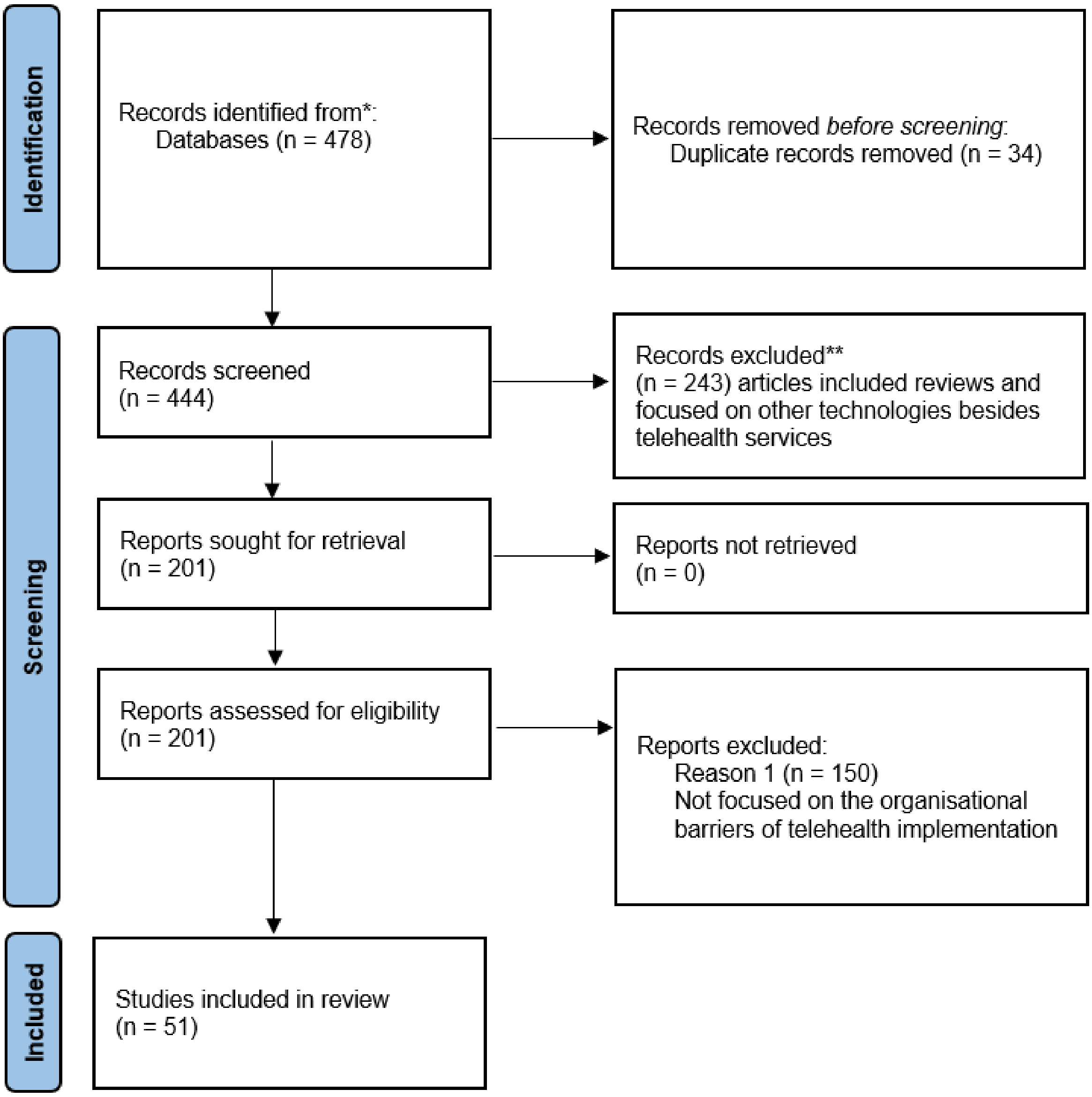
The purpose of the review was to identify the organisational level key predictive influential factors and the relevant elements that would act as facilitators and barriers to the uptake of telehealth in New Zealand. The sources used include journal articles, theses and dissertations, reports by governmental and non-governmental agencies, white papers, conference proceedings, and the websites of professional bodies and ICT organisations obtained from various internet sites and databases, including Ovid Medline, and Embase. A search strategy was developed to find the relevant literature from these search engines, and this is explained in Appendix B. The researcher also searched the *Journal of Telemedicine and Telecare*, Google scholar and PubMed for relevant studies. The initial intention was to search for literature to find studies investigating the barriers and challenges related to implementing telehealth services within New Zealand but there was a very limited number of these studies. Because of this, the search was extended to include studies from OECD countries that investigated the organisational-level barriers for telehealth. All the 34 OECD countries were screened for telehealth services, and 11 countries were included in the search that had a wide-scale implementation of telehealth.

3.4.3 Inclusion and Exclusion Criteria

The literary works included in the study had to meet the inclusion criteria before they were captured into the analysis programme (NVivo). The inclusion criteria were articles and reports about the organisational level factors that influence implementing, scaling, and sustainable telehealth services and original research works with findings based on any combination of the authors' observations and original surveys such as questionnaires or interviews. Furthermore, only studies published from 2005 to May 2018, written in the English language, were included (Figure 2).

Figure 2

Identification of Studies and Literature Synthesis Method



3.4.4 Results

Out of the 478 articles from all the search engines, 243 were obtained from the search process, which included reviews and focused on technologies other than telehealth services: these 243 were excluded. In addition, 34 articles were excluded because they were duplicates. Ninety-nine articles were not focused on the organisational barriers to the implementation of telehealth, and therefore they too were excluded. Table 2 shows the remaining 51 articles included in the study from each country

Table 2

List of Included Studies by Country

Country	No of studies
Australia	8
Canada	5
Denmark	3
Finland	1
New Zealand	5
Norway	5
UK	6
USA	18
Total	51

In addition, the selected studies utilised different data collection strategies and were based on varying hospital settings. Although some articles were not specific to the hospital setting, others considered intensive care, geriatric care, psychiatry, dermatology, paediatric, acute care, emergency medicine, rehabilitation medicine, ambulatory care, pathology, stroke care, hospice, veteran care, and community care settings. Most of the included studies were qualitative (focus groups and interviews). The selected studies indicate telehealth acceptability and feasibility when the services/programs are not well understood to develop an instrument to measure the technology adoption/implementation. A summary of the authors of the studies and publication details, the country where the studies were conducted, the setting, and the data collection strategy are shown in (Table 3).

Table 3

Summary of the Details of the Included Studies

Author & Year	Country	Hospital Setting	Data Collection Strategy
Alami et al. 2017	Norway	Not specific	Interviews
Alami et al. 2018	Canada	Pathology	Qualitative evaluative research
Armstrong et al. 2011	USA	Dermatology	Interviews
Bagot et al. 2017	UK	Stroke	Interviews
Barrett et al. 2009	Australia	Chronic care in rural settings	Interviews
Bradford et al. 2015	Australia	Rural settings	Interviews
Caffrey et al. 2017	Australia	Orthopaedics	Interviews
Christesen, 2018	Denmark	Chronic obstructive pulmonary disease (COPD)	Interviews and observations
Collier et al. 2016	Australia	Palliative care	Focus groups and interviews
Gagnon et al. 2005	Canada	Not specific	Questionnaire and interviews
Gagnon et al. 2006	Canada	Rural settings	Interviews
Goedken et al. 2016	USA	Tele-ICU, rural settings	Interviews
Hopp et al. 2007	USA	Veterans Health Administration	Interviews
Joseph et al. 2011	UK	Not specific	Surveys
Kahn et al. 2014	USA	Intensive care (ICU)	ICU telemedicine installations.

Author & Year	Country	Hospital Setting	Data Collection Strategy
Kayyali et al. 2017	UK	Not specific	Interviews
Kierkegaard, 2014	Denmark	Not specific	Survey
Koltveit et al. 2017	Norway	Diabetes foot care	Focus groups
Krog et al. 2018	Denmark	Depression	Interviews
Lam & Mackenzie, 2005	USA	Military	Interviews
Levine et al. 2014	USA	Geriatric care	Focus groups
Lucas, 2013	NZ	Emergency medicine	Interviews
Mair et al. 2007	UK	Not specific	Interviews
Mansouri-Rad et al. 2013	USA	Not specific	Surveys
McGoey et al. 2015	NZ	Dermatology	Survey
Merchant et al. 2015	USA	Not Specific	Interviews
Moffatt & Eley, (2011	Australia	Not specific	Interviews
Mozer et al. 2015	Australia	Rehabilitation medicine	Survey
Newman, 2016	Australia	Rural mental health care	Interviews and focus groups
O'Toole, Jr et al. 2011	USA	Stroke	Interviews
Pare et al. 2016	Canada	Pathology	Interviews
Peddle, 2007	Canada	Not specific	Interviews
Qirim, 2006	NZ	Psychiatry and dermatology	Interviews
Radhakrishnan et al. 2015	USA	Home geriatric care	Interviews
Ray et al. 2015	USA	Rural paediatrics	Interviews

Author & Year	Country	Hospital Setting	Data Collection Strategy
Rogove et al. 2012	USA	Acute Care	Survey
Sanders et al. 2012	UK	Geriatric care	Interviews
Silva et al. 2012	USA	Stroke care	Survey
Smaeadottir et al.	Norway	Not specific	Interviews and questionnaire
Sorensen et al. 2014	Norway	Stroke care	Survey
Spaulding et al. 2005	USA	Not specific	Survey
Stevenson, 2014	NZ	Ambulatory care	Interviews
Taylor et al. 2015	UK	Community healthcare settings	Focus groups
Uscher-Pines et al. 2014	USA	Pediatric settings	Survey
Vuononvirta et al. 2009	Finland	Not specific	Interviews
Wade & Eliott, 2012	NZ	Not specific	Interviews
Wade et al. 2014	Australia	Not specific	Interviews
Whitten & Mackert, 2005	USA	Hospice and Psychiatry	Focus groups, interviews, and surveys
Whitten et al. 2005	USA	Hospice	Focus groups
Whitten et al. 2009	USA	Hospice	Focus groups and interviews
Zanaboni et al. 2014	Norway	Not specific	Surveys

3.4.4.1 Method for Synthesis of the Literature. The thematic analysis method was used to analyse the literature search results. Thematic analysis is a qualitative approach that identifies similar patterns of meaning in data to answer the research questions (Maguire & Delahunt, 2017). This qualitative approach was applied to analyse the data obtained from the literature review. Various analytical methods were used in qualitative research: thematic analysis, discourse analysis, narrative analysis, and content analysis. Thematic analysis was the most common form of analysis and offered a comfortable and flexible approach to analysing the qualitative data (Braun & Clarke, 2006; Javadi & Zarea, 2016).

The approach follows a process to analyse the collected data in a scientific and obvious way to categorise and create the common themes and patterns from the data (Braun & Clarke, 2006; Carlin, 2016; Johnson & Wislar, 2012). The thematic analysis follows the themes and patterns at a macro level, whereas the content analysis focuses on a micro or individual level. Data driven (bottom-up) and theory driven (top-down) were the primary forms of thematic analysis. The data-driven approach follows an inductive analysis of mapping the recognised themes relating to the data, whereas the theory driven approach was based on the theory and driven by a predetermined model (Javadi & Zarea, 2016). The theory-driven approach provides more analytical details of some aspects of the collected data but less analytical details of the complete collected data than the data-driven form. Because of this type of issue, Braun and Clarke (2006) developed a six-step guide by applying both the forms sequentially in conducting a qualitative thematic analysis (Braun & Clarke, 2006). In this study, the six-step process was undertaken to analyse the literature obtained from the search strategy and these steps are described as follows:

3.4.4.2 Step 1: Familiarisation with the Data. The researcher read and re-read the data to become familiar with the content. In this study, the researcher read through the content when determining the suitability of each article to the study and then re-read it later, before coding.

3.4.4.3 Step 2: Coding. Coding involves generating labels or codes that identify data features that are important or relevant to the research question. The researcher coded the data set in this study and collated the codes and data extracts as required. The included studies were uploaded into the NVivo analysis programme to help the researcher identify and document the codes in the dataset. All influential factors that impact the implementation, adoption, or sustainability of telemedicine or telehealth projects were coded and classified into similar groupings. The codes identified were listed and are described in the next chapter.

3.4.4.4 Step 3: Searching for Themes. The third step involved examining the codes and the data to identify broader patterns of meaning, also referred to as potential themes. In this study, several potential themes were identified.

One of the themes was the *role of leadership and management in guiding staff to adopt telehealth*. Management was in charge of staff education and training, consulting staff prior to implementing telehealth, and involving physicians throughout the process. Follow-up, creating an enabling environment and empowering staff to use telehealth technology can also be considered a managerial and, more precisely, a human resource function. The respondents were clear that telehealth should not be imposed on them and that clinician acceptance and attitudes influenced the adoption and implementation of telehealth.

A second potential theme was *integrating telehealth technology in the organisation's business and culture*. The respondents stated that the organisation had to make changes at the organisational level to accommodate telehealth and allocate time, capacity, and resources to institute telehealth into the organisation's practices. In other words, telehealth had to be normalised into the organisation. Normalisation is the process of including an element in the organisation's long-term strategy, mission, vision, and objectives. The normalisation of telehealth services means it should not be just a passing project but rather something that the organisation wishes to stick with for the long term.

A third potential theme was the *provision of infrastructure*. Infrastructure, particularly internet and equipment, were necessary for the successful implementation and adoption of telehealth. The equipment must work well, and users must be sure and guaranteed that it will work when they use it. Physicians were busy and did not have time to gamble with the functionality of the equipment. When there were disruptions, such as bandwidth limitations in rural areas or extreme weather, the organisation needed alternatives. The bottom line was that the infrastructure should be available and functional.

A fourth potential theme was *financial resources*. The respondents pointed out that most telehealth projects had initial funding but no recurrent funding. Given that telehealth projects are capital-intensive, the organisation should determine the initial and ongoing available funding sources before implementing the project, particularly if the intention is to scale up or sustain the project over the long term.

The fifth, and last potential theme was the *relations between the organisation and the broader healthcare context or setting in which it operates*. These influence how the organisation relates with other organisations, including those in healthcare and technology, the ownership, partnerships, and governance of the healthcare organisation and the state, size, and location of the healthcare organisation. These factors influence reimbursing, credentialing, interoperability of systems and sharing of data and information.

3.4.4.5 Step 4: Reviewing Themes. The fourth step involves checking the potential themes against the data to evaluate their relevance and determine whether they answer the research question. The potential themes identified in the previous step were the role of leadership and management, integrating telehealth technology in the organisation's business and culture, provision of infrastructure, provision of financial resources, relations between the organisation, and the broader healthcare context. In this step, as advocated by Braun and Clarke (2006), the analysis was moved from a descriptive to an interpretative approach by relating the findings of the third step to the NASSS framework. This procedure aimed at merging and refining the domains to be consistent with the underpinning domains of the NASSS framework in answering the research question. The emerging factors were mapped to the domains of the NASSS framework, which underpins this research (Table 4).

Table 4

Emerging Influential Factors Matched to the NASSS Framework

Organisational level influential factors	Domain (NASSS Framework)
Long-term strategy Normalisation Capacity Integration Culture Processes Stakeholder support Risk Management Affordability	The organisation Embedding and adaptation over time
Education and training Usability Trust Competency Qualifications Champions Acceptance Satisfaction Engaging	The Adopter system
Infrastructure Needs Reliably Usability Availability Completeness Interoperability Information accuracy Compliance Consistency Scalability	The technology Value proposition
Initial investment Reoccurring funds Long-term funds	The organisation
Regulatory Legal Reimbursement Support Size Patient Location	The Wider Context

The role of management does not precisely describe the organisation's role in managing, training, and empowering staff to accept, use, and adopt telehealth technology and therefore this theme was renamed to *the organisation's role in human resources*. The potential themes *integrating telehealth technology in the organisation's business and culture*, *technology and infrastructure*, and *financial resources* describe organisation-level barriers to adopting, implementing, and sustaining telehealth and were not changed at this stage. *Relations between the organisation and the larger healthcare context* as a potential theme also describes an organisation-level barrier/ facilitator to the implementation, adoption, and sustainability of telehealth but in a broader context, and that label also remained.

3.4.4.6 Step 5: Defining and Naming Themes. Step five includes a detailed analysis of the potential themes and developing an informative name for each theme. Minor changes to the labels of the themes were made to reflect elements of barrier or facilitation at the organisational level. The potential theme of the *organisation's role in human resources* describes the healthcare organisation's role to develop and empower their staff to adopt, implement, and sustain telehealth. Because this study examines barriers and influencing pillars at the organisation level, the potential theme was renamed *Human Resources Function*. Also, the potential theme *integrating telehealth technology in the organisation's business and culture* was renamed *Extent of Technology Integration*. The potential theme *infrastructure* was renamed *Technology Infrastructure* to reflect a barrier/facilitator at the organisation level. The potential theme *financial resources* was renamed *Financial Support to Indicate the Organisation's role*. The potential theme *relations between the organisation and the larger healthcare context* was renamed *Factors in the Organisation's External Environment*. The renamed final themes derived from the analysis were: Extent of Technology Integration, Human Resources Function, Technology Infrastructure, Financial Support Services, and Factors in the Organisation's External Environment. These represent organisational-level barriers or influencing factors to the implementation, adoption and long-term sustainability of telehealth technologies.

3.4.4.7 Step 6: Write Up. The last step of the thematic analysis involved putting together the themes, data extracts, and narrative analysis in the context of the literature search to answer the research questions. Table 5 shows the themes and the factors at the organisational level that influence the uptake of sustainable telehealth services identified in the literature review.

Table 5

Emerging Themes and Influential Factors Identified in the Literature Review

Themes	**Influential factors**	**Domain (NASSS Framework)**
The Extent of Technology Integration	Long-term strategy	Domain: The organisation Domain: Embedding and adaptation over time
	Normalisation	
	Capacity	
	Integration	
	Culture	
Human Resources	Education and training	Domain: The Adopter system
	Usability	
	Trust	
	Competency	
	Qualifications	
	Champions	
	Acceptance	
	Satisfaction	
	Engaging	
Technology Infrastructure	Infrastructure	Domain: The technology Domain: Value proposition
	Needs	
	Infrastructure	
	Reliably	
	Usability	
	Availability	
	Completeness	
	Interoperability	
	Information accuracy	
	Compliance	
	Consistency	
	Scalability	
Financial Support	Initial investment	Domain: The organisation
	Reoccurring funds	
	Long-term funds	

Themes	Influential factors	Domain (NASSS Framework)
External Environment	Regulatory	Domain: The wider context
	Legal	
	Reimbursement	
	Support	
	Size	
	Patient	
	Location	

The discussion of the emerging themes in the context of the literature and the theoretical framework is detailed in the next chapter.

3.5 Phase 02: Survey

This phase constituted the second of the three phases and focused on understanding the status of telehealth services across the DHBs in New Zealand. The status of telehealth services across the DHBs was studied by administering a survey across the 20 DHBs in New Zealand. The survey was carried out between October 2018 and March 2019 to achieve the aims of Phase 02 of the study.

3.5.1 Development of the Survey

Three important aspects were considered while developing the questions for the survey, namely, the type of information that needed to be collected from the respondents, the selection of the appropriate respondents, and the approaches to extract appropriate information (Goodman, 1997; Patten, 2016).

The collected information on the survey was informed by the factors identified during Phase 01 of the study. The identified factors at the organisational level across the five main components (the extent of technology integration, human resources function, technology infrastructure, financial support, and factors in an organisation’s external environment) were presented with telehealth experts from the New Zealand Telehealth Leadership Group (NZTLG). The NZTLG includes clinicians, policymakers, planning and funding managers, ICT experts and industry representatives to drive telehealth in New Zealand. This group had conducted national surveys in 2011 and 2014 to assess the status of telehealth across the DHBs (NZ Telehealth Forum and Resource Centre, 2014). The NZTLG formed a working group that included the researcher to conduct the survey. The NZTLG working group members were:

- Arun Sam Singh Selwyn Jebaraj, the researcher of this study
- Andrew Panckhurst, Communications Director Mobile Health;
- Judy Eves, Sector Portfolio Manager Data and Digital Ministry of Health; and
- Patricia Kerr, Programme Lead NZTLG.

The NZTLG working group met initially face-to-face for the first meeting and then held five virtual meetings to discuss, develop, pre-test, and distribute the survey.

The researcher presented the key findings from Phase 01 and the aims of Phase 02 of the study to the stakeholders of the NZTLG at the first meeting. The objectives of the first meeting were to establish a timeframe for the various components of conducting the survey, namely, developing the initial questions for the survey, designing the survey on Qualtrics, pre-testing the survey, and distributing the final version of the surveys from Qualtrics. The working group discussed the factors at the organisational level to get the required information to assess the status of telehealth across the DHBs on the survey instrument. The initial questions were drafted based on factors identified from Phase 01 of the study and the questions asked earlier in the 2014 survey.

The objective of the second (first virtual) meeting was to discuss and refine the drafted questions by consulting the expertise of the stakeholders from the NZTLG, who were asked to review the drafted questions for relevance, appropriateness, and face validity. The working group made extensive efforts to ensure the expert views were incorporated to ensure the questions on the survey were clearly formulated to address the survey objectives and easy to understand for the participants. The researcher created the survey based on the refined questions on Qualtrics, a web-based platform for conducting online surveys.

The layout and flow of the questions on each survey section were discussed during the third meeting. The layout of the questions in each section was updated, and all the logic questions in Part 1 and 2 of the survey were tested.

The fourth meeting was held to pre-test the drafted survey in Qualtrics. The draft survey in Qualtrics was pre-tested with five telehealth service users across different DHBs. Notes from the pre-testing of the survey were shared with the experts, who had conducted the national survey in 2014. The telehealth experts reviewed and compared the results to the 2014 survey and updated the content of the questions to collect reliable data. The survey questions were shared and discussed with the thesis supervisors to check the content validity and reliability of the instrument. The suggestions from the experts and thesis supervisors were considered to amend the final questions on both parts of the survey. The data generated from the pilot study were not included in the full study.

The fifth meeting was held for sending out the final email invitation containing the survey links for both parts of the Qualtrics survey. The survey was made available online for six months, from October 2018 to March 2019.

The final follow-up meeting was held to discuss the response rate and send reminder emails to all respondents who had partially completed the survey. The first email reminder was sent after a month to all the key contact persons of the DHBs to increase the response rate to the survey. After three months, all the participants, who had partially completed Part 1 of the survey, were contacted to check whether they wanted to withdraw or complete the survey. A follow-up email to all key contact persons about Part 2 of the survey was sent to increase the response rate. A retake link was generated and emailed to key contact persons who wanted to update or complete Part 1 of the survey. The retake survey link starts the survey from the beginning, but the respondent's original answers were prepopulated and enabled them to edit and replace the original responses. None of the participants requested to withdraw the survey responses. The final follow-up reminder email was sent a week before closing the survey on Qualtrics.

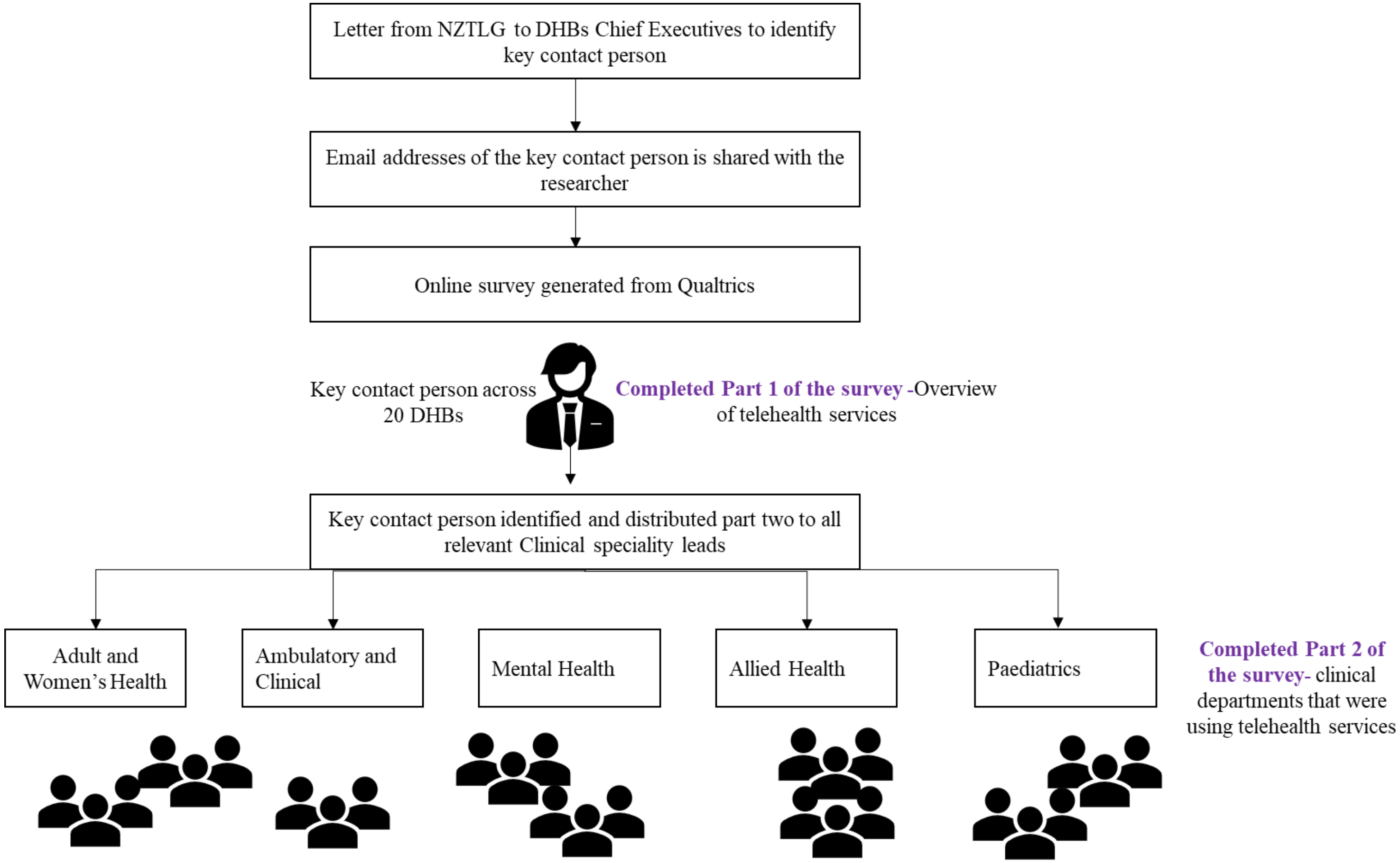
3.5.2 Approach to Distribute the Survey

The survey had two parts, the distribution of the survey was completed with the support of the NZTLG (Figure 3). The NZTLG contacted the Chief Executive officers of each of the 20 DHBs to nominate a key contact person to complete the survey on behalf of their DHB. The strength of selecting the key contact person who is particularly knowledgeable and competent is an effective mechanism to collect reliable and robust data (Tongco, 2007). The key contact person email address across all the 20 DHBs was shared with the researcher. The researcher generated an email survey invitation to all the 20 key contacts with a cover sheet attached as Appendix C from Qualtrics. The email had the survey links, brief instructions on how to complete the survey by clicking on the survey links, the information sheet (Appendix D), and the consent form (Appendix E). The information document gave a brief description of the purpose and importance of the study, detailing the need for completing the survey.

The email invitation had two links: an individualised link for Part 1 and a web-based link for Part 2. The key contact person from each DHB completed the first part using the individualised link and distributed the second part (web-based link) across their organisation. The key contact person was best placed to identify and reach the range of relevant clinical team leads using telehealth across the organisation. The clinical team leads disseminated Part 2 of the survey (web-based link) to all the relevant staff who uses telehealth services. The approach enabled to reach of all the clinical services that use different telehealth interactions and their stages of implementation.

Figure 3

Approach to Distribution of the Survey



Clicking the individualised (Part 1) or web-based (Part 2) link opens a web-based format displaying the information sheet. The information sheet (attached as Appendix D) page explained the purpose of the study and their willingness to participate in the study. All participants in the study were informed about the purpose of the study, and be informed participation was voluntary. Should they choose to participate, they were free to withdraw from the study at any time, without any consequences, upon which any data they have provided was not used. If they wish to participate, they could click the *Continue* button, displaying the Consent sheet (attached as Appendix E). The participant needed to complete all the questions and click the Continue button to consent to participate in the survey to answer the questions. Each page displayed two buttons, *Next* to start a new question and *Back* to go back to edit the previously answered questions. The participants could leave the survey at any point before completing the survey and return to the same page by clicking the link. The link automatically saves the data as the participant progresses through the survey. The participants find the *Submit* button at the end of the survey, and clicking the Submit button will display the message to the participant *You have now completed the survey. Thank you very much for your participation in the survey*.

3.5.3 Part 1 of the Survey

As presented in (Appendix F), Part 1 of the survey had nine sections (Table 6) to understand the telehealth governance, video conferencing environment, technical infrastructure, NZTLG support, benefits, and challenges of telehealth services across the DHBs. The questions were constructed on the dichotomous scale to have consistency in responses, and there was a comment box for the respondents to volunteer any additional information to the questions.

3.5.4 Part 2 of the Survey

As per Appendix G, Part 2 of the survey asked questions relating to the specialities/services they were completing the survey. They were also asked to include telehealth services used in the past, current services, and soon-to-be-implemented planned services. Participants were asked to select the type of telehealth interactions used in the various specialities, namely first patient contact, follow up appointment, acute assessment, clinical image, clinician to clinician, multi-disciplinary meetings (referred to in clinical settings as MDMs), nurse clinics, remote monitoring, and clinical education. Upon selecting the type of telehealth interaction, they were asked to select the phase of implementation, the estimated total number of telehealth interactions in the past six months, the estimated percentage of contacts made through telehealth, patient/participant locations, and telehealth benefits. The data completed by the clinical departments reflected a point in time and was based on self-reported telehealth activity because some DHBs did not have a mechanism to record all their telehealth activities.

Table 6

Part 1 of the Survey: Sections and Description of the Questions

Survey Part 1	**Description of the section**
Section 1- Governance	The questions in this section dealt with telehealth governance, focusing on staff resources (clinical leader, programme manager), telehealth strategies and policies, telehealth governance group, and telehealth service delivery (protocols and guidelines, staff training).
Section 2- Video conferencing usage	Section 2 questions identified video conference usage in clinical and non-clinical services, namely, administrative and management meetings, clinical education, communication meetings inside and outside of healthcare organisations, use of services relating to health or disability, and patient consultations.
Section 3: Clinical activity – Video conferencing for patient consultations	Section 3 asked questions to understand the use of video conferencing for patient consultation and the processes to normalise telehealth services, namely, methods to keep track of telehealth consultations, how telehealth consultations are recorded in the patient management systems, and any planned new telehealth services.
Section 4: Clinical activity- Video conferencing for MDMs and patient consultations	Section 4 contained questions relating to using video for multi-disciplinary meetings (MDMs) with multi-disciplinary coordinators conducting those meetings. Questions were asked regarding the various specialities included and the protocols for conducting the MDMs.

Survey Part 1	**Description of the section**
Section 5 – Technical infrastructure for using video conferencing	Section 5 mainly focused on questions relating to the technical infrastructure, such as the difference between the hardware-based units, software-based units, type and number of the video-conferencing solutions, processes relating to normalising technology, technology capacity to meet current demand, and ongoing financial support.
Section 6 – other telehealth services and technologies	Section 6 focused on new telehealth technologies and services in use across the organisation.
Section 7 – Telehealth benefits	Section 7 contained questions geared to establishing whether organisations conducted formal/structured evaluations and, mainly, to discover how well telehealth services are promoted across organisations.
Section 8- Barriers to uptake of telehealth	The questions in Section 8 aimed to understand the barriers to the uptake of possible or existing telehealth services.
Section 9 – New Zealand Telehealth Forum and Telehealth Leadership Group Support	The questions in Section 9 related to establishing the benefits of using the current support from the New Zealand Telehealth Forum and discovering whether respondents had any knowledge of future support from the Telehealth Leadership Group for the uptake of telehealth services in the organisation.
There was a final (yes/no) question which asked the survey respondents whether they could be further contacted for Phase 03 of the study to share their experiences in providing telehealth services.	

3.5.6 Analysis of the Data from the Survey

As discussed earlier, quantitative techniques were used to analyse the data collected from both survey parts. Data were downloaded from the Qualtrics application, coded, and entered into the spreadsheet. All identifiable data were de-identified to protect the confidentiality of the participants. The data were analysed with the IBM Statistical Package for the Social Sciences (SPSS) software. All 20 DHBs completed Part 1 of the survey. The completed responses were compared with the 2014 survey responses and checked for inconsistencies. All the inconsistent data were verified with the relevant key contact persons with the support of the working group.

A total of 161 responses covering 337 services from 18 (of the 20) DHBs were included in this study. Two hundred and seven responses were collected from Part 2 of the survey. Forty-six responses were incomplete and hence not included in the study. The Part 2 data were indicative rather than definitive because they were self-reported by the clinical departments. Descriptive statistics such as frequencies and percentages were calculated to understand the status of telehealth across the DHBs in New Zealand. Cross tabulation and the Mann-Whitney U Test compared two independently sampled groups. The open-ended questions were analysed thematically to assess the benefits and challenges of telehealth services across the DHBs in New Zealand. The results from both parts of the survey are discussed in detail in Chapter 5

3.6 Phase 03: Semi-structured Interviews

The research question for Phase 03 aims to obtain information regarding the in-depth factors at the organisational level that influence the uptake of telehealth services across the DHBs in New Zealand. This objective was achieved by conducting semi-structured interviews. The outcome of the phase was used to evaluate the best practices, share lessons and, ultimately, guide the stakeholders in collaborating for an increased and sustainable uptake of telehealth services.

3.6.1 Pilot Testing

The questions from the semi-structured interview guide were based on the survey results and the literature review from phase 01 of the study. The supervisors of this research reviewed the questions of the semi-structured interview guide and checked the logical relevance to the research questions and then the questions were updated to reflect the supervisor's comments. An expert member from the NZTLG was asked to review and provide feedback on the updated semi-structured guide to assess the structure and relevance of the questions to the topic. In addition, a pilot interview was conducted to elucidate the flow of the questions. The pilot testing enabled the researcher to practice the interviewing skills. Feedback was drawn from the pilot interview testing that allowed the researcher to provide a more engaging introduction and appropriate prompting questions. Notes were made during the pilot testing, and minor changes resulted in the final refinement of the questions. The content of the questions on the semi-structured interview guide is included in Appendix H.

3.6.2 Selection Procedure and Eligibility Criteria of Interviewees

The respondents for the interviews were identified from the survey participants who indicated their interest in a follow-up interview. The eligibility criteria for the respondents for the interviews were that the respondents should be part of the DHBs, have knowledge and experience of telehealth service implementation, and be willing to participate in the interviews. An introductory email was sent to all who expressed their willingness to participate in the follow-up interview. As seen in Appendix I, the introductory email was to familiarise the potential participants with the purpose of the interviews. The email contained guidelines for the interview, an information sheet (Appendix J), and a consent form (Appendix K) specific to the semi-structured interviews.

Ten respondents expressed their interest in participating in the interviews. Following the response, the researcher shared an online scheduling tool with the participants to set up a 60-minute interview at a time convenient to them between 20 May to 30 June 2019. The online scheduling tool collected the respondents' names, phone numbers, and email addresses. The interview schedule was done according to the convenience and flexibility of the availability of the participants. Eight of the ten potential participants returned signed consent forms and booked an interview time. The semi-structured interview guide was sent, as shown in Appendix H, to prepare for the interview and consider the questions before the interview sessions. All eight respondents were reminded one day prior to their scheduled date, and any changes were rescheduled within the allocated timeframe at the respondent's convenience. The remaining two respondents were followed up on emails but were not available to participate during the time frame. The interviews were conducted via Zoom because of the geographical distribution of the participants.

3.6.3 Approach to Conduct the Interviews

The interviews were semi-structured and conducted using Zoom in the designated room for confidential interviews in the Rehua building, University of Canterbury. The questions were based on the survey results and the literature review to clarify their responses and provide more information through "memory jogging" (Bowling, 2005). A semi-structured approach offers a flexible approach to add additional spontaneous questions during the interview, facilitating further probing questions and clarification. A semi-structured interview guide was developed with predetermined questions to guide the researcher to cover all the specific areas, and the required information was gathered from the participants during the interview (DiCicco-Bloom & Crabtree, 2006).

The semi-structured interview guide (Appendix H) had five parts and was structured using key components of the study with minimal prompting to elicit ongoing responses from the respondents. The researcher used the interview guide to prompt specific responses, such as filling the gaps or eliciting more detailed responses. The five parts of the semi-structured interview guide are described below.

3.6.3.1 Part 1 – Interview Introduction. The researcher started the interview by reminding the participants of the purpose of the interview. The information sheet was displayed on the screen, and the researcher explained the information sheet, as seen in Appendix J. The researcher also confirmed the participant's willingness and consent to participate in the interview. As seen in Appendix K, the consent form was displayed on the screen; the participant was given time to read through the consent form, and the researcher obtained verbal consent before starting the interviews. The participants were also informed of the need for audio recordings of the interview sessions, and their willingness and consent was sought before commencing the interview.

3.6.3.2 Part 2 – Telehealth Service Description. In this part, the researcher started with some basic questions relating to their organisation's involvement with telehealth services. Some of the questions focused on how they define telehealth services, their roles in telehealth services, when and how long they had been using telehealth services, the type of services delivered, and the extent of telehealth service utilisation in their organisations. The questions are in (Appendix H).

3.6.3.3 Part 3 – Factors Affecting Telehealth Uptake. In this part, the researcher asked questions focused on discovering the in-depth key factors that would enhance the updating of telehealth services in their organisations. The questions were geared to discovering the enabling factors relating to starting telehealth services and overcoming any important barriers during operations. Participants shared how telehealth services had changed over time and how they were able to overcome any unexpected challenges. Participants also shared their views on the sustainable uptake of telehealth services and how future telehealth services were being developed in their organisations. Some of the participants also shared the challenges and barriers to services that had ceased operating.

3.6.3.4 Part 4 – More Specific Prompts on the Main Themes. The researcher used this part to prompt responses covering factors relating to human resources, organisation, technical, financial, and environmental contexts. The human context included questions relating to the willingness and acceptance of staff to use telehealth services and the availability of internal and external expert resources to operate and maintain current and proposed telehealth services. Participants were asked to share the telehealth strategy and plan and how organisational support and commitment influenced the adoption of telehealth services in their organisation. The technical context included questions relating to the telehealth infrastructure and the ICT characteristics that influence telehealth applications Participants also shared their views on the economic feasibility, availability of the funding sources to implement, operate, and maintain the proposed and current telehealth applications. Factors relating to external support from the government, namely, policies and regulations of telehealth services, were also discussed.

3.6.3.5 Part 5 – Concluding Question. Finally, participants were asked to share the one most important factor that influenced the uptake of telehealth services in their organisation.

Each interview session was audio-recorded, and notes were taken, which were carefully transcribed, cleaned, and checked afterwards. Participants who requested were sent a copy of their interview transcript to comment on and add to or delete as they saw fit.

3.6.4 Analysis of Interviews

The audio-recorded interviews were downloaded from the Zoom application and transcribed by the researcher. The interviews were transcribed by the researcher to become familiarised with the data. Consistent with the mixed method-concurrent triangulation design, thematic data analysis was adopted as most suitable for analysing qualitative data. According to Barberan-Garcia et al. (2014), thematic analysis is a strategy that is used to analyse themes and patterns in qualitative data through the use of coding. *Coding* as a process through which qualitative data are broken down into individual components. The emerging themes were identified during the transcription and coding stages of the thematic analysis. The emerging themes were selected based on two characteristics, namely, uniqueness and prevalence, to the key themes and subthemes from Phase 01. Themes were singled out depending on whether they were prevalent across the entire data set to ensure that emerging topics evolved from the initial themes and were, thus, representative of the real data. The interviews were analysed in the context of the five major themes underpinning the NASSS framework developed from Phase 01 of this study. The process followed is highlighted in Table 7.

Table 7

The Process of Coding and Analysis of Interview Data

Steps	Steps followed	Description of the steps
1	Administering semi-structured interviews	Interviews were conducted with all participants who agreed to participate in the study using the Zoom video-conferencing application.
2	Create transcripts from the audio recorded interviews	The audio-recorded interviews were downloaded from the Zoom application and transcribed immediately to familiarise the data and minimise errors.
3	Organising the transcribed data	Initial data coding to ensure that the necessary data was allocated to the key themes and subthemes - the initial framework was developed from Phase 01 of this study.
4	Coding the organised data	Allocated data in each of the themes were coded to identify emerging outcomes and patterns.
5	Reviewing the coded data	The researcher extensively reviewed the emerging codes to guarantee accuracy.
6	Naming the codes	The emergent outcomes under each theme were analysed and named.
7	Analysis and presentation of the data	The data from each theme was presented, and emerging outcomes were construed through the coding process.

The analysis adopted the manual method of extracting codes from the transcribed interviews rather than using the Nvivo application used in Phase 01. This is related to the Buchanan and Jones (2010) study, which revealed that such systems might lead to the over-simplification of the multi-dimensional attributes of the original data set. The manual process involved rereading the transcripts word-for-word and underlining the codes consistently. These codes were then collated and compared (Clarke & Braun, 2013).

After generating the codes and aligning them with the research questions, the study focused on identifying patterns of meaning. Chapter 6 provides a brief overview of each interview and patterns of meaning gleaned from the data.

The final framework of this study was developed by integrating the findings from all three phases of the study. Phase 01 was a literature review that analysed the organisational-level factors that influence the uptake of sustainable telehealth services. The initial version of the developed framework identified five themes: the extent of technology integration, human resources function, technology infrastructure, financial support services, and factors in an organisation's external environment. The final framework was refined by Phase 02 and Phase 03 specific to the New Zealand context. In Phase 02, a survey was designed to assess the status of telehealth services across the DHBs. In Phase 03, semi-structured interviews were conducted to understand the in-depth factors at the organisational level that influence the uptake of sustainable telehealth services.

3.7 Ethics Approval

Ethical approval was obtained from the University of Canterbury Human Ethics Committee (abbreviated form: HEC) for Phase 02 and Phase 03 of this study.

Approval for conducting Phase 02 was obtained from the following committee/group, as shown in (Appendix L, M, and N)

1. Ngāi Tahu Consultation and Engagement Group (16 August 2018) (Appendix L).
2. New Zealand Telehealth Leadership Group (27 September 2018) (Appendix M**)**
3. The University of Canterbury Human Ethics Committee – HEC 2018/97 approval date (03 October 2018) (Appendix N).

The approval for conducting Phase 03 was obtained from the following committee/group, as shown in (Appendix O and P)

1. Ngāi Tahu Consultation and Engagement Group (24 January 2019) (Appendix O).
2. The University of Canterbury Human Ethics Committee – HEC 2019/07 approval date (04 March 2019) (Appendix P).

In both phases of the study, the respondents were informed about the need and purpose of the study and provided their informed consent prior to their participation

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Chapter 4 Results

This chapter describes the findings from the three phases of the research:

- Phase 01 (literature review),
- Phase 02 Part 1 (survey of one key contact from each of the 20 DHBs),
- Phase 02 Part 2 (survey of 161 respondents from the clinical specialities across the DHBs who use telehealth services), and
- Phase 03 (semi-structured interviews with 8 respondents). Each section concludes with a summary that provides a precis of that section.

4.1 Phase 01: Literature Review Themes

This section describes the findings of Phase 01 of the research. This research phase investigated the factors at the organisational level that influence the uptake of telehealth services. The identified factors were used to develop an initial version of the framework to guide the scaling-up of telehealth technologies across the DHBs in New Zealand.

Phase 01 was an extensive literature review to identify the factors at the organisational level that influenced sustainable telehealth services. The materials were obtained from relevant online databases and analysed through the thematic analysis technique discussed in Chapter 3 (Braun & Clarke, 2006). NVivo qualitative analysis software programme was used to analyse the literature and identify the potential themes. The analysed results were discussed in relation to the NASSS framework to develop an initial version of the framework for organisational level factors that influence the implementation of telehealth services.

The following sections discuss the emerging themes identified in Chapter 2 within the context of the literature and the NASSS framework

4.1.1 The Extent of Technology Integration

This theme describes the extent to which the organisation was willing to integrate telehealth into its business as usual and culture. *Workload and routines, Integration of telehealth, availability of resources, communication from leaders, engaging/involving staff, dedicated management and leadership and organisational culture* were the themes described in the following sections.

4.1.1.1 Workload and Routines. Physicians and nurses noted that telehealth requires introducing new tasks to their existing tight work schedules. Tele-orthopaedics required a significant redesign of processes, including prescribing, imaging, documenting, physical examinations, and plastering fractures (Caffery, Taylor, et al., 2017). The sociotechnical barriers added many responsibilities to health professionals while introducing telehealth services into the routine work schedules. Health care professionals explained how additional responsibilities and heavy workloads make introducing telehealth into the regular workday difficult (Peddle, 2007). Telehealth was also considered to increase the workload, which was also seen as a barrier to adoption (Peddle, 2007).

McGoey et al. (2015), which explored improving access to dermatologists using telehealth in New Zealand, stated that the technology added an extra step or more minutes when a phone call would be enough. In the same study, Teledermatology, in particular, took up to 30 minutes compared to just 15 minutes for a phone call (McGoey et al., 2015). Hopp et al (2006) study assessed perceptions of telehealth providers in Veterans Health Administration hospitals added telehealth services added more time as they need to go to a separate room to conduct video visits. Semi-structured interviews conducted with 36 healthcare practitioners in London stated clinicians need to set aside allocation time to complete telehealth services which are not always available (Kayyali et al., 2017).

The organisation's failure to adjust work practices and processes to accommodate telehealth increased practitioners' workload. Lucas (2013) stated use of telehealth added more work to clinicians at the West Coast District Health Board. Time constraints and workloads were seen as barriers and distractions for people using telehealth services (Lucas, 2013). Time constraints can be a significant barrier because practitioners will not use telehealth if it takes too much time. For example, the use of telehealth added more work to clinicians.

4.1.1.2 Integration of Telehealth in the Organisation and Long-Term Strategy.

Respondents in the Alami et al. (2017) study, which explored the factors associated with the uneven utilisation of telehealth services in Norway, stated a need for a long process of learning and adaptation before the project could be successful. The study found telehealth systems are difficult to integrate and differ depending on the maturing of the organisation to initiate a restructuring. Integration of telehealth services in the organisation requires a long process of learning and adaptation (Alami et al., 2017). Organisations without the capacity to adjust or adapt to the new way of doing things do not successfully implement, scale-up, or adopt telehealth. Semi-structured interviews conducted by Wade and Eliott (2012) across 37 various telehealth services in Australia on the uptake of sustainable telehealth services noted that telehealth services had to be normalised in the organisation to be successful (Wade & Eliott, 2012). Respondents also complained that their organisations did not use telehealth technology in their medium or long-term organisational strategies. In the study conducted by Joseph et al. (2011) across the organisations in England to understand the factors that influenced implementation of telehealth the respondents stated that telehealth was implemented as a “project” and without any strategy (Joseph et al., 2011). Without a long-term strategy woven into the organisation, the respondents pointed out that the success and continuity of the projects depended on clinicians and their willingness to implement the technology (Joseph et al., 2011). In Alami et al. (2018), none of the 22 healthcare organisations investigated across the eastern Quebec telepathology network had a long-term plan lasting more than three years. Most projects were set to just one year. The lack of a global strategy in Quebec was blamed as the cause for the lack of concrete support from decision-making authorities when it comes to telehealth systems (Alami et al., 2018).

4.1.1.3 Availability of Human and Infrastructure-Related Resources. Participants in the various studies emphasised that the deployment of telehealth technologies came with the need for more resources in the form of human and infrastructural resources, without which adoption would be hindered. A qualitative field study conducted by Gagnon et al. (2006) across the four remote regions of Quebec noted the need for extra rooms to put the equipment. In Norway, the location of the equipment in the hospital was a challenge if it was seen as an extra stop for the patient or if the physician had to go to a different location to conduct the sessions (Sorensen et al., 2014). Also, participants in the Sorensen study conducted across the country's largest hospitals in Norway to evaluate the successful integration of telehealth services pointed out that the lack of space in the emergency room reduced the accessibility and availability of the equipment (Sorensen et al., 2014). Respondents from the Barrett et al. (2000) study that investigated the challenges faced in implementing a telehealth enabled chronic wound care system in Western Australia highlighted the need to increase the staff, considering that telehealth increased the workload for staff. Newman (2016) study that evaluated the providers' experiences in using large scale telehealth services across Australia stated that although they had access to telehealth, specialists, such as psychiatrists were not available. Telehealth staffing plays a vital role in uptake of telehealth services. The study that was conducted with more than 40 services providers stated staff shortages and understaffing influenced clinicians' willingness to use telehealth technology (Newman et al., 2016).

4.1.1.4 Communication from Leaders. Communication at different levels of the organisation was emphasised. Kolltveit et al. (2017) conducted a study with the healthcare professionals and leaders in Western Norway to facilitate the engagement and participation of telehealth services reported that information about the intervention often did not reach them because people from "higher-up" (management) did not communicate effectively. Lack of effective communication channels at the organisational levels impedes the ability of the leaders to follow up and fully support their staff in the implementation process (Kolltveit et al., 2017).

4.1.1.5 Engaging/Consulting/Involving Staff. Another factor influencing the adoption of telehealth was the organisation's managerial approach to technology. Respondents in the study explored the influence of organisational factors on telehealth adoption across 32 hospitals in Quebec stated that the senior management failed to address their (the physicians') interests when implementing the new technology (Gagnon et al., 2005). The physician from the same study said, "They [the management] have consulted us but did not take our concerns into account". In Alami et al. (2018), the clinicians explained that they refused to use telepathology in Quebec because the management used a "top-down" approach and did not consult or integrate them into the project. The study conducted by Smaradottir et al. (2016) explored the design and evaluation of telehealth services in Norway and pointed out that respondents felt they were valued when they provided feedback about the system (Smaradottir et al., 2016).

4.1.1.6 Dedicated Management and Leadership. Participants highlighted the need for responsible and committed leaders to support and guide the rollout of telehealth services. Kolltveit et al. (2017) that explored the conditions for success in introducing telehealth services across Western Norway, pointed out dedicated leaders as a positive factor for the uptake of telehealth services. Telehealth leaders should drive the intervention more strategically and prioritise communication (Kolltveit et al., 2017). The need for committed and responsible leaders who support telehealth services is important. A dedicated telehealth clinical leadership team that links clinical and operational leaders enables sustainable telehealth services (Victoria Wade & Eliott, 2012). Providing effective leadership by working with all parts of the delivery system, ensuring telehealth services are implemented effectively (Kolltveit et al., 2017).

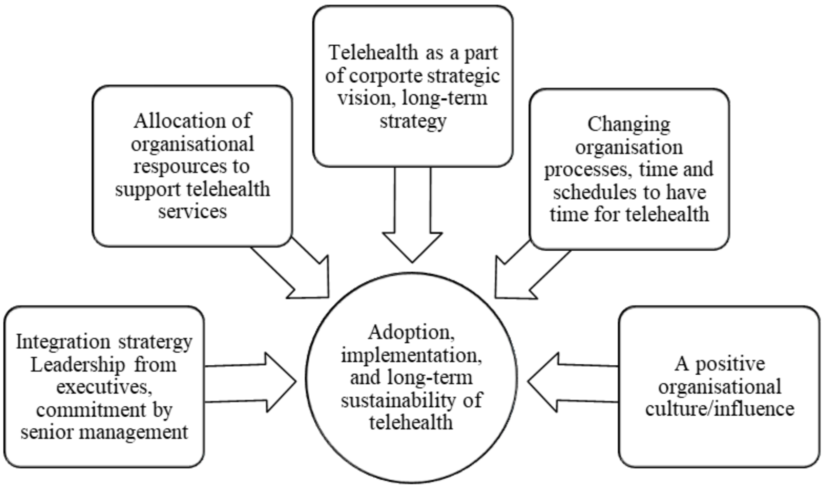
4.1.1.7 Organisational Culture. Some respondents reported an unwillingness to change how things worked at the organisation. One of the respondents in the longitudinal qualitative study conducted across three rural ICU facilities in the United States to explore the organisational culture to maximise telehealth services uptake noted difficulty adapting to the change in practice. Staff may be underutilising the telehealth services due to the norms of the corporate culture before the introduction of telehealth services (Goedken et al., 2017).

Organisations involve different administrative, professional and political cultures (Alami et al., 2017). Implementing telehealth services should not neglect the importance of knowing the work culture into which the telehealth technology will be introduced (Kolltveit et al., 2017). Determining ideal methods for adapting to change organisational cultures and integrating telehealth services by formalising new routines are key components for the successful implementation of telehealth services (Goedken et al., 2017).

Full integration of technology into business as usual processes demands that the organisation make changes to its practices, procedures, business and management to allow telehealth to thrive. It also demands that telehealth becomes part of the long-term strategy and not a passing project. Being part of the organisation’s long-term strategy will involve inclusion in its strategic vision, mission, and objectives. It will also see the setting aside of resources to support telehealth services and commitment by senior management. The extent to which the organisation is willing to integrate telehealth determines how the technology will be implemented, adopted, or sustained in the long term. Full integration means that the organisation will allocate the necessary resources to see the project succeed. Resource allocation includes monetary and managerial support to the users interested in fully embracing the technology. The influential factors for telehealth adoption, implementation, and sustainability under this theme were changes in the organisation's operations, organisational culture, and processes to provide telehealth services that do not become a burden for practitioners, allocation of resources (such as money), a commitment by senior management officials, leadership from the executives and incorporation into the organisation's long-term strategy. The barriers under this theme were failure to allocate resources, make changes in the organisation's processes to accommodate telehealth services, lack of long-term strategy and implementation of telehealth services as a passing project and not as part of the organisation's strategy. A visual representation of influential factors and barriers is shown in Figure 4.

Figure 4

The Extent of Technology (telehealth) Integration in the Healthcare Organisation and Telehealth Adoption, Implementation, and Long-Term Sustainability of Telehealth Projects



4.1.1.8 Relation to the NASSS Framework. The extent of technology integration was captured in two of the NASSS' domains; the Organisation and Embedding and Adapting over time. According to (Greenhalgh et al., 2017), telehealth needs to be of value, and the organisation should have adequate capacity, resources, and good managerial relations with a shared vision, and the scope for adapting and embedding the technology should be strong. Commitment and leadership from executives were vital in leading the rest of the organisation to integrate and embrace telehealth fully. Good leadership was also critical in engaging organisation members and creating a high tension for change. Before acquiring technology, the organisation can conduct a feasibility study to determine its needs and develop the technology to address shortcomings or challenges. A needs assessment will ensure a good fit for the technology in the organisation. New infrastructure in support equipment was required, and a change in business processes and operations so that practitioners were not overburdened; however, all these changes can be aligned to already established and existing procedures. Embedding and adaptation over time were possible if the organisation engages staff to monitor the use of technology over time and respond to change and new needs by reconfiguring the technology and changing the operational procedures (Table 8).

4.1.2 Human Resources Function

This theme described the function of the workforce to adopt, implement and continue to use telehealth technologies. The key factors identified from studies were *staff acceptance, clinicians as champions, staff training, uncertainty about the usefulness of the technology, fear of change, fear of job loss, staff comfort, staff willingness to use the technology and comfortable using face-face consultations*.

4.1.2.1 Clinician Acceptance/Clinician Buy-in. Respondents said that clinicians' acceptance or buy-in of the technology positively influenced the adoption of telehealth technology; however, they emphasised that clinicians needed more time to adjust. A respondent in the Merchant et al. (2015) study that explored the key informants' perceptions on using telehealth services from 36 hospitals across 22 states in the United States stated that positive clinical buy-in would improve if they are given time to adjust to using telehealth services. Ongoing education and resources to encourage telehealth technology can create positive buy-in from clinicians. While some clinicians may support the technology, others may be less enthusiastic about having busy schedules and not grasp how telehealth could benefit them (Merchant et al., 2015). Clinicians pushed back when they felt pressured to use the technology and when they perceived the use of telehealth as implying that their skills were not adequate.

4.1.2.2 Clinicians as Champions. Clinicians had been regarded as facilitators essential to the success of telehealth projects in diabetic foot care across Western Norway and described as "leading lights or champions" (Kolltveit et al., 2017). They do this by engaging in the intervention and encouraging other clinicians to use it. The enthusiasm has been valuable to other clinicians to start using the technology. (Kolltveit et al., 2017). Some organisations had organisation guidelines requiring physicians to use telehealth services, but due to inadequate or lack of follow-up and enabling environment, uptake by physicians was low. Clinicians play a vital role as telehealth champions in overcoming the repeated technical and organisational barriers in delivering telehealth services in Australia (Wade & Eliott, 2012). The organisation's role is to train doctors, equip them with the necessary resources, and convince them that telehealth would be good for their practices. The success and continuity of the telehealth projects depend on the willingness of the clinicians to use telehealth. Tehelealth champions are ambassadors to other clinicians to help to choose the right technology and educate them on how to use the technology (Alami et al., 2017).

4.1.2.3 Staff Training. Physicians, clinicians and other healthcare professionals were involved in the day-to-day use of telehealth technologies. Their use or disuse determines the technology's sustainability, adoption, and scaling-up. Respondents in the included studies mentioned that telehealth services required a basic level of technical knowledge. Hopp et al. (2006) study examined providers' perceptions of the factors that influence the implementation of telehealth across the Veterans Health Administration hospitals in the United States and found that adequately training staff with the technology plays a crucial role in implementing sustainable telehealth services. Staff appreciated learning about the technology before start using the technology (Hopp et al., 2006). Sanders et al. (2012) study explored the barriers to participating and adopting telehealth services within the Whole System Demonstrate trial in the United Kingdom. The study found that expectations and experiences of telehealth services can disrupt the uptake of telehealth services (Sanders et al., 2012). Although the organisation's role was to train and offer ongoing support and educational sessions for staff members to be confident about using technology, that was not always happening. (Sanders et al., 2012).

4.1.2.4 Uncertainty about Usefulness/Accuracy and Safety of Telehealth. Some respondents had concerns about how accurate, useful or safe telehealth technology was, particularly for their patients. Clarity about the outcomes to measure and concerns about healthcare quality were identified as barriers. Usefulness and accuracy were particularly important for practices such as dermatology (Mair et al., 2007). The use of telehealth technology did not significantly impact re-hospitalisation or nursing caseload (Mair et al., 2007). Also, uncertainty about the evidence available to back telehealth was a barrier to adopting the technology in mainstream healthcare (Mansouri-Rad et al., 2013). Lack of available evidence made it difficult to secure investment and funding because such organisations were looking for interventions that prioritise cost savings and time and improve patient outcomes. The study conducted by Taylor, Coates, Wessels, et al. (2015) across four community health settings in the UK explored the factors that affected telehealth adoption to expand the services. Participants from the study felt frustrated that they were not able to show the benefits of telehealth, which decision-makers require on the data to show the value of telehealth services for the patients. (Taylor, Coates, Wessels, et al., 2015)

4.1.2.5 Fear of Change. Nurses were afraid that technology would make them redundant or change the nature of their jobs. A study by Whitten et al. (2005) on factors that influence tele-hospice utilisation across four hospice centres in Michigan noted resistance from staff as telehealth services did not provide solutions to solve their existing problem. Some nurses also had concerns about losing mileage reimbursement, while others thought tele-hospice would be a threat to their autonomy (Whitten et al., 2005).

4.1.2.6 Fear of Job Loss. Technicians who were interviewed to know the factors that impacted the large decentralised telepathology projects in Eastern Quebec, Canada reported, they were afraid that telehealth would result in the departure of pathologists and laboratories would close as he pointed out, "I fear that one day our work will be transferred elsewhere, and then we will be nothing more than specimen wrappers" (Pare et al., 2016).

4.1.2.7 User Comfort with Technology. Some users were afraid that the technology, such as touching, or mishandling, would damage the technology (Al-Qirim 2007). Others disliked their video image on the screens. Others doubted their capacity to engage with the equipment and technology (Sanders et al., 2012).

4.1.2.8 User Attitude and Trust in the Technology. Spaulding et al. (2005) surveyed 356 physicians across 20 counties in Kansas, United States, to explore the critical factors that influenced telehealth adoption to improve patient access showed that users with a positive attitude tend to be early adopters. In the study, the number of telehealth referrals that adopters made was significantly correlated with the users' perceptions (Spaulding et al., 2005).

4.1.2.9 Threats to Personal Relationships. Doctors were afraid that telehealth threatened the personal relationships they formed with their colleagues, peers, and patients. The respondents in the study conducted by Ray et al. (2015) interviewed rural paediatricians across 17 states within the United States to identify factors that improved access to telehealth services and described informal networks with specialists and sub-specialities that were at risk due to technology (Ray et al., 2015).

4.1.2.10 Preference for Old Ways and Fear of Losing Contact with Patients. Some respondents in the Hopp et al. (2006) study said they did not want to use telehealth because it takes a lot of effort to develop a personal relationship over video than it does in person. One of the fears from staff is the video may replace the real face time with the patients (Hopp et al., 2006). Another respondent from the study investigating the perceived usefulness of telehealth adoption across established expert telehealth providers in Australia stated few clinicians are less comfortable and confident in making a realistic diagnosis using telehealth technology (Moffatt & Eley, 2011).

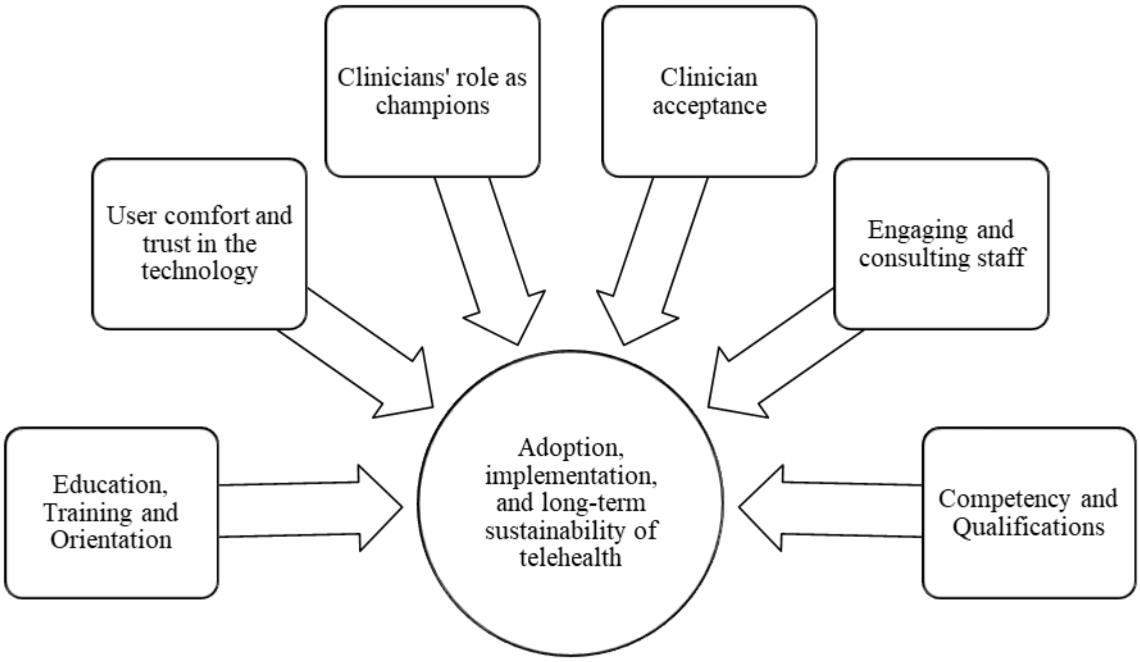
Users work directly with the system, and as the literature review showed, their attitudes and acceptance of the system determine its success. Doctors, nurses, and other health practitioners form a vital component in adopting technology because they use it directly. Clinicians were the direct users of the technology, and therefore, their acceptance of telehealth services influenced the adoption and long-term sustainability of telehealth. If the technology did not work for these users, the project's adoption, implementation, or long-term sustainability was limited. Senior management cannot lead the organisation into adopting or maintaining the system without the staff.

Participants from the above stated studies emphasised the need to be consulted, engaged, and included in decision-making before, during, and after the implementation of telehealth projects. Including staff in deciding to implement a telehealth project and consulting them about their needs enabled the organisation to acquire technology that addressed the ongoing challenges. End-user involvement meant the technology was relevant to the organisation and enhanced adoption. Engaging the staff during rollout and post-implementation identified challenges, and management can therefore address them before they become barriers. Staff training was vital because it equips the users with the right skills to use the technology. Furthermore, organisations should have policies and procedures to ensure that all staff have the necessary qualifications and competencies to practice telehealth services safely. Staff competency could be developed through structured on-the-job training.

Indeed, some of the codes identified were fear of change, fear of losing contact with patients, preference for old ways, bad past experiences, trust in the technology, need for technical knowledge, user attitude, and user comfort with technology. Staff training ensures the transfer of skills and the knowledge to work with technology, improves attitude, enhances user comfort with technology, trust in the technology, and alleviates the fear of change and loss of contact with patients. As a consequence, clinician acceptance, staff training, education and involvement, as well as inclusion in decision-making, regarding telehealth purchases, needs, and implementation are influential factors in telehealth's adoption, implementation, and long-term sustainability. The barriers were the failure to consult and engage staff and a failure to train and educate staff. The relationship between these factors and the adoption and long-term sustainability of telehealth is visualised in Figure 5.

Figure 5

Human Resource Function and Telehealth Adoption, Implementation, and Long-Term Sustainability of Telehealth Projects



4.1.2.11 Relation to the NASSS Framework. The human resources function was captured in the NASSS framework as the adopter system. According to Greenhalgh and colleagues (2017), staff must be trained to use the system to engage with it. Staff may also have concerns about the threat technology poses to their practice, job, and even patients (Greenhalgh et al., 2017). Involving and consulting them helps address these fears and boosts adoption and sustainability. Staff training boosts their confidence, trust, and comfort with the technology and addresses fear of change and threats to their practice. Other users, such as patients and caregivers, were not discussed nor addressed by this review because they are not relevant to organisational factors (Table 8).

4.1.3 Technology Infrastructure

Technology infrastructure describes *internet availability and reliability, technical problems* (computers, software and other equipment), *and their ease of* use technology regardless of location or conditions. The respondents identified various technology and infrastructure barriers and facilitators to telehealth adoption, implementation and long-term sustainability.

4.1.3.1 Internet and Equipment Reliability. Internet reliability was reported as an important factor in the successful implementation and adoption of telehealth services. One of the respondents from the semi-structured interviews conducted across telehealth expert providers in Australia pointed out, “The phone is unlikely to go down” and that people want to be “confident it will work when they access it” (Moffatt & Eley, 2011). Caffery, Taylor, et al. (2017) conducted interviews across nine tele-orthopaedic services and identified internet and equipment reliability as the key factors influencing telehealth uptake in Australia. Unreliable equipment and internet connection disappoint health care professionals and patients in delivering professional services using telehealth technology (Caffery, Taylor, et al., 2017). A respondent in Lucas’s study (2013), who explored clinicians’ perceptions of telehealth services in the rural and remote emergency departments in New Zealand, noted that the weather disrupts infrastructure, particularly in rural areas, and organisations need to address these problems (Lucas, 2013).

4.1.3.2 Technical Problems. Technology disruption, such as the breakdown of equipment, also affects the ability of staff to work. One of the respondents in the study conducted by Collier et al. (2016) to explore the factors that integrate telehealth services into community palliative care programmes stated technical issues slow the uptake of telehealth services. Technical issues are a huge issue, and certainly, when the machines are playing up, they cannot get through. Suddenly, it is easier to go back to the normal ways of doing it. (Collier et al., 2016). If the users were not sure they could rely on the technology and it would not fail when they needed it, they would likely abandon it. In the Collier et al. (2016) study, clinicians made it clear that they would not accept telehealth if the equipment were slow or the quality of the sound or images was not acceptable. Telehealth equipment requires continued updating and maintenance as well as replacements. The organisation must upgrade the telehealth infrastructure to meet evolving user needs (Collier et al., 2016).

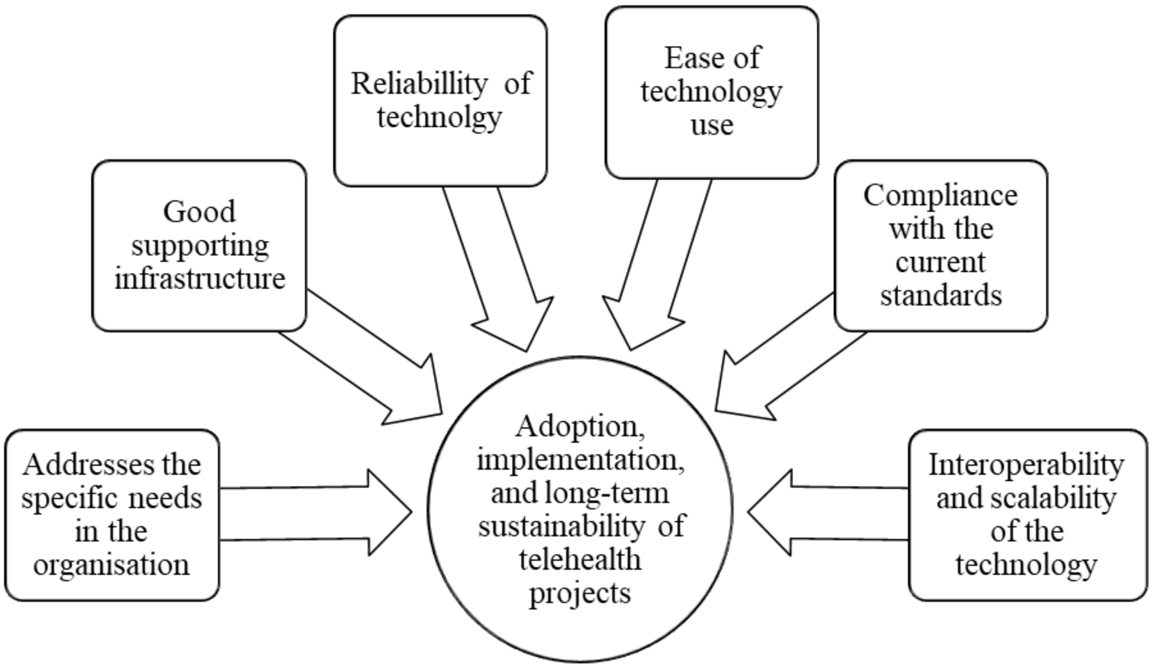
4.1.3.3 Ease of Technology Use. Some participants identified the need for technical knowledge as a barrier to using telehealth. Problems associated with using the technology and not having adequate knowledge on how to use the technology were reported as barriers to uptake of telehealth services (Moffatt & Eley, 2011). One of the healthcare professionals from the study conducted by Kolltveit et al. (2017) to explore the factors that facilitate the uptake of telehealth services stated that technology must be simple and easy to use. The staff's reluctance to use the technology happens when the technology takes much time and attention to use (Kolltveit et al., 2017).

The thematic analysis revealed that users avoided technology that did not work but embraced technology that worked every time. Users wanted assurance that the technology was easy to use, should not involve too much effort and work consistently. The codes under this theme were *internet reliability*, *bandwidth*, *ease of use*, *information overload*, *patient eligibility* and *technical problems*. Internet reliability and bandwidth were factors in rural/remote areas. Some participants reported these problems in their areas and also during extreme weather. Good internet infrastructure enhances reliability and boosts users' access to technology and trust. As mentioned before, users need to be assured that the technology will work when they need it. Technical problems involving the computer, software, applications or peripheral devices were also pointed out as barriers to telehealth adoption and use. Users, particularly medical practitioners, did not have time to fiddle with equipment or programmes that did not work. For this reason, the organisation needs to consider a significant investment in technology infrastructure to promote its use. Some participants also complained of patient eligibility and information overload as barriers. Telehealth technology cannot be used in all patient cases, and therefore, a feasibility study needs to be conducted so that the technology acquired can be specific to the organisation's needs. Information overload will be addressed by acquiring a system that is easy to use.

As a consequence of this, influential factors were the ease of use of the technology, the reliability of the internet, and supporting infrastructure and technology that addresses the organisation's specific needs. Barriers to adopting technology are a weak internet infrastructure, technical problems with the technology, difficulties using the technology and if the technology is not specific to the organisation and its needs. Figure 6 shows the relationship between the influential factors and adoption, implementation, and long-term sustainability of telehealth projects.

Figure 6

Technological Infrastructure and Telehealth Adoption, Implementation, and Long-Term Sustainability of Telehealth Projects.



4.1.3.4 Relation to the NASSS Framework. Technology infrastructure was captured in the technology and value proposition domains of the NASSS framework. According to past research (Greenhalgh et al., 2017), the technology should be dependable, interoperable and easy to use without requiring complex knowledge. The supply model should be easy such as plug and play, without the need for significant customisation. It should address the specific needs of the organisation, such as having a clear business case, good chances of a return on investment, and being desirable and effective. Without these, the technology becomes too complicated for users, and they may abandon it altogether. The most suitable technology was that which can be customised for the organisation on a needs basis. The organisation should not shy away from installing good infrastructure because it will influence the accuracy of the data generated and its dependability in decision-making. Good infrastructure such as fast internet speeds and high computer processing power can enhance the image, sound clarity, and, subsequently, data accuracy. The organisation should consider carefully the suppliers and technology before implementing it because it is one of the most significant factors for adoption and long-term sustainability. As part of the initial negotiations with the suppliers, the organisation should consider supplier relationships and long-term sustainability, for example, if the supplier were no longer present in the market. Large organisations had the power and financial resources to negotiate with suppliers. Before acquiring the technology, the organisation needs to consider all of these factors and involve stakeholders to ensure that issues of safety, cost-efficiency, desirability, and relevance are addressed before purchase (Table 8).

4.1.4 Financial Support Services

The codes under this theme were funding, costs and *monetary incentives for doctors*.

4.1.4.1 Funding. Implementing telehealth technologies was a resource-intensive activity, according to the included studies. According to respondents, money was one of the most relevant resources in the implementation and adoption of telehealth (Hopp et al., 2006). One of the healthcare professionals in the study conducted by Kayyali et al. (2017) among the healthcare professionals in London to explore the factors that impede the telehealth adoption in healthcare delivery stated telehealth technology is expensive to implement. There are not enough initial investments to set up the technology, infrastructure and equipment as they are very expensive (Kayyali et al., 2017). Most telehealth projects usually had an initial fund to start, but no recurrent funding was provided. The study that explored the uneven utilisation of telehealth in Norway stated long-term sustainability was not taken into account as one of the respondents pointed out, "We hope that the project financing will become a financing activity. Or else, we are forced to look to other funds. If we do not, we will have to close down the project" (Alami et al., 2017). Another respondent stated that financing was constrained because healthcare financing was activity-based, where developments were finance based on the value they show. Short-term funding was not applicable in telehealth because benefits were the long-term, and therefore, a short-term budget was not suitable.

4.1.4.2 Costs. Semi-structured interviews were conducted by Radhakrishnan et al. (2015) across the home telehealth agency in Texas, United States, to explore the factors that contributed to unsustainable telehealth services and found; that telehealth equipment was costly to maintain. The ongoing investment in equipment and infrastructure maintenance is pretty pricey. With the advancement in new technologies, existing technology becomes obsolete two years after being implemented (Radhakrishnan et al., 2015). Apart from the initial investment, continued maintenance, upgrades, replacing lost equipment, and support increases the costs of operating telehealth services (Radhakrishnan et al., 2015).

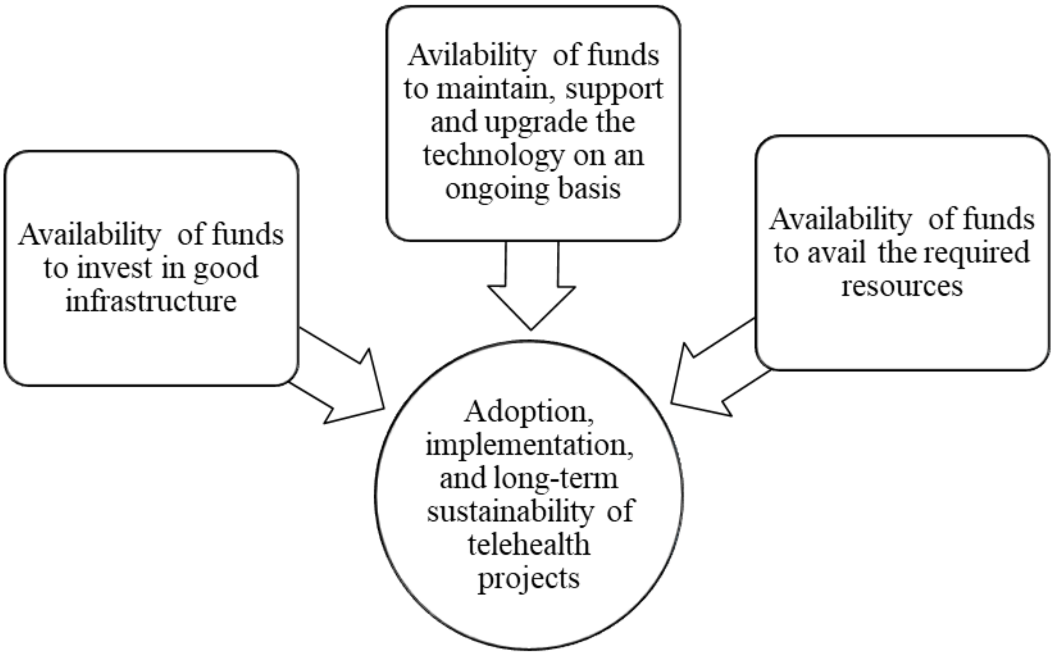
4.1.4.3 Monetary Incentives for Doctors. Funding for doctors was identified as a barrier in the study conducted to understand the factors that contributed to the uptake of telehealth in Australia (Moffatt & Eley, 2011). Telehealth projects tend to be capital-intensive, and initial funding covers the associated costs of purchasing the technology and the resources required to begin implementation. The initial cost can be significant, depending on the system to be implemented. However, as discussed in previous themes, the organisation should invest in good infrastructure which is simple and easy to use, influencing technology adoption. Recurrent funding takes care of ongoing expenses, maintenance costs, upgrades and repairs.

Internal funding within the organisation supported most telehealth projects, and sometimes, external initiatives promoted telehealth services. Problems in finding financial sources to help the projects during set-up and in the long-term make sustainability and scaling-up difficult after completing the pilot phase. In other words, before implementing a telehealth project, the organisation should consider both initial and recurrent funding and particularly look for recurring sources of funds to sustain the projects in the long term. The thematic analysis revealed that organisations tend to abandon projects if there is no additional funding. The organisation by itself may not be able to support such a project and relies on external financing; however, some funders may wish to support only specific applications such as clinical specialities.

As a consequence, the organisation should determine sources of recurrent funding before implementation. Financial support was critical, particularly for the long-term sustainability of the project. Adequate financial resources are required to support a telehealth project, including infrastructure and human resources. Some participants in the included studies also insinuated that doctors would like monetary incentives to use telehealth projects. The factors influencing the adoption, implementation, and sustainability of telehealth projects were the availability of funds to invest in adequate infrastructure, the availability of funds to support the required resources, and the availability of funds to help, maintain, and upgrade the system on an ongoing basis. The barriers were a lack of adequate funds and resources to initiate and support the system. Figure 7 shows the relationship between financial resources and the adoption, implementation, and long-term sustainability of telehealth projects.

Figure 7

Financial Resources and Telehealth Adoption, Implementation, and Long-Term Sustainability of Telehealth Projects



4.1.4.4 Relation to the NASSS Framework. Greenhalgh and colleagues (2017) captured funding in the organisation domain of the NASSS framework. According to Greenhalgh and colleagues (2017), single organisations with adequate resources are likely to have dedicated budgets above the cost of technology to support the maintenance and implementation of the technologies. Multiple organisations involving partnerships and collaboration make it difficult to acquire sufficient funds. Sustainable telehealth services consider both initial and recurrent funds. Initial funding was needed to support the initial implementation and resources required for the project to start. For any support, repairs, maintenance, and upgrades of telehealth technology, organisations needed recurrent funds. Without adequate resources and a dedicated budget, the organisation may not handle the high maintenance costs or sustain the project over the long term. Funders may have conditions such as they can only fund certain specialities or healthcare settings. All telehealth services should consider these factors before implementation. Thus, planning is necessary before implementation (Table 8).

4.1.5 Factors in the Organisation's External Environment

The codes identified under this theme include *regulations and legal policies, reimbursement*, *credentialing*, *fragmented ownership of technology*, *sharing and continuity of data and information, interoperability of systems due to different ownership structures, patient factors,* and *location and size of the organisation*. The respondents also pointed out some factors that affect the implementation of telehealth and sustainability that were out of the immediate healthcare organisation's control. For example, various regulatory, legal, and cultural factors influenced the adoption and sustainability of telehealth projects.

4.1.5.1 Regulation: Licensure and Credentialing. Legal factors influence the adoption, implementation, and sustainability of a telehealth project, most of which are outside the organisation's control. For example, different countries have different regulations governing credentialing and licensing. Respondents from various included studies pointed out that credentialing and reimbursing policies were significant barriers. In a survey conducted in the United States across 97 programmes to assess the status of telestroke activity, respondents said that there was no national-level medical licensing and credentialing for physicians. If physicians change between states, they have to undergo the process again (Silva et al., 2012). Uscher-Pines and Kahn (2014) surveyed to identify the success factors and barriers to widespread use of pediatric emergency telehealth in the United States and reported that community hospitals were unwilling to modify their bylaws on telehealth credentialing (Uscher-Pines & Kahn, 2014).

4.1.5.2 Legal Factors. Physicians were concerned about malpractice liability in telehealth services. Health professionals are worried about the liability issues associated with any adverse event using telehealth services (Levine et al., 2014). The issues regarding malpractice liability made it difficult for physicians to embrace telehealth services fully. Respondents in the Caffrey et al. (2017) study also noted that there might be confusion about laws regarding the storage of patient images and privacy (Caffery, Taylor, et al., 2017). The national culture was found to influence staff perception towards information policies, regulations, and privacy. Establishing guidelines and procedures to understand and overcome the legal and information security issues influences telehealth adoption.

4.1.5.3 Insurance and Reimbursement. Reimbursement for telehealth services was not always available, and where available, there were specific and strict criteria governing the process of telehealthcare for the physician. Alami et al. (2017) study that explored the multi-level factors that affect telehealth utilisation and uptake in Norway pointed out the funding model as a major obstacle to the widespread use of telehealth and interprofessional collaboration (Alami et al., 2017). Not all services in telehealth interactions were reimbursed, and for most countries, only teleconsultations were reimbursed. In the Alami et al. (2017) study, GPs, and other health practitioners involved, were not compensated, and only specialists were reimbursed even though they all participated in the teleconsultation. Without reimbursement, respondents in the Uscher-Pines et al. (2014) study said that the long-term sustainability of telehealth projects was significantly limited. The initial capital is not sustainable for long-term operations of telehealth technology. Value in using the technology and reimbursement funding models are critical to sustainability (Uscher-Pines & Kahn, 2014).

4.1.5.4 Patient Factors. Participants highlighted patient eligibility and training as some of the patient factors that could influence the adoption of telehealth. Not all conditions can or should be treated by telehealth, and therefore, not all patients are eligible (Whitten et al., 2005; Whitten & Mackert, 2005).

4.1.5.5 Governance of Healthcare Organisations. Different healthcare organisations at different levels, such as private and public hospitals, district and municipal hospitals, or rural and urban hospitals, differ in how they adopt telehealth services due to the various factors that facilitate or hinder adoption at the respective levels. Lack of coordination between healthcare organisation levels was one of the barriers identified in the results of the included studies. According to one study, Telehealth infrastructure, predisposition, and expertise differed for hospitals in Northern Norway than Western Norway, resulting in varying adoption rates due to funding and governance structures (Alami et al., 2017). Funding mechanisms, administration and cultures may also cause fragmentation. The diversity of governance structures and stakeholders makes the implementation more complex. Implementing telehealth services requires a variety of technologies with fragmented ownership. There is an important need for information, leadership and change management strategies to support the telehealth implementation. Most organisations do not have enough funds and skills needed to implement telemedicine services. (Alami et al., 2017).

The respondents in the Alami et al. (2017) study also noted that telehealth utilises multiple technologies with different owners, which impacts the sharing of information, patient data and communication.

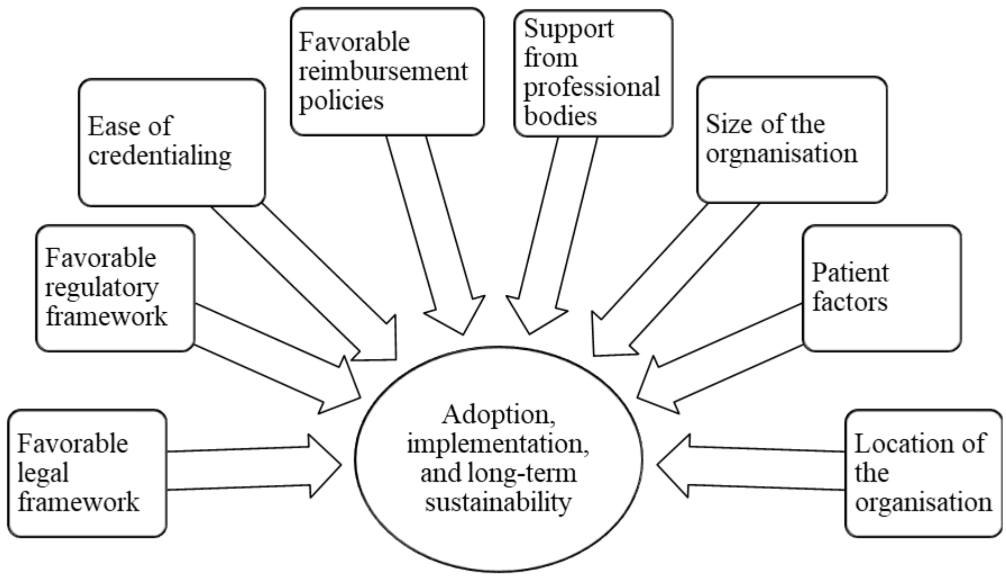
4.1.5.6 The Size or Location of the Organisation. The size of the healthcare organisation and its location (rural vs urban) may also influence the adoption of telehealth services. The size of the organisation reflects the resources available to implement telehealth services. Goedken et al. (2017) conducted semi-structured interviews across three rural ICU facilities in the United States to evaluate the rural hospital staff perceptions of telehealth before and after implementation. According to respondents, facilities in rural areas had fewer resources, and telehealth can help complement these resources. Rural hospitals are the biggest reapers of the benefits of using technology (Goedken et al., 2017). Population density also influences access to resources to conduct telehealth. According to respondents, low population density areas use telehealth services to reduce travel distance to medical facilities, while urban areas incur high costs and, therefore, are looking to save costs (Kierkegaard, 2015). In addition, rural areas experienced barriers due to the unavailability of equipment skills and poor internet access (Moffatt & Eley, 2011).

These factors were relevant because the organisation operates within an environment that influences its operations and activities. Reimbursement and credentialing may be outside the organisation's control but were of significant importance to the adoption and long-term sustainability of telehealth technologies. Regulations and legal policies governing patient safety and sharing of data may also be outside the organisation's control; however, they guide how medical practitioners use telehealth technologies. The organisation may control interoperability due to technology ownership and agreements with suppliers and partnering organisations. The location and size of the organisation will influence infrastructure access (such as the internet), funds, and its ability to negotiate. Patients and their caregivers were users of telehealth systems too. Their attitudes, therefore, training, and knowledge about the system can influence whether its adoption was successful.

The influential factors in the external environment were a favourable regulatory and legal environment, favourable insurance terms, and support by professional bodies and associations. The barriers were inadequate reimbursing, bureaucracies in credentialing, lack of support from professional bodies, and hostile regulations and legal frameworks. The factors are visualised in Figure 8

Figure 8

Factors in the Organisation's External Environment and Telehealth Adoption, Implementation, and Long-Term Sustainability of Telehealth Projects



4.1.5.7 Relation to the NASSS Framework. According to Greenhalgh and colleagues (2017), the broader context domain describes the organisation's environment. Adoption and sustainability of telehealth services were enhanced if national financial and regulatory requirements were in place and professional bodies were supportive. For telehealth services to be sustainable external organisations should lobby to ensure the national frameworks and policies guiding reimbursement, credentialing and telehealth technology operations (Table 8).

4.1.6 Summary

This section discusses the findings from the literature review and a qualitative synthesis using thematic analysis was performed. The thematic analysis results developed the initial version of the framework underpinned the NASSS framework. The initial framework developed from Phase 01 of the study comprises five domains: the extent of technology integration, human resources function, technology infrastructure, financial support services and factors in an organisation's external environment. The organisational level factors from each domain of the initial framework informed the initial survey questions in phases 02 and 03 of the study. Table 8 summarises how the NASSS framework domains reflect the themes of the initial framework applicable to identified domains. The phase 03 interviews were analysed in the context of the five major themes underpinning the NASSS framework developed from Phase 01 of this study (Table 8).

Table 8

Discussion of the Emerging Themes in Relation to the NASSS Framework

Themes	**Sections**	**How the theme applies to the domain**
The extent of Technology Integration	Domain: The organisation	The organisation needs adequate resources to support telehealth projects, will need senior leadership to give guidance and senior management will need to commit, engage staff, and lead.
		The organisation should consult and include staff to get widespread support. Getting the right technology for the hospital settings will create a good innovation fit and create high tension for change.
		New infrastructure/technology should be in place when required. The ease of funding decision will depend on the organisation and the resources at its disposal.
		Changes in workflow schedules to avoid burdening practitioners. New schedules to normalise the technology into established routines and care pathways.

Themes	Sections	How the theme applies to the domain
		Build a shared vision, engage staff, put up new practices and monitor the impact. Senior management needs to lead and engage staff; project managers should set up new practices and monitor impact.
	Domain: Embedding and adaptation over time	There was a substantial scope for adapting and embedding the technology as context changes.
		Sensemaking, reflection, and action to adopt technology should be encouraged.
Human Resources	Domain: The Adopter System	Existing staff will need to learn new skills. Reorganising work schedules to fit telehealth services.
Technology Infrastructure	Domain: The technology	To be customised to fit the needs of the organisation, boosting interoperability, usability, scalability, and dependability.
		Generated data and knowledge should be trustworthy, accurate, and sufficient for decision-making, but all these depend on the infrastructure.
		Staff training was required. Ongoing support might be needed. The level of instruction and training is not detailed or complex.

Themes	Sections	How the theme applies to the domain
		Plug and play technology could be adequate so that the required customisation is not extensive. Could be easily substituted if the supplier withdraws.
	Domain: Value Proposition	A feasibility study could determine if the technology was appropriate for the organisation and whether it addresses the specific organisational needs. The feasibility study also helps to develop the business case and enhance the return on investment.
		The effectiveness and desirability of the technology will depend on its ease of use and whether it addresses specific needs. Its safety and cost-effectiveness can be part of the negotiations with the suppliers.
Financial support	Domain: The organisation	Both infrastructure and human resources were required to support the implementation of telehealth projects. Both require initial and ongoing funding.
		Readiness is judged by the availability of initial and recurrent funding as well as the availability of funding sources. Sorting external funding sources, meeting the needs of the organisation and funders.

Themes	Sections	How the theme applies to the domain
		New infrastructure, maintenance, upgrading and repairs would are required. These will cost a significant portion of the recurrent expenditure.
External Environment	Domain: The Wider Context	Credentialing should not be bureaucratic, reimbursement models, patients need to be informed and trained on how to use telehealth, and professional bodies should be in support. The legal system should define aspects such as patient safety and protection of data for uniformity. Some of these requirements are not in place nationally, limiting the adoption of telehealth.

4.2 Phase 02- Part 1: Survey Findings

This section describes the findings of the survey results carried out during Phase 02 Part 1 of the study. The objective of this phase of the study was to determine the status of the telehealth environment across the DHBs in New Zealand. Part 01 of the survey included a sample of 20 DHBs and was completed online by the key contact person nominated by the Chief Executive officers of each of the 20 DHBs. All 20 DHBs completed Part 1of the survey, which enabled the researcher to know the complete status of the telehealth environment across the DHBs in New Zealand.

The participants completed the survey online using the Qualtrics software, and the collected data were downloaded into a spreadsheet. Each part of the survey data was coded and loaded on the Statistical Package for the Social Sciences (SPSS) software (version 27) to perform the statistical analysis. The following sections describe the findings from Part 1 of the survey that all the 20 DHBs completed.

4.2.1 Video Conferencing Environment across the DHBs

This section presents the findings of Part 1 of Phase 02 of this research, that is, the survey questions directed to the DHB key contact, as nominated by the Chief Executive Officer of each DHBs, on the key factors in the Video Conferencing (VC) environment to cover the usage, facilities, capacity, compliance, and infrastructure of VC across the DHBs in New Zealand.

4.2.1.1 Video Conferencing Usage. DHBs reported using VC for both clinical and non-clinical purposes. All DHBs used VC for non-clinical administration and clinical MDMs (Multi-Disciplinary Meetings). Nineteen DHBs used VC for connecting clinicians and patients to manage clinical telehealth interactions. Findings from the survey indicated the number of that DHBs using VC for patient consultations has grown from 16 in 2014 to 19 in 2019.

Table 9

Video Conferencing Usage across DHBs

Video conferencing usage across DHBs	DHBs *n* (%)
Administrative and management meetings	20 (100)
MDM meetings	20 (100)
Clinicians and patients	19 (95)
Clinical education	16 (80)
Primary/NGO and secondary care	15 (75)
Organisations outside health	12 (60)
Services related to health or disability services	11 (55)

Note. Percentage values are calculated based on reported numbers (N =20)

Fifteen DHBs reported using VC services to connect with healthcare organisations, compared to only 12 DHBs connecting with organisations outside the healthcare sector; however, the lowest usage of VC was to connect individuals with disabilities and so provide telehealth services (Table 9).

4.2.1.2 Video Conferencing Scheduling Facilities. Strong technical and help desk support is important for user satisfaction. DHBs reported providing telehealth technical support to reinforce the use of telehealth technology. Nineteen DHBs provided help desk technical support for their workforce to use telehealth technology. The DHB IT department or the VC infrastructure suppliers provided technical support to use the technology. In addition, 17 DHBs reported using a booking system to schedule room-based or virtual rooms for telehealth consultations. Most of the 15 DHBs reported using the booking system to schedule and use room-based telehealth consultations (Table 10).

Table 10

Video Conferencing Scheduling Facilities and Help Desk Support

Video conferencing facilities	DHBs *n* (%)
Help desk support for VC users	19 (95)
Booking systems for room-based VC	15 (75)
Booking systems for virtual meeting rooms	13 (65)

Note. Percentage values are calculated based on reported numbers (N =20)

The majority of the DHBs reported using Microsoft Outlook to schedule room based meeting rooms. DHBs reported managing the bookings systems to use the VC facilities through their IT departments or the clinical departments where the VC units were located.

4.2.1.3 Video Conferencing Capacity. In 2014, only four DHBs reported having enough capacity to meet their current demands for telehealth services. Survey findings in 2019 show a notable improvement, with half of the DHBs reported having enough VC capacity to meet the demands for telehealth services. As noted in the survey results, VC infrastructure still clearly remains the main barrier to uptake telehealth services across the DHBs. Eight DHBs reported having an investment plan to allocate more funds to increase their current VC capacity (Table 11). Although the number of DHBs reported having an investment plan increased from 2014, half the DHBs reported not having an investment plan. Much work needs to be done to meet the growing demand for telehealth services.

Table 11

Video Conferencing Capacity to Meet the Demand for Telehealth

Video conferencing capacity s	DHBs *n* (N)	%
VC capacity meeting current demands	10 (20)	50
Investment plan to meet the unmet VC demands	8 (10)*	80
Compliance to meet NZ HISO standards	17 (20)	85

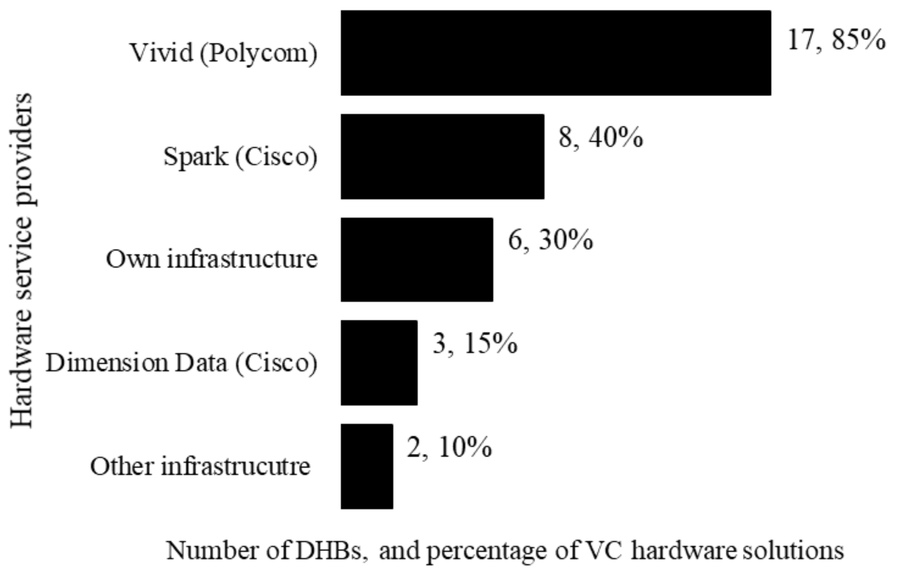
*Note.**DHBs answered saying they do not meet their current capacity

4.2.1.4 Video Conferencing Compliance. The majority of the 17 DHBs (Table 11) reported their current VC technology meets compliance with *Health Information Standards Organisation (HISO 10049.1.2014) Video Conferencing Interoperability Standard*. The overall response across the DHBs noted that the current VC technology across the DHBs mostly met the required standards to enable connectivity and interoperability between providers. This was a notable improvement from 2014 when 14 DHBs reported being unsure of whether they met the relevant HISO Standards. Findings from this (2019) survey suggest that the modern VC infrastructure and industry partners are working to enable connectivity and interoperability between providers.

4.2.1.5 Video Conferencing Hardware Solutions. Although all 20 DHBs reported using hardware VC solutions, the providers of these solutions varied widely across the DHBs (Figure 9). Implementing hardware-based solutions requires significant capital, and infrastructure maintenance requires ongoing licensing costs.

Figure 9

Video Conferencing Service Providers for Hardware-based Solutions



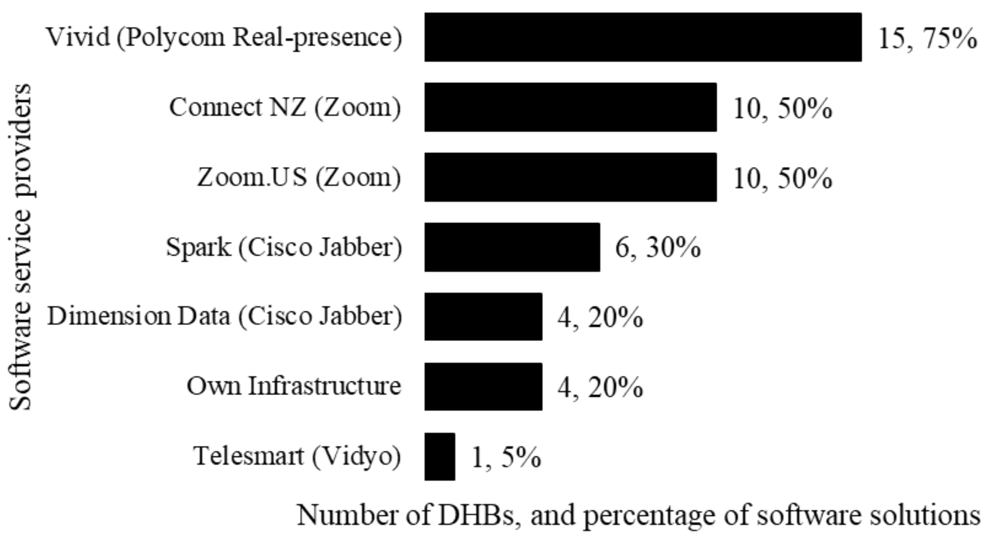
Note. Percentage values are calculated based on reported numbers (N =20) Percentages do not total 100 percent since DHBs uses more than one hardware-based solution.

Video conferencing evolved as a hardware-based network provided by Vivid solutions in New Zealand. Video conferencing across DHBs are provided now using both hardware-based and software-based solutions. Vivid Solutions were the sole provider across many DHBs in 2014 and remained the dominant provider for hardware infrastructure solutions for VC in 2019, with 17 DHBs using Vivid (Polycom) devices. Cisco was one of the other major hardware-based solutions reported across 10 DHBs. Spark and Dimension Data are the two large providers of Cisco hardware equipment. The use of hardware-based clinical carts remained very low, with numbers across all DHBs around ten. DHBs started implementing lower-cost software-based VC solutions to deploy the VC capacity better. Software-based solutions allow DHBs to allocate hardware solutions to complex telehealth interactions such as MDM meetings and larger meetings.

4.2.1.6 Software Services Providers. Software-based VC solutions started emerging in 2014, and all the 20 DHBs reported using software-based VC solutions for telehealth services. Software-based solutions can run on a range of phones, tablets and computers. Some solutions may require software to be installed on the devices, and others can run through an internet browser. Although Vivid was the largest provider for software-based solutions, 16 DHBs reported using Zoom through Zoom US and Connect NZ providers (Figure 10).

Figure 10

Video Conferencing Service Providers for Software-based Solutions



Note. Percentage values are calculated based on reported numbers (N =20)

* Percentages do not total 100 per cent since DHBs uses more than software-based solutions

DHBs reported having hundreds of video-capable users and endpoints across their organisation, although the DHBs did not report the exact numbers on the survey. Moreover, five out of six DHBs from the central Region reported using Spark software solutions (Figure 10). Only one DHB reported using Vidyo as their software solution and reported having over 300 licenses

4.2.1.7 Software Providers by Regions. All the DHBs across the Northern and Southern regions use Vivid solutions as their software provider. In addition, all the Northern Region DHBs reported using Zoom, provided by Connect NZ. Both the Midland and the Central Region DHBs reported a varied number of software solutions. Cisco Jabber was widely reported by Central Region DHBs. All the DHBs across the Midland, Central, and Southern regions reported using their own software solutions for video conferencing (Table 12).

Table 12

Software-Based Providers by Regions

Software services providers	Regions				
	Northern *n* (%)	Midland *n* (%)	Central *n* (%)	Southern *n* (%)	Total *n* (%)
Vivid (Polycom Real-presence)	4 (100)	1 (20)	5 (83)	5 (100)	15 (75)
Zoom.US (Zoom)	1 (25)	3 (60)	4 (67)	2 (40)	10 (50)
Connect NZ (Zoom)	4 (100)	1 (20)	3 (50)	2 (40)	10 (50)
Spark (Cisco Jabber)	0	1 (20)	5 (83)	0	6 (30)
Dimension Data (Cisco Jabber)	0	3 (60)	1 (17)	0	4 (20)
Own Infrastructure	0	2 (40)	1 (17)	1 (20)	4 (20)
Telesmart (Vidyo)	0	0	0	1 (20)	1 (5)

Note: Northern (N= 4), Midland (N=5), Central (N= 6), Southern (N=5), Total (N= 20)

4.2.2 Governance and Telehealth Strategy

Organisations with telehealth governance groups should have a clear telehealth strategy to oversee and direct telehealth services across their organisation. In 2011, no formal governance groups were established across DHBs, but 13 DHBs reported having a governance group in 2014. The numbers have dropped, and only 11 DHBs in this study reported having a governance group to direct and support telehealth services across their organisation. This is even though more than 80% of the DHBs that reported having a telehealth governance group had a telehealth strategy to support telehealth services across their organisation. However, six DHBs that reported not having a governance group had a telehealth strategy in place, and three DHBs reported not having either a governance group or a telehealth strategy (Table 13). In addition, DHBs in the Northern Region reported incorporating the Regional Information Systems Plan (ISSP), and the Southern Region reported incorporating the South Island Regional Strategy.

Table 13

Oversight and Investment of Telehealth Services

		Telehealth Governance		Total
		No *n* (%)	Yes *n* (%)	
Telehealth Strategies	No	3 (33.3)	2 (18.2)	5
	Yes	6 (66.7)	9 (81.8)	15
Total		9	11	20

Note. Percentage values are calculated based on reported numbers (N =20)

4.2.3 Telehealth Workforce

A dedicated telehealth workforce was viewed as being integral to supporting telehealth services across the DHBs. The telehealth workforce is the basic component, and their desire and potential to use telehealth services determines the uptake of telehealth services across the DHBs. Clinical leaders are champions in the telehealth workforce to increase the use and spread of telehealth services. In 2011, only two DHBs reported having an appointed clinical leader, and this number increased to 10 DHBs in 2014; however, only ten DHBs reported having clinical leaders, although not the same DHBs as reported in 2014. The loss of clinical leaders may be because clinical leaders might have left the role, and new appointments were not made. Survey findings showed 12 DHBs having telehealth programme managers who played an important role in implementing and expanding telehealth services across the organisation, an increase from the seven reported in 2014. Moreover, only 14 DHBs reported having MDM coordinators, a decrease of two since 2014. MDM coordinators are responsible for coordinating telehealth clinics and services (Table 14)

Table 14

Staff Resources Relating to Telehealth Services

Human resource	DHBs *n* (%)
MDM coordinators	14 (70)
Telehealth programme manager	12 (60)
Appointed telehealth clinical leader	10 (50)

Note. Percentage values are calculated based on reported numbers (N =20)

4.2.3.1 Reported Telehealth Services to Appointed Telehealth Programme Managers. Power Pivots were used to merge both parts of the survey data to analyse the reported clinical specialities across each DHBs. A Mann-Whitney U test was run to determine the differences in the reported telehealth services between DHBs that reported having an appointed telehealth programme manager or not. Reported telehealth services with an appointed telehealth programme manager (mean rank =11.80) were statistically significantly higher than those who did not have an appointed programme manager (mean rank =6.63), U =17, Z =-2.022, P =.041.

4.2.4 Delivery of Telehealth Services

Protocols and training to use telehealth technology influenced the uptake of telehealth services within the organisation. Protocols and training include guidelines for patient consent, as well as the procedures and processes to conduct telehealth interactions. Fourteen DHBs provided clinicians with clinical training to use VC facilities, but only seven DHBs reported having established protocols and guidelines for telehealth services (Table 15).

Table 15

Delivery of Telehealth Services across DHBs

Telehealth services delivery	DHBs n (%)
Telehealth protocols and guidelines	7 (35)
Clinician training	14 (70)
Method to count telehealth consultations	11 (55)
Patient consults entered in PMS	11 (55)
Using MOH- Telehealth mode of delivery code	11 (55)
Telehealth evaluation	7 (35)

Note. Percentage values are calculated based on reported numbers (N =20)

Reliable data play a key role in measuring the uptake of telehealth services. Eleven DHBs stated they had a method to count and record all the telehealth consultations in their Patient Management Systems (PMS), but only nine DHBs used the Ministry of Health telehealth delivery codes to record all the telehealth consults. Collecting the right data from telehealth services enabled the evaluation of telehealth services. Evaluating telehealth data was critical to ensure telehealth services enable safe and quality delivery of services. Only seven DHBs, however, reported conducting a formal evaluation on their current telehealth services (Table 15). Readily available reliable data can evaluate telehealth service performance to inform business cases for investment in telehealth.

4.2.5 Multi-Discipilary Team Meetings

All 20 DHBs reported using VC for their MDM meetings. Thirteen DHBs reported having protocols to run the meetings (Table 16).

Table 16

Multi-Disciplinary Team Meetings

Multi-Disciplinary meetings (MDM)	DHBs *n* (%)
MDM using VC	20 (100)
MDM coordinators	14 (70)
MDM Protocols	13 (65)

Note. Percentage values are calculated based on reported numbers (N =20)

Nearly three quarters (71%) of DHBs who had a MDM coordinator reported having protocols to manage the MDM meetings (Table 17), and almost half (45%) had MDM protocols to conduct the MDM meetings.

Table 17

MDM Coordinators and Protocols for MDM Meetings

		Protocols for MDM meetings		Total
		No *n* (%)	Yes *n* (%)	
MDM Coordinators	No	3 (50.0)	3 (50.0)	6
	Yes	4 (28.6)	10 (71.4)	14
Total		7	13	20

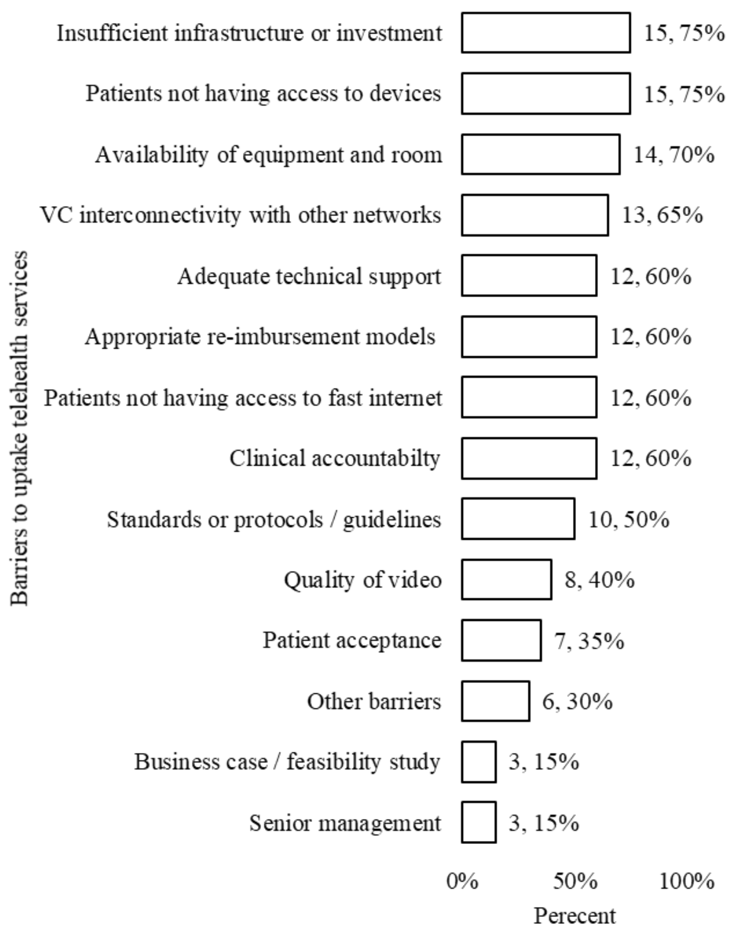
Note. Percentage values are calculated based on reported numbers (N =20)

4.2.6 Barriers to Uptake of Telehealth

Consistent with the aim of the study, the survey asked DHBs about the barriers to the uptake of telehealth services across their organisation. All 20 DHBs reported three or more barriers to uptake the current telehealth services (Figure 11).

Figure 11

Barriers to Uptake of Telehealth Services across the DHBs



Note. Percentage values are calculated based on reported numbers (N =20)

* Percentages do not total 100 per cent since each DHB reported more than barriers to uptake of telehealth services.

The most significant barriers reported were insufficient infrastructure and patients not having access to devices, followed by telehealth rooms/equipment availability and VC interconnectivity issues with the top five barriers related to infrastructure and technology (Figure 11). Reported barriers were grouped into governance-related barriers, clinical challenges, patient-related challenges, and technology/equipment barriers consistent with the similar implementation of telehealth studies.

4.2.6.1 Technical/Equipment Barriers. The survey identified that 13 DHBs reported that their VC interconnectivity was a barrier to the uptake of telehealth services. Out of the 16 DHBs that reported meeting the HISO standards, only five DHBs reported no barriers to their VC interconnectivity (Table 18).

Table 18

HISO Standards and VC Interconnectivity Barriers

		Barrier- VC interconnectivity		
		No *n* (%)	Yes *n* (%)	Total
Meeting HISO interoperability standards	No	1 (66.7)	1 (33.3)	3
	Yes	5 (25.0)	12 (75.0)	17
Total		6	13	20

Note. Percentage values are calculated based on reported numbers (N =19)

Adequate availability of telehealth infrastructure is a key factor for enabling sustainable uptake of telehealth services. In particular, the patient's limited access to devices and insufficient infrastructure were the top listed barriers that challenge the spread of telehealth services across the DHBs (Figure 11). Eight of the DHBs that reported not having an investment plan reported equipment availability and insufficient infrastructure as a barrier to uptake telehealth services (Table 19).

Table 19

Investment Plan and Infrastructure Barriers

		Reported barriers to uptake telehealth services	
		Availability of equipment *n* (%)	Insufficient infrastructure or investment *n* (%)
Reported having an investment plan	Yes (N=6)	5 (38.5)	6 (42.9)
	No (N=8)	8 (61.5)	8 (57.1)

Note. Percentage values are calculated based on reported numbers (N =20), Availability of equipment (N=13), Insufficient infrastructure or investment (N=14)

4.2.6.2 Appointed Clinical Leaders to Factors Contributing to the Uptake of Telehealth Services. Three-quarters of the DHBs who had an appointed clinical leader did not report access to devices as a barrier to the uptake of telehealth services. In addition, 67% of the DHBs, who had a clinical telehealth leader, did not report clinical accountability as a barrier to uptake of telehealth services (Table 20).

Table 20

Appointed Clinical leaders to Factors Contributing to Uptake of Telehealth Services

Factors contributing to uptake of telehealth services	Appointed clinical leaders *n* (%)
Access to devices	3 (75)
Clinical accountability	4 (67)
Standards or protocols / guidelines	5 (63)
Patient acceptance	6 (50)

Note. Percentage values are calculated based on reported numbers (N =20).

*Factors contributing to uptake of telehealth services notes the number of DHBs who did not report any barriers for the uptake of telehealth services.

4.2.6.3 Appointed Telehealth Programme Managers to Factors Contributing to the Uptake of Telehealth Services.

Three-quarters of the DHBs who had a telehealth programme manager did not report any challenges related to access to devices and telehealth protocols as a barrier to the uptake of telehealth services. Four DHBs (67%) that reported having a telehealth programme manager reported having proper reimbursement models to uptake telehealth services (Table 21).

Table 21

Telehealth Programme Managers to Factors Contributing to Uptake of Telehealth Services

Factors contributing to uptake of telehealth services	Telehealth Programme Managers *n* (%)
Access to devices	3 (75)
Standards or protocols / guidelines	6 (75)
Reimbursement models	4 (67)
Senior management	8 (53)

Note. Percentage values are calculated based on reported numbers (N =20). Factors contributing to uptake of telehealth services notes the number of DHBs who did not report any barriers for the uptake of telehealth services.

4.2.6.4 Telehealth Governance to Factors Contributing to the Uptake of Telehealth Services.

More than half of the DHBs that reported having telehealth governance did not report telehealth business cases or senior management as a barrier to uptake of telehealth services (Table 22).

Table 22

Telehealth Governance to Factors Contributing to Uptake of Telehealth Services

Factors contributing to uptake of telehealth services	Governance *n* (%)
Business case	9 (56)
Senior management	8 (53)
Access to devices	2 (50)
Clinical accountability	3 (50)
Re-imbursement models	3 (50)
VC interconnectivity	3 (50)
Adequate technical support	3 (43)
Access to fast internet	3 (43)
Patient acceptance	5 (42)
Availability of equipment	2 (40)
Standards or protocols / guidelines	3 (38)
Quality of video	4 (36)
Insufficient infrastructure or investment	1 (25)

Note. Percentage values are calculated based on reported numbers (N =20). Factors contributing to uptake of telehealth services notes the number of DHBs who did not report any barriers for the uptake of telehealth services.

4.2.6.5 Telehealth Strategy to Factors Contributing to the Uptake of Telehealth Services. None of the 20 DHBs who had a telehealth strategy in place reported access to devices as a barrier to uptake of telehealth services. Nearly forty per cent of the DHBs that had telehealth strategy in place did not report (12 out of 13) barriers that challenge the uptake of telehealth services (Table 23).

Table 23

Telehealth Strategy to Factors Contributing to Uptake of Telehealth Services

Factors contributing to uptake of telehealth services	Having Telehealth strategy *n* (%)
Access to devices	4 (100)
Standards or protocols / guidelines	7 (88)
Clinical accountability	5 (83)
Re-imbursement models	5 (83)
Business case	12 (75)
Senior management	11 (73)
Patient acceptance	8 (67)
Quality of video	7 (64)
Adequate technical support	4 (57)
VC interconnectivity	3 (50)
Access to fast internet	3 (43)
Availability of equipment	2 (40)
Insufficient infrastructure or investment	1 (25)

Note. Percentage values are calculated based on reported numbers (N =20). Factors contributing to uptake of telehealth services notes the number of DHBs who did not report any barriers for the uptake of telehealth services.

4.2.7 Promoting Telehealth Services

Promoting telehealth services across the organisation increases the awareness to use telehealth services. Eleven DHBs reported promoting telehealth services across their organisations by newsletter, websites, and at events. Telehealth programme managers and telehealth clinical leaders play a key role in promoting the uptake of telehealth services.

Table 24

Telehealth Programme Managers Promoting Telehealth Services

		Promoting Telehealth		Total
		No	Yes	
		n (%)	*n* (%)	
Telehealth programme manager	No	6 (66.7)	2 (18.2)	8
	Yes	3 (33.3)	9 (81.8)	12
Total		9	11	20

Note. Percentage values are calculated based on reported numbers (N =20)

Eighty-one percent of DHBs reported having a telehealth programme manager (Table 24), and 63.8 % of the DHBs reported having a telehealth clinical leader who promoted telehealth services across their organisations (Table 25). Dedicated leaders promote the awareness to increase the use of telehealth services.

Table 25

Telehealth Clinical Leaders to Promoting Telehealth Services

		Promoting Telehealth		Total
		No	Yes	
		n (%)	*n* (%)	
Telehealth clinical leader	No	6 (66.7)	4 (36.4)	10
	Yes	3 (33.3)	7 (63.8)	10
Total		9	11	20

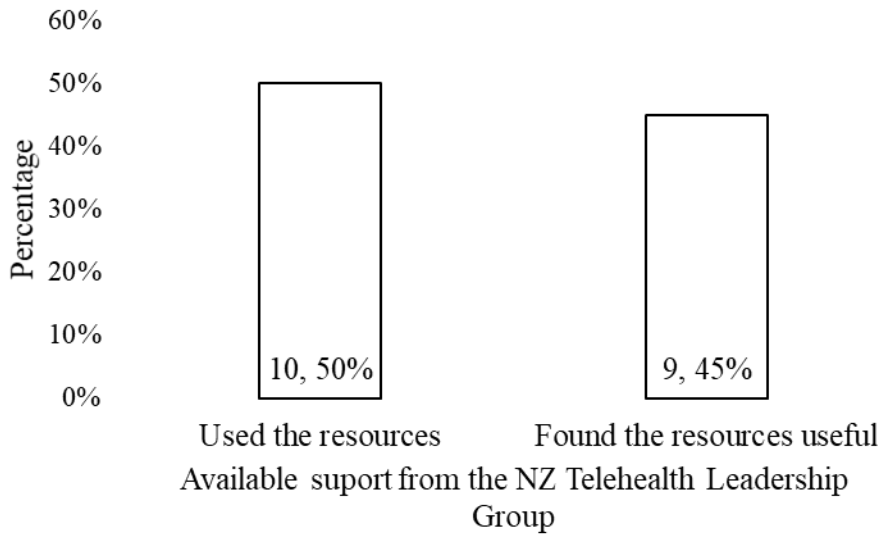
Note. Percentage values are calculated based on reported numbers (N =20)

4.2.8 NZ Telehealth Leadership Group support

The survey further sought to evaluate the support available to the organisations by the New Zealand Telehealth Leadership Group Support (NZTLG). The Ministry of Health appointed the NZTLG to run the New Zealand Telehealth Forum and Resource Centre to promote telehealth use across New Zealand. The Resource Centre platform provided comprehensive guidelines and resources to implement and promote sustainable telehealth programs within New Zealand.

Figure 12

Support from the NZ Telehealth Leadership Group



Note. Percentage values are calculated based on reported numbers (N =20)

DHBs were asked to cite whether they used the support services provided by the NZTLG on the forum website. Some of the support systems that the research investigated included case studies, telehealth guidelines, and national advocacy for telehealth systems. Survey findings suggested that only 10 DHBs reported using the telehealth resource centre and found it helpful in supporting telehealth services across their organisations. The results identified that most DHBs did not consider the information in the websites to be useful. Only nine DHBs cited the information useful in advancing telehealth uptake and implementation

(Figure 12). Most of the DHBs reported using the website's case studies, presentation, and generic guidelines. Nine DHBs stated that they were unaware of such resources, and this may explain why ten DHBs were not using the resources available from the telehealth resource centre (Table 26).

Table 26

Types of Useful Support from the New Zealand Telehealth Forum and Resource Centre

Types of useful support	DHBs *n* (%)
Generic guidelines	15 (75)
Presentations	14 (70)
Case studies	14 (70)
Advice specific to needs	12 (60)
Advocacy at local, regional, and national levels	12 (60)
Awareness	11 (55)
Other support	2 (10)

Note. Percentage values are calculated based on reported numbers (N =20)

The New Zealand Telehealth Forum and Resource Centre should continue to disseminate high-quality guidelines and best practices to inform related useful support to DHBs on telehealth services for appropriate use and spread across New Zealand.

4.2.9 Summary of Phase 02 Part 1: Survey findings

Part 1 of the survey reported that all the DHBs used telehealth services. The findings reported video conferencing, the widely used telehealth technology, differed significantly and reported an increased demand to meet the current capacity across the DHBs. The survey provided insights into the video conferencing environment, telehealth governance, workforce and delivery of telehealth services across the DHBs in New Zealand. DHBs reported telehealth barriers alongside the support from professional bodies to promote the uptake of telehealth services across the country, benefiting New Zealanders. Most DHBs identified insufficient infrastructure or investment and patients not having access to devices as the barriers to uptake of telehealth services. The next section describes the findings from Phase 02 Part 2 completed by the respondents from the clinical specialities across the DHBs.

4.3 Phase 02- Part 2: Survey Findings

This section describes Part 2 of the survey results during Phase 02 of the study. The nominated key person across each DHBs referred Part 2 of the survey to each of the clinical services departments that used telehealth services in their organisation. One hundred and sixty-one respondents from 18 DHBs completed Part 2 of the survey. The participants completed the survey online using the Qualtrics software, and the collected data were downloaded into a spreadsheet. Each part of the survey data was coded and loaded on the Statistical Package for the Social Sciences (SPSS) software (version 27) to perform the statistical analysis. The open-ended answers from Part 2 of the survey were analysed thematically. Braun and Clarke's (2006) six-step thematic analysis method was applied to know the reported benefits and challenges of using telehealth services across the DHBs in New Zealand. The following sections present the findings from the clinical services that use telehealth technologies across the DHBs in New Zealand.

4.3.1 Clinical Services Using Video Conferencing

The usage of Video Conferencing (VC) by clinical services has grown considerably since 2014. Three hundred and thirty-seven clinical services across the DHBs reported that telehealth services were covered under five major clinical categories, namely: adult and women's health, allied health, ambulatory and clinical, mental health, and paediatrics. Appendix Q provided the range of clinical services reported across the five main clinical categories

4.3.2 Telehealth Services Reported by Clinical Speciality

4.3.2.1 Telehealth Services Reported by Clinical Speciality across DHBs.

Eighteen DHBs reported a total of 337 services that use telehealth services. The highest number of telehealth services (102) was reported by adult and women's health, with paediatrics reporting the least at only 28 telehealth services (Table 27).

Table 27

Clinical Speciality Using Telehealth Services

Clinical speciality	reported telehealth services n (%)
Adult and Women's Health	102 (30.3)
Mental Health	79 (23.4)
Allied Health	71 (21.2)
Ambulatory and Clinical	57 (16.9)
Paediatrics	28 (8.3)

Note. Percentage values are calculated based on 337 reported services

4.3.2.2 Telehealth Services Reported by DHBs and Regions. Fifteen DHBs from the North Island reported 181 telehealth services compared to five DHBs from the South Island, reporting 156 telehealth services. The Southern Region, however, reported the highest number of telehealth services (156), compared to other regions (Table 28)

Table 28

Reported Telehealth Services by Regions

Region (Island *)	DHBs** *n* (%)	reported telehealth services*** *n* (%)
Southern (SI)	5 (25)	156 (46.3)
Northern (NI)	4 (20)	69 (20.5)
Central (NI)	6 (30)	68 (20.2)
Midland (NI)	5 (25)	44 (13.1)

*Note.** SI- South Island, NI- North Island,

** Percentage values are calculated based on reported numbers (N =20),

*** Percentage values are calculated based on the reported number of telehealth services (N =337)

4.3.2.3 The Reported Telehealth Services across the Regions by Clinical Specialities.

Overall, the regions reported various clinical telehealth services across the five main clinical specialities. The Southern Region 62 (39.7 %) and Northern Region 30 (43.5 %) reported a higher number of telehealth services from the adult and women's health speciality. The Midland Region reported a significant number of telehealth services from mental health 16 (36.4%). Allied Health specialities were widely reported 28 (41.2 %) from the Central Region (Table 29).

Table 29

Reported Telehealth Services by Speciality across each Region

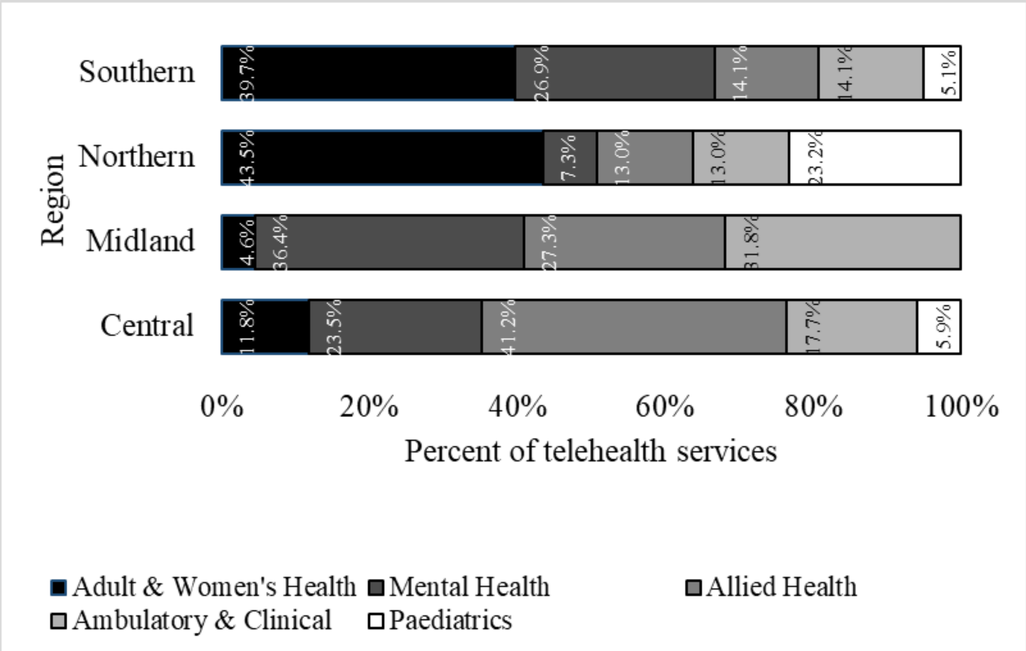
Region	Adult & Women's Health *n* (%)	Mental Health *n* (%)	Allied Health *n* (%)	Ambulatory & Clinical *n* (%)	Paediatrics *n* (%)	Total
Southern	62 (39.7)	42 (26.9)	22 (14.1)	22 (14.1)	8 (5.1)	156
Northern	30 (43.5)	5 (7.3)	9 (13.0)	9 (13.0)	16 (23.2)	69
Midland	2 (4.6)	16 (36.4)	12 (27.3)	14 (31.8)	-	44
Central	8 (11.8)	16 (23.5)	28 (41.2)	12 (17.7)	4 (5.9)	68

Note. Percentage values are calculated based on 337 reported services

Compared to the reported clinical specialities, the Northern Region reported 43.5% adult and women's health and 23.2% paediatrics related telehealth services. The Central Region reported 41.2 % of allied health services; the Midland Region reported 36.4% mental telehealth services but did not report any telehealth services from the paediatrics speciality (Figure 13).

Figure 13

Reported Telehealth Services by Speciality across each Region



4.3.2.4 Top Five Telehealth Services Reported by Clinical Services across the Regions. The highest total number of reported telehealth services by clinical services were varied in numbers across the regions. The Southern Region reported ten clinical services across community and outpatient mental health, eight in oncology, and six in acute mental health inpatients. In contrast, the Central Region reported five across occupational therapy and four in speech-language therapy (Table 30).

Table 30

Total Top Five Services Reported by Region across the DHBs

Region	Community and outpatient mental health	Oncology	Occupational therapy	Acute mental health inpatients	Speech-language
Southern	10	8	2	6	2
Central	2	3	5	2	4
Northern	2	4	2	1	2
Midland	3		2	1	2
Total	17	15	11	10	10

4.3.3 Types of Telehealth Interactions Reported by Clinical Service

Three hundred and thirty-seven clinical services reported 13 different telehealth interactions to provide telehealth services. The reported telehealth interaction types fell under patient present or clinical/team contact categories. It was interesting to note that 241 clinical services used a high number of telehealth interactions for follow up appointments and only 20 used for case conferences when compared to other telehealth interactions (Table 31).

Table 31

Reported Telehealth Interactions by Clinical Services

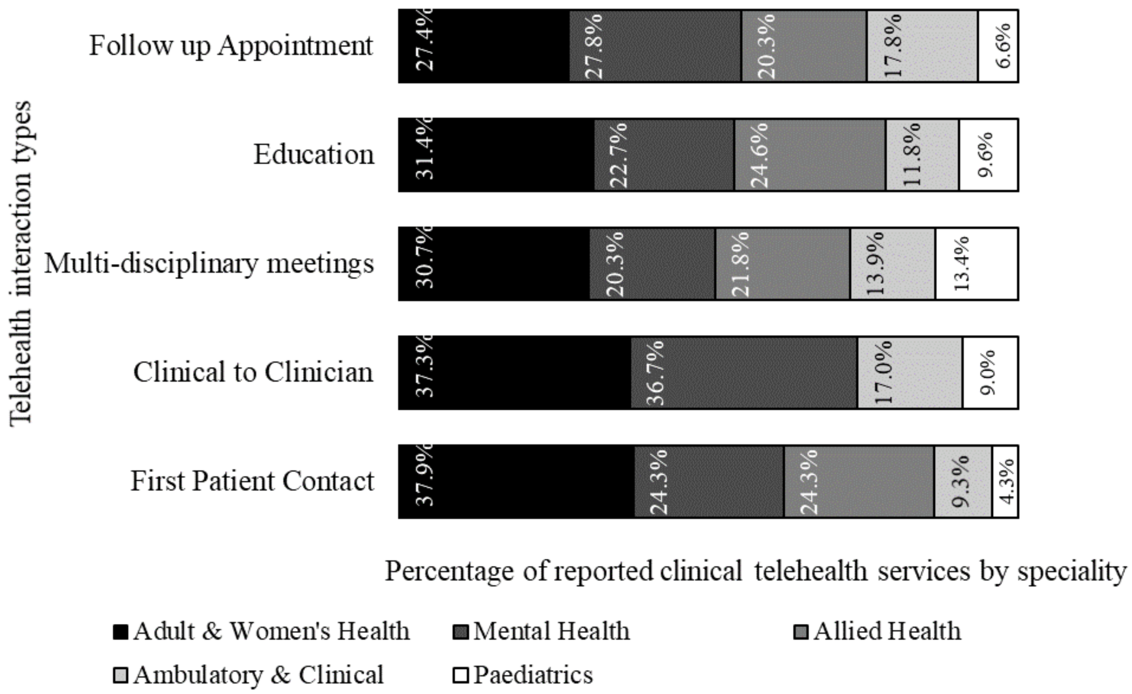
Patient present/clinician only present	Type of telehealth interaction	Clinical services reported using telehealth *n* (%)
Patient present	Follow up appointment	241 (71.5)
	Patient first contact	140 (41.5)
	Remote monitoring	84 (24.9)
	Nurse clinics	72 (21.4)
	Acute assessment	58 (17.2)
	After hours consultation-patient present	35 (10.4)
	Group patient sessions	27 (8.0)
Clinicians only	Education	220 (65.3)
	Multi-disciplinary meetings	202 (59.9)
	Clinician to clinician	177 (52.5)
	Clinical image	49 (14.5)
	After hours consultation-patient not present	36 (10.7)
	Case conference	20 (5.9)

Note: Percentage is more than 100% as each clinical service uses more than one telehealth interaction. *Percentage values are calculated based on reported numbers (N =337)*

Among the patient present interaction types, 241 were follow-up appointments followed by 140 first patient contacts. Similarly, among the clinicians only present interactions, 220 were education, followed by 202 MDMs (Table 31).

Figure 14

Top Reported Telehealth Interaction Types by Clinical Specialities



The top five telehealth interaction types included two patients related telehealth interactions, and three clinicians only presented telehealth interaction types. Overall, adult and women's health specialities reported a high number of services across all the top five telehealth interactions, followed by mental health speciality services (Figure 14).

4.3.4 Stages of Implementation of Reported Telehealth Interaction Types

A total of 997 telehealth interaction types reported their stages of implementation. Around 587 of the reported interactions across the DHBs were in their active stages of implementation (Table 32).

Table 32

Reported Telehealth Interactions – Stages of Implementation

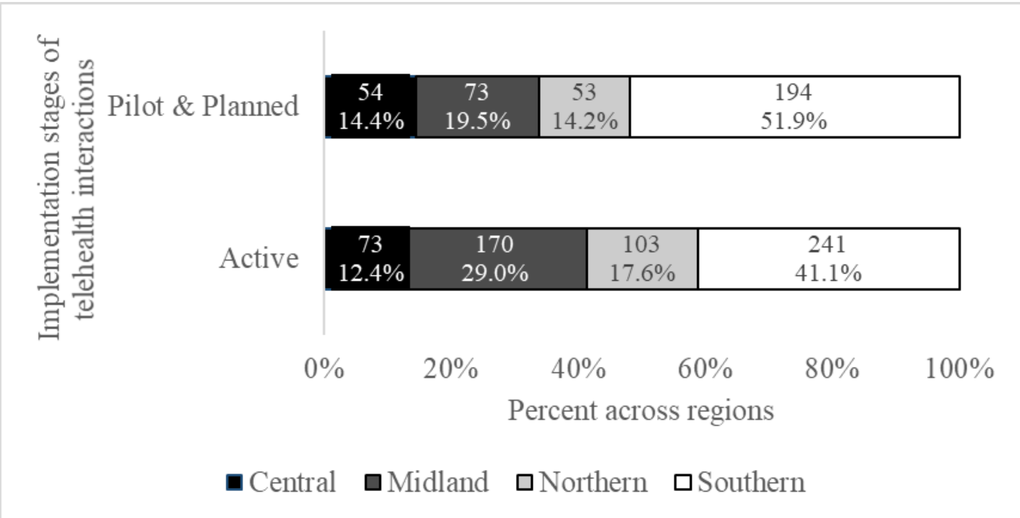
Stages of implementation of the reported telehealth interactions	reported telehealth interactions *n* (%)
Active	587 (58.9)
Pilot & planned	374 (37.5)
Ended*	36 (3.6)
Total	997 (100)

Note. Percentage values are calculated based on reported telehealth interactions (N =997)
**Ended- The services that have ended in some cases could be due to a lack of funding*.

The Southern Region reported a high number of active telehealth interactions at 241, followed by the Midland Region at 170. In addition, although the Southern Region reported many planned and active telehealth interactions, they reported a shift in the stages of implementation of the telehealth interaction (Figure 15)

Figure 15

Shift on Stages of Implementation of Telehealth Services by Region

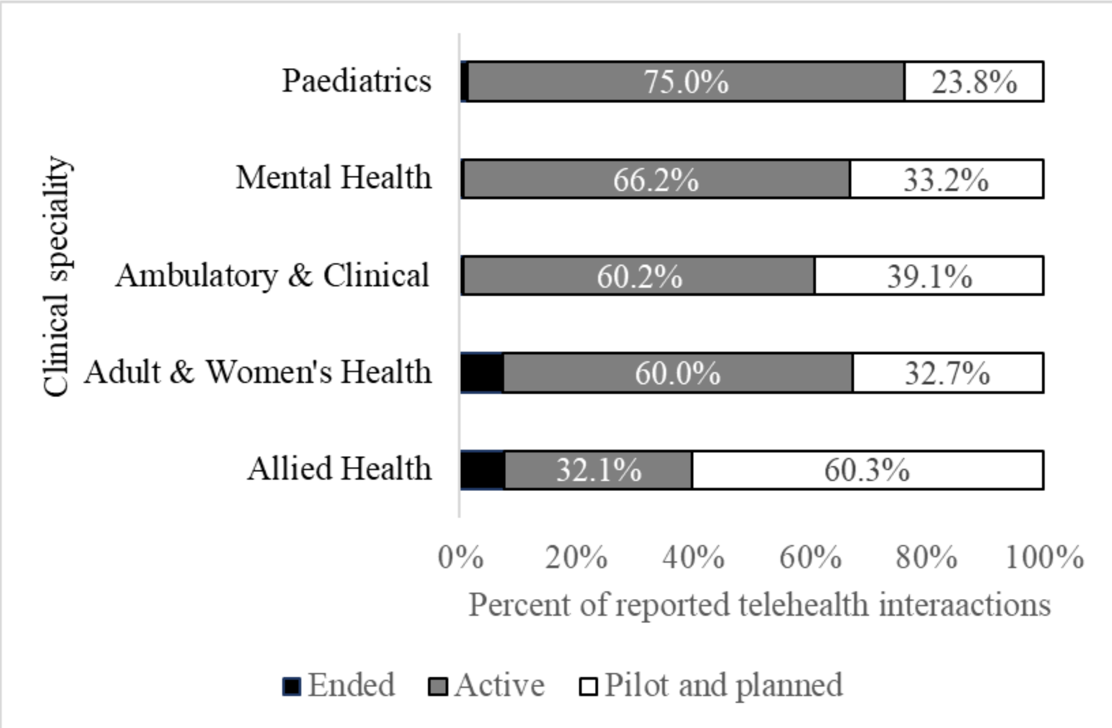


Note. Percentage values are calculated based on reported active and pilot/planned telehealth interactions (N =961)

The Southern Region reported a higher percentage of the pilot and planned (51.9%) services than their active services (41.1%). The same shift was also seen in the Central Region; however, neither the Midland nor Northern regions reported this shift (Figure 15).

Figure 16

Stages of Implementation of the Reported Telehealth Interactions by Speciality



Note. Percentage values are calculated based on reported telehealth interactions (N =997)

Paediatrics reported the highest percentage (75%) of active telehealth interactions, followed by mental health speciality (66.2%) and Allied health reported a higher percentage of planned services (60.3%). Both Adult and Women's Health and Allied Health reported a higher percentage of reported telehealth services that were terminated. But less than 1% of the services across the paediatrics and ambulatory and clinical specialities were reported to have ceased. Moreover, mental health specialities reported only active and planned services (Figure 16).

4.3.5 The Shift in Focus on the Telehealth Interaction with Patients

Out of the 997 reported telehealth interactions, 961 reported either their telehealth interactions were either active (587) or planned (374) for the future. The majority (350) of reported telehealth interactions across the DHBs that were active at the time of the survey were from clinicians only telehealth interactions (Table 33).

Table 33

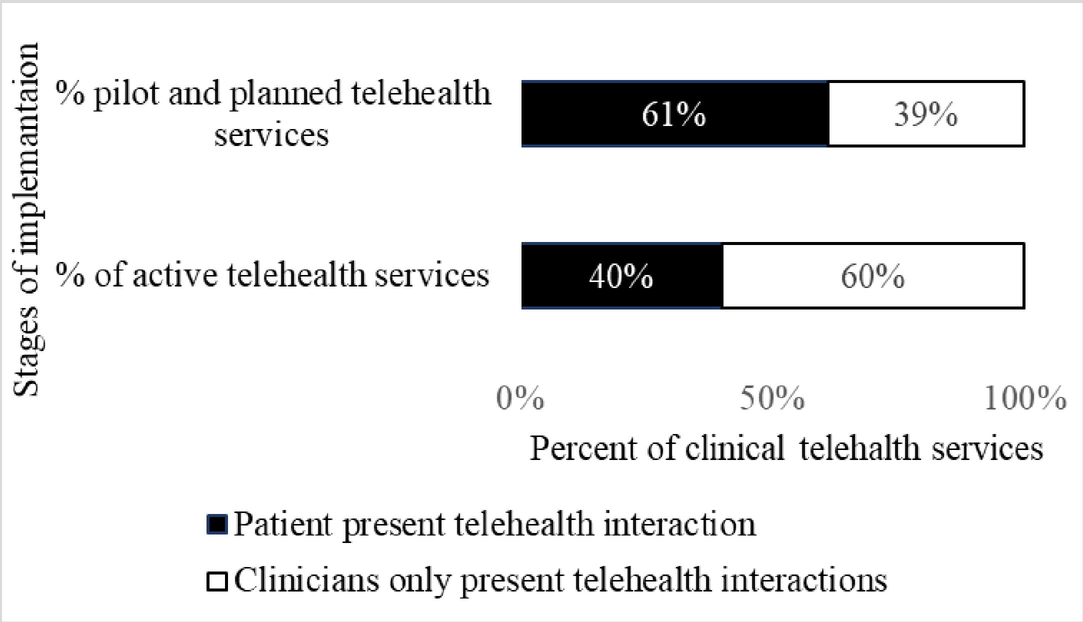
Stages of Implementation of Patient Present Telehealth Interaction Services

Type of telehealth interactions	Active telehealth interactions *n* (%)	Pilot and planned telehealth interactions *n* (%)
Patient present telehealth interaction	237 (40)	229 (61)
Clinicians only present telehealth interactions	350 (60)	145 (39)
Total	587 (100)	374 (100)

The reported pilots and planned telehealth interactions show a shift to patient involvement and telehealth interactions that involve patients reported a higher percentage on their pilot and planned services (61%) as when compared to current active services (40%) (Figure 17).

Figure 17

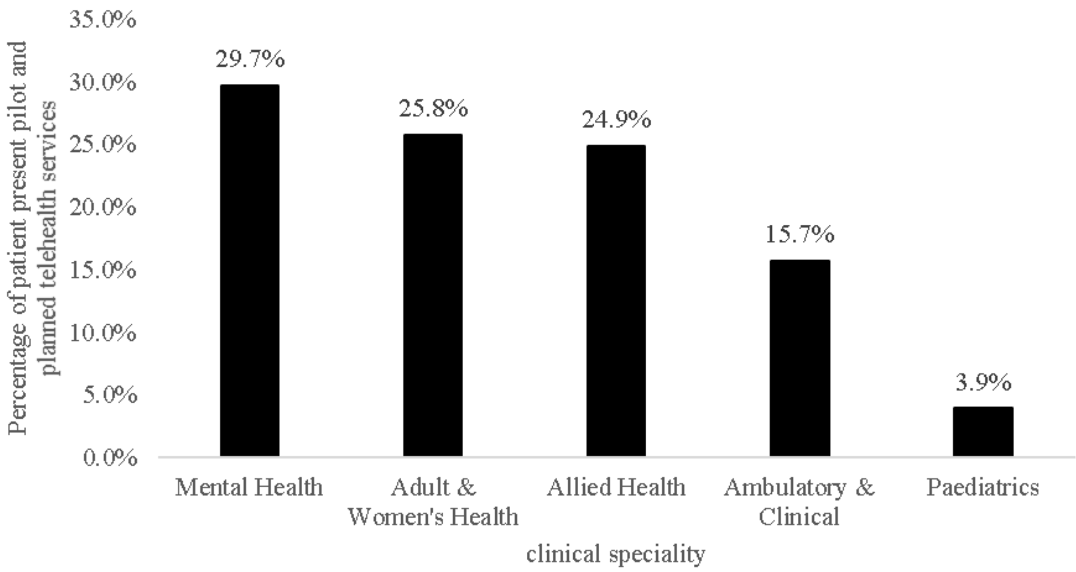
Clinical Telehealth Services at Different Stages of Implementation



Two hundred and twenty-nine telehealth interactions in all specialities were reported to involve patients in their planned services (Table 33); however, mental health reported a higher percentage to involve patients related telehealth interactions in their planned services as compared to other specialities (Figure 18)

Figure 18

Patient Present Pilot and Planned Telehealth Services by Specialities



4.3.6 Reported Location of Patients or Remote Participants

Out of the 997 reported telehealth interactions, 656 interactions reported the primary location of the patients. Four hundred and eighty-four reported patient locations were from the main DHB hospital to another DHB facility, generally a rural hospital. Only one DHB reported the primary location of the patient to be an aged care facility (Table 34)

Table 34

Primary Location of the Patients or Remote Participants

Location of patients /remote participants	reported telehealth interactions *n* (%)
DHB Hospital	484 (74)
Home/Work	79 (12)
Primary Health	51 (8)
Other	40 (6)
Aged Care	2 (<1%)

Note. Percentage values are calculated based on reported numbers (N =656)

The majority (55.3%) of the active telehealth services reported that the primary location of the patients were from DHBs (Table 35)

Table 35

Primary Location of the Patients and Stages of Implementation

Region	Ended *n* (%)	Active *n* (%)	Pilot and planned *n* (%)	Total
DHB	29 (5.6)	288 (55.3)	204 (39.2)	521
Home/work	9 (8.1)	44 (39.6)	9 (52.3)	111
Primary Health	1 (1.9)	26 (50.0)	12 (48.1)	52
Other	-	24 (49.0)	28 (49.0)	48
Aged Care	1 (66.7)	1 (33.3)	-	3

The reported pilots and planned telehealth interactions showed a shift towards involving patients from home/work. Telehealth interactions where the primary location of patients was home/work reported a higher percentage to be at a pilot and planned stage (52.3%) as compared to current active services (39.6%) (Table 35)

4.3.7 Telehealth Benefits and Challenges

This section presents the qualitative component of the research; the researcher thematically analysed the open-ended responses of the participants to know the benefits and challenges of telehealth services across the DHBs in New Zealand. The open-ended answers were loaded into Nvivo software and read thoroughly to generate initial codes related to grouped ideas. The codes were modified to answer the objectives and were transformed into thematic categories and sub-themes. The themes were then reviewed with the corresponding responses. Braun and Clarke's (2006) six-step thematic analysis method was applied. As a result of the thematic analysis, there were 152 survey respondents on the benefits, which generated nine underlying themes. There were 109 survey respondents on the perceived challenges, which generated 12 underlying themes (Table 36). The reviewed themes were defined and discussed in the following sections

Table 36

Breakdowns of Themes from Survey Two – Open-Ended Answers

Key question/themes	**Survey respondents**	**Number of themes**
Key benefits that influence telehealth services across the DHBs in New Zealand	152 survey respondents	Nine themes
Perceived challenges that impede the uptake of telehealth services	109 survey respondents	Ten themes

Note. Total number of survey respondents (N= 161)

4.3.7.1 Telehealth Benefits. The first thematic category explored the reported telehealth benefits across the DHBs in New Zealand (Table 37). The top three themes relate to the benefits reported for patients. Fifty-nine of the 149 survey respondents (40%) stated that telehealth services improved the patient experience by saving time, energy, and resources.

Table 37

Telehealth Benefits that Influence Telehealth Services across the DHBs in New Zealand

Telehealth benefits	Themes	references *n* (%)
Patient benefits	Improves patient experience- saving their time, energy, and resources	59 (40)
	Improves patient access to care - in terms of efficiency, accessibility, and response time	42 (28)
	Addresses geographic issues - for patients living in remote areas	30 (20)
Healthcare workers benefits	Improves health professionals' work experience - saving their time, energy, and resources	32 (21)
	Enhances clinical processes - collaboration and networking of clinical teams from different areas	28 (19)
	Promotes safety of staff members - especially when travelling and being exposed to dangerous settings	5 (3)
	Promotes clinical education for both patients and clinicians	3 (2)
Health systems benefits	Minimises the burden on hospital infrastructure and facilities	9 (6)
	Improves attendance rates of patients in general	3 (2)

Note. Percentage values are calculated based on reported numbers (N =149)

*12 missing data were not taken while calculating the percentages

Aside from improving patient experience, another 42 respondents added that telehealth services could improve patient care efficiency, accessibility, and response time to access healthcare. In addition, thirty participants also emphasised how telehealth services reduce or eliminate inequities in healthcare as the telehealth services address geographic issues for patients living in remote areas.

Telehealth services allow patients to save their time, especially when appointments take a few minutes only and patients are from distant places. Telehealth reduces travel times, improves equity for rural patients to access timely care. Participants noted that the impact of telehealth services is not only beneficial for patients but also benefits healthcare professionals and organisations. Using the technology, healthcare professionals can access continuing education and professional development activities. Telehealth services improve the work experience and enhance the clinical processes by networking across clinical teams from different areas. Collaboration increases to provide specialist advice to patients and reduces time spent travelling. Reduced travel expenses to patients and healthcare workers can benefit the healthcare systems. Participants stated that bringing care closer to the comfort of patient homes eliminates the stress of travelling long distances for consultations and treatments. Telehealth services bring care closer to home, reduce travel expenses and reduce the demand on emergency departments. It also improves the efficiency and accessibility for patients to reduce the inequities in access to health services.

4.3.7.2 Telehealth Challenges. Under the second thematic category or the perceived challenges that impede the uptake of telehealth services, the majority or 56 of the 109 respondents reported the challenges relating to lack of access to reliable equipment and infrastructure, especially devices, internet connection, and technology to use telehealth services (Table 38).

Table 38

Perceived Challenges that Impede the Uptake of Telehealth Services

Themes	references *n* (%)
Lack of access to reliable equipment and infrastructure (especially devices, internet connection)	56 (51)
Costs of technology - Installation and licenses	14 (13)
Lack of staff training to use technology	12 (11)
Hard to buy-in or support to use of new telehealth technology	8 (7)
Lack of community training and support for patients to use technology	8 (7)
Lack of workforce- extra-work on telehealth scheduling	7 (6)
Lack of formal processes to use telehealth in routine practises	7 (6)
Lack of support from leaders	7 (6)
Inadequate time and resources to adapt to the new system	7 (6)
Clinicians who prefer face-to-face consultations	7 (6)

Note. Percentage values are calculated based on reported numbers (N =109)

**52* missing data were not taken while calculating the percentages

The majority of the participants believed that telehealth services were being hindered by the inadequacy of equipment, infrastructure, and other relevant resources to integrate the services in their system successfully. Another important theme was encountering issues with the financial costs of telehealth programme installation and licenses, which was noted by 14 respondents, that is 13% of the sample. Finally, participants stated the lack of staff training on telehealth technology and devices, which was shared by 12 respondents (11% of the sample) (Table 38).

While organisations have strategies to integrate telehealth systems into routine practices, these efforts should be studied with the underlying micro-processes that operationalise the strategy. Implementing telehealth services introduces a sudden and often substantial change to how work is done, by the processes automated by the technology may not evolve quickly and may result in unintended consequences. The unintended consequences can be prevented by identifying the gap between the level of automation and the people and processes using the automation. As telehealth services occur outside traditional healthcare settings(e.g., closer to patients' homes), DHBs need to better evidence on how to design and evaluate telehealth services to support care in these contexts. Micro and macro-level organisational level factors need to be considered before telehealth services. The elements need to be studied before implementation and post-implementation. Furthermore, telehealth users need to be involved in understanding the nature of technology-induced changes and how they impact their daily routine practices. As telehealth services are more widely implemented across the DHBs, it is essential to ensure telehealth technology fits in the organisational setting where it will be used.

4.3.8 Summary of Phase 02 Part 2: Survey Findings

Part 2 of the survey reported the clinical services from the five major categories that use telehealth services across the DHBs in New Zealand. Findings reported a variable uptake of telehealth across the regions and clinical specialities. Survey findings reported a shift in the telehealth services focus, from clinician related to patient-related telehealth interactions to involve patients having the provision of using such services closer to home. Survey findings reported the telehealth benefits to include a reduction in travel time and cost for patients and health workers, improved access to care overcoming geographical challenges, increased opportunities for collaboration with patients and other clinicians, promotes clinical education, and minimises the burden on hospital infrastructure and facilities.

4.4 Phase 03 – Findings of the Semi-structured Interviews from Eight Respondents

The previous sections 4.2 and 4.3 provided detailed findings from Phase 02 (the survey) to identify the status of telehealth services and their barriers to uptake across the DHBs in New Zealand. This section presents the findings of Phase 03 of the research (semi-structured interviews) and explores the factors influencing the uptake of sustainable telehealth across the New Zealand DHBs. To offer rich and detailed information, a qualitative thematic approach was taken by conducting semi-structured interviews as discussed in Chapter 3, reflecting the practical and pragmatic requirements of the developed framework. Semi-structured interviews were conducted with a total of eight respondents who indicated their willingness for a follow-up interview after the survey. All interviews were conducted virtually by Zoom due to the geographical distribution of the respondents. The study used the semi-structured interview guide (Appendix H) described in Chapter 3 to collect responses. The questions explored in-depth factors influencing the uptake of sustainable telehealth services across the DHBs in New Zealand. The main aim of this section was to evaluate the interview responses regarding factors at the organisational level that influences the uptake of sustainable telehealth services across the DHBs. These were examined in the context of the five major themes underpinning the NASSS Framework developed from Phase 01 of this study. These objectives were transformed into thematic categories, with grouped themes containing corresponding interview responses. Braun and Clarke’s (2006) six-step thematic analysis method was applied.

4.4.1 Views About Defining Telehealth

The definition of telehealth used in the semi-structured interviews was that of the New Zealand Telehealth Leadership Group (NZTLG): “the use of information and communication technologies to deliver healthcare when patients and care providers are not in the same physical location” (NZ Telehealth Forum and Resource Centre, 2018a). All respondents agreed to this definition, but five of eight indicated different views to define telehealth. When asked to comment on the definition used for this study, one respondent stated that telehealth services were mainly used for remote clinical meetings: "*I guess remote meetings across, you know where somebody sits in front of a computer with a camera – I guess, most of it is clinical discussions, is my experience of it.*" Another respondent described a wider scope of telehealth services across the clinical services: "*I suppose it has two components… the core clinical stuff, and then the wider clinical service development stuff".*

In addition to different views on the scope of telehealth services, respondents stated different opinions on the scope of telehealth technology. According to one respondent, telehealth technology covers any health technology that supports patient care: "*Use of technology devices that support assisted, assisted augmented, and communication devices – pretty much anything in a health technology space that supports patient healthcare*." Another stated a wider scope of telehealth technology that enables better communication with people: "*For me, it is a further development of communicating with people – if you look at Morse code, phone, email, internet, normal telephone, and then the next way is telehealth… Probably mainly how it started was offering telephone conversations. So, offering sort of telephone follow-ups with patients*." One respondent had a different name for providing telehealth services: "*I guess I see it more as virtual health rather than telehealth*."

Respondents expressed differing views on the scope of the technology and the services that use telehealth across their organisations. The scope of telehealth services varied from covering clinical discussion meetings to wider organisational, clinical services. The scope of technology varied from audio and video to email and any health technology supporting patient care delivery. Although respondents generally understood telehealth, their differing views showed a lack of common understanding of the telehealth technology and services across the organisations.

4.4.2 The Extent of Technology Integration

The extent of the technology integration describes the factors influencing DHBs' capacity and readiness to implement change and integrate telehealth services into routine practices. Embedding telehealth services into routine practices requires extensive work to support their use and spread, including but not limited to changes to procedures, practices, and management structures, and allocating adequate resources to support integration. The subthemes identified from Phase 03 semi-structured interviews on the extent of technology integration are listed in (Table 39).

Table 39

The Extent of Technology Integration: Factors that Enable Potential Uptake of Telehealth Services

Themes	Subthemes
Extend of technology integration	Central supportive telehealth governance group.
	Clear long term strategic vision to direct and measure the success of telehealth services.
	Dedicated telehealth leaders to drive telehealth services.
	Value of leaders -Creating partnerships with other organisations
	Support from senior leadership.
	Organisational wide telehealth strategy.
	Technology that can integrate into routine practises.
	Significant changes to current processes and practices are required.
	Automating booking systems
	Organisational readiness' to implement change
	Adequate workforce and infrastructure

4.4.2.1 Governance and Leadership Team Support. Respondents highlighted the importance of governance and the role of leaders to guide and support the uptake of telehealth services across the DHBs. One respondent stated:

"But from a clinician's perspective, it is about having leadership and good governance in place so that clinicians feel supported using telehealth as a mechanism for ensuring to get the best possible outcomes… So it needs to be leadership and governance to support the telehealth strategy across the organisation."

Generally, supportive governance structures are likely to promote the adoption of progressive developments such as telehealth. One of the respondents in this regard stated:

"I think some of the other unexpected challenges… is the lack of opportunity for governance – across these pieces of work across each DHB… identifying governance structures and enhancing industry-wide leadership and governance if telehealth is to be effectively integrated into the healthcare system."

Although respondents stated the need for central governance to drive telehealth leadership across the DHBs, no specific recommendations were made for the best governance structures.

Another element that respondents consistently reinforced was the role of leadership to facilitate the potential use and spread of telehealth services. Six of eight interviewees mentioned the value of having telehealth leadership supporting the implementation of telehealth. Telehealth leaders play a vital role in establishing and creating partnerships with other organisations: "*We also have, of course, got our Telehealth Leadership Group… We talk quite regularly with the telehealth facilitators [in two other regions]. We all learn from each other, and we all share stuff*." Respondents stated that having the right leaders was the key to implementing telehealth services successfully: "*Telehealth services… have been successful, have been having the right leadership sponsors*." A good governance structure with dedicated, responsible leaders creates partnerships across organisations to support and share knowledge to use telehealth services. Telehealth leaders build relationships between clinical and operational teams across and within organisations to drive organisational capacity to use telehealth services. Despite this, respondents reported a lack of long-term vision and strategy to guide telehealth solutions.

4.4.2.2 Long-Term Vision and Strategy The use of telehealth services should be driven by a long-term vision and clear strategy across the organisation. One of the respondents stated: "*There needs to be the overarching strategic vision to drive long-term telehealth technology solutions across our organisation.*" Despite telehealth services having existed across specialities for more than three years, their adoption does not seem to have a long-term integration strategy. A respondent stated:

"We… spent a long time... I would say more than three years now... trying to find the right product and a telehealth link at the DHB was very focused on a hardware-based product. I have done extensive, reasonably extensive reading and research about it and felt there were real opportunities to move to a software-based product. So that is where we have got a little bit stuck."

As stated by this respondent, long-term vision and strategy can provide a roadmap to drive and measure sustainable telehealth services across the organisation: "*A clear roadmap and a guide for how this has a vision for the next few years to measure telehealth services for the organisation is needed so much for sustainable telehealth*." Moreover, respondents stated that a lack of strategy and support to use of telehealth services from senior leadership resulted in very slow uptake: *"Lack of strategy… not having an organised, coordinated response from our top leadership, organisation on how to operationalise this on the scale, and that it has been at a very slow pace*." However, as stated by one respondent, the lack of organisation-wide telehealth strategy created department-specific goals and strategies for telehealth: "*In* *the absence of having a strategic vision from our organisation, putting in a local vision and local working groups of enthusiasts or interested parties to plan how to deliver and change things*." The interview findings showed the need for a long-term vision and strategy to direct, guide and measure the success of telehealth services for sustainable uptake. A lack of long-term strategy and support from leadership groups may lead departments to establish short-term goals and strategies for telehealth. In addition, respondents stated that telehealth service use only spreads when technology is integrated into business-as-usual processes.

4.4.2.3 Workload and Routines. Integrating telehealth services into routine practices requires organisational readiness to implement these changes. Existing telehealth processes are difficult to use and add an extra workload to the scheduling system. As stated by one of the respondents: "*The booking and scheduling have been even harder. So the admin staff and booking people… is a little bit of added burden to them, and there are some added steps in the process that they have to do*." Simple technology requires a systematic change across all telehealth technologies to be integrated into routine processes and practices:

"It is a systematic change of all of the systems, so that it [telehealth] is an easy part of our day, that there is just a button that we click on our computers that pops up a screen, and we dial in the number, and it is done. Without having to kind of log in and do more work... it should be just as easy as opening up your mail, and you would open up your video consultation within a system, whatever that system might be… so that it then does very much become a business-as-usual practice."

In particular, most respondents said that clinicians mostly preferred using simple and flexible systems that they were already familiar with everyday operations.

Respondents stated that automating the existing booking systems could improve efficiency to reduce the extra work burden but would require significant changes to practices: "*Recording telehealth appointments in our patient administration system was difficult.*

Automating the current manual booking procedures to schedule telehealth consults could free up tons of admin time… back and forth… but will involve significant changes in the current practices.” Delivering services using telehealth technology involves integrating new processes and ways of working within the DHBs and organisational readiness to implement change with other stakeholders:

“Organisational culture needs to be addressed to create sustainable telehealth services for an uptake… So from our staff and team willing to use it, I do not think that is an issue… as I say, it is part of business as usual, from our staff perspective.”

According to the respondents, the existing telehealth technology was not easy to use and added extra workload to the existing processes and practices. Simple scheduling technology can integrate telehealth services into routine practices but highlights the work needed to implement change in the organisation.

Almost all respondents described telehealth service implementation by targeting specific specialities and then upscaling the technology to other specialities and areas of clinical consultations. One respondent reported an incremental telehealth adoption strategy: “*And we are using it… since 2013. Moreover, that is from our intensive care. DHB-wide, they are one year earlier*.” Another respondent stated: “*We already had a paediatrician doing their clinic… Probably mainly how it started was offering telephone conversations. So, offering sort of telephone follow-ups with patients.*” These responses indicate that following a stepwise approach enables the successful uptake of sustainable telehealth services. Telehealth services across specialities were achieved in not a single step but several, in which the number of functions addressed by the technology increased.

Although all respondents stated they had been using telehealth services in their specialities for over three years, services were not still widely integrated into routine practices, as stated by this respondent: “*Well, we would like to see that it becomes a business* *as usual*." Respondents stated that integrating telehealth services into routine practice increases staff workloads, creating resistance from staff. Ultimately, the success of any technology adoption strategy depends on organisational readiness to implement change and staff willing to support the change to integrate telehealth into business as usual. However, organisational readiness may vary with the adequacy of resources required to support telehealth integration.

4.4.2.4 Availability of Adequate Resources. Respondents stated that deploying telehealth technology required allocating adequate resources for sustainable uptake of telehealth services. Allocating adequate resources enables staff acceptance across organisations to adopt the technology: "*We have some people that are not as keen to adopt the technology; however, I think that is, as they say, I think it is more resourcing than anything else*." One respondent stated that an inadequate telehealth workforce makes integrating telehealth into routine practices challenging and leads to slow uptake:

"Poor uptake… It is around resourcing as it becomes another thing in a busy environment they have to deal with, which can be quite a challenge. They feel that they do not necessarily have the appropriate staff resourcing for trying to make that a business-as-usual capacity."

Another respondent described the importance of: *"the availability of internal experts and resources to implement telehealth services… the expectation of both leadership and organisational managers to ensure that telehealth is optimised."* Respondents also emphasised that the deployment of telehealth services needed more experts and resources, without which, uptake will be hindered.

Dedicated spaces and adequate technology resources to use telehealth services enable uninterrupted use of the technology:

"One of the other surprising issues was, that I had not thought of initially, was the location of the room… There need to be more telehealth units available, probably just linking to people's PCs… Few dedicated spaces were available for the uninterrupted use of the telehealth services."

Furthermore, respondents stated that having the right resources plays a key role in gaining staff acceptance and engaging them to use telehealth services:

"We also have a strong group that is very willing and engaged with it and wants to use the technology. It is just making sure, again, that we have got that right in the resources… The good speakers, and the good cameras, and all of those sorts."

Allocating adequate resources plays a critical role in influencing the uptake of telehealth technology. Adequate resources include enough staff, the right technology and the space to deliver telehealth services. Planning for these extra staff and technology resources support staff acceptance of using the technology and integrating it into routine practice. Findings from the interviews showed that a central governance group with dedicated leaders to support the long-term vision and strategy for telehealth influences the potential use of telehealth services across the organisations. The potential spread of telehealth services varies and depends on organisational readiness to integrate them into routine practices. Effective change management strategies, with communication plans and available required resources, influence the integration of telehealth services.

4.4.3 Human Resources

The human resources component describes respondents' views of how staff acceptance influences the potential use and spread of telehealth services across the organisations. Implementing telehealth services across DHBs require new work procedures, and the availability of the right staff and training is needed to support the use of the technology. The subthemes identified from the Phase 03 semi-structured interviews on human resources are listed in (Table 40).

Table 40

Human Resources: Factors that Enable Uptake of Telehealth Services

Theme	Sub-themes
Human Resources	Staff acceptance Early staff engagement Supporting staff to use the technology Clinical champions - promote a positive culture Support and empower champions Support clinicians as champions Formal dedicated telehealth training Tailor telehealth training to the local context Investment in training Ongoing available technical support Evidence-based guidelines support training and education

4.4.3.1 Staff Acceptance. Staff acceptance was the most influential element for the successful uptake of telehealth services. According to one respondent, the willingness of staff to use the technology plays a key role in the success and continuity of telehealth services: "*But I do think sometimes, it would not matter how much expertise you would have about the technology, and if it is not coming across to staff as useful, then it will not happen*."

Respondents stated that engaging and supporting staff in the change process influences them to accept the technology:

"We have been thinking ahead constantly, and that in itself we need to move services to involve staff who use the technology support change process… Engage and support them to know the value of using technology... Suppose you can make them realise the value. In that case, they will use it in everyday practices."

Respondents also stated that when staff understood the value of using telehealth technology, it became embedded into everyday practices. Supporting clinicians and showing them how to use the technology removes their resistance to using it and enables more buy-in:

"I think for clinicians, it needs to be easy, of course, and I think that they need to have someone guiding them through the process initially. Also, clinicians who do not use it often, so maybe a specialist in [the] city, who might only see two or three patients in the rural areas once a month, might need someone to be there with them to guide them through the process so that it goes smoothly, and they do not get frustrated with it."

Early staff engagement and support explaining the value of the technology can remove any resistance and ensure a solid buy-in to telehealth services. In addition, most respondents emphasised that clinical telehealth champions play a vital role in supporting the uptake of telehealth services.

4.4.3.2 Telehealth Champions. Clinical telehealth champions are critical to enabling staff acceptance and spreading the uptake of telehealth services. Clinical champions support and build relationships with other departments, as well as promote a positive culture to spread telehealth services across organisations. They drive the uptake of telehealth services by promoting and building relationships across the organisations. One respondent stated:

"I think, again, you almost want clinical champions within each organisation. Part of that role is promoting video links for the meetings and so on, which would be a good way of doing it… I think, by and large, people are persuaded by personal experience, and if you can get them into a room where Zoom is being used, and it is working brilliantly, then that tends to be pretty powerful."

Respondents also consistently highlighted the special role champions play to encourage their colleagues to use the systems. Clinicians found it more effective to learn from their peers, who also acted as champions.

Clinical champions with the right technological skills promoted a positive culture and tailored their intentions to fit the organisation in the spirit of wanting the new technology to work:

"We need to have some clinical champions to do that, go from department to department and offer them… the system, use it, come and try it. I suppose greater expertise, having people who seem to know about the upcoming technologies, not just what they used before… seem to be easy convincing clinicians to use telehealth."

Clinical champions also take ownership to drive buy-in from other clinicians to use telehealth services:

"I think that is very hard, to sell that to some clinicians who are maybe stressed, overworked… peer support. As other people are doing it, you become the exception rather than the norm. However, now, at the moment, it is the champions."

Clinician acceptance supported by champions was the main driver for sustainable uptake of telehealth services. Supporting clinicians as champions also cultivates acceptance from the majority of clinicians across the organisation. Champions can spread the services by building relationships between services and clinicians because new services cannot be implemented in isolation:

"Stroke services evolved into the consultants who supported those services across other wards, were then rotated into another area wanting to replicate some of those opportunities to their other meeting schedules, which occurred, and a growth in that with then the administrative staff being asked by those therapists: When can we use this, and how can we use this?"

According to the respondents, identifying and supporting clinicians who are willing to use technology can enable a wider clinical acceptance of using telehealth:

"We were only doing it with one or two or three keen clinicians to start with… and with the idea that once we have got it working well, they will spread it amongst their peers. So, we want them to be the champions to help us spread this in the next phase."

Clinical champions are real enthusiasts who want to support and encourage their peers to use telehealth services. Supporting and empowering clinicians who are willing to use technology, supported by champions, can create local champions to spread the uptake of telehealth services.

4.4.3.3 Staff Training. Among the pertinent themes that emerged from the analysis of the interview data was the need for staff training. In particular, six of the eight respondents highlighted the need to undertake regular, formal, and tailored training to address concerns and resistance from staff. They consistently opined that staff must be trained regularly on using the constantly-evolving systems.

Respondents highlighted that staff training and education promoted the use and spread of telehealth. They stated that they were uncomfortable using the technology because of the lack of dedicated formal training. One respondent stated: "*I feel a little bit uncomfortable with this technical infrastructure as I had no formal training*." However, the interviews also indicated that staff in rural and remote areas understood the benefits of telehealth and learned how to use the technology without formal core training. According to one respondent, training tailored to the local context enhances the sustainability of services:

"I think that staff's training and upskilling and practice have been something which we have had to do ourselves very much, and grow it and tailor it to each local context, but once that has been established for local context, it seems to enhance the sustainability."

Findings suggest respondents lack standardised formal training on telehealth technology. In contrast, one respondent argued: *"Our staff use telehealth a lot because of our remoteness and rurality; however, the use of telehealth relies on possibly a specialist in* *another city, and they may not be as up with using telehealth."* This reveals that although some clinicians in some areas are competent in telehealth, many are not. The disparate training of health professionals across DHBs may affect the sustainable uptake of telehealth services. Interview respondents attributed the unequal training to the likely inadequate investment in training and education to use the technology.

4.4.3.4 Ongoing Support. Respondents stated that a strong driver for sustainable telehealth services was ongoing technical support and technical staff availability: *"One most common thing for a sustainable telehealth is the ongoing IT support… Keeping it easy and having someone who translates the IT language into the clinical language.*" Staff also needed training and support to use and set up their technology to provide telehealth services: *"The camera, and I do not know the name of the camera, which is on average, you can Zoom and things. So there was a bit of playing around*." Telehealth education should include clear general and specific guidelines on how to use the technology: "*I have been, there are no clear guidelines on even how to use Skype, how to use Zoom, how to upload*." A lack of evidence-based guidelines to support telehealth services was a particular concern for some clinicians: "*Few clinicians have the concern… mentioned, about the anxiety about giving remote advice... We lack evidence-based guidelines to gain confidence on telehealth.*" Providing complete appropriate education and available support when needed helped increase the use of the technology:

"I am constantly dealing with clinicians who are saying I need to do… but where can I do it… I could see a lot more of it being used if there is more support available. You can give us the best system; if I do not know how to use it properly, it does not help."

Four respondents spoke about the importance of having technical teams to avoid staff members becoming frustrated with the systems. Many respondents said that most clinical users had limited technical knowledge and were inadequately trained in using such systems.

They also highlighted that staff training boosted their confidence, trust, and comfort with the technology, as well as addressing fear of change and threats to their practice.

4.4.4 Technology Infrastructure

Respondents identified various technology and infrastructure factors that influenced the use and spread of sustainable telehealth services. The key themes elicited were the required ICT infrastructure, reliable internet connectivity, the complexity of telehealth technology applications, and interoperability. The subthemes identified from Phase 03 semi-structured interviews on technology infrastructure are listed in (Table 41).

Table 41

Technology Infrastructure: Factors that Enable Uptake of Telehealth Services

Theme	Sub-themes
Technology Infrastructure	Access to reliable technology
	Access to reliable internet
	Simple and easy to use technology
	Interoperability and system compatibilities

4.4.4.1 Access to Reliable Infrastructure and Technology. The majority of respondents believed that the technical elements of the technology hindered the use of telehealth services. Features such as video and audio quality, adequate infrastructure, and access to reliable technology significantly impacted the actual and perceived usability and appropriateness of the technology. According to one respondent, the video and audio quality played a key role in using the technology to attain maximum patient benefits: "*You must have excellent equipment. Sounds and sight need to be perfect for the maximum patient benefit*." Good video quality enables more staff buy-in to use the technology: "*The clarity of the video, the stability of the video, all those sorts of things, it makes a compelling of using it more and more*." Another respondent stated that telehealth technology should be flexible and reliable to provide high-quality video:

"We have now created a Zoom cart, which can move around in the hospital. It has two cameras, remotely accessible so I can zoom in and out, and one is a wide-angle camera to see the whole thing. And it has one click to set up like we are doing our Zoom now. And it seems to be so far very reliable and, from the quality, very good."

Respondents stated that the existing technology was not reliable or accessible for use when needed*: "The technology breaks down occasionally… unable to make connections or, more recently, no sound, we have sometimes had to talk to each other by speakerphone to enable a meeting."* Another respondent reported issues with setting up or finding adequate infrastructure as challenges to using telehealth technology: *"Have been asked to move several times, have other centres that cannot find a machine to log in to at the right time to attend our meetings."* Another respondent explained challenges in using the right tools and resources to access the technology: *"Improved access on laptops to enable access to patients in times that they are available. Currently, it is a mission to find a suitable login and available room to book. Currently, access is limited by licence availability."* Furthermore, respondents stated that access to reliable technology improved patient care*: "Fast access to imaging, increased access to education and multi-disciplinary team meetings district-wide and nationally."* Having access to reliable technology improved patient care in terms of efficiency, accessibility and response time.

4.4.4.2 Reliable Internet Connectivity. Providing video telehealth services depended largely on the internet, and overall telehealth service success depended on the reliability of internet connectivity. All respondents stated a need for reliable internet access for wide scale uptake across the organisation. Reliable internet connected clinicians and other medical staff to their patients much easier, facilitating the satisfaction of both health professionals and patients. However, according to one respondent, the overall effectiveness of telehealth services in New Zealand was undermined because not all parts of the country have reliable connectivity:

"As well as reliable networks. I think that is one thing that we find. We have places that do not have reliable internet in our country. Not even just broadband, but cellphone coverage or anything like that, to even access it, or these things. And I think that will become a limiting factor if it continues."

Another respondent corroborated this: *"People on the West Coast have no access to cellphone or internet; 3% of the people on the West Coast have no access to cellphone or internet."* Respondents appreciated the significant role of the internet in supporting telehealth in the specific context of New Zealand. One respondent expected that having reliable internet connectivity would cost more for healthcare facilities in the country, but the benefits from the investment would far outweigh the costs:

"In terms of the internet, I cannot comment on how much it would cost us to have the internet for these things, but I think certainly in terms of productivity, it is overwhelmingly positive, overcomes the actual financial cost of the technology."

Closely related to reliable connectivity was the issue of bandwidth. Bandwidth determines the speed at which data can be transferred and mostly determines video communication over the internet. Slow data transfer significantly undermines the delivery of services: "*Yeah, but I mean the main issue is that we are just so behind in health in terms of these things. We have bandwidth limits… so all those things have to be sorted out*." Another respondent noted the challenge of older buildings affecting the strength of internet coverage:

"Very poor coverage, that is a problem, and it is difficult retrofitting buildings that do not have wi-fi hubs all over them… So, that is an issue, I suppose, is the fact that we have got some older buildings, which do not quite have the strength of the signal."

Using telehealth technology became easier when respondents had reliable internet connectivity in their working environments: *"To have decent wi-fi strength, in the working environment… and when you have got that, obviously the telehealth stuff becomes much easier."* The responses demonstrated that internet reliability was one of the most profound impediments to the effectiveness of telehealth services across the DHBs in New Zealand.

4.4.4.3 Ease of Technology Use. Given that the telehealth technology relied on reliable internet and bandwidth, the uptake of services required effective technology that is simple to access: "*Making sure that we have got good, effective technology that's easy to use, everybody can access it in a way that's meaningful to them. And making sure that the patients can access it*." Reliable, user-friendly and convenient technology was critical to ensure sustainable telehealth services. When clinicians knew how to use the technology, they used telehealth services: "*Ability to perform a telehealth consultation… that every clinician that comes into the organisation understands how to do it*." Even with all the identified issues addressed, the ultimate consideration under this theme was how easy the technology was to use for both clinicians and patients. Although communication technologies are used daily, some uncertainty seems to exist about using them in the telehealth context: "*I think people are still anxious about the technology not working properly because sometimes people will say: Oh, let us just arrange face-to-face because it is easier to use*." This comment shows that people feel that telehealth is much more difficult than traditional face-to-face meetings.

Respondents stated that technology should be simple to support staff to work efficiently and effectively:

"I think if there was a requirement for all government agencies to work within one platform, there would be simple systems of how to log in to the telehealth, and it would make communication between services a lot better and simpler within service but particularly between services, including connecting with the patient at patient level."

Another respondent stated: *"It needs to be really easy to set up, that's the main thing because doctors are allowed to do all sorts of things, but they're not able sometimes to press a button to connect."* Technology should be simple, quick and easy to use, ensuring patient care is not comprised while providing telehealth services:

"It should be really simple to do videos because it's everywhere, but it's just a little bit more difficult within our context because we have old systems, and we have issues with interoperability, so all those things have to be sorted out."

One respondent stated:

"Some of our clinicians are not quite as tech-savvy. We have been working hard to make sure that the technology is clicked and turned on, and they do not have to do too much to it, and do not have to rely on tech people to come and set things up every time, and all of those sorts of things. That is about it. Simplicity."

Respondents revealed that seemingly easy skills such as the use of computers were not common to all people in all locations: *"There is normally someone there that's pretty tech-savvy and can sort out the problems by themselves, without got anybody else in."* The presence of people in New Zealand with low competency in using computers and other relevant hardware undermines the ability to use telehealth. Generally, the interview findings reflected that the success of telehealth depended on how easy the technology was to use.

Interoperability issues must be overcome to enable the technology to be used to the greatest benefit: *"There does not seem to be much knowledge of how to manage issues of interoperability between [the Departments of] Corrections, Justice and the DHB. And the response times have been extremely slow."* Lack of interoperability, in which different systems cannot communicate between DHBs, had been a particular issue: *"Interoperability is probably the biggest problem we have at the moment, getting two services to talk each other."* Another respondent referred to the same issue: *"The Christchurch surgeon can* *consult with a patient in Golden Bay using telehealth because he has all their information in front of them… Whereas, in Wellington, that is not possible because we do not have the connection."* Telehealth infrastructure needed to be standardised, enabling interoperability of systems across the DHBs*: "With the interoperability of video, this expands our ability to connect with other organisations significantly."*

Reliability, accessibility and interoperability of telehealth technology played a significant role in the use and spread of telehealth services. Interview respondents stated that although individual organisations likely had dedicated budgets to support interoperability within DHBs, a coordinated approach across DHBs was needed to support it.

4.4.5 Financial Support Services

The interview findings suggested that implementation of telehealth required significant financial investments at all stages. Respondents stated that inconsistent telehealth infrastructure resulted in huge investments. Almost all stated that funding issues were a significant barrier to the uptake of telehealth in their workplace and implementing innovative telehealth enabled models of care that required funding support. The subthemes identified from Phase 03 semi-structured interviews on financial support systems are listed in (Table 42).

Table 42

Financial Support Services: Factors that Enable Uptake of Telehealth Services

Theme	Sub-themes
Funding	Infrastructure investment.
	Ongoing funding to support staff and technology
	Sustainable funding.

4.4.5.1 Telehealth Infrastructure Investment. Respondents indicated initial funding towards telehealth infrastructure is important across the organisations. In the specific context of initial funding, one said: "*I guess we have not specifically tackled the funding issue because the telehealth technical team have been so slow at giving us pricing options and so forth… The initial options offered by the telehealth team are very expensive*." Challenges were reported in establishing the telehealth infrastructure due to a lack of initial capital for the initiation of the project, and technical teams had not provided adequate guidance on the costs of different options.

In addition, the initial funding allotted for incompatible telehealth infrastructure was significant*: "About finance, the initial investment was very expensive. They involved ongoing licensing costs of thousands per annum and setup costs of over $10,000… Inconsistent hardware resulted in huge investment."* Although the initial investment was expensive, the initial funding resources did not fulfil the technical requirements and needs. Respondents revealed that initial funding was a challenge for investing in telehealth infrastructure; after this, recurrent funding relating to maintenance, upgrades, replacing lost equipment and support increased the costs of operating telehealth services. A respondent stated:

"It is really interesting because we are in pretty much financially constrained times. Considering the ongoing licensing cost and maintenance of the equipment… training staff on how to use technology… put forward the case for scaling it up, which will cost more. It is not huge still; it is not a high cost, but it is the cost of all the licenses, and we have also put in the cost of one FTE to support all of this."

Respondents reported that predicting the use and spread of telehealth technology and the amount of ongoing investment needed to keep it running was often impossible.

The recurrent funding to support telehealth services depended on how well stakeholders could justify the benefits of their telehealth programs: "*I think regarding* *funding, being able to justify the cost of more web-based and mobile solutions. Again, over the years has been easier as it has become more acceptable, and throughout the organisation, people see the greater value in it*." In general, respondents stated that providers needed to show the impact of telehealth in terms of cost savings and convenience for continued funding to be guaranteed. One respondent indicated the need for an elaborate long-term strategy that addressed how telehealth aligns with specific positive outcomes related to cost savings. Even given the ability to reduce costs, however, one respondent emphasised the need for financial incentives for providers to ensure successful implementation. One explicitly stated that no incentives existed for providers in some facilities to use telehealth. For these reasons, even with sufficient recurrent funding, the technology performed sub-optimally due to most doctors using the traditional face-to-face consultation approach.

4.4.5.2 Ongoing Investment. In addition to initial investment on telehealth technology, respondents reported a wide range of necessary resources to support telehealth services. One specifically noted the need for adequate human resources in the form of internal experts and general fixed assets to implement a telehealth programme:

"It is just making sure, again, that we have got that right staff and the training to support the workforce. They are there to support them to do it. The good speakers, and the good cameras, and all of those sorts of tech support that to make sure things run okay."

Facilitating funding to support staff and technology influenced the uptake of sustainable telehealth services across the organisations.

4.4.5.3 Sustainable Funding. Effective funding facilitation and coordination approaches across DHBs could support integrated telehealth technology across the country. As stated by one respondent:

"The other thing we are promoting throughout the organisation is because we have many general practices… when you think across DHBs and the big picture… cost–benefit

and other factors, take a coordinated, maybe… I will say national approach across the DHBs to implement a national health information platform… something similar that we are currently doing with the South Island information systems… bringing together to one system… you know the benefits for patients… seamless integration across organisations… The big question is do we have funding."

A coordinated approach to update telehealth technology could result in more current, better-value solutions to the problems of interconnectivity across networks. As stated by the respondents, investing in a national telehealth platform would require a huge investment, but could support sustainable telehealth services to benefit patients.

The current funding model to support telehealth services was not sustainable, influenced by small-scale projects that were most effective in delivering healthcare convenient to patients and providers. One of the respondents emphasised:

"I think what is the biggest piece missing because we need to drive by health outcomes connecting secondary and primary care sites… Currently, we are focused on specific departments… which we do on a very small scale… fragmented… Patients can use video consult[ation]s for some of the consults but not for all specialities… Staff that push the patient at the centre of what they do will adopt telehealth because they will understand how it reduces the travel, in terms of not only kilometres, time, cost."

Furthermore, the interviews showed that funding for telehealth services might be sustained only when the services focus on achieving health outcomes and improving service access. Interview respondents stated that telehealth pilot initiatives should be driven by nationwide telehealth outcomes that would reduce the funding spent on more pilot initiatives.

4.4.6 The External Environment

In addition to the internal factors established to play a very important role in the success of telehealth in the DHBs in New Zealand, this component describes respondents' reported views on the factors external to their organisation that influence the uptake of telehealth services. These factors comprised regulatory guidelines to use telehealth services, digital literacy, and access to reliable devices and the internet. The subthemes identified from Phase 03 semi-structured interviews on the external environment are listed in (Table 43).

Table 43

External Environment: Factors that Enable Uptake of Telehealth Services

Theme	Sub-themes
Influential factors in the External Environment	Regulatory guidelines for telehealth
	Reimbursement policies to incentive telehealth
	Patient access and affordability to devices
	Patient access and affordability to the internet
	Digital literacy for patients
	Multiple partnerships - interoperability of system

4.4.6.1 Legal Factors. Respondents indicated that the legal issues associated with patient safety while using telehealth services limited clinicians from using these services. One respondent stated: "*I believe that the liability problem is the most concerning aspect of this. What happens if an unfavourable event occurs and the provider fails to respond appropriately? Will it come back to harm us*?" Another respondent stated that organisations have no policy on using devices when they do not work correctly.

Moreover, poor internet connectivity created less confidence to use telehealth services:

"Access to good internet in hospital and peripheral centres is always a trouble… Suddenly the internet goes down. You get disconnected with patients… No policies to

regulate the use of devices and software… This creates excessive fear regarding confidentiality when delivering patient care."

Unreliable internet impacts the video quality, causing issues in delivering telehealth services:

"Unreliable internet is a barrier to providing smooth video services. It can lead to privacy, security, and confidentiality issues that can affect the patients' personal lives. As well as there are no specific legal rules for holding or withdrawing the data of the patients."

Existing protocols may not be sufficient to manage the risk between providers and patients and may adversely influence patient safety, resulting in inefficient service use. Professional bodies to regulate the protocols and guidelines for using telehealth could enable providers to understand and overcome the legal issues that currently limit the uptake of telehealth services. DHB stakeholders and professional bodies need to consider whether existing legal and regulatory policies support telehealth to develop the most supportive legal frameworks to govern it.

4.4.6.2 Patient Affordability to Access Devices and the Internet. Patients, who were willing to use telehealth services, did not always have access to devices and reliable internet to access services. One respondent stated:

"Some patients are willing and want to use video consults… Several times, clinicians have asked me…[for] Devices for video conferencing for staff and to loan to the patient or family… You know still we have this problem of sorting devices' cost and device management for patients who want to use the services… Long way to go, and it is always a barrier, specifically as we cover people across rural areas."

Training programmes should address cultural barriers to support and train patients who may need to navigate telehealth consultation: "*Cultural barriers... Some patients require* *training sheets... You can see our patient information sheet that we have put on our website… but the question is does everyone uses the same…*"

Another respondent highlighted the issue of the cost for patients to access reliable internet:

"The ability for health organisations to say, look, this call I will make should be cost-neutral to the patient. Moreover, it should not cost them. It should not cost us. It is a way government need to think of providing health when we know the benefits of telehealth in providing healthcare access… Certainly, we have large pockets of our community that have no cellphone coverage at all… Or they are on cellular satellite data, which is horrendously expensive, and so they just would not bother to get anything from a telehealth."

The interview findings showed that organisations need to address and mitigate cost barriers to ensure equitable access to telehealth. Moreover, respondents stated that the lack of processes to provide reliable devices and proper training to patients might widen the inequalities in accessing care:

"More technical issues and accessing the app for patients on their devices... with software solutions… The question always arises how to provide technical support to patients… No structure to support telehealth clinics… Each department has their processes to use technology… Who would support patients to attend an appointment... Where and how would they access equipment if they do not have a reliable device... Are we creating more access to patients or providing access to only who have access to devices."

Digital literacy and accessibility issues due to the reliability of devices and the internet for disadvantaged populations influenced telehealth service use and spread across the DHBs.

4.4.6.3 Reimbursement Models for Telehealth Services. The existing telehealth reimbursement policies did not specify the costs or telehealth services funded. As stated by one respondent:

"There were some issues with clarifying the services funded for telehealth services… Maybe more awareness across the department to extend the scope to other community providers… I do not think we have a proper reporting mechanism for accounting telehealth services… You know that all comes again to interoperable infrastructure that can collect… and having a system for counting telehealth services."

Respondents stated that clarifying the costs of telehealth services enabled more uptake from providers across primary care. The existing reimbursement capabilities to support telehealth services had significant gaps, and existing reimbursement models to incentivise telehealth providers needed to be designed, implemented, and sustained.

4.4.6.4 Interoperability of Systems due to Different Ownership Structures. Generally, interoperability in this context refers to the ability of the different systems applied by different organisations to work together. For patients, interoperability made things much easier since learning how a particular telehealth system worked also meant learning how all other systems worked, leading to a higher likelihood of success. However, one respondent described an insufficient level of interoperability in telehealth systems: "*There does not seem to be much knowledge of how to manage interoperability issues between [the Department of] Corrections Justice and the DHB… The response times have been extremely slow*." This was supported by another respondent: "*We have limits on interoperability issues… Connecting to community and primary care providers, so all those things have to be sorted out*." These statements show that DHBs have not yet been able to standardise telehealth systems. Solving the interoperability challenge would be one of the main steps towards achieving full approval of telehealth systems by all relevant health sector stakeholders.

4.4.7 Summary of the Semi-Structured Interviews

This section discussed understanding the factors that potentially enhance the use and spread of sustainable telehealth services across the DHBs in New Zealand. It has presented several insights into the success of telehealth in the country. The first theme assessed the extent of technology integration. An in-depth assessment of the level of understanding of the telehealth concept revealed that the technology was understood differently by the different respondents. The lack of a single clear definition underscored the lack of a common understanding of the technology, despite its use for a relatively long time in New Zealand. In addition, all the integration strategies highlighted by respondents appeared to be short-term and organisation-specific rather than long-term, industry-wide strategies. Generally, therefore, the evaluation of the first theme findings revealed that telehealth technology was not yet fully integrated into the entire healthcare system in New Zealand. Full integration was dependent on staff acceptance of using telehealth technology.

The importance of staff willingness to use the technology led to a more in-depth investigation of the human resources function as the second theme. The findings of this research indicated a general willingness to adopt the technology; however, employees were still concerned about their ability to handle the technical aspects of telehealth, which highlighted the need for technical support teams available to assist in case of challenges. Some respondents also mentioned telehealth training to ensure staff members possessed the necessary skills to work with the technology. Telehealth is also a relatively new approach to healthcare delivery and this means changes to the traditional procedures that the healthcare workforce has had to follow. The findings, therefore, indicated that telehealth's success depended on how staff members were involved in the change process from inception to implementation. This involvement allowed them to contribute to the new procedures that should be followed and makes the staff feel valued, reducing the likelihood of resistance to change.

The findings showed that the lack of technology infrastructure was one of the main reasons telehealth was not successfully implemented across the DHBs. Many respondents indicated that issues of accessibility to reliable technology and internet connectivity and bandwidth profoundly undermined the adoption of telehealth. One of the main observations under this theme was that some areas in New Zealand had poor internet connectivity, making it impossible to use telehealth as the main method of healthcare delivery. For this reason, technology infrastructure should be improved to support telehealth integration. With the adequate infrastructure in place, patients, as well as healthcare professionals, must be convinced that the technology is easy to use and more convenient than the traditional face-to-face consultation approach.

Financial support is the fourth theme identified from the presented data. One common observation was that financial investments were required in the adoption of telehealth. In the specific context of initial funding, uptake was reported to have been relatively slow due to the large capital investments required for the project. Moreover, the funding models did not account for recurrent funding for the workforce and telehealth project infrastructure. A reasonable argument could be that it was impossible to predict the use and spread of telehealth technology and the amount of ongoing investment needed to maintain it. The success of telehealth investment to facilitate implementing national ICT infrastructure can benefit DHBs to enable better health outcomes for patients.

The final theme sought to establish some of the external factors influencing the adoption of telehealth. In the specific context of New Zealand, telehealth services reduced the costs of providing services, but ambiguity in reimbursement models to incentivise telehealth is one of the biggest challenges to uptake across the DHBs. Moreover, the spread of telehealth services may widen the existing inequalities in accessing healthcare, given patients without access to devices and the internet.

4.5 Summary of Chapter 4

This chapter reported the data from the three phases of the research: Phase 01 (literature review), Phase 02 Part 1 (survey of one key contact from each of the 20 DHBs), Phase 02 Part 2 (survey of 161 respondents across the DHBs who use telehealth services), and Phase 03 (semi-structured interviews with eight respondents) Each section concludes with a summary that provides a precis of that section. The next chapter discusses and integrates these reported findings into the final framework to enhance the uptake of telehealth services across the DHBs in New Zealand.

Chapter 5 Discussion and Conclusion

5.1 Introduction

This study develops a framework to enhance the uptake of sustainable telehealth services across the DHBs in New Zealand. Three phases of research inform the development of the framework aim was achieved through three phases answering the research questions (Figure 19).

Figure 19

The Three Phases of the Research

Phase 01
What are the factors at the organisational level that influence the uptake of sustainable telehealth services?

Phase 02
What is the status of telehealth services across the DHBs in New Zealand?

Phase 03
What are the factors at the organisational level that influence the uptake of sustainable telehealth services across the DHBs in New Zealand

The objectives from each phase of the research were:

Phase 01: Literature review.

- To identify factors at the organisational level that influence the uptake of sustainable telehealth services.
- To develop an initial version of a framework for the implementation of telehealth in New Zealand underpinned by a theoretical framework.

Phase 02: Survey across 20 DHBs in New Zealand.

- To understand the status of the telehealth environment across the DHBs in New Zealand

Phase 03: Semi-structured interviews.

- To understand the factors at the organisational level that influence the uptake of sustainable telehealth services across the DHBs in New Zealand.

The findings of the surveys and interviews (Phase 02 and Phase 03) are first discussed in the context of the review of relevant literature from within New Zealand and internationally, which is underpinned by the NASSS framework (Phase 01). From the integrated findings, a revised framework is developed, and then the chapter outlines a set of recommendations for implementation at both the national and DHB level, as well as noting the strengths and limitations of this research and comments on directions for future research in telehealth in New Zealand.

Phase 01 was a literature review that analysed the organisational-level factors that influence the uptake of sustainable telehealth services. Fifty-one studies were identified by searching the databases, and Braun and Clarke (2006) six-step process of thematic analysis was performed. The thematic analysis results were used to develop an initial version of the framework underpinned by the NASSS framework (Greenhalgh et al., 2017). The initial version of the developed framework identified five themes: the extent of technology integration, human resources function, technology infrastructure, financial support services, and factors in an organisation's external environment (Table 5).

In Phase 02, a survey was designed to assess the status of telehealth services across the DHBs. The survey was distributed in two parts across all 20 DHBs. Quantitative analysis was performed on both Part 1 and 2 of the survey responses to reveal the status of telehealth services across the DHBs. The open-ended answers from Part 2 of the survey were analysed thematically to understand survey respondents' thoughts, perceptions, and experiences about telehealth services' benefits and challenges across the DHBs in New Zealand.

In Phase 03, semi-structured interviews were conducted to understand the in-depth factors at the organisational level that influence the uptake of sustainable telehealth services. Qualitative thematic data analysis identified the factors at the organisational level within the context of the five major themes developed from Phase 01 of this study. Based on a mixed-methods concurrent triangulation approach, this study developed the framework to describe the status of telehealth and identified several factors at the organisational level that influence the use and spread of telehealth services across the DHBs. The context and the components of the final framework are described in the below sections.

5.2 Differing Views on Defining Telehealth

Although the study used an agreed definition of telehealth, the interview findings show differing views that reflect a lack of common understanding of telehealth technology across the DHBs. The findings identify the need for a single agreed definition of telehealth to support standardised language to understand telehealth services. The telehealth definition used in the study was adopted from the NZTLG: “the use of information and communication technologies to deliver health care when patients and care providers are not in the same physical location” (NZ Telehealth Forum and Resource Centre, 2018a). The Medical and Dental Council of New Zealand use the same telehealth definition (Dental Council, 2020; Medical Council of New Zealand, 2020b). Findings from the interviews and the cited literature also use the term “virtual healthcare” to define telehealth (New Zealand Health IT, 2020). The NZTLG acknowledges an ongoing debate on telehealth terminology (Association of Salaried Medical Specialists, 2020).

In addition, although the interviews identify a general understanding of what telehealth services entail, a common understanding of the scope of telehealth technology and services is lacking across the DHBs. Existing literature states that varied definitions reflect how telehealth services are applied based on the nature of existing services (Fisk et al., 2020), the intent of the organisations, and the population they serve (Doarn et al., 2014). On these bases, the study recognises the need for a consistent definition to better understand and share the scope and vision of telehealth services across New Zealand. The differing definitions of telehealth highlight telehealth as an open and constantly evolving science to incorporate advancements in technology and adapt to societies' changing health needs and contexts (WHO Global Observatory for eHealth, 2010)

5.3 Broad Coverage and Variable Uptake of Telehealth Services

All the DHBs report using telehealth services for clinical and non-clinical purposes. The focus in this study is on telehealth services across the five major clinical categories: adult and women's health, allied health, ambulatory and clinical, mental health and paediatrics, and there has been a significant increase in reported clinical services since the 2014 stocktake, which reported approximately 55 services on clinical telehealth interactions (NZ Telehealth Forum and Resource Centre, 2014). This 2019 study finds there are now a broad coverage of telehealth services across 337 clinical services, reporting 997 telehealth interactions. The coverage varies across clinical specialities and regions. Clinical specialities report the stages of their implementation of telehealth, namely ended, active, pilot and planned. Paediatrics report a smaller number of telehealth services than other specialities but note that a higher percentage of their telehealth services are in the active implementation stage. The surveys show there is a significant planned uptake of telehealth services in allied health compared to other specialities. Although there are five DHBs in the South Island, compared to 15 across the North Island, the southern DHBs report a higher percentage of telehealth services than the other regions.

The higher percentage of active services across paediatrics aligns with the establishment of the New Zealand TelePaediatric Service connecting DHBs to improve paediatric services across the country (King, 2003). The significant planned uptake of telehealth across allied health could be due to the potential benefits reported by the providers in rural and remote areas (Speyer et al., 2018). The South Island comprises 23% of New Zealand's total population but has geographical challenges to access appropriate health services (South Island Alliance, 2019). When patients have to travel long distances to access in-person medical care, telehealth is a viable alternative (Ajami & Lamoochi, 2014). Similar approaches have been successfully implemented across other developed countries (Bhaskar et al., 2020; Scott et al., 2020; Thapa & Sein, 2018) to access timely and better healthcare services. Consistent with the literature, this study suggests telehealth services arising from rurality and remoteness (Fisk et al., 2020) may account for the high presence of telehealth services in the South Island.

A similar study, to the present one, that measured telehealth services for clinical services, training, and workforce support in New South Wales reported a broad coverage and variable uptake across regions and specialities (NSW Ministry of Health, 2015). Other studies explain this variable uptake of telehealth services across specialities and regions by targeted funding, programmes led by telehealth champions (Alami et al., 2017), and clinical considerations (Drake et al., 2021) that may inform future priority services (Drake et al., 2021; Gagnon et al., 2006). Here, the differential uptake of telehealth services seems to relate to DHBs not having processes to manage equity, with services driven by the particular interests of a lead organisations, and a local specialist who runs the telehealth programme. Telehealth programmes that depend on local specialists may not be sustainable, and result in marked variability (Sheridan et al., 2011). This variation raises issues related to implementation factors that may increase inequalities (Department of Prime Minister and Cabinet, 2021; Drake et al., 2021; NSW Ministry of Health 2016). Given the variations, this study proposes a "no one-size-fits-all" approach, and that DHBs need to tailor programmes across the regions and clinical specialities to achieve equitable health outcomes for all New Zealanders (National Health Committee, 2010). Achieving nationwide equity relies on all 20 DHBs having a process to manage the equity in offering telehealth services. Further research is needed to investigate the underlying factors to tailor specific strategies to promote equitable and sustainable telehealth services across New Zealand.

5.4 Bringing Care Closer to Home

The surveys indicate 13 interaction types that fall within patient or clinician related categories to provide telehealth services across the DHBs. Follow-up appointments are widely reported for patient-related telehealth interactions. These high numbers of telehealth follow-up appointments are consistent with other large-scale implementation of telehealth studies (Donelan et al., 2019; Koziatek et al., 2021) that also result in low Emergency Department return and inpatient admission rates (Barnett et al., 2006; Donelan et al., 2019; Koziatek et al., 2021) and reduced travel and accommodation expenses (Jong et al., 2019; Snoswell et al., 2020; The Royal New Zealand College of General Practitioners, 2017). The survey reports a shift in focus to patient-related telehealth interactions to deliver health services to patients. In addition, telehealth services show a clear shift to reaching the patients at home or work. By bringing care closer to patients' homes, this improves their health outcomes and aligns more closely with the *New Zealand Health Strategy* (Ministry of Health, 2016b). However, for the full potential of telehealth will not be realised if clinicians are reluctant to change how they work to use telehealth services (Greenhalgh et al., 2017). In addition, many Māori and Pasifika communities prefer *kanohi ki te kanohi* (face to face) interactions, which allows for trust-building and authentic engagement (Tīaho Limited, 2020), both of which may be lost when bringing care closer to home with telehealth consultations (Gurney et al., 2021). Whether telehealth services are used may depend more on engagement and patient-provider relationships despite the potential benefits of telehealth of improved access to quality health care (Meno et al., 2021). When using telehealth services it is important to find a balance that ensures face-to-face interactions are not lost, and telehealth services supplement in-person visits (Gasteiger et al., 2019). As such, the uptake of services by patients' needs and their perspectives on the use of telehealth needs to be further investigated (Imlach et al., 2020). Further research should explore the factors that facilitate care closer to home and the possible impacts of telehealth on health outcomes.

5.5 The Extent of Telehealth Integration

This framework component considers telehealth governance and the organisation's capacity and readiness to drive change to integrate technology into routine practice for scaling up sustainable telehealth services.

A governance group is the management structure that includes a clear telehealth strategy to oversee and invest in telehealth services, an important factor to facilitate their use (Smith et al., 2020). The surveys found that 80% of the DHBs with a governance group report having a telehealth strategy in place but nearly half of the DHBs report not having a telehealth governance group. Supported by existing wide scale implementation of telehealth, the interview findings show the need for a strong and clear central governance framework to provide strategic direction and guidance for the sustainable uptake of telehealth services (NSW Ministry of Health, 2015; South Island Alliance, 2019; Wade et al., 2016). In addition, the interviews and the literature identify the need for an overarching vision to facilitate a long-term strategy for adapting telehealth technology (Kho et al., 2020; NSW Ministry of Health, 2015).

Similar studies have also reported that such strategies enable successful implementation of telehealth services (Bjaalid et al., 2015; Larsen et al., 2016). Long-term strategies and policies supported by robust governance drive the implementation and uptake of telehealth services (Lluch & Abadie, 2013). This findings in the present study contrast with the existing literature, which states that strong governance across DHB-style organisational structures will provide strategic direction and guidance for the uptake of telehealth services (NSW Ministry of Health, 2015; South Island Alliance, 2019; Wade et al., 2016). Given the well-established importance of governance groups (Arkwright et al., 2017), the lack of a management structure for most DHBs is notable. Although most DHBs have a telehealth strategy (Moura, 2016), this study recommends that DHBs establish central telehealth governance as a key initial step to implementing sustainable services (Arkwright et al., 2019).

The literature indicates that successful telehealth models have been driven by strong governance with dedicated and responsible leaders to support the change and speed of telehealth adoption (Arkwright et al., 2019). Research on large, successful telehealth services has determined the importance of dedicated leaders (Ellimoottil et al., 2018) to implement and expand their services. The surveys here show that DHBs with an appointed telehealth programme manager report more telehealth services, but only 12 had an appointed manager. Findings from the interviews indicate the need for a dedicated telehealth clinical leadership team to engage and communicate with clinical and operational leaders to support and build relationships that underpin telehealth success (Arkwright et al., 2019; Wade & Eliott, 2012). In line with existing literature, the interviews highlight that the responsibility and accountability of dedicated leaders (Arkwright et al., 2017) drives change in the organisation's capacity to integrate (Kho et al., 2020) and scale-up telehealth technology (Kho et al., 2020; Lindsay et al., 2019; NSW Ministry of Health, 2015).

DHBs need to collaborate and adapt practices to integrate telehealth technology. According to the interviewees, using telehealth services in routine practice increases workloads and this creates resistance to the technology (Peddle, 2007). Planning for this workload and providing resources to support new processes are identified as success factors to embed telehealth technology into existing practice (Hopp et al., 2006; Lucas, 2013; May et al., 2003). The interviews suggest that telehealth services should be implemented to address specific clinical needs rather than just implemented on the basis of the availability of technology. An incremental adoption strategy that target specialities ensures telehealth services are clinically relevant and functionally fit for purpose. Addressing specific needs and sharing positive experiences (Taylor, Coates, Brewster, et al., 2015) encourages a stronger clinical staff buy-in (Janardhanan et al., 2008; Kim et al., 2013) that results in higher acceptance of embedding telehealth services into usual practices (Bouamrane et al., 2011; May et al., 2003; McEvoy et al., 2014; Morrison, 2014). By embedding telehealth services into routine practices, there can be greater clinical efficiencies that improve both the outcomes and sustainability of the services (South Island Alliance, 2020).

The NASSS framework discusses the capacity and readiness of the organisation to implement technology, integrate it into existing practices, and support the work needed to implement and sustain change (Greenhalgh et al., 2017). The variable uptake of telehealth suggests that telehealth services have occurred through various efforts at regional levels, based on short-term or regional strategies that helped improve their efficiency and quality. The interview findings support the NASSS framework and suggest that the integration of telehealth services across DHBs is low. Extensive work is needed to establish a central governing body to utilise the regional bodies' shared vision and strategies to define a long-term plan to drive sustainable development telehealth uptake across New Zealand. The study suggests that DHBs must coordinate with key stakeholders across the regions to establish national telehealth governing body. National governance can articulate the vision to direct and implement long-term national telehealth strategies, allowing DHBs to direct and implement services appropriate to the local context.

In line with the organisational component of the NASSS framework, the study also finds that effective clinical leadership is needed to embrace the organisation's capacity and readiness to support change to scale up telehealth service uptake. Telehealth leaders need to identify and build partnerships across and within organisations to innovate and support best practices. Findings from the study encourage future research to examine the change management processes that facilitate the implementation of telehealth services across organisations. Although this study does not measure the extent of disruption caused by implementation, it does suggest that DHBs need to implement effective telehealth scheduling systems supported by adequate resources (McGoey et al., 2015; Peddle, 2007) to improve the overall use of telehealth services. The adoption of technology is a dynamic process, achieved over time, and DHBs should investigate new processes (May & Finch, 2009) to normalise and embed telehealth services into routine practices for their potential spread and scale-up (May & Finch, 2009). Telehealth services become embedded in the routine service delivery model when such integration occurs, ensuring greater clinical efficiencies and improved service sustainability. The key factors that influence potential internal scalability are establishing a national governing body to drive a long-term telehealth strategy, effective clinical leaders to drive the change and adequate resources (including a dedicated telehealth workforce) and efficient technology infrastructure (Figure 20).

5.6 Human Resources

The human resources component of the framework explains how the workforce adopts and continue to use telehealth technology across the organisation. A dedicated telehealth workforce is integral to support its implementation and ongoing use in a successful way (Gagnon et al., 2006; James et al., 2021). The telehealth workforce is the fundamental component of an organisation, and findings suggest that the desire and potential of the workforce to use the technology determines the complexity of uptake and ability to scale up telehealth services across the DHBs. The desire and potential to use technology reflects the importance of staff acceptance and training that enables adoption and sustainability. In line with the literature, most interviewees in this study state that staff acceptance was the key to successfully implementing telehealth services (Merchant et al., 2015). The interviews and literature suggest that the key success factors influencing staff willingness to use telehealth technology are engaging and empowering staff at all levels, obtaining their input about service selection, and communicating the operational changes. Staff willingness to use technology facilitates strong buy-in and ownership of the services (Alami et al., 2018; Doorenbos et al., 2011; Gagnon et al., 2005).

The findings in this study and the experience of successful telehealth services suggest that clinical champions are critical to creating a positive environment (Merchant et al., 2015; Morrison, 2014) to promote staff acceptance. DHBs with a dedicated clinical leader, promoted telehealth benefits within their organisations. Champions identify, support, and empower staff to participate in the decision-making process to integrate telehealth services into routine practice for sustainable uptake (Collier et al., 2016; Deldar et al., 2016; Lucas, 2013; Wade et al., 2014). However, organisations that are dependent on sole clinical champions report slower uptake of telehealth services, and telehealth programmes fail when champions leave the organisation (Kho et al., 2020).

Promoting telehealth services increases access to use the technology (Hoffman, 2020), integrates services into routine practices, builds key relationships with stakeholders (Valenta et al., 2021), and facilitates wide scale adoption (Gray et al., 2011). Although some DHBs have an appointed telehealth leader and promote telehealth, the study suggests that DHBs need to identify and engage telehealth clinician champions (Gray et al., 2011; Wade & Eliott, 2012) and conduct telehealth evaluations to promote wide scale implementation within organisations. The potential to use telehealth technology comes from educational and organisational support.

The interviews found that staff are uncomfortable using the technology because they have no telehealth training. Formal training has been acknowledged as an important facilitator for implementation (Edirippulige & Armfield, 2017). The interview findings show that the DHBs need to allocate time and resources to train staff to develop a training methodology. However, even with healthcare workforce shortages (Ministry of Health, 2020b), staff in rural and remote areas understood telehealth's benefits and learned how to use the technology.

Inadequate training and a lack of time and resources for training may add workload pressures and increase stress levels, which can impede the uptake of telehealth services (James et al., 2021; Ministry of Health, 2020c; Wade & Eliott, 2012). From the interviews, it is clear that training resources require evidence-based guidelines to support technology usage. In other healthcare contexts lack of evidence-based resources has already been cited as a barrier to widespread sustainable uptake of telehealth services (Wade et al., 2016). Effectively trained staff have the skills to ensure smooth daily operations (James et al., 2021), implementing telehealth services to their full potential (Cheng et al., 2021; Pit & Bailey, 2018). Furthermore, interviewees express a need not just for formal core training but also for ongoing technical support (Brewster et al., 2014) that is simple to access (Ausenhus & Higgins, 2019). Simple telehealth education and training are also cited in the literature as an enabling factor in the uptake of sustainable services (James et al., 2021).

The surveys highlight that DHBs used VC least for connecting with disability services. The existing literature reports that the lesser usage of telehealth services for individuals with disabilities is due to a lack of clinician knowledge and confidence to prescribe using these services (Morris et al., 2019). Similar studies have stated that guidelines to use the technology and the availability of technical support for rapid issue resolution increase the uptake of telehealth services (Kho et al., 2020). More telehealth services were reported by the DHBs that had clinician training; however, although most DHBs have trained staff in telehealth usage, only around a third of DHBs report having protocols and guidelines for the operation of the services.

In addition, only one in three DHBs have an established method to count telehealth consultations. DHBs must provide adequate training and resources to support the workforce in new work practices to succeed (Hopp et al., 2006; Lucas, 2013). Guidelines, training, and technical support enhance telehealth uptake (Honey & Wright, 2018; Picot, 2000); however, most DHBs report not having clear guidelines, which may negatively influence adequate staff training and willingness to use the technology. Evidence-based guidelines established with local context and priorities indicate staff willingness (Ferlie et al., 2001) to use more telehealth services (Bhaskar et al., 2020).

The adopter system component of the NASSS framework reflects the importance of staff acceptance and training to address threats to using the technology and to enable adoption and sustainability (Greenhalgh et al., 2017). Along with the NASSS framework, the study suggests that DHBs' telehealth clinical champions create a positive environment to promote staff acceptance of the technology. With staff acceptance and champions to maintain motivation, educational and organisational support can integrate telehealth services into existing care pathways and practices to promote their sustainable uptake. However, the study suggests future research to investigate the challenges of identifying clinician champions in rural areas, given clinician shortages and high staff turnover (Ministry of Health, 2020b). Moreover, the role of clinical champions and impact on the uptake and sustainability of telehealth services needs to be studied further.

The study emphasises that staff training builds confidence and trust to address the fear of change and threats to using the technology. Evidence-based training and support ensure clinicians understand the limitations of telehealth and are confident in using the technology, which enables its adoption and continued use. Training programmes require guidelines and protocols that clarify the workflow, plans, and procedures to ensure consistency in daily operation with any changes to the workforce. The study recommends that DHBs invest in an adequate telehealth workforce and provide formal training and support to deliver high-quality, sustainable telehealth services. Moreover, the study emphasises establishing clinical governance to define the roles and responsibilities of staff and professional bodies to develop core training guidelines to promote nationwide telehealth training programmes for sustainable services uptake across DHBs. The key factors that contribute to the framework and affect the potential scalability across DHBs are staff acceptance, clinical telehealth champions, a dedicated and skilled telehealth workforce, core formal training, ongoing support and telehealth guidelines (Figure 20).

5.7 Technology Infrastructure

The technology infrastructure component of the framework discusses the physical factors impacting the availability, dependability, interoperability, and usability of technologies and how technology adds value to shape the scale-up and spread of telehealth services.

This study finds that VC is the widely used telehealth technology across the DHBs. The survey shows that DHBs predominantly use VC for clinical and non-clinical purposes, and they have grown considerably since the 2014 DHB stocktake (NZ Telehealth Forum and Resource Centre, 2014). Similar studies that measure implementation of telehealth across Australia also report VC as the most commonly used telehealth technology (NSW Ministry of Health 2016). The literature indicates, and our survey confirms, that VC infrastructure differs significantly across the DHBs, resulting in system incompatibilities and interoperability issues across and within them (South Island Alliance, 2019).

Interoperability is defined as “the ability of different information technology [IT] systems and software applications to communicate, exchange data, and use the information that has been exchanged” (HIMSS, 2021). Although most DHBs meet VC interoperability standards (Ministry of Health, 2019b), the multivendor VC environment led to VC incompatibility. Different infrastructures and processes are not always interoperable within and across DHBs. The recent gap analysis report published by the Ministry of Health stated that very little interoperability exists between the DHB systems, and this is consistent with the present survey findings (Ministry of Health, 2020a). The survey responses indicate that the adoption of software-based solutions has led to growth in VC usage since the 2014 stocktake report (NZ Telehealth Forum and Resource Centre, 2014). Although DHBs report system incompatibilities across and within their organisations, widespread adoption of VC is resulting in a significant increase in its use.

Nineteen DHBs report providing adequate helpdesk support, and 17 report having a booking system to use telehealth services across their organisations. The findings and existing literature suggest that the growth in VC usage is influenced by adequate helpdesk support (Valenta et al., 2021) and scheduling technology (Seto et al., 2019). The study also finds that DHBs' VC capacity is still a substantial challenge for the uptake of telehealth services. The need for VC capacity is growing, and not having enough interoperable systems across and within DHBs poses a significant challenge to sustainable telehealth services across the country. Adequate telehealth infrastructure is defined as providing appropriate facilities to conduct telehealth consultations, and such facilities should be compatible to use the technology (NSW Ministry of Health, 2015). Fifteen DHBs report not having adequate telehealth infrastructure and that this is a barrier to telehealth service uptake. Adequate availability of infrastructure is key in enabling sustainable telehealth services (Greenhalgh et al., 2017; James et al., 2021; Wade et al., 2014).

The dependability of telehealth technology addresses the technical features that impact its actual and perceived usability and appropriateness (Greenhalgh et al., 2017). The interviews and existing literature report that DHBs have old IT infrastructures, most of which are outdated (Ministry of Health, 2020d) and cannot easily support new technologies nor can they adapt to different clinical circumstances (Ministry of Health, 2020a). According to the interviewees, booking telehealth services is not easy on the existing systems, and this highlights the need for effective and simple scheduling solutions. Every interviewee stated that reliable, convenient and easy-to-use technology is crucial to implementing sustainable telehealth services. Such technology improves the efficiency, accessibility and speed of care (Zimlich, 2021) and encourages greater clinician and staff buy-in to integrate into routine business practices for sustainable uptake (James et al., 2021; Wade et al., 2014).

From the interviews, it is evident that patients living in rural and isolated regions are less likely to have reliable broadband internet and adequate bandwidth than those in urban areas. Inadequate and unreliable internet limits their ability to use telehealth services to access timely and appropriate care. The Broadband Strategy addresses access to fast internet connections, but this remains a challenge, causing significant issues for rural health providers (Technology Users Association New Zealand, 2020). Telehealth technology relies on the internet for audio and video connections; hence, access to a safe, secure, and reliable network is important (Moffatt & Eley, 2011). The majority of interview participants identify inadequate bandwidth and poor internet connections as barriers to the uptake of telehealth services. Unreliable internet is a barrier to smooth video services, and this can lead to privacy, security, and confidentiality issues (Caffery, Bradford, et al., 2017; Moffatt & Eley, 2011; Pare et al., 2016). The interviewees stressed that the cost of investing in reliable communications infrastructure remains a challenge for DHBs. National data show that significant gaps exist across New Zealand in accessing the internet, with several groups having relatively low access (Grimes & White, 2019); however, recent research that explores the use of free internet access at public libraries to address internet inequalities report that using these spaces for telehealth services is promising and suggests more research to guide its implementation (DeGuzman & Jain, 2020).

The technology dependability component of the NASSS framework (Greenhalgh et al., 2017) highlights that trustworthiness and data accuracy plays a significant role in decision-making to use the technology. The data generated by the old infrastructure across DHBs may not be accepted, trusted, or considered sufficient for decision-making, which poses a significant barrier to using telehealth technology. Despite the current efforts by DHBs to implement telehealth services, clinicians and patients may not be willing to use the technology due to the many frustrations associated with access and reliable connectivity. According to Collier et al. (2016), such frustrations with technological systems usually undermine the adoption of telehealth developments by making old ways more attractive. Based on the literature and our interviews, a more reliable communications infrastructure, including patient access to internet connections, is required to achieve the full potential of telehealth services.

The value proposition of the NASSS framework addresses the desirability, efficacy, safety and cost-effectiveness of new technology to add value to the uptake of services. Professional bodies linking organisations through shared governance, values, and goals have helped spread innovations (Meyer et al., 1997). These bodies require the capacity, commitment, technical capability, and skills to assist and facilitate collaboration across organisations (Lomas, 2000; Rogers, 2003).

More complex implementation processes require greater support from the inter-organisational network for success (Meyers et al., 1999; Valente, 2005). This study and the literature emphasise that DHBs need to establish a professional body to innovate a coordinated approach to update the infrastructure. Future studies should explore the development of a telehealth platform to add value, seamlessly connect systems, and to integrate to spread the scale-up of telehealth services across the country. This study highlights that DHBs should explore implementing a single, fully integrated, fit-for-purpose national infrastructure that would make the delivery of services more efficient (Ministry of Health, 2020a).

In line with the NASSS framework, this study highlights the need for that DHBs to upgrade their technology infrastructure and address procurement sustainability issues to enable increased use of telehealth technology (Heuer et al., 2019; Zimlich, 2021). Future studies should investigate the cost-effectiveness and benefits of new telehealth technologies integrated into routine practices. Most IT infrastructure across the DHBs' is outdated and inadequate and cannot support new technologies to align with clinical needs. In addition, the multivendor VC environment has resulted in interconnectivity issues across and within DHBs. Inadequate and unreliable internet across DHBs also limits their ability to use telehealth services to provide timely and appropriate care. The data generated may not be accepted and this slows service uptake.

Staff may also abandon telehealth technology that does not function well with existing IT systems. This study suggests that DHBs take a nationally coordinated approach to resolve interoperability, availability, and reliability issues to update IT infrastructure and telehealth platforms, which will provide value for money and meet VC interoperability standards. The key factors that influence potential scalability across DHBs are investing in upgraded and reliable IT infrastructure, availability of reliable and user-friendly telehealth technology, and interoperable telehealth technology (Figure 20). Nevertheless, success will be determined by government funding to invest in technology and the communications infrastructure throughout the country

5.8 Funding Considerations

This component of the framework describes the nature of the funding decisions. The study shows that significant growth in VC usage and inconsistent and insufficient infrastructure creates a challenge to the uptake of telehealth services across the DHBs.

Inconsistent infrastructure across and within DHBs requires an investment in technology. The funding challenges the interviewees' report are the initial infrastructure setup costs, recurring costs for licensing, internet access, and maintenance of technology. At present, the DHBs' telehealth funding is managed within the currently available funding that lacks ongoing investment.

In line with the literature, the interviewees note that DHBs should allocate ongoing funding to train and support a skilled workforce to enable a sustainable uptake of telehealth services across New Zealand (Jonnagaddala et al., 2021; Kim et al., 2020). DHBs may need to target ongoing funding to telehealth-enabled models of care that are most suited to deliver effective, efficient services that are most convenient for the patient in the right locations. DHBs may need to plan and invest in infrastructure and the workforce to ensure the scope of telehealth services to community and primary care providers. By collaboration with providers to bring care closer to patient homes and communities, DHBs can reduce the demand for specialist care.

A further finding of this study is that funding for telehealth services may be sustained only when there is a focus on achieving health outcomes by an integration of healthcare systems. The interview participants stated that nationwide telehealth outcomes should drive telehealth pilot initiatives to reduce the funding spent on more pilots. The organisation domain of the NASSS framework acknowledges that a lack of ongoing funding, investments in inconsistent infrastructure, and a lack of focus on achieving outcomes make the implementation of telehealth across DHBs complex. The interviews suggest that shifting telehealth funding models to achieve health outcomes can enable providers to manage costs more effectively while promoting quality care (Gregg, 2021). Targeted, sustainable funding should focus on services that use telehealth technology, and provide financial incentives for training and adopting telehealth services that can enable their spread (Tran, 2021).

Consistent with the literature, this study indicates that an effective, targeted funding framework to facilitate a national ICT infrastructure (Ministry of Health, 2021d) can enable better health outcomes for the country (Department of Prime Minister and Cabinet, 2021) and potentially scale-up sustainable telehealth services (Bauer et al., 2018; Ministry of Health, 2020b). There is a need for coordinated funding for a single infrastructure to ensure service integration across all regions and DHBs. Consistent systems can enable DHBs to create meaningful, evidence-based data, which adds value to business cases for telehealth-enabled models of care. In addition, nationwide health outcomes should drive telehealth initiatives, and DHBs must operate innovatively to use resources more effectively while promoting quality care. Further studies are required to investigate the impacts of a national funding framework that would integrate telehealth services in the health systems to facilitate a sustainable funding model across New Zealand. The key factors that contribute to the framework identified from the study and influence the potential scalability across DHBs are the initial and ongoing investment in telehealth infrastructure and the workforce, funding to telehealth-enabled models of care, and a sustainable funding model that underpins telehealth services (Figure 20).

5.9 External Environment (The Wider Context)

The external environment component of the framework reports addresses findings on the wider organisational and sociocultural context regarding regulatory, reimbursement, and professional support for implementing telehealth services. The external factors describe how the wider system shapes the context in which the technology is implemented and influences the potential for sustainable uptake across the DHBs. The influential external factors identified are regulation, networking with community providers, professional body support, reimbursement policies, patient factors, and telehealth evaluations.

The study reveals the importance of telehealth regulations to understand and overcome the legal issues limiting telehealth service uptake (Becker et al., 2019). Where providers understand the legal issues associated with patient safety, security, and privacy concerns can overcome limitations to provide safe and quality care using telehealth services (Australian Institute for Health and Welfare, 2020). This study did not find licensure and credentialing challenges in the New Zealand context in relation to the successful implementation of telehealth services (Silva et al., 2012; Uscher-Pines & Kahn, 2014).

Reimbursing telehealth services was a common sustainability challenge cited by providers across the literature (Tran, 2021) and more than half the DHBs report that a lack of appropriate reimbursement models is a challenge to uptake. The interviews suggest that procedures to clarify costs would enable a greater uptake of telehealth services by providers across primary care. The current reimbursement capabilities to support telehealth services have significant gaps, and funding models to incentivise telehealth providers must be designed, implemented, and sustained.

Interviewees also report that not everyone wanting telehealth services across rural areas can afford reliable internet and devices. Fifteen DHBs report that patients lack access to reliable devices and internet access and this too is a barrier to the uptake of telehealth services. Although patient willingness to use telehealth services is driven by personal choice (Wilson et al., 2021), not having access to reliable infrastructure and support to use devices may amplify inequalities in accessing health services (Wilson et al., 2021). Inequality in access to the internet and other digital facilities will exacerbate the existing gap in healthcare access, perhaps making access difficult and equitable for marginalised communities (Campbell et al., 2020; Zhou, 2020).

Both Māori and Pasifika populations have low access to digital devices (connectivity, affordability, and accessibility) compared to other ethnic groups in New Zealand (Grimes &

White, 2019). The 2019 report on digital inclusion and wellbeing in New Zealand carried out by Motu Economic and Public Policy Research (Motu) showed that Māori (12.23%) and Pasifika (10.55%) are the most likely populations not to have internet access (Grimes & White, 2019). Without access to digital technology, whānau cannot access a range of health and wellbeing benefits. With the onset of the pandemic in 2020, the impact has increased and extended the digital divide for Māori compared to the wider population. Whānau who did not have access to digital devices during the national lockdowns were isolated from their communities, missed out on essential information, and lost access to government services (NZ Digital Government, 2021). The importance of community involvement in all stages of the design and implementation of telehealth services contributes to successful telehealth uptake (Kidd et al., 2019).

Telehealth services provided during COVID-19 lockdowns, guided by the principles of te Tiriti o Waitangi, with a whānau ora approach, has seen significant uptake of telehealth services, which is improving equity across whānau who do not have access to health services (Ministry of Health, 2021a). Embedding matauranga Māori and implementing te Tiriti principles across the health and disability system requires a commitment to achieve Māori health equity (Tīaho Limited, 2020). Kaupapa Māori centric models of care used by the Māori providers are whānau centred and also underpinned by Māori principles and practices in health delivery (Tīaho Limited, 2020). The whānau ora approach is whānau centred and is used by Māori providers to promote a holistic community and individual development (Kidd et al., 2019).

The whānau ora approach to telehealth services across Māori and Pasifika communities enables greater participation to better access health services (Ministry of Health, 2021a). A whānau ora approach empowers whānau, which helps provides the right tools to use telehealth services and thus enables a greater participation and better access health services for both Māori and Pasifika communities (Ministry of Health, 2021a). Caffery et al. (2018) note that both the family-centred approach and also indigenous health workers are important factors to facilitate telehealth services that reflect culturally appropriate healthcare for Indigenous Australians.

The New Zealand Productivity Commission (2015) identified the Whānau Ora Navigators' approach as the key example of an integrated whānau centred approach. Whānau ora navigators work directly with families to help them identify their needs and take a whānau-centred approach to access health services (New Zealand Productivity Commission, 2015). In addition, this approach enables a culturally grounded, holistic approach to improve the wellbeing of whānau (family) and address the individual needs of family members within the context of whānau; however, the Whānau ora approach needs strong support from other government agencies to succeed (Office of the Auditor-General, 2015). Considering whānau ora approach central to the telehealth framework benefits individuals and their families to build relationships with the clinical team. In addition, trust and long-term relationships with Māori health providers facilitates better access for Māori into mainstream healthcare services (Kidd et al., 2019). The development of a telehealth strategy that upholds te Tiriti o Waitangi can contribute to achieving health equity in Māori (Health Quality & Safety Commission, 2019). An equitable approach must be institutionalised while implementing telehealth services because national and regional attempts to achieve health equity have focused on Māori but have paid less attention to Pasifika and Asian communities, disabled people, and those on a low income (Sheridan et al., 2011). Further research is needed to understand the impact of telehealth on Māori and Pasifika communities to access health care in New Zealand

Cultural competency is a requisite component for good health outcomes and plays a key role in achieving health equity for Māori (Medical Council of New Zealand, 2019; Sheridan et al., 2011). Telehealth services should be culturally tailored to fit the needs of

Māori and Pasifika communities to increase the reach and adoption and, therefore, improve health outcomes (Dawson et al., 2020). Māori and Pasifika health workers include the cultural competency programmes in telehealth services while engaging with Māori and Pasifika whānau (Ministry of Health, 2021a).

The Māori and Pasifika workforce plays an important role in addressing the social and cultural factors that impact health outcomes (Dawson et al., 2020; Ministry of Health, 2019a). The *Māori Health Workforce Report 2018* stated that only 7.2 % of the workforce in the DHBs are Māori (Te Rau Matatini, 2018), and Māori, moreover, doctors are under-represented at 3.5% compared to 14.7% of the non-Māori population (Goodyear, 2020). Training non-Māori health workers on cultural competency will support health workers equipped to create a culturally safe environment to improve Māori health (Tīaho Limited, 2020). Māori are grossly under-represented in Senior Medical Officer roles (Te Rau Matatini, 2018), and health systems require Māori leadership and partnerships working closely with whānau and communities to bring equity by design, thus ensuring Māori have improved access to care (Health Quality & Safety Commission, 2019).

DHBs need to take an equity-first approach to avoid the unintended consequences of further marginalising Māori and Pasifika communities (Gurney et al., 2021). Wide scale implementation of telehealth can occur when patients have the resources and support required to access it. The Sponsored Data Initiative started by the Ministry of Health in response to COVID-19 aimed to remove the cost barriers to access essential health and wellbeing information (Ministry of Health, 2021e). For telehealth services to be part of usual care, DHBs need to implement similar policies to achieve an equitable choice of service to access telehealth service. To enable equity in accessing telehealth services, DHBs should implement strategies to address the cost barriers and challenges associated with patient access to devices and the internet (Wilson et al., 2021). Much work is needed to consult and collaborate between DHBs to develop a shared commitment and understanding of telehealth-enabled models of care. This will link community health providers and consumers to access equitable services for sustainable uptake. Easy and convenient access to specialist care may drive more patients to use services who would not have received this care if telehealth had not been available (Licurse & Mehrotra, 2018). DHBs should use evidence-based guidelines and promote programmes that improve health literacy and decision-making to prevent an unnecessary increase in inappropriate telehealth consultations (Tran, 2021).

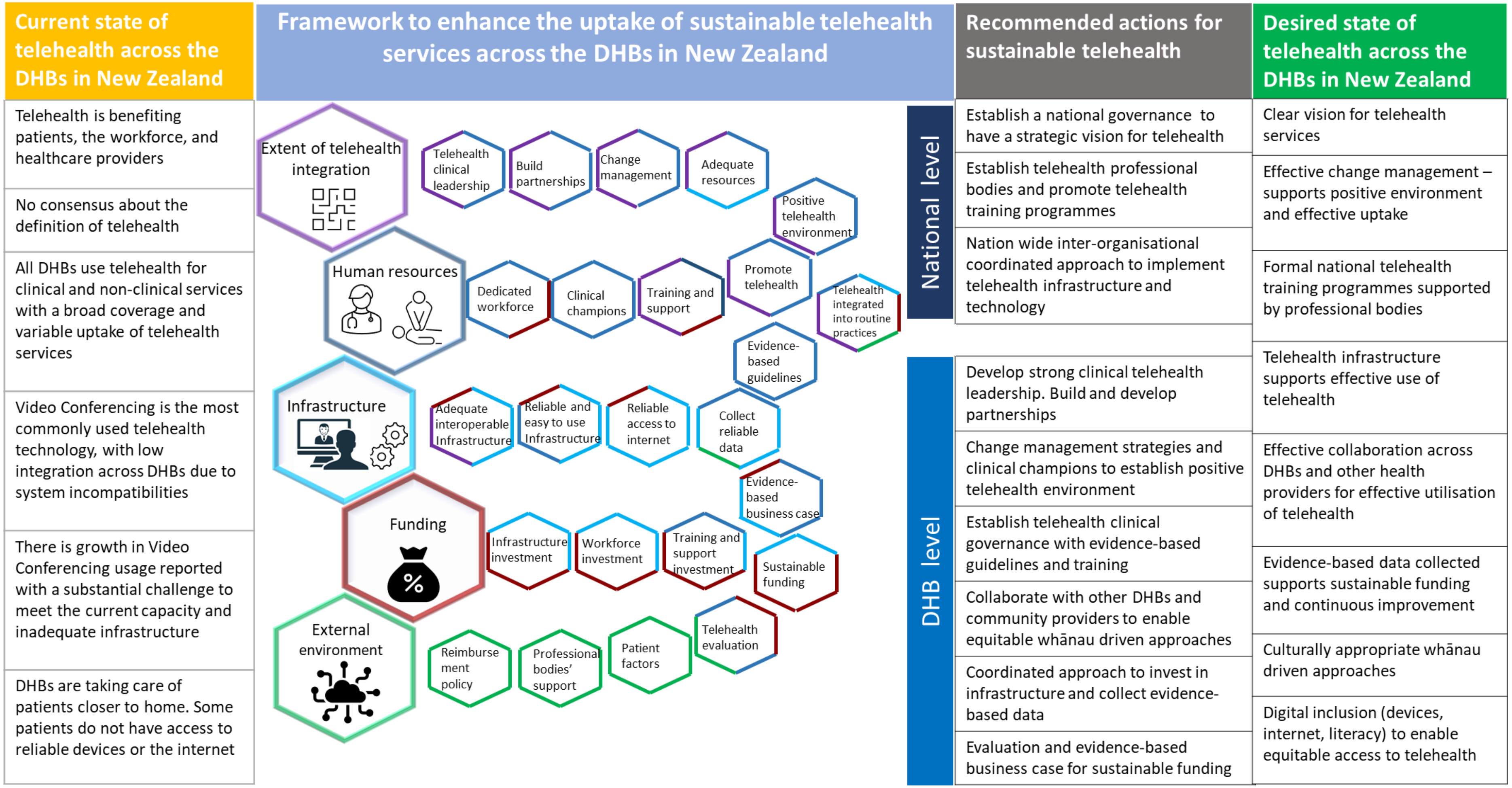
The literature suggests that telehealth evaluation is critical to promoting the use and spread of telehealth services (Alami et al., 2018; Alami et al., 2019; Tran, 2021). An established method to collect and connect telehealth datasets to health datasets will support more rigorous evidence-based practice and guidelines (Productivity Commission, 2015) to evaluate telehealth services' usage and impacts. Evaluation data from DHBs will be critical to ensure well-commissioned and effective delivery of services. More equitable health outcomes will develop evidence-based funding reforms and drive policy development to take up telehealth services (Adler-Milstein et al., 2014). Collaboration with organisations can enable appropriate data-sharing to evaluate the performance of telehealth activities across the country, supporting evidence-based funding reforms for developing health policy for potential increased service spread. The evaluation and monitoring of telehealth services can support alternative reimbursement models to incentivise services for potentially scalable uptake. Although international evaluations have shown a significant body of evidence on telehealth benefits (Shaw et al., 2018), more research is needed to explore the impacts of the culture and context on the quality of care, the health outcomes, and the equity, which is still lacking in New Zealand (Gurney et al., 2021).

The findings suggest that the involvement of professional bodies in establishing and publishing national policies to regulate telehealth programmes will enable potentially scalable uptake and spread of telehealth services across New Zealand. Studies on the wide scale adoption of telehealth services report the importance of key government bodies to support this (NSW Ministry of Health 2016; Vogel, 2020). Although this study did not explore the roles and responsibilities of the NZTLG to support and promote telehealth services, not clearly defining the roles and responsibilities of government bodies will be a barrier to the uptake of telehealth services across the country (NSW Ministry of Health 2016). Findings from the survey and the literature suggest a need for a central telehealth governance group to oversee and regulate the professional bodies responsible for implementing telehealth services across the country (Canadian Medical Association, 2019; Michael, 2011; NSW Ministry of Health 2016; Vogel, 2020). Greater involvement of the leadership group in telehealth will ensure the successful expansion of services across the country.

The final framework summarises the current state of telehealth services across the DHBs in New Zealand (Figure 20). The organisational level influential factors that enhance the uptake of telehealth services are categorised across the five main domains underpinned by the NASSS framework. The influential factors are represented in the honeycomb dimensional to describe how the organisational level factors are interrelated to the other domains. The final framework outlines the desired state of telehealth services across the DHBs in New Zealand by recommending actions at the national and DHB levels. The next chapter describes the recommended steps to achieve the desired state of telehealth services across the DHBs in New Zealand

Figure 20

Framework to Enhance the Uptake of Sustainable Telehealth Services across the DHBs in New Zealand



5.10 Future Directions and Recommendations

The COVID-19 pandemic has changed the landscape of healthcare delivery. The need for physical distancing while providing health services has been challenging and put significant pressure on healthcare providers (NZ Telehealth Forum, 2021). A significant rise in the use of telehealth services across the DHBs occurred as a consequence of COVID-19 and subsequent national lockdown in March 2020 (McBeth, 2020b). Healthcare providers had been shifting to a greater use of telehealth services, but they have become increasingly common during the pandemic (Medical Council of New Zealand, 2021).

The gap analysis that the Digital Enablement Programme notes that the mass shift to telehealth services across New Zealand when the pandemic began could not be sustained (Ministry of Health, 2020a). The rollout of the telehealth programme during the COVID-19 pandemic should, however, be supported and continued and so build a sustainable and quality service for the future (McBeth, 2020a). Improving and fine-tuning the funding models will lead to telehealth services that can be sustained through and beyond the pandemic (Ministry of Health, 2020b; Tran, 2021). The MOH funded several streams of digital enablement work to increase telehealth services when the COVID-19 pandemic began. With the extra funding, DHBs reported a tenfold increase in the uptake of telehealth services but struggled to sustain these services and there has been a marked decrease in the use of telehealth since the 2020 peak of the crisis (McBeth, 2020b). After the lifting of the Level 4 restrictions that severely limited non-essential activities, providers reported many challenges and so returned to in-person interactions (Association of Salaried Medical Specialists, 2020).

The fragmented uptake of telehealth services across the regions and clinical specialities reflects the complex fragmentation of the health system in New Zealand that fuels inequalities (Goodyear-Smith & Ashton, 2019). Findings from this study demonstrate that the fragmented uptake of telehealth services occurred across a number of DHBs and was based on short-term or regional strategies that helped improve the efficiency and overall quality of telehealth services. DHBs on their own cannot enable sustainable telehealth services, and a whole-system strategy is required to influence the use and spread of telehealth services (Association of Salaried Medical Specialists, 2020). There is the need for a clearly articulated telehealth vision and strategic direction to drive sustainable telehealth across New Zealand. This study addresses this need and from the finding the following recommendations can guide future implementation of telehealth services and the strategic direction of telehealth across the DHBs in New Zealand. Some recommendations from this study are for implementation at the national level and some are specific to the DHB level.

5.10.1 National-Level Recommendations

Central telehealth governance with a long-term strategic role:

- Strong central telehealth governance should be established to set a long-term strategic direction for implementing national telehealth services across the DHBs in New Zealand. Moreover, the central governance should utilise the existing regional and local governance arrangements across the DHBs to establish a clear long-term strategic direction for telehealth that drives equitable health outcomes for New Zealanders.
- The national governance should take a strong lead, ensuring that the vision of the national telehealth services is integrated across DHBs. Furthermore, a clear roadmap of how telehealth can be implemented effectively should be developed to ensure consistent progress across DHBs.

National telehealth services with a clear roadmap and an agreed definition of telehealth:

- An agreed definition of telehealth and a clear roadmap to guide national telehealth services across the country, with the flexibility of DHBs to implement and integrate telehealth services to suit local requirements, are needed.

A national telehealth framework to utilise, implement, promote, and monitor the national telehealth services:

- The national telehealth framework should establish professional bodies to carefully consider the national, regional, and local resources to implement sustainable telehealth services.
- The framework must also define and access the current telehealth infrastructure across the DHBs to invest in a single, simple, scalable, and long-term sustainable telehealth solution. A nationwide method to implement telehealth infrastructure includes a more reliable communications infrastructure, patient access to internet connections, and an upgrade of current technology infrastructure
- Evidence-based training programmes should be provided to promote telehealth services, whereas professional bodies and the New Zealand Telehealth Resource Centre should be provided funding to develop and promote formal telehealth programmes and guidelines nationwide.
- The progress of national telehealth services must be monitored and evaluated, and these services must be integrated into healthcare settings to achieve health outcomes and evidence-based strategic funding models for sustainable, coordinated telehealth programmes.

5.10.2 DHB-Level Recommendations

- A dedicated telehealth clinical leadership team that supports and connects clinical and operational leaders to support ongoing implementation is needed, enabling widespread uptake of sustainable telehealth services within the organisations.

- There is a need for more telehealth clinical leaders who can be strong telehealth champions to establish a positive telehealth environment and drive the uptake and implementation of telehealth services across the DHBs.
- Clinical governance should be established to support and promote clinician engagement and leadership.
- Collaborations with primary and secondary care providers are required to reduce the burden of cost on DHBs and bring care closer to home.
- In addition to collaborations with other DHBs, kaupapa Māori providers and community providers, a coordinated approach is needed to invest in infrastructure and collect evidence-based data for more sustainable funding for telehealth.
- Telehealth programmes should be monitored and evaluated to share lessons across the organisations for the wide-scale adoption of telehealth services in New Zealand.

5.11 Strengths and Limitations of This Study

The core novel contribution of this study is the development of a framework to assess and enhance the uptake of telehealth services across the DHBs in New Zealand. This framework is novel in terms of its scope and context, because it was developed according to the context and needs of the DHBs. As discussed in Chapter 2, the existing frameworks are neither suitable nor effective for assessing and enhancing the uptake of telehealth services across the DHBs in New Zealand. This study argues that, to the best of the researcher's knowledge, no other framework in New Zealand has been developed specifically for this purpose. The proposed framework is holistic since it covers all the factors at the organisational level within the scope of this research consistent with the context and needs of the DHBs in New Zealand. The researcher investigated the status of all DHBs and the factors at the organisational level that influence the uptake of telehealth services. Again, this study argues to the best of the researcher's knowledge, no comprehensive scientific study has investigated the organisational-level factors that influence the uptake of telehealth services across New Zealand DHBs at the national level. It would have been impossible for the researcher to conduct a national study, of this scale, across all the DHBs without the immense support of and working alongside the NZTLG.

Despite the substantial contributions of this study, the research outlines the following limitations.

Scope of the Thesis

This study is restricted in the focus of its scope, which is to develop a framework applicable to the DHBs in New Zealand. Within the scope of this research, the proposed framework thus considers only the factors at the *organisational level* that influence the scalability of telehealth services. This study, therefore, does not consider any factors at the individual level outside its scope.

The research is limited to organisational-level factors of DHBs, specifically the context and needs of DHBs. This proposed framework thus could not be applied to other settings nor provide a framework to implement telehealth within other countries. As discussed in Chapter 2, although most countries are expected to face some common challenges in implementing and scaling up telehealth services, each nation will have its own unique sets of factors related to characteristics such as the wider context (both macroeconomic and political), implementation strategies for telehealth, and resources available for implementation (e.g., infrastructure and funding).

This study evaluated the uptake of sustainable and scalable telehealth services both at the system and organisational but not the individual factors. However, future studies could explore the influential factors at the micro-level enabling a sustainable uptake of telehealth services.

The extant literature in telehealth is large, and the review analysis included studies published up to May 2018. Although the literature search strategy on Phase 01 followed a robust process, it is unlikely to be exhaustive and relevant literature may have been overlooked. In addition, it did not include studies that have emerged since the onset of the pandemic. Efforts to minimise this limitation have been made by including some more recent literature on telehealth, relevant to New Zealand and within the context of the pandemic, in the discussion chapter; however, this remains a limitation.

The survey data reflects a point in time (between October 2018 and March 2019) and is based on the participants' self-reported telehealth activity. The nominated key contact person from each DHB reported Part 1 of the Phase 02 survey. Because the nominated person may not know the complete telehealth environment across their DHB, the collected data were indicative rather than definitive. Participants from Phase 02 Part 2 may reflect a degree of self-selection bias because their participation in completing the survey was self-selection. However, the collected data were reliable for knowing the trends and telehealth environments across the DHBs, and helps inform future research to address the above limitations.

The respondents who were invited to participate in the Phase 03 interviews were limited to those who had completed the survey in Phase 02 of the study. The interview respondents' answers were opinions and limited to eight respondents. The sample was a relatively small targeted sample of respondents who indicated their interest in participating in the follow-up interviews. The sample size cannot be said to be based on a representative sample or may have exaggerated some findings from the study. Findings from Phase 03 of the study reflected respondents' perspectives and may not be able to be generalised in all contexts, but they have provided useful data about the factors that influence the uptake of telehealth services across the DHBs in New Zealand.

This research followed a concurrent triangulation design due to the time limitations of the research. Some of the interesting findings evolved from the phase 02 of the study could be explored further in phase 03 by following a sequential explanatory triangulation design.

Timeline of the Study

Timelines are essential for any doctoral thesis. The survey and interviews were conducted from October 2018 to August 2019. An unexpected and significant change to the telehealth environment materialised at the mid-point of the PhD candidature when the COVID-19 pandemic altered the landscape of healthcare delivery. Despite time and resource limitations, I was able to gather some related data to include in the discussion to reveal how the pandemic may influence the uptake of telehealth services. In 2020, the Ministry of Health provided NZD10.5 million to DHBs and GP practices that support locally-led telehealth services. With its Digital Enablement Programme, new telehealth programmes may have begun and become normal services, while a few programmes may have ended.

5.12 Future Research

This research has raised several new questions that must be investigated further. Overall, the study demonstrates the widespread development of telehealth services across the DHBs in New Zealand. More research must be conducted to analyse how digitisation in New Zealand could affect telehealth services in the future and how health services can be improved further. Given the context of COVID-19, the rapidly changing and unpredictable environment will increase the demand for telehealth services nationwide, and the need for high-quality research in telehealth must be prioritised. As noted in the discussion, telehealth research should focus on the impact of telehealth on health outcomes, reducing the inequalities in access to care. Future studies could explore how telehealth can best fit into New Zealand's healthcare systems for a wide scale integrated uptake to have an overall impact on the health outcomes, costs, and efficiency of the health system. Future research in telehealth, including the following proposals, could contribute to refining and updating the developed framework.

First, a follow-up assessment of the current state of telehealth services across the DHBs could indicate any changes in the influential factors that emerged during and as a consequence of the pandemic, enabling a sustainable uptake of telehealth services. Furthermore, the follow-up assessment could establish how processes and workflows for DHBs have been changed during the pandemic to integrate telehealth into routine practices. The influential factors could be explored further to draw more meaningful insights to revise the framework.

Second, the framework could be extended to develop a national telehealth framework that could cover the telehealth services across New Zealand, and which would begin considering the current state of telehealth services across primary care and non-governmental organisations. The revised, extended framework could inform the Ministry of Health to create and develop a systematic approach to implementing and spreading telehealth services nationwide. Future studies could explore the phases of work, immediate implementation phase (prepare stage) and progressive implementation phase (action phase) for implementing national telehealth services with the establishment of Health New Zealand.

Third, at the time of completing this thesis, my current work involves working on a project that aims to collaborate with DHBs to promote the uptake of telehealth services across the South Island. The project is intended to collaborate with kaupapa Māori providers to connect Māori whānau to access telehealth. The aim of the project is to understand the Māori experience of telehealth. The knowledge gained through conducting this study should enable the researcher to refine the framework from the equity perspective and whānau experiences to use telehealth services.

Finally, future studies could further explore the factors to refine the framework by investigating telehealth services outside New Zealand. Most value will be gained from comparing more-developed telehealth programmes in developed countries and unplanned telehealth systems in developing countries. Comparing these to investigate the implementation of telehealth services in other countries could contribute to developing the framework. The framework could also be tested on similar health systems which has similar size and cultural mix as New Zealand.

5.13 Conclusion

Increasingly New Zealand has been facing various challenges with access, utilisation, affordability, and uneven availability of staff to address equity in providing a high quality of care across the DHBs. These challenges included access to care, medical workforce shortages, as well as both an ageing population and an ageing health workforce. In addition, pertaining to substantial land area and widely dispersed population, rural regions across New Zealand have consistent and significant gaps between supply and demand across all major healthcare workforce. The difficulties that New Zealand's healthcare system were facing were exacerbated when the COVID-19 pandemic changed the landscape of healthcare delivery, posing significant pressure on healthcare providers. A significant rise in telehealth services was reported at the onset of the pandemic and the initial lockdowns but this could not be sustained and most of the services switched back to a traditional in-person delivery model. Telehealth services, if implemented successfully, can serve as a solution or at least as a part to reduce some of the major healthcare challenges in New Zealand.

Abandoned and failed telehealth services across various countries like Australia, The United Kingdom, The United States, and South Africa indicate the need for extensive research before, during, and after implementing a telehealth innovation or project. In such a situation, frameworks and models can identify factors to guide implementation or scaling up telehealth services. Several of the frameworks that are available are either country-specific or technology-specific. There are limitations in the applicability of existing frameworks because no framework had been developed specifically for New Zealand in the context of telehealth services. This research has developed a framework specifically for telehealth in the New Zealand context and the scalability of telehealth services across the DHBs in New Zealand. This study focused on providing insight into the status of telehealth services and environment in New Zealand and the key factors that enhance sustainable telehealth's scalability across the DHBs.

Establishing national governance for telehealth will direct and implement a long-term national strategy. National governance and strategy can guide DHBs to implement and integrate telehealth appropriate to the local context. A balance of national, regional, and local services establishing a collective and mutual agreement between all DHBs, community care providers, NGOs, and Kaupapa Māori providers can help deliver telehealth services that drive equitable health outcomes. Telehealth clinical leadership teams across DHBs must prepare the healthcare workforce for telehealth by bringing change and developing new routines as the integration of services with existing practices increases workload. In addition, adequate workforce and infrastructure resources are necessary for upscaling.

A dedicated workforce, including clinical telehealth leaders and teams, clinical champions, and evidence-based training, will enable staff acceptance and promote a positive telehealth environment. Professional bodies to develop and promote formal training programmes and clinical governance that supports clinician engagement and leadership are key factors driving telehealth spread across the DHBs. The study highlights issues related to telehealth infrastructure and the need for modern, efficient, reliable, and simple technology to update IT infrastructures to help collect reliable data. Good-quality data can enable evaluation that can, in turn, promote evidence-based guidelines for training a robust workforce.

A national approach to investing in infrastructure addresses interoperability issues and helps collect good-quality data, making a strong business case for more sustainable funding. Sustainable funding models are created by collaborations with primary and secondary care providers. Bringing care closer to patient homes can reduce the burden of cost on DHBs; however, lack of patient access to devices and internet in rural and some other areas is a barrier for deprived populations that will create a digital divide and increase inequalities in accessing care. Investment in equitable and sustainable approaches to bring whānau centred services should be a key priority for wide-scale implementation of telehealth. Finally, a national policy to establish national telehealth services is needed to integrate telehealth in health systems. The developed framework and the recommendations can support decision-makers and providers to use and spread sustainable telehealth services across the DHBs. With the unprecedented times of the pandemic, there is a continuing need for telehealth services to change and adapt, and the thesis sets out a clear direction for advancing the process.

References

Adler-Milstein, J., Kvedar, J., & Bates, D. W. (2014). Telehealth among US hospitals: several factors, including state reimbursement and licensure policies, influence adoption. *Health Affairs, 33*(2), 207-215. https://doi.org/10.1377/hlthaff.2013.1054

Agency for Healthcare Research and Quality. (2021). *Telehealth during COVID-19.* https://effectivehealthcare.ahrq.gov/sites/default/files/pdf/telehealth-COVID-19-protocol_0.pdf

Ahmadi, H., Nilashi, M., & Ibrahim, O. (2015). Organizational decision to adopt hospital information system: An empirical investigation in the case of Malaysian public hospitals. *International Journal of Medical Informatics 84*(3), 166-188. https://doi.org/10.1016/j.ijmedinf.2014.12.004

Ahmadi, H., Nilashi, M., Shahmoradi, L., & Ibrahim, O. (2017). Hospital Information system adoption: Expert perspectives on an adoption framework for Malaysian public hospitals. *Computers in Human Behavior, 67*, 161-189. https://doi.org/10.1016/j.chb.2016.10.023

Ajami, S., & Lamoochi, P. (2014). Use of telemedicine in disaster and remote places. *Journal of Education and Health Promotion, 3*. https://doi.org/10.4103/2277-9531.131886

Al-Qirim, N. A. (2005). Critical success factors for strategic telemedicine planning in New Zealand. *Telemedicine Journal and E-Health, 11*(5), 600-607. https://doi.org/10.1089/tmj.2005.11.600

Alaboudi, A. A. N. (2017). *JoinSTNassistant framework: An agile holistic framework for assisting decision in healthcare facilities to join Saudi telemedicine network* [Doctoral, Staffordshire University]. http://eprints.staffs.ac.uk/id/eprint/3805

Alami, H., Fortin, J.-P., Gagnon, M.-P., Pollender, H., Tetu, B., & Tanguay, F. (2018). The challenges of a complex and innovative telehealth project: a qualitative evaluation of the eastern Quebec telepathology network. *International Journal of Health Policy and Management*, *7*(5), 421. https://doi.org/10.15171/ijhpm.2017.106

Alami, H., Gagnon, M.-P., & Fortin, J.-P. (2019). Some multidimensional unintended consequences of telehealth utilization: a multi-project evaluation synthesis. *International Journal of Health Policy and Management*, *8*(6), 337-352. https://doi.org/10.15171/ijhpm.2019.12

Alami, H., Gagnon, M. P., Wootton, R., Fortin, J. P., & Zanaboni, P. (2017). Exploring factors associated with the uneven utilization of telemedicine in Norway: a mixed methods study. *BMC Medical Informatics and Decision Making, 17*(1), 180. https://doi.org/10.1186/s12911-017-0576-4

Ammenwerth, E., Gräber, S., Herrmann, G., Bürkle, T., & König, J. (2003). Evaluation of health information systems—problems and challenges. *International Journal of Medical Informatics, 71*(2), 125-135. https://doi.org/10.1016/s1386-5056(03)00131-x

Ammenwerth, E., Iller, C., & Mahler, C. (2006, 2006/01/09). IT-adoption and the interaction of task, technology and individuals: a fit framework and a case study. *BMC Medical Informatics and Decision Making*, *6*(1), 3. https://doi.org/10.1186/1472-6947-6-3

Aoki, N., Dunn, K., Fukui, T., Beck, J. R., Schull, W. J., & Li, H. K. (2004). Cost-effectiveness analysis of telemedicine to evaluate diabetic retinopathy in a prison population. *Diabetes Care*, *27*(5), 1095-1101. https://doi.org/10.2337/diacare.27.5.1095

Arkwright, B., Jones, J., Osborne, T., Glorioso, G., & Russo Jr, J. (2017). Telehealth governance: an essential tool to empower today's healthcare leaders. *Telehealth and Medicine Today, 2*(3). https://doi.org/10.30953/tmt.v2.12

Arkwright, B. T., Nash, M. L., & Light, M. E. (2019). Telehealth finance variables and successful business models. *Telehealth and Medicine Today, 4*(0), 33-59. https://doi.org/10.30953/tmt.v4.140

Association of Salaried Medical Specialists. (2017). *International medical migration: How can New Zealand compete as specialist shortages intensify?* https://www.asms.org.nz/wp-content/uploads/2017/02/IMG-Research-Brief_167359.5.pdf

Association of Salaried Medical Specialists. (2020). *ASMS Research brief telehealth*. https://www.asms.org.nz/wp-content/uploads/2020/09/Telehealth-research-brief-173982.pdf

Attewell, P. (1992). Technology diffusion and organizational learning: The case of business computing. *Organization Science, 3*(1), 1-19. https://doi.org/10.1287/orsc.3.1.1

Ausenhus, J. A., & Higgins, W. J. (2019). An evaluation of real-time feedback delivered via telehealth: Training staff to conduct preference assessments. *Behavior Analysis in Practice*, *12*(3), 643-648. https://doi.org/10.1007/s40617-018-00326-1

Australian Institute for Health and Welfare. (2020). *Health expenditure Australia 2018-19*. https://www.aihw.gov.au/getmedia/a5cfb53c-a22f-407b-8c6f-3820544cb900/aihw-hwe80.pdf.aspx?inline=true

Baker, J. (2012). The Technology–Organization–Environment framework. In Y. K. Dwivedi, M. R. Wade, & S. L. Schneberger (Eds.), *Information Systems Theory: Explaining and Predicting Our Digital Society* (Vol. 1, pp. 231-245). Springer. https://doi.org/10.1007/978-1-4419-6108-2_12

Barnett, M. L., Ray, K. N., Souza, J., & Mehrotra, A. (2018). Trends in Telemedicine Use in a Large Commercially Insured Population, 2005-2017. *JAMA*, *320*(20), 2147-2149. https://doi.org/10.1001/jama.2018.12354 %J JAMA

Barnett, T. E., Chumbler, N. R., Vogel, W. B., Beyth, R. J., Qin, H., & Kobb, R. (2006). The effectiveness of a care coordination home telehealth program for veterans with diabetes mellitus: a 2-year follow-up. *The American Journal of Managed Care*, *12*(8), 467-474.

Bauer, M. S., Krawczyk, L., Tuozzo, K., Frigand, C., Holmes, S., Miller, C. J., Abel, E., Osser, D. N., Franz, A., & Brandt, C. (2018). Implementing and sustaining team-based telecare for bipolar disorder: lessons learned from a model-guided, mixed methods analysis. *Telemedicine Journal and E-Health*, *24*(1), 45-53. https://doi.org/10.1089/tmj.2017.0017

Becker, C. D., Dandy, K., Gaujean, M., Fusaro, M., & Scurlock, C. (2019). Legal perspectives on telemedicine part 1: legal and regulatory issues. *The Permanente Journal*, *23*, 18-293. https://doi.org/10.7812/TPP/18-293

Bergmo, T. S. (2009). Can economic evaluation in telemedicine be trusted? A systematic review of the literature. *Cost Effectiveness and Resource Allocation*, *7*(1), 18. https://doi.org/10.1186/1478-7547-7-18

Bergmo, T. S. (2014). Using QALYs in telehealth evaluations: a systematic review of methodology and transparency. *BMC Health Services Research*, *14*(1), 332. https://doi.org/10.1186/1472-6963-14-332

Bhaskar, S., Bradley, S., Chattu, V. K., Adisesh, A., Nurtazina, A., Kyrykbayeva, S., Sakhamuri, S., Yaya, S., Sunil, T., & Thomas, P. (2020). Telemedicine across the globe-position paper from the COVID-19 pandemic health system resilience Program international consortium (Part 1). *Frontiers in Public Health*, *8*, 644. https://doi.org/10.3389/fpubh.2020.556720

Bjaalid, G., Laudal, T., & Mikkelsen, A. (2015). Hairy goals in change management: The case of implementing ICT-supported task planning in a hospital setting. *Journal of*

Change Management, *15*(4), 274-307. https://doi.org/10.1080/14697017.2015.1067243

Bouamrane, M.-M., Osbourne, J., & Mair, F. S. (2011). Understanding the implementation & integration of remote & tele-health services. An overview of normalization process theory. 5th International Conference on Pervasive Computing Technologies for Healthcare (PervasiveHealth) and Workshops, Dublin, Ireland.

Bouwman, H., Van Den Hooff, B., & Van De Wijngaert, L. (2005). *Information and communication technology in organizations: adoption, implementation, use and effects*. Sage. https://doi.org/10.4135/9781446211519

Bowling, A. (2005). Mode of questionnaire administration can have serious effects on data quality. *Journal of Public Health*, *27*(3), 281-291. https://doi.org/10.1093/pubmed/fdi031

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77-101. https://doi.org/10.1191/1478088706qp063oa

Brewster, L., Mountain, G., Wessels, B., Kelly, C., & Hawley, M. (2014). Factors affecting front line staff acceptance of telehealth technologies: A mixed-method systematic review. *Journal of Advanced Nursing*, *70*(1), 21-33. https://doi.org/10.1111/jan.12196

Broens, T. H., Huis in't Veld, R. M., Vollenbroek-Hutten, M. M., Hermens, H. J., van Halteren, A. T., & Nieuwenhuis, L. J. (2007). Determinants of successful telemedicine implementations: a literature study. *Journal of Telemedicine and Telecare*, *13*(6), 303-309. https://doi.org/10.1258/135763307781644951

Caffery, L. J., Bradford, N. K., Smith, A. C., & Langbecker, D. (2018, 2018/12/01). How telehealth facilitates the provision of culturally appropriate healthcare for Indigenous Australians. *Journal of Telemedicine and Telecare*, *24*(10), 676-682. https://doi.org/10.1177/1357633X18795764

Caffery, L. J., Bradford, N. K., Wickramasinghe, S. I., Hayman, N., & Smith, A. C. (2017, Feb). Outcomes of using telehealth for the provision of healthcare to Aboriginal and Torres Strait Islander people: a systematic review. *Australian & New Zealand Journal of Public Health, 41*(1), 48-53. https://doi.org/https://dx.doi.org/10.1111/1753-6405.12600

Caffery, L. J., Taylor, M., North, J. B., & Smith, A. C. (2017). Tele-orthopaedics: A snapshot of services in Australia. *Journal of Telemedicine and Telecare, 23*(10), 835-841. https://doi.org/10.1177/1357633X17732800

Campbell, J. D., Harris, K. D., & Hodge, R. (2001). Introducing telemedicine technology to rural physicians and settings. *The Journal of Family Practice*, *50*(5), 419-424.

Campbell, L. H., Smith, A. C., & Brooks, P. (2020). The NBN futures forum: Social and economic benefits of broadband for digital inclusion and telehealth. *Journal of Telecommunications and the Digital Economy, 8*(3), 18-32. https://doi.org/10.18080/jtde.v8n3.346

Canadian Medical Association. (2019). *Virtual care in Canada: Discussion paper*. https://www.cma.ca/sites/default/files/pdf/News/Virtual_Care_discussionpaper_v2EN.pdf

Carlin, A. (2016). Book review: Introducing research methodology: A beginner's guide to doing a research project.

Sociological Research Online, *21*(2), 288-289. https://doi.org/10.1177/136078041602100204

Cason, J. (2014). Telehealth: a rapidly developing service delivery model for occupational therapy. *International Journal of Telerehabilitation, 6*(1), 29-36. https://doi.org/10.5195%2Fijt.2014.6148

Chan, T. F. I., Borja, M., Welch, B., & Batiuk, M. E. (2016). Predicting the probability for faculty adopting an audience response system in higher education. *Journal of*

Information Technology Education: Research, *15*, 395-407. https://doi.org/10.28945/3548

Charness, N., Demiris, G., & Krupinski, E. (2012). *Designing telehealth for an aging population: A human factors perspective*. CRC Press.

Cheng, C., Humphreys, H., & Kane, B. (2021). Transition to telehealth: Engaging medical students in telemedicine healthcare delivery. *Irish Journal of Medical Science*, 1-18. https://doi.org/10.1007/s11845-021-02720-1

Coiera, E. (2013). Why e-health is so hard. *The Medical Journal of Australia*, *198*(4), 178-179. https://doi.org/10.5694/mja13.10101

Collier, A., Morgan, D. D., Swetenham, K., To, T. H., Currow, D. C., & Tieman, J. J. (2016). Implementation of a pilot telehealth programme in community palliative care: A qualitative study of clinicians' perspectives. *Palliative Medicine*, *30*(4), 409-417. https://doi.org/10.1177/0269216315600113

Connolly, K. K. (2013). *The digital divide and health outcomes: A teleretinal imaging study* University of Hawai'i at Manoa]. https://eric.ed.gov/?id=ED555080

Controller and Auditor-General. (2006). *Progress with priorities for health information management and information technology*. Office of the Auditor-General. Retrieved March 9, 2006, https://oag.parliament.nz/2006/wave/docs/wave.pdf

Cornwall, J., Davey, J. A., Raymont, A., Lynn, R., New Zealand Institute for Research on, A., New Zealand. Ministry of, H., & Health Services Research, C. (2003). *The impact of population ageing in New Zealand on the demand for health and disability support services, and workforce implications*. https://www.health.govt.nz/system/files/documents/publications/cornwallanddavey.pdf

Craig, J., & Petterson, V. (2005). Introduction to the practice of telemedicine. *Journal of Telemedicine and Telecare, 11*(1), 3-9. https://doi.org/10.1177/1357633X0501100102

Creswell, J. W. and V. L. P. Clark (2017). Designing and conducting mixed methods research, Sage publication.

Cresswell, K., & Sheikh, A. (2013). Organizational issues in the implementation and adoption of health information technology innovations: an interpretative review. *International Journal of Medical Informatics, 82*(5), e73-e86. https://doi.org/10.1016/j.ijmedinf.2012.10.007

Cresswell, K. M., Bates, D. W., & Sheikh, A. (2013). Ten key considerations for the successful implementation and adoption of large-scale health information technology. *Journal of the American Medical Informatics Association, 20*(e1), e9-e13. https://doi.org/10.1136/amiajnl-2013-001684

Crisp, N., & Chen, L. (2014). Global supply of health professionals. *The New England Journal of Medicine, 370*(10), 950-957. https://doi.org/10.1056/nejmra1111610

Cusack, C. M., Pan, E., Hook, J. M., Vincent, A., Kaelber, D. C., & Middleton, B. (2008). The value proposition in the widespread use of telehealth. *Journal of Telemedicine and Telecare, 14*(4), 167-168. https://doi.org/10.1258/jtt.2007.007043

Darkins, A., Kendall, S., Edmonson, E., Young, M., & Stressel, P. (2015). Reduced cost and mortality using home telehealth to promote self-management of complex chronic conditions: a retrospective matched cohort study of 4,999 veteran patients. *Telemedicine Journal and E-Health, 21*(1), 70-76. https://doi.org/10.1089/tmj.2014.0067

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319-340. https://doi.org/10.2307/249008

Dawson, A. Z., Walker, R. J., Campbell, J. A., Davidson, T. M., & Egede, L. E. (2020). Telehealth and indigenous populations around the world: a systematic review on current modalities for physical and mental health. *MHealth, 6*, 30-30. https://doi.org/10.21037/mhealth.2019.12.03

Day, K., Hunter, I., Rao, V., Russell, G., Roskvist, R., Moir, F., Gill, E., & van der Werf, B. (2021). Survey protocol for exploring video and phone use in Aotearoa New Zealand general practice: considerations for future telehealth. *BMJ Health & Care Informatics, 28*(1). https://doi.org/10.1136/bmjhci-2020-100309

De Veer, A. J., Fleuren, M. A., Bekkema, N., & Francke, A. L. (2011). Successful implementation of new technologies in nursing care: a questionnaire survey of nurse-users. *BMC Medical Informatics and Decision Making, 11*(1), 67. https://doi.org/10.1186/1472-6947-11-67

DeGuzman, P. B., & Jain, N. (2020). Can public libraries be leveraged to expand access to telehealth? Exploration of a strategy to mitigate rural health disparities. *MedRxiv*. https://doi.org/10.1101/2020.08.18.20177287

Deldar, K., Bahaadinbeigy, K., & Tara, S. M. (2016). Teleconsultation and clinical decision making: A systematic review. *Acta Informatica Medica, 24*(4), 286-292. https://doi.org/10.5455/aim.2016.24.286-292

DeLone, W. H., & McLean, E. R. (1992). Information systems success: The quest for the dependent variable. *Information Systems Research, 3*(1), 60-95. https://doi.org/10.1287/isre.3.1.60

Demiris, G., Charness, N., Krupinski, E., Ben-Arieh, D., Washington, K., Wu, J., & Farberow, B. (2010). The role of human factors in telehealth. *Telemedicine Journal and E-Health, 16*(4), 446-453. https://doi.org/10.1089/tmj.2009.0114

Denadai, R. (2020). COVID-19 pandemic as a driver for spreading virtual care globally: The future starts now. *Clinics (Sao Paulo, Brazil), 75*, e1967-e1967. https://doi.org/10.6061/clinics/2020/e1967

Dental Council. (2020). *Guidelines for using telehealth in dentistry during the COVID-19 alert level response*. https://www.dcnz.org.nz/assets/Uploads/COVID/Telehealth-during-COVID-19-response.pdf

Department of Prime Minister and Cabinet. (2021). *Building a stronger health and disability system that delivers for all New Zealanders*. https://dpmc.govt.nz/sites/default/files/2021-04/heallth-reform-white-paper-summary-apr21.pdf

DiCicco-Bloom, B., & Crabtree, B. F. (2006). The qualitative research interview. *Medical Education, 40*(4), 314-321. https://doi.org/10.1111/j.1365-2929.2006.02418.x

Doarn, C. R., Pruitt, S., Jacobs, J., Harris, Y., Bott, D. M., Riley, W., Lamer, C., & Oliver, A. L. (2014). Federal efforts to define and advance telehealth - a work in progress. *Telemedicine Journal and E-Health, 20*(5), 409-418. https://doi.org/10.1089/tmj.2013.0336

Donelan, K., Barreto, E. A., Sossong, S., Michael, C., Estrada, J. J., Cohen, A. B., Wozniak, J., & Schwamm, L. H. (2019). Patient and clinician experiences with telehealth for patient follow-up care. *The American Journal of Managed Care, 25*(1), 40-44.

Doorenbos, A. Z., Demiris, G., Towle, C., Kundu, A., Revels, L., Colven, R., Norris, T. E., & Buchwald, D. (2011). Developing the native people for cancer control telehealth network. *Telemedicine Journal and E-Health, 17*(1), 30-34. https://doi.org/10.1089/tmj.2010.0101

Drake, C., Lian, T., Cameron, B., Medynskaya, K., Bosworth, H. B., & Shah, K. (2021). Understanding telemedicine's “New Normal”: Variations in telemedicine use by specialty line and patient demographics. *Telemedicine and e-Health*. https://doi.org/10.1089/tmj.2021.0041

Ebad, R. (2013). Telemedicine: Current and future perspectives. *International Journal of Computer Science Issues, 10*(6), 242.

Edirippulige, S., & Armfield, N. (2017). Education and training to support the use of clinical telehealth: A review of the literature. *Journal of Telemedicine and Telecare, 23*(2), 273-282. https://doi.org/10.1177/1357633X16632968

Ekeland, A. G., Bowes, A., & Flottorp, S. (2010). Effectiveness of telemedicine: A systematic review of reviews. *International Journal of Medical Informatics, 79*(11), 736-771. https://doi.org/10.1016/j.ijmedinf.2010.08.006

Ellimoottil, C., An, L., Moyer, M., Sossong, S., & Hollander, J. E. (2018). Challenges and opportunities faced by large health systems implementing telehealth. *Health Affairs, 37*(12), 1955-1959. https://doi.org/10.1186/s12913-016-1436-0

Estabrooks, C. A., Derksen, L., Winther, C., Lavis, J. N., Scott, S. D., Wallin, L., & Profetto-McGrath, J. (2008). The intellectual structure and substance of the knowledge utilization field: A longitudinal author co-citation analysis, 1945 to 2004. *Implementation Science, 3*(1), 49. https://doi.org/10.1186/1748-5908-3-49

Fatehi, F., & Wootton, R. (2012, 2012/12/01). Telemedicine, telehealth or e-health? A bibliometric analysis of the trends in the use of these terms. *Journal of Telemedicine and Telecare, 18*(8), 460-464. https://doi.org/10.1258/jtt.2012.gth108

Ferlie, E., Gabbay, J., Fitzgerald, L., Locock, L., & Dopson, S. (2001). Evidence-based medicine and organisational change: an overview of some recent qualitative research. In *In L Ashburner (Ed.), Organisational behaviour and organisational studies in health care: Reflections on the future* (pp. 18-42). Palgrave Macmillan. http://eprints.soton.ac.uk/id/eprint/61776

Fisk, M., Livingstone, A., & Pit, S. W. (2020). Telehealth in the context of COVID-19: Changing perspectives in Australia, the United Kingdom, and the United States. *J Med Internet Res, 22*(6), e19264. https://doi.org/10.2196/19264

Gagnon, M.-P., Duplantie, J., Fortin, J.-P., & Landry, R. (2006). Implementing telehealth to support medical practice in rural/remote regions: what are the conditions for success. *Implementation Science, 1*, 18. https://doi.org/10.1186/1748-5908-1-18

Gagnon, M.-P., Godin, G., Gagné, C., Fortin, J.-P., Lamothe, L., Reinharz, D., & Cloutier, A. (2003). An adaptation of the theory of interpersonal behaviour to the study of telemedicine adoption by physicians. *International Journal of Medical Informatics, 71*(2), 103-115. https://doi.org/10.1016/s1386-5056(03)00094-7

Gagnon, M.-P., Lamothe, L., Fortin, J.-P., Cloutier, A., Godin, G., Gagné, C., & Reinharz, D. (2005). Telehealth adoption in hospitals: an organisational perspective. *Journal of Health Organization and Management, 19*(1), 32-56. https://doi.org/10.1108/14777260510592121

Gammon, D., Johannessen, L., Sørensen, T., Wynn, R., & Whitten, P. (2008). An overview and analysis of theories employed in telemedicine studies. *Methods of Information in Medicine, 47*, 260-269. https://doi.org/10.3414/ME0484

Gasteiger, N., Anderson, A., & Day, K. (2019, 12/01). Rethinking engagement: Exploring women's technology use during the perinatal period through a Kaupapa Māori consistent approach. *New Zealand College of Midwives Journal, 55*, 20-26. https://doi.org/10.12784/nzcomjnl55.2019.3.20-26

Gauld, R., Goldfinch, S., & Dale, T. (2006). *Dangerous enthusiasms: E-government, computer failure and information system development*. Otago University Press. https://doi.org/10.1177%2F0894439307307360

Giddens, A. (1984). *The constitution of society: Outline of the theory of structuration*. University of California Press. http://www.communicationcache.com/uploads/1/0/8/8/10887248/the_constitution_of_society.pdf

Gilson, L., & Raphaely, N. (2008). The terrain of health policy analysis in low and middle income countries: a review of published literature 1994–2007. *Health Policy and Planning, 23*(5), 294-307. https://doi.org/10.1093/heapol/czn019

Glasgow, R. E., Lichtenstein, E., & Marcus, A. C. (2003). Why don't we see more translation of health promotion research to practice? Rethinking the efficacy-to-effectiveness transition. *American Journal of Public Health, 93*(8), 1261-1267. https://doi.org/10.2105/ajph.93.8.1261

Goedken, C. C., Moeckli, J., Cram, P. M., & Reisinger, H. S. (2017). Introduction of Tele-ICU in rural hospitals: Changing organisational culture to harness benefits. *Intensive and Critical Care Nursing, 40*, 51-56. https://doi.org/10.1016/j.iccn.2016.10.001

Gogia, S. B., Maeder, A., Mars, M., Hartvigsen, G., Basu, A., & Abbott, P. (2016). Unintended consequences of tele health and their possible solutions. Contribution of the IMIA working group on telehealth. *Yearbook of Medical Informatics*(1), 41-46. https://doi.org/10.15265/iy-2016-012

Goodman, R. (1997). The strengths and difficulties questionnaire: A research note. *Journal of Child Psychology and Psychiatry, 38*(5), 581-586. https://doi.org/10.1111/j.1469-7610.1997.tb01545.x

Goodyear-Smith, F., & Ashton, T. (2019). New Zealand health system: universalism struggles with persisting inequities. *The Lancet, 394*(10196), 432-442. https://doi.org/10.1016/S0140-6736(19)31238-3

Goodyear, K. (2020). *Te Waipounamu South Island health workforce data*. https://www.sialliance.health.nz/wp-content/uploads/SI-Health-Workforce-Data-October-2020.pdf

Graham, M. L., Uesugi, K. H., Niederdeppe, J., Gay, G. K., & Olson, C. M. (2014). The theory, development, and implementation of an e-intervention to prevent excessive gestational weight gain: e-Moms Roc. *Telemedicine Journal and E-Health*, *20*(12), 1135-1142. https://doi.org/10.1089/tmj.2013.0354

Gray, L. C., Smith, A. C., Armfield, N. R., Travers, C., Croll, P., & Caffery, L. J. (2011). *Telehealth assessment - Final report*. https://www.telehealth.org.nz/assets/standards/UniQuest-Telehealth-Assessment-Report.pdf

Green, N. J. (2020). *Exploring the impact of telehealth videoconferencing services on work systems for key stakeholders in New Zealand : a sociotechnical systems approach : a thesis presented in partial fulfilment of the requirements for the degree of Doctor of Philosophy in Management at Massey University, Albany, New Zealand* [Doctoral, Massey University]. http://hdl.handle.net/10179/16468

Greenhalgh, T., Robert, G., Macfarlane, F., Bate, P., & Kyriakidou, O. (2004, 2004). Diffusion of innovations in service organizations: systematic review and recommendations. *The Milbank quarterly*, *82*(4), 581-629. https://doi.org/10.1111/j.0887-378x.2004.00325.x

Greenhalgh, T., Wherton, J., Papoutsi, C., Lynch, J., Hughes, G., A'Court, C., Hinder, S., Fahy, N., Procter, R., & Shaw, S. (2017). Beyond adoption: a new framework for theorizing and evaluating nonadoption, abandonment, and challenges to the scale-up, spread, and sustainability of health and care technologies. *J Med Internet Res*, *19*(11). https://doi.org/10.2196/jmir.8775

Greenspun, H., Korba, C., & Kane, A. (2016). *Realizing the potential of telehealth: Federal and state policy is evolving to support telehealth in value-based care models*.2018, from https://www2.deloitte.com/content/dam/Deloitte/us/Documents/life-sciences-health-care/us-lshc-realizing-the-potential-of-telehealth.pdf

Gregg, J. (2021). *Telehealth funding reforms must prioritise value for patients*. https://ahha.asn.au/news/telehealth-funding-reforms-must-prioritise-value-patients

Grimes, A., & White, D. (2019). *Digital inclusion and wellbeing in New Zealand*. https://motu-www.motu.org.nz/wpapers/19_17.pdf

Grol, R. P., Bosch, M. C., Hulscher, M. E., Eccles, M. P., & Wensing, M. (2007). Planning and studying improvement in patient care: the use of theoretical perspectives. *The Milbank quarterly, 85*(1), 93-138. https://doi.org/10.1111/j.1468-0009.2007.00478.x

Gurney, J., Fraser, L., Ikihele, A., Manderson, J., Scott, N., & Robson, B. (2021). Telehealth as a tool for equity: pros, cons and recommendations. *New Zealand Medical Journal, 134*(1530), 111-115.

Hailey, D., & Crowe, B. (2003). A profile of success and failure in telehealth–evidence and opinion from the successes and failures in telehealth conferences. *Journal of Telemedicine and Telecare, 9*(2_suppl), 22-24. https://doi.org/10.1258/135763303322596165

Hart, C. (1998). *Doing a literature review: Releasing the social science research imagination*. Sage.

Hasanain, R. A. (2015). *Development of an EMR implementation framework for public hospitals in Saudi Arabia* Queensland University of Technology]. https://eprints.qut.edu.au/91387/1/Rihab_Hasanain_Thesis.pdf

Health Information Strategy Steering Committee. (2005). *Health Information strategy for New Zealand 2005*. Ministry of Health.

https://www.health.govt.nz/system/files/documents/publications/health-information-strategy_0.pdf

Health Quality & Safety Commission. (2019). *A window on the quality of Aotearoa New Zealand's health care 2019*. https://www.hqsc.govt.nz/assets/Health-Quality-Evaluation/PR/Window_2019_web_final.pdf

Healy, J.-C. (2008). *Implementing e-Health in developing countries: Guidance and principles*. https://www.itu.int/ITU-D/cyb/app/docs/e-Health_prefinal_15092008.PDF

Henderson, C., Knapp, M., Fernández, J.-L., Beecham, J., Hirani, S. P., Cartwright, M., Rixon, L., Beynon, M., Rogers, A., & Bower, P. (2013). Cost effectiveness of telehealth for patients with long term conditions (Whole Systems Demonstrator telehealth questionnaire study): nested economic evaluation in a pragmatic, cluster randomised controlled trial. *The BMJ, 346*, f1035. https://doi.org/10.1136/bmj.f1035

Hendy, J., Chrysanthaki, T., Barlow, J., Knapp, M., Rogers, A., Sanders, C., Bower, P., Bowen, R., Fitzpatrick, R., & Bardsley, M. (2012). An organisational analysis of the implementation of telecare and telehealth: the whole systems demonstrator. *BMC Health Services Research, 12*(1), 403. https://doi.org/10.1186/1472-6963-12-403

Heuer, A., Hector, J. R., & Cassell, V. (2019). An update on telehealth in allied health and interprofessional care. *Journal of Allied Health, 48*(2), 140-147.

HIMSS. (2021). *Interoperability in Healthcare*. https://www.himss.org/resources/interoperability-healthcare

Hoffman, D. A. (2020). Increasing access to care: Telehealth during COVID-19. *Journal of Law and the Biosciences, 7*(1), lsaa043. https://doi.org/10.1093/jlb/lsaa043

Holden, R. J., & Karsh, B.-T. (2010). The technology acceptance model: its past and its future in health care. *Journal of Biomedical Informatics, 43*(1), 159-172. https://doi.org/10.1016/j.jbi.2009.07.002

Honey, M., & Wright, J. (2018). Nurses developing confidence and competence in telehealth: results of a descriptive qualitative study. *Contemporary Nurse*, *54*(4-5), 472-482. https://doi.org/10.1080/10376178.2018.1530945

Hopp, F., Whitten, P., Subramanian, U., Woodbridge, P., Mackert, M., & Lowery, J. (2006). Perspectives from the Veterans Health Administration about opportunities and barriers in telemedicine. *Journal of Telemedicine and Telecare, 12*(8), 404-409. https://doi.org/10.1258/135763306779378717

Imlach, F., McKinlay, E., Middleton, L., Kennedy, J., Pledger, M., Russell, L., Churchward, M., Cumming, J., & McBride-Henry, K. (2020). Telehealth consultations in general practice during a pandemic lockdown: survey and interviews on patient experiences and preferences. *BMC Family Practice, 21*(1), 1-14. https://doi.org/10.1186/s12875-020-01336-1

James, H. M., Papoutsi, C., Wherton, J., Greenhalgh, T., & Shaw, S. E. (2021). Spread, scale-up, and sustainability of video consulting in health care: Systematic review and synthesis guided by the NASSS framework. *J Med Internet Res*, *23*(1), e23775. https://doi.org/10.2196/23775

Janardhanan, L., Leow, Y. H., Chio, M. T., Kim, Y., & Soh, C. B. (2008). Experience with the implementation of a web-based teledermatology system in a nursing home in Singapore. *Journal of Telemedicine and Telecare, 14*(8), 404-409. https://doi.org/10.1258/jtt.2008.080105

Jasperson, J. S., Carter, P. E., & Zmud, R. W. (2005). A comprehensive conceptualization of post-adoptive behaviors associated with information technology enabled work systems. *MIS Quarterly*, *29*(3), 525-557. https://doi.org/10.2307/25148694

Javadi, M., & Zarea, K. (2016). Understanding thematic analysis and its pitfall. *Journal of Client Care*, *1*(1), 33-39. https://doi.org/10.15412/J.JCC.02010107

Jean, C., Jankovic, M., Stal-Le Cardinal, J., & Bocquet, J.-C. (2015). Predictive modelling of telehealth system deployment. *Journal of Simulation, 9*(2), 182-194. https://doi.org/10.1057/jos.2014.27

Jódar-Sánchez, F., Ortega, F., Parra, C., Gómez-Suárez, C., Jordán, A., Pérez, P., Bonachela, P., Leal, S., & Barrot, E. (2013). Implementation of a telehealth programme for patients with severe chronic obstructive pulmonary disease treated with long-term oxygen therapy. *Journal of Telemedicine and Telecare*, *19*(1), 11. https://doi.org/10.1177/1357633X20916567

Johnson, B. R., & Onwuegbuzie, A. (2004). Mixed methods research: A research paradigm whose time has come. *Educational Researcher*, *33*(7), 14-26. https://doi.org/10.3102%2F0013189X033007014

Johnson, T. P., & Wislar, J. S. (2012). Response rates and nonresponse errors in surveys. *Jama, 307*(17), 1805-1806. https://doi.org/10.1001/jama.2012.3532

Jong, M., Mendez, I., & Jong, R. (2019). Enhancing access to care in northern rural communities via telehealth. *International Journal of Circumpolar Health, 78*(2). https://doi.org/10.1080/22423982.2018.1554174

Jonnagaddala, J., Godinho, M. A., & Liaw, S.-T. (2021). From telehealth to virtual primary care in Australia? A Rapid scoping review. *International Journal of Medical Informatics*, *151*. https://doi.org/10.1016/j.ijmedinf.2021.104470

Joseph, V., West, R. M., Shickle, D., Keen, J., & Clamp, S. (2011). Key challenges in the development and implementation of telehealth projects. *Journal of Telemedicine and Telecare*, *17*(2), 71-77. https://doi.org/10.1258/jtt.2010.100315

Justinia, T. (2017). The UK's national programme for IT: Why was it dismantled? *Health Services Management Research*, *30*(1), 2. https://doi.org/10.1177/0951484816662492

Kairy, D., Lehoux, P., & Vincent, C. (2014). Exploring routine use of telemedicine through a case study in rehabilitation. *Pan American Journal of Public Health, 35*(5-6), 337-344.

Kamal, M. M., Bigdeli, A. Z., Themistocleous, M., & Morabito, V. (2015, 2015/03/01/). Investigating factors influencing local government decision makers while adopting integration technologies. *Information and Management*, *52*(2), 135-150. https://doi.org/10.1016/j.im.2014.06.007

Kane, G. C., & Labianca, G. (2011). IS avoidance in health-care groups: A multilevel investigation. *Information Systems Research*, *22*(3), 504-522. https://doi.org/10.1287/isre.1100.0314

Kaplan, B. (2001). Evaluating informatics applications—some alternative approaches: theory, social interactionism, and call for methodological pluralism. *International Journal of Medical Informatics, 64*(1), 39-56. https://doi.org/10.1016/S1386-5056(01)00184-8

Kayyali, R., Hesso, I., Mahdi, A., Hamzat, O., Adu, A., & Nabhani Gebara, S. (2017). Telehealth: misconceptions and experiences of healthcare professionals in England. *International Journal of Pharmacy Practice*, *25*(3), 203-209. https://doi.org/10.1111/ijpp.12340

Keene, L., Bagshaw, P., Nicholls, M. G., Rosenberg, B., Frampton, C. M., & Powell, I. (2016). Funding New Zealand's public healthcare system: time for an honest appraisal and public debate. *New Zealand Medical Journal, 129*(1435), 10-20. https://doi.org/12321

Kelders, S. M., Kok, R. N., Ossebaard, H. C., & Van Gemert-Pijnen, J. E. (2012). Persuasive system design does matter: a systematic review of adherence to web-based interventions. *J Med Internet Res*, *14*(6). https://doi.org/10.2196/jmir.2104

Kho, J., Gillespie, N., & Martin-Khan, M. (2020). A systematic scoping review of change management practices used for telemedicine service implementations. *BMC Health Services Research, 20*(1), 1-16. https://doi.org/10.1186/s12913-020-05657-w

Khoja, S., Durrani, H., Scott, R. E., Sajwani, A., & Piryani, U. (2013). Conceptual framework for development of comprehensive e-health evaluation tool. *Telemedicine Journal and E-Health, 19*(1), 48. https://doi.org/10.1089/tmj.2012.0073

Kidd, J., Raphael, D., Cassim, S., Black, S., Blundell, R., & Egan, R. (2019). Health service provider responses to indigenous peoples with cancer: An integrative review. *European Journal of Cancer Care, 28*(2), e12975. https://doi.org/10.1111/ecc.12975

Kidholm, K., Ekeland, A. G., Jensen, L. K., Rasmussen, J., Pedersen, C. D., Bowes, A., Flottorp, S. A., & Bech, M. (2012, Jan). A model for assessment of telemedicine applications: mast. *Int J Technol Assess Health Care, 28*(1), 44-51. https://doi.org/10.1017/s0266462311000638

Kierkegaard, P. (2015). Mapping telemedicine efforts: surveying regional initiatives in Denmark. *Telemedicine Journal and E-Health, 21*(5), 427-435. https://doi.org/10.1089/tmj.2014.0123

Kiernan, G. (2020). *Examining health funding in budget 2020 for the association of salaried medical specialists*. https://www.asms.org.nz/wp-content/uploads/2020/06/Examining-health-funding-in-Budget-2020-final.pdf

Kifle Gelan, M. (2006). *A theoretical model for telemedicine: Social and value outcomes in sub-Saharan Africa* Stockholm University]. https://www.dissertations.se/dissertation/d6f566239b/

Kim, J.-H., Desai, E., & Cole, M. B. (2020). *How the rapid shift to telehealth leaves many community health centers behind during the COVID-19 pandemic*. https://www.healthaffairs.org/do/10.1377/hblog20200529.449762/full/

Kim, J. A. (2010). Telehealth in the developing world. *Healthcare Informatics Research, 16*(2), 140-141. https://doi.org/10.4258/hir.2010.16.2.140

Kim, T. J., Arrieta, M. I., Eastburn, S. L., Icenogle, M. L., Slagle, M., Nuriddin, A. H., Brantley, K. M., Foreman, R. D., & Buckner, A. V. (2013). Post-disaster Gulf Coast recovery using telehealth. *Telemedicine Journal and E-Health, 19*(3), 200-210. https://doi.org/10.1089/tmj.2012.0100

King, A. (2003). *Launch of NZ Telepaediatric Service*. https://www.beehive.govt.nz/speech/launch-nz-telepaediatric-service

King, G., Richards, H., & Godden, D. (2007). Adoption of telemedicine in Scottish remote and rural general practices: a qualitative study. *Journal of Telemedicine and Telecare, 13*(8), 382-386. https://doi.org/10.1258/135763307783064430

Knight, S.-a., & Cross, D. (2012). Using contextual constructs model to frame doctoral research methodology. *International Journal of Doctoral Studies*. https://doi.org/10.28945/1559

Kolltveit, B. H., Gjengedal, E., Graue, M., Iversen, M. M., Thorne, S., & Kirkevold, M. (2017). Conditions for success in introducing telemedicine in diabetes foot care: a qualitative inquiry. *BMC Nursing, 16*, 2. https://doi.org/10.1186/s12912-017-0201-y

Korpelainen, E. (2011). *Theories of ICT system implementation and adoption: A critical review*. http://lib.tkk.fi/SCIENCE_TECHNOLOGY/2011/isbn9789526041506.pdf

Kowitlawakul, Y. (2011). The technology acceptance model: predicting nurses' intention to use telemedicine technology (eICU). *CIN: Computers, Informatics, Nursing, 29*(7), 411-418. https://doi.org/10.1097/NCN.0b013e3181f9dd4a

Koziatek, C., Klein, N., Mohan, S., Lakdawala, V., Swartz, J., Femia, R., Press, R., & Caspers, C. (2021). Use of a telehealth follow-up system to facilitate treatment and discharge of emergency department patients with severe cellulitis. *The American*

Journal of Emergency Medicine, *41*, 184-189.
https://doi.org/10.1016/j.ajem.2020.01.061

Kukafka, R., Johnson, S. B., Linfante, A., & Allegrante, J. P. (2003). Grounding a new information technology implementation framework in behavioral science: a systematic analysis of the literature on IT use. *Journal of Biomedical Informatics*, *36*, 218-227. https://doi.org/10.1016/j.jbi.2003.09.002

Labaree, D. R. V. (2017). *Organizing your social sciences research paper: Theoretical framework*. http://libguides.usc.edu/writingguide/theoreticalframework

Labaree, R. V. (2009). *Research guides: Organizing your social sciences research paper: Qualitative methods*. https://libguides.usc.edu/writingguide/qualitative

Larsen, S. B., Sørensen, N. S., Petersen, M. G., & Kjeldsen, G. F. (2016). Towards a shared service centre for telemedicine: Telemedicine in Denmark, and a possible way forward. *Health Informatics Journal*, *22*(4), 815-827. https://doi.org/10.1177/1460458215592042

Latour, B. (1999). *Pandora's hope: essays on the reality of science studies*. Harvard university press.

Lehoux, P., Sicotte, C., Denis, J.-L., Berg, M., & Lacroix, A. (2002). The theory of use behind telemedicine: how compatible with physicians' clinical routines? *Social Science & Medicine*, *54*(6), 889-904. https://doi.org/10.1016/s0277-9536(01)00063-6

Leon, N., Schneider, H., & Daviaud, E. (2012). Applying a framework for assessing the health system challenges to scaling up mHealth in South Africa. *BMC Medical Informatics and Decision Making*, *12*(1), 123-123. https://doi.org/10.1186/1472-6947-12-123

Leukel, J., Fernandes, J., Heidebrecht, A., & Schillings, S. (2012). Agency theory in e-healthcare and telemedicine: A literature study. In N. Wickramasinghe, R. Bali, R.

Suomi, & S. Kirn (Eds.), *Critical Issues for the Development of Sustainable E-health Solutions* (pp. 313-330). Springer. https://doi.org/10.1007/978-1-4614-1536-7_20

Levine, M., Richardson, J. E., Granieri, E., & Reid, M. C. (2014). Novel telemedicine technologies in geriatric chronic non-cancer pain: primary care providers' perspectives. *Pain Medicine, 15*(2), 206-213. https://doi.org/10.1111/pme.12323

Licurse, A. M., & Mehrotra, A. (2018, May 15). The effect of telehealth on spending: Thinking through the numbers. *Annals of Internal Medicine, 168*(10), 737-738. https://doi.org/10.7326/m17-3070

Lin, F.-R., & Hsieh, P.-S. (2014). Analyzing the sustainability of a newly developed service: An activity theory perspective. *Technovation, 34*(2), 113-125. https://doi.org/10.1016/j.technovation.2013.08.004

Lin, H.-F., & Lin, S.-M. (2008). Determinants of e-business diffusion: A test of the technology diffusion perspective. *Technovation, 28*(3), 135-145. https://doi.org/10.1016/j.technovation.2007.10.003

Lindsay, J. A., Day, S. C., Amspoker, A. B., Fletcher, T. L., Hogan, J., Day, G., Helm, A., Stanley, M. A., & Martin, L. A. (2019). Personalized implementation of video telehealth. *Psychiatric Clinics of North America, 42*(4), 563-574. https://doi.org/10.1016/j.psc.2019.08.001

Liu, J. X., Goryakin, Y., Maeda, A., Bruckner, T., & Scheffler, R. (2017). Global health workforce labor market projections for 2030. *Human Resources for Health, 15*(1), 11-11. https://doi.org/10.1186/s12960-017-0187-2

Lluch, M., & Abadie, F. (2013). Exploring the role of ICT in the provision of integrated care—evidence from eight countries. *Health Policy, 111*(1), 1-13. https://doi.org/10.1016/j.healthpol.2013.03.005

Lomas, J. (2000). Using 'linkage and exchange' to move research into policy at a Canadian foundation. *Health Affairs, 19*(3), 236-240. https://doi.org/10.1377/hlthaff.19.3.236

Lucas, J. A. (2013). Clinicians' perceptions of telemedicine: opportunities and barriers for Emergency Medicine.

Maguire, M., & Delahunt, B. (2017). Doing a thematic analysis: A practical, step-by-step guide for learning and teaching scholars. *All Ireland Journal of Higher Education, 9*(3).

Mair, F., Finch, T., May, C., Hiscock, J., Beaton, S., Goldstein, P., & McQuillan, S. (2007). Perceptions of risk as a barrier to the use of telemedicine. *Journal of Telemedicine and Telecare*, *13*(1_suppl), 38-39. https://doi.org/10.1258/135763307781645158

Mansouri-Rad, P., Mahmood, M. A., Thompson, S. E., & Putnam, K. (2013). Culture matters: Factors affecting the adoption of telemedicine. 2013 46th Hawaii International Conference on System Sciences, Wailea, HI, USA.

Marikyan, D. (2003). *Unified Theory of Acceptance and Use of Technology*. https://open.ncl.ac.uk/theory-library/unified-theory-of-acceptance-and-use-of-technology.pdf

Marques, A., Oliveira, T., Dias, S. S., & Martins, M. F. O. (2011). Medical records system adoption in European hospitals. *Electronic Journal of Information Systems Evaluation, 14*(1), 89-99. https://doi.org/10.1002/9781118093467.ch1

Mars, M. (2013). Telemedicine and advances in urban and rural healthcare delivery in Africa. *Progress in Cardiovascular Diseases, 56*(3), 326-335. https://doi.org/10.1016/j.pcad.2013.10.006

May, C., & Finch, T. (2009). Implementing, embedding, and integrating practices: an outline of normalization process theory. *Sociology, 43*(3), 535-554. https://doi.org/10.1177/0038038509103208

May, C., Gask, L., Atkinson, T., Ellis, N., Mair, F., & Esmail, A. (2001). Resisting and promoting new technologies in clinical practice: the case of telepsychiatry. *Social Science & Medicine*, *52*(12), 1889-1901. https://doi.org/10.1016/s0277-9536(00)00305-1

May, C., Harrison, R., Finch, T., MacFarlane, A., Mair, F., & Wallace, P. (2003). Understanding the normalization of telemedicine services through qualitative evaluation. *Journal of the American Medical Informatics Association*, *10*(6), 596-604. https://doi.org/10.1197/jamia.M1145

McBeth, R. (2020a). *$10.5m telehealth funding for DHBs and GPs*. https://www.hinz.org.nz/news/528250/10.5m-telehealth-funding-for-DHBs-and-GPs.htm

McBeth, R. (2020b). *Exclusive: Massive rise in telehealth at DHBs revealed*. https://www.hinz.org.nz/news/528449/EXCLUSIVE-Massive-rise-in-telehealth-at-DHBs-revealed.htm

McDowell, J. E., McClean, S., FitzGibbon, F., & Tate, S. (2015). A randomised clinical trial of the effectiveness of home-based health care with telemonitoring in patients with COPD. *Journal of Telemedicine and Telecare*, *21*(2), 80-87. https://doi.org/10.1177/1357633X14566575

McEvoy, R., Ballini, L., Maltoni, S., O'Donnell, C. A., Mair, F. S., & MacFarlane, A. (2014). A qualitative systematic review of studies using the normalization process theory to research implementation processes. *Implementation Science*, *9*(1), 2. https://doi.org/10.1186/1748-5908-9-2

McGoey, S. T., Oakley, A., & Rademaker, M. (2015). Waikato Teledermatology: a pilot project for improving access in New Zealand. *Journal of Telemedicine and Telecare*, *21*(7), 414-419. https://doi.org/10.1177/1357633X15583216

McKenna, R. (2010). Using information and communications technology to enable the exchange of information between New Zealand clinicians and health providers. *New Zealand Medical Journal, 123*(1314), 92-104.

Medical Council of New Zealand. (2016). *The New Zealand medical workforce in 2013 and 2014* https://www.mcnz.org.nz/assets/Publications/Workforce-Survey/868ebcb045/Workforce-Survey-2013-2014.pdf

Medical Council of New Zealand. (2019). *He Ara Hauora Māori: A pathway to Māori health equity*. https://www.mcnz.org.nz/assets/standards/6c2ece58e8/He-Ara-Hauora-Maori-A-Pathway-to-Maori-Health-Equity.pdf

Medical Council of New Zealand. (2020a). *Clarifying expectations around the delivery of telehealth in New Zealand*. https://www.mcnz.org.nz/about-us/news-and-updates/clarifying-expectations-around-the-delivery-of-telehealth-in-new-zealand/

Medical Council of New Zealand. (2020b). *Telehealth*. https://www.telehealth.org.nz/assets/2021/Regulations/Statement-on-telehealth.pdf

Medical Council of New Zealand. (2021). *Current: Clarifying expectations around the delivery of telehealth in New Zealand*. https://www.mcnz.org.nz/about-us/news-and-updates/clarifying-expectations-around-the-delivery-of-telehealth-in-new-zealand/

Menachemi, N., Burke, D. E., & Ayers, D. J. (2004). Factors affecting the adoption of telemedicine—a multiple adopter perspective. *Journal of Medical Systems, 28*(6), 617-632. https://doi.org/10.1023/b:joms.0000044964.49821.df

Meno, M., Abe, J., Fukui, J., Braun-Inglis, C., Pagano, I., & Acoba, J. (2021). Telehealth amid the COVID-19 pandemic: perception among Asian, Native Hawaiian and Pacific Islander cancer patients. *Future Oncology, 17*(23), 3077-3085. https://doi.org/10.2217/fon-2021-0136

Merchant, K. A., Ward, M. M., & Mueller, K. J. (2015). Hospital views of factors affecting telemedicine use. *Rural Policy Brief, 5*(2015), 1-4.

Meyer, M., Johnson, J. D., & Ethington, C. (1997). Contrasting attributes of preventive health innovations. *Journal of Communication, 47*(2), 112-131. https://doi.org/10.1111/j.1460-2466.1997.tb02709.x

Meyers, P. W., Sivakumar, K., & Nakata, C. (1999). Implementation of industrial process innovations: factors, effects, and marketing implications. *Journal of Product Innovation Management*, *16*(3), 295-311. https://doi.org/10.1016/S0737-6782(98)00044-7

Michael, G. (2011). *A national telehealth strategy for Australia – For discussion*. https://www.who.int/goe/policies/countries/aus__support_tele.pdf

Milat, A. J., Bauman, A., & Redman, S. (2015). Narrative review of models and success factors for scaling up public health interventions. *Implementation Science*, *10*(1), 113. https://doi.org/10.1186/s13012-015-0301-6

Milat, A. J., King, L., Bauman, A. E., & Redman, S. (2012). The concept of scalability: increasing the scale and potential adoption of health promotion interventions into policy and practice. *Health Promotion International*, *28*(3), 285-298. https://doi.org/10.1093/heapro/dar097

Miller, E. A. (2006). Solving the disjuncture between research and practice: Telehealth trends in the 21st century. *Health Policy, 82*(2), 133-141. https://doi.org/10.1016/j.healthpol.2006.09.011

Ministry of Health. (1996). *Health information strategy for the year 2000*. Ministry of Health. https://www.moh.govt.nz/notebook/nbbooks.nsf/0/90F5A5E0B3A319F94C2565D7000E2F09/$file/Health%20information%20strategy%202000.pdf

Ministry of Health. (2001). *From strategy to reality: The WAVE project*. https://www.moh.govt.nz/notebook/nbbooks.nsf/0/854A4886C085DD5ECC256B0A00061F93/$file/From%20strategy%20to%20reality.pdf

Ministry of Health. (2013a). *National Health IT plan update 2013/14*. Ministry of Health. https://www.health.govt.nz/system/files/documents/publications/national-health-it-plan-update-2013-14-nov13.pdf

Ministry of Health. (2013b). *New Zealand health survey. Annual update of key findings*. Ministry of Health. https://www.moh.govt.nz/NoteBook/nbbooks.nsf/0/C5E688F85B4C4165CC2582A9006DB410

Ministry of Health. (2016a). *Health of the health workforce 2015*. Ministry of Health https://www.health.govt.nz/system/files/documents/publications/health-of-health-workforce-2015-feb16_0.pdf

Ministry of Health. (2016b). *New Zealand Health Strategy: Future direction*. Ministry of Health. http://www.health.govt.nz/system/files/documents/publications/new-zealand-health-strategy-futuredirection-2016-apr16.pdf

Ministry of Health. (2017). *Maturity assessments*. https://www.health.govt.nz/our-work/digital-health/maturity-assessments

Ministry of Health. (2019a). *Health and independence report 2018*. https://www.health.govt.nz/system/files/documents/publications/health-and-independence-report-2018.pdf

Ministry of Health. (2019b). *Videoconferencing endpoint naming scheme HISO 10049.2:2019*. https://www.health.govt.nz/system/files/documents/publications/hiso-10049-2-2019-videoconferencing-endpoint-naming-scheme-jul19.pdf

Ministry of Health. (2020a). *Digital enablement oversight group*. https://www.health.govt.nz/system/files/documents/media/digital-enablement-gap-analysis-final.pdf

Ministry of Health. (2020b). *Health and Disability System Review*. https://systemreview.health.govt.nz/assets/Uploads/hdsr/health-disability-system-review-final-report.pdf

Ministry of Health. (2020c). *Health workforce funding review - Current state report*. https://www.health.govt.nz/system/files/documents/pages/health_workforce_funding_review_-_current_state_final_25_nov.pdf

Ministry of Health. (2020d). *The national asset management programme for district health boards. Report 1: The current-state assessment.* https://www.health.govt.nz/system/files/documents/publications/national-asset-management-programme-district-health-boards-report-current-state-assessment9june2020.pdf

Ministry of Health. (2021a). *Canterbury-based PHO uses whānau ora approach to support use of telehealth in rural communities*. https://www.health.govt.nz/our-work/digital-health/digital-enablement/digital-enablement-stories/canterbury-based-pho-uses-whanau-ora-approach-support-use-telehealth-rural-communities

Ministry of Health. (2021b). *District health boards*. https://www.health.govt.nz/new-zealand-health-system/key-health-sector-organisations-and-people/district-health-boards

Ministry of Health. (2021c). *Health workforce advisory board 2020: Annual report to the Minister of Health*. https://www.health.govt.nz/system/files/documents/publications/health-workforce-advisory-board-annual-report-11nov2020.pdf

Ministry of Health. (2021d). *Hira (National health information platform)*. https://www.health.govt.nz/our-work/digital-health/other-digital-health-initiatives/hira-national-health-information-platform

Ministry of Health. (2021e). *Sponsored data*. https://www.health.govt.nz/our-work/digital-health/other-digital-health-initiatives/sponsored-data

Moffatt, J., & Eley, D. (2011). Barriers to the up-take of telemedicine in Australia-a view from providers. *Rural and Remote Health Journal, 11*(1581), 1-6. https://doi.org/10.22605/RRH1581

Monitor. (2013). *Closing the NHS funding gap: how to get better value health care for patients*. .October 10, 2013, from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/284044/ClosingTheGap091013.pdf

Morgan, D. L. (2007). Paradigms lost and pragmatism regained: Methodological implications of combining qualitative and quantitative methods. *Journal of Mixed Methods Research, 1*(1), 48-76. https://doi.org/10.1177/2345678906292462

Morris, J., Jones, M., Thompson, N., Wallace, T., & DeRuyter, F. (2019). Clinician perspectives on mRehab interventions and technologies for people with disabilities in the United States: a national survey. *International Journal of Environmental Research and Public Health, 16*(21), 4220. https://doi.org/10.3390/ijerph16214220

Morrison, J. G. (2014). *Understanding the work of telehealth implementation using normalization process theory* Simon Fraser University]. https://summit.sfu.ca/item/14010

Moullin, J. C., Sabater-Hernández, D., Fernandez-Llimos, F., & Benrimoj, S. I. (2015). A systematic review of implementation frameworks of innovations in healthcare and resulting generic implementation framework. *Health Research Policy and Systems, 13*(1), 16-16. https://doi.org/10.1186/s12961-015-0005-z

Moura, L. (2016). The need for a strategy for telehealth. *Journal of the International Society for Telemedicine and EHealth, 4*(e2), 1-7.

Nana, G., Stokes, F., Molano, W., & Dixon, H. (2013). New Zealand nurses: workforce planning 2010-2035.

National Health Committee. (2010). *Rural Health - Challenges of distance opportunities for innovation*. https://www.moh.govt.nz/notebook/nbbooks.nsf/0/A06B332FA631554BCC2576C00008CE96/$file/rural-health-challenges-opportunities.pdf

National Health IT Board. (2010). *National Health IT plan*. National Health IT Board. https://www.health.govt.nz/system/files/documents/publications/national-health-it-plan-v11.pdf

National Health IT Board. (2015). *Stocktake of district health boards' telehealth activity*. http://healthitboard.health.govt.nz/health-it-groups/new-zealand-telehealth-forum/telehealth-resources-and-case-studies/stocktake

National Health IT Board. (2016). *Waikato DHB launches first NZ virtual health service*. http://healthitboard.health.govt.nz/news-events/news/waikato-dhb-launches-first-nz-virtual-health-service

Nerlich, M., Balas, E. A., Schall, T., Stieglitz, S.-P., Filzmaier, R., Asbach, P., Dierks, C., Lacroix, A., Watanabe, M., Sanders, J. H., Doarn, C. R., Merrell, R. C., & Subproject, G. G. H. A. (2002). Teleconsultation practice guidelines: report from G8 global health applications subproject 4. *Telemedicine Journal and E-Health, 8*(4), 411. https://doi.org/10.1089/15305620260507549

New Zealand Health IT. (2020). *The future of virtual health care in New Zealand*. https://www.telehealth.org.nz/assets/2020/NZVIG/Position-Paper-Future-of-Virtual-Health-Care-in-NZ-Nov-20-Published.pdf

New Zealand Productivity Commission. (2015). *Appendix C case study: Whānau Ora*. https://www.productivity.govt.nz/assets/Documents/6e7cb6e142/social-services-final-report-summary.pdf

Newman, L., Bidargaddi, N., & Schrader, G. (2016). Service providers' experiences of using a telehealth network 12 months after digitisation of a large Australian rural mental health service. *International Journal of Medical Informatics, 94*, 8-20. https://doi.org/10.1016/j.ijmedinf.2016.05.006

Nilsen, P. (2015). Making sense of implementation theories, models and frameworks. *Implementation Science 10*(1), 53-53. https://doi.org/10.1186/s13012-015-0242-0

NSW Ministry of Health. (2015). *Strategic review of telehealth in NSW: Final report*. https://www.telehealth.org.nz/assets/standards/strategic-review-of-telehealth-in-NSW1.pdf

NSW Ministry of Health (2016). *NSW health - Telehealth framework and implementation strategy*. https://www.health.nsw.gov.au/virtualcare/Publications/nsw-telehealth-framework.pdf

NZ Digital Government. (2021). *Report: Digital inclusion user insights - Māori*. https://www.digital.govt.nz/dmsdocument/177~report-digital-inclusion-user-insights-maori/html

NZ Telehealth Forum. (2021). *COVID-19 and telehealth provision for health providers*. https://www.telehealth.org.nz/assets/190322-NZTLG-COVID-19-Telehealth-Provision-for-Health-Providers.pdf

NZ Telehealth Forum and Resource Centre. (2014). *New Zealand Telehealth Stocktake*. https://www.telehealth.org.nz/assets/Uploads/nz-telehealth-stocktake-report-dhbs.pdf

NZ Telehealth Forum and Resource Centre. (2017a). *NZ Telehealth resource centre*. https://www.telehealth.org.nz/

NZ Telehealth Forum and Resource Centre. (2017b). *What is telehealth*. https://www.telehealth.org.nz/health-provider/what-is-telehealth/

NZ Telehealth Forum and Resource Centre. (2018a). *About Telehealth*. https://www.telehealth.org.nz/map/

NZ Telehealth Forum and Resource Centre. (2018b). *Video consultation*. https://www.telehealth.org.nz/health-provider/what-is-telehealth/video-consultation/

NZ Telehealth Forum and Resource Centre. (2019). *New Zealand telehealth survey 2019 District Health Boards*. https://www.telehealth.org.nz/assets/Uploads/191120-Telehealth-Report-2019-Short-Version-HiNZ-Web.pdf

NZ Telehealth Forum and Resource Centre. (2020). *A HiNZ special report into telehealth at New Zealand DHBs and the impact of COVID-19*. https://www.telehealth.org.nz/news/a-hinz-special-report-into-telehealth-at-new-zealand-dhbs-and-the-impact-of-covid-19/

NZ Telehealth Forum and Resource Centre. (2021). *Overview of New Zealand Telehealth Forum*. https://www.telehealth.org.nz/assets/2021/About-us/NZTF-Overview-Graphic-IncHeader-V5.pdf

OECD. (2019). *Recent trends in international mobility of doctors,nurses and medical students*. https://www.oecd-ilibrary.org/content/component/5ee49d97-en

OECD. (2020). *Contribution of migrant doctors and nurses to tackling COVID-19 crisis in OECD countries*. Retrieved May 13, 2020, 2020, from https://read.oecd-ilibrary.org/view/?ref=132_132856-kmg6jh3kvd&title=Contribution-of-migrant-doctors-and-nurses-to-tackling-COVID-19-crisis-in-OECD-countries

OECD. (2021). *Empowering the health workforce* OECD. Retrieved July 19, 2021, 2021, from https://www.oecd.org/health/health-systems/Empowering-Health-Workforce-Digital-Revolution.pdf

Office of the Auditor-General. (2015). *Whānau Ora: The first four years*. https://oag.parliament.nz/2015/whanau-ora/docs/whanau-ora.pdf

Oliveira, T., & Martins, M. F. (2011). Literature review of information technology adoption models at firm level. *The Electronic Journal of Information Systems Evaluation, 14*(1), 110-121.

Orruño, E., Gagnon, M. P., Asua, J., & Abdeljelil, A. B. (2011). Evaluation of teledermatology adoption by health-care professionals using a modified Technology Acceptance Model. *Journal of Telemedicine and Telecare, 17*(6), 303-307. https://doi.org/10.1258/jtt.2011.101101

Pare, G., Meyer, J., Trudel, M. C., & Tetu, B. (2016). Impacts of a large decentralized telepathology network in Canada. *Telemedicine and e-Health, 22*(3), 246-250. https://doi.org/10.1089/tmj.2015.0083

Parmelli, E., Flodgren, G., Beyer, F., Baillie, N., Schaafsma, M. E., & Eccles, M. P. (2011). The effectiveness of strategies to change organisational culture to improve healthcare performance: a systematic review. *Implementation Science*, *6*(1), 33. https://doi.org/10.1186/1748-5908-6-33

Patten, M. L. (2016). *Questionnaire research: A practical guide*. Routledge.

Pearce, C., & Bainbridge, M. (2014). A personally controlled electronic health record for Australia. *Journal of the American Medical Informatics Association, 21*(4), 707-713. https://doi.org/10.1136/amiajnl-2013-002068

Peddle, K. (2007). Telehealth in context: Socio-technical barriers to telehealth use in Labrador, canada. *Computer Supported Cooperative Work, 16*(6), 595-614. https://doi.org/10.1007/s10606-006-9030-3

Perednia, D. A., & Allen, A. (1995). Telemedicine technology and clinical applications. *The Journal of the American Medical Association, 273*(6), 483. https://doi.org/10.1001/jama.1995.03520300057037

Picot, J. (2000). Meeting the need for educational standards in the practice of telemedicine and telehealth. *Journal of Telemedicine and Telecare, 6*(Suppl 2), 59-62. https://doi.org/10.1258/1357633001935608

Pit, S. W., & Bailey, J. (2018). Medical students' exposure to, knowledge and perceptions of telehealth technology: is our future workforce ready to embrace telehealth service delivery? *Health Education in Practice: Journal of Research for Professional Learning, 1*(2), 55-72.

Plsek, P. E., & Greenhalgh, T. (2001). Complexity science: The challenge of complexity in health care. *British Medical Journal, 323*(7313), 625. https://doi.org/10.1136/bmj.323.7313.625

Prochaska, J. O., & Velicer, W. F. (1997). The transtheoretical model of health behavior change. *American Journal of Health Promotion, 12*(1), 38-48. https://doi.org/10.4278/0890-1171-12.1.38

Productivity Commission. (2015). *Efficiency in Health*. https://www.pc.gov.au/research/completed/efficiency-health/efficiency-health.pdf

Pumplun, L., Fecho, M., Wahl, N., Peters, F., & Buxmann, P. (2021, Oct 15). Adoption of machine learning systems for medical diagnostics in clinics: Qualitative interview study. *J Med Internet Res, 23*(10), e29301. https://doi.org/10.2196/29301

Quin, P. (2009). *New Zealand Health system reforms research paper 09/03* https://www.parliament.nz/resource/en-NZ/00PLSocRP09031/9772cc5da74650da549200e3627fef0ef46c5fa7

Radhakrishnan, K., Xie, B., & Jacelon, C. S. (2015). Unsustainable home telehealth: A Texas qualitative study. *The Gerontologist*, *56*(5), 830-840. https://doi.org/10.1093/geront/gnv050

Raison, N., Khan, M. S., & Challacombe, B. (2015). Telemedicine in surgery: What are the opportunities and hurdles to realising the potential? *Current Urology Reports*, *16*(7), 1-8. https://doi.org/10.1007/s11934-015-0522-x

Räsänen, P., Roine, E., Sintonen, H., Semberg-Konttinen, V., Ryynänen, O.-P., & Roine, R. (2006). Use of quality-adjusted life years for the estimation of effectiveness of health care: A systematic literature review. *Int J Technol Assess Health Care*, *22*(2), 235-241. https://doi.org/10.1017/S0266462306051051

Ray, K. N., Demirci, J. R., Bogen, D. L., Mehrotra, A., & Miller, E. (2015). Optimizing telehealth strategies for subspecialty care: Recommendations from rural pediatricians. *Telemedicine Journal and E-Health*, *21*(8), 622-629. https://doi.org/10.1089/tmj.2014.0186

Riley, W. T., Rivera, D. E., Atienza, A. A., Nilsen, W., Allison, S. M., & Mermelstein, R. (2011). Health behavior models in the age of mobile interventions: are our theories up to the task? *Translational Behavioral Medicine*, *1*(1), 53-71. https://doi.org/10.1007/s13142-011-0021-7

Rogers, E. M. (1995). *Diffusion of innovations* (Vol. 12).

Rogers, E. M. (2003). *Diffusion of innovations*. Free Press.

Rogers, E. M. (2004). A prospective and retrospective look at the diffusion model. *Journal of Health Communication*, *9*(S1), 13-19. https://doi.org/10.1080/10810730490271449

Rosenberg, B. (2018). *Did the 2018 budget provide enough for health?* https://union.org.nz/wp-content/uploads/2018/06/Did-Budget-2018-Provide-Enough-for-Health.pdf

Rufo, R. Z. (2012). Use of change management theories in gaining acceptance of telemedicine technology. *Critical Care Nursing Quarterly, 35*(4), 322-327. https://doi.org/10.1097/CNQ.0b013e3182684f67

Ruiz Morilla, M. D., Sans, M., Casasa, A., & Giménez, N. (2017, 2017/06/27). Implementing technology in healthcare: insights from physicians. *BMC Medical Informatics and Decision Making, 17*(1), 92. https://doi.org/10.1186/s12911-017-0489-2

Ryu, S. (2010). History of Telemedicine: Evolution, context, and transformation. *Healthcare Informatics Research*, 158-165. https://doi.org/10.4258/hir.2010.16.1.65

Sanders, C., Rogers, A., Bowen, R., Bower, P., Hirani, S., Cartwright, M., Fitzpatrick, R., Knapp, M., Barlow, J., & Hendy, J. (2012). Exploring barriers to participation and adoption of telehealth and telecare within the Whole System Demonstrator trial: a qualitative study. *BMC Health Services Research, 12*(1), 220. https://doi.org/10.1186/1472-6963-12-220

Sarah, D. (2021). *Rural health at a crossroads: tailoring local services for diverse communities*. ASMS. https://www.asms.org.nz/wp-content/uploads/2021/04/Rural-generalism.pdf

Scotland, J. (2012). Exploring the philosophical underpinnings of research: Relating ontology and epistemology to the methodology and methods of the scientific, interpretive, and critical research paradigms. *English Language Teaching, 5*(9), 9. https://doi.org/10.5539/elt.v5n9p9

Scott, A. C., McDonald, A., Roberts, T., Martin, C., Manns, T., Webster, M., Walker, D., Sandford, A., Scuffham, P., & Atherton, J. J. (2020). Cardiovascular telemedicine program in rural Australia. *The New England Journal of Medicine*, *383*(9), 883-884. https://doi.org/10.1056/NEJMc1913719

Scott, P. J., & Briggs, J. S. (2009). A pragmatist argument for mixed methodology in medical informatics. *Journal of Mixed Methods Research*, *3*(3), 223-241. https://doi.org/10.1177%2F1558689809334209

Scott, W. R. (2005). Institutional theory: Contributing to a theoretical research program. *Great Minds in Management: The Process of Theory Development*, *37*, 460-484.

Seto, E., Smith, D., Jacques, M., & Morita, P. P. (2019). Opportunities and challenges of telehealth in remote communities: case study of the Yukon telehealth system. *JMIR Medical Informatics*, *7*(4), e11353. https://doi.org/10.2196/11353

Shaw, T., Hines, M., & Kielly-Carroll, C. (2018). *Impact of digital health on the safety and quality of health care*. https://apo.org.au/sites/default/files/resource-files/2018-01/apo-nid245811.pdf

Sheridan, N. F., Kenealy, T. W., Connolly, M. J., Mahony, F., Barber, P. A., Boyd, M. A., Carswell, P., Clinton, J., Devlin, G., Doughty, R., Dyall, L., Kerse, N., Kolbe, J., Lawrenson, R., & Moffitt, A. (2011, 2011/10/20). Health equity in the New Zealand health care system: a national survey. *International Journal for Equity in Health*, *10*(1), 45. https://doi.org/10.1186/1475-9276-10-45

Shi, L. (2012). The impact of primary care: a focused review. *Scientifica (Cairo)*, *2012*, 432892. https://doi.org/10.6064/2012/432892

Shore, J. (2015). The evolution and history of telepsychiatry and its impact on psychiatric care: Current implications for psychiatrists and psychiatric organizations. *International Review of Psychiatry*, *27*(6), 469-475. https://doi.org/10.3109/09540261.2015.1072086

Silva, G. S., Farrell, S., Shandra, E., Viswanathan, A., & Schwamm, L. H. (2012). The status of telestroke in the United States: a survey of currently active stroke telemedicine programs. *Stroke, 43*(8), 2078-2085. https://doi.org/10.1161/STROKEAHA.111.645861

Simon, S. R., Keohane, C. A., Amato, M., Coffey, M., Cadet, B., Zimlichman, E., & Bates, D. W. (2013). Lessons learned from implementation of computerized provider order entry in 5 community hospitals: a qualitative study. *BMC Medical Informatics and Decision Making, 13*(1), 67-67. https://doi.org/10.1186/1472-6947-13-67

Singh, R., Mathiassen, L., Stachura, M. E., & Astapova, E. V. (2010). Sustainable rural telehealth innovation: a public health case study. *Health Services Research, 45*(4), 985-1004. https://doi.org/10.1111/j.1475-6773.2010.01116.x

Sittig, D. F., & Ash, J. S. (2011). On the importance of using a multidimensional sociotechnical model to study health information technology. *Annals of Family Medicine, 9*(5), 390-391. https://doi.org/10.1370/afm.1291

Slotnick, H. B., & Shershneva, M. B. (2002). Use of theory to interpret elements of change. *Journal of Continuing Education in the Health Professions, 22*(4), 197-204. https://doi.org/10.1002/chp.1340220403

Smaradottir, B., Gerdes, M., Martinez, S., & Fensli, R. (2016). The EU-project United4Health: User-centred design of an information system for a Norwegian telemedicine service. *Journal of Telemedicine and Telecare, 22*(7), 422-429. https://doi.org/10.1177/1357633X15615048

Smith, A. C., Thomas, E., Snoswell, C. L., Haydon, H., Mehrotra, A., Clemensen, J., & Caffery, L. J. (2020). Telehealth for global emergencies: Implications for coronavirus disease 2019 (COVID-19). *Journal of Telemedicine and Telecare, 26*(5), 309-313. https://doi.org/10.1177/1357633X20916567

Snoswell, C. L., Taylor, M. L., Comans, T. A., Smith, A. C., Gray, L. C., & Caffery, L. J. (2020). Determining if telehealth can reduce health system costs: Scoping review. *J Med Internet Res, 22*(10), e17298. https://doi.org/10.2196/17298

Sood, S. P., Negash, S., Mbarika, V. W. A., Kifle, M., & Prakash, N. (2007). Differences in public and private sector adoption of telemedicine: Indian case study for sectoral adoption. *Studies in Health Technology and Informatics, 130*, 257.

Sorensen, T., Dyb, K., Rygh, E., Salvesen, R., & Thomassen, L. (2014). A qualitative description of telemedicine for acute stroke care in Norway: technology is not the issue [Research Support, Non-U.S. Gov't]. *BMC Health Services Research, 14*, 643. https://doi.org/0.1186/s12913-014-0643-9

South Island Alliance. (2019). *Telehealth strategy for South Island DHBs*. https://www.sialliance.health.nz/wp-content/uploads/South-Island-Telehealth-Strategy-FINAL-v7_4-August-2019.pdf

South Island Alliance. (2020). *South Island Regional Services Plan 2020 - 2023*. https://www.sialliance.health.nz/wp-content/uploads/SIRSP-2020-23-Final-signed.pdf

Spaulding, R. J., Russo, T., Cook, D. J., & Doolittle, G. C. (2005). Diffusion theory and telemedicine adoption by Kansas health-care providers: critical factors in telemedicine adoption for improved patient access. *Journal of Telemedicine and Telecare, 11*(1_suppl), 107-109. https://doi.org/10.1258/1357633054461903

Speyer, R., Denman, D., Wilkes-Gillan, S., Chen, Y., Bogaardt, H., Kim, J., Heckathorn, D., & Cordier, R. (2018). Effects of telehealth by allied health professionals and nurses in rural and remote areas: a systematic review and meta-analysis. *Journal of Rehabilitation Medicine, 50*(3), 225-235. https://doi.org/10.2340/16501977-2297

Strehle, E. M., & Shabde, N. (2006). One hundred years of telemedicine: does this new technology have a place in paediatrics? *Archives of Disease in Childhood, 91*(12), 956-959. https://doi.org/10.1136/adc.2006.099622

Sundin, P., Callan, J., & Mehta, K. (2016). Why do entrepreneurial mHealth ventures in the developing world fail to scale? *Journal of Medical Engineering and Technology, 40*(7-8), 444-457. https://doi.org/10.1080/03091902.2016.1213901

Suter, P., Suter, W. N., & Johnston, D. (2011). Theory-based telehealth and patient empowerment. *Population Health Management*, *14*(2), 87-92. https://doi.org/10.1089/pop.2010.0013

Swanson, R. A., & Chermack, T. J. (2013). *Theory building in applied disciplines*. Berrett-Koehler Publishers. https://www.bkconnection.com/static/Theory_Building_EXCERPT.pdf

Taylor, J., Coates, E., Brewster, L., Mountain, G., Wessels, B., & Hawley, M. S. (2015). Examining the use of telehealth in community nursing: identifying the factors affecting frontline staff acceptance and telehealth adoption. *Journal of Advanced Nursing*, *71*(2), 326-337. https://doi.org/10.1111/jan.12480

Taylor, J., Coates, E., Wessels, B., Mountain, G., & Hawley, M. S. (2015, 2015/12/01). Implementing solutions to improve and expand telehealth adoption: participatory action research in four community healthcare settings. *BMC Health Services Research*, *15*(1), 529. https://doi.org/10.1186/s12913-015-1195-3

Te Rau Matatini. (2018). *Everyone counts Māori health workforce report 2018*. https://terauora.com/wp-content/uploads/2019/05/Te-Iti-me-te-Rahi-Survey-Report-January2019-FINAL5.pdf

Technology Users Association New Zealand. (2020). *Rural connectivity symposium 2020 communique*. https://tuanz.org.nz/wp-content/uploads/2021/02/Rural-Symposium-Communique-2020-Final.pdf

Thapa, D., & Sein, M. K. (2018). Trajectory of Affordances: Insights from a case of telemedicine in Nepal. *Information Systems Journal*, *28*(5), 796-817. https://doi.org/10.1111/isj.12160

The Royal New Zealand College of General Practitioners. (2017). *Telehealth and technology-based health services in primary care*. https://www.rnzcgp.org.nz/gpdocs/New-website/Advocacy/Position-Statements/Telehealth-and-technology-based-health-services-in-primary-care-updated-....pdf

The Treasury. (2014). *2014 Briefings to incoming Ministers* https://www.treasury.govt.nz/publications/bim/briefing-incoming-minister-health-2014

Theodore, B. R., Whittington, J., Towle, C., Tauben, D. J., Endicott-Popovsky, B., Cahana, A., & Doorenbos, A. Z. (2015). Transaction cost analysis of in-clinic versus telehealth consultations for chronic pain: Preliminary evidence for rapid and affordable access to interdisciplinary collaborative consultation. *Pain Medicine*, *16*(6), 1045-1056. https://doi.org/10.1111/pme.12688

Thomas, G., Reddy, S., & Oliel, S. (2013). *Global health workforce shortage to reach 12.9 million in coming decades*. World Health Organisation. https://apps.who.int/mediacentre/news/releases/2013/health-workforce-shortage/en/index.html

Tīaho Limited. (2020). *Kaupapa Māori evaluation of the CCDHB health care home programme*. https://www.ccdhb.org.nz/about-us/integrated-care-collaborative-alliance/health-care-home/tiaho-limited-ccdhb-health-care-home-kaupapa-maori-evaluation-final-report-22july2020.pdf

Tongco, M. D. C. (2007). Purposive sampling as a tool for informant selection. *Ethnobotany Research and Applications, 5*, 147-158.

Tran, M. (2021). *Towards a sustainable funding model for telehealth in Australia*. https://ahha.asn.au/system/files/docs/publications/deeble_issues_brief_no_43.towards_a_sustainable_funding_model_for_telehealth_in_australia.pdf

Tsiknakis, M., & Kouroubali, A. (2009). Organizational factors affecting successful adoption of innovative eHealth services: A case study employing the FITT framework. *International Journal of Medical Informatics*, *78*(1), 39-52. https://doi.org/10.1016/j.ijmedinf.2008.07.001

Uscher-Pines, L., & Kahn, J. M. (2014). Barriers and facilitators to pediatric emergency telemedicine in the United States. *Telemedicine Journal and E-Health, 20*(11), 990-996. https://doi.org/10.1089/tmj.2014.0015

Valenta, S. R., Glanville, M., & Sederstrom, E. (2021). Telehealth development, implementation, and sustainability challenges: An inroduction into the telehealth service implementation model. In D. W. Ford & S. R. Valenta (Eds.), *An inroduction into the telehealth Telehealth service Service implementation Implementation modelModel (TSIM™)* (pp. 61-69). Springer International Publishing. https://doi.org/10.1007/978-3-030-64050-7_4

Valente, T. W. (2005). Network models and methods for studying the diffusion of innovations. *Models and Methods in Social Network Analysis, 28*, 98-116. https://doi.org/10.1017/CBO9780511811395.006

Van Dyk, L. (2014). A review of telehealth service implementation frameworks. *International Journal of Environmental Research and Public Health, 11*(2), 1279-1298. https://doi.org/10.3390/ijerph110201279

Venkatesh, V., Thong, J. Y., & Xu, X. (2016). Unified theory of acceptance and use of technology: a synthesis and the road ahead. *Journal of the Association for Information Systems, 17*(5). https://doi.org/10.17705/1jais.00428

Venkatraman, S., Sundarraj, R. P., & Seethamraju, R. (2015). Healthcare analytics adoption-Decision model: A case study. [Conference proceedings]. Pacific Asia Conference on Information Systems 2015, Singapore.

Vogel, L. (2020). Canada has long way to go on virtual care. *Canadian Medical Association Journal, 192*(9), E227-E228. https://doi.org/10.1503/cmaj.1095851

Wade, V., & Eliott, J. (2012). The role of the champion in telehealth service development: a qualitative analysis. *Journal of Telemedicine and Telecare, 18*(8), 490-492. https://doi.org/10.1258/jtt.2012.gth115

Wade, V., Gray, L., & Carati, C. (2017). Theoretical frameworks in telemedicine research. *Journal of Telemedicine and Telecare, 23*(1), 181. https://doi.org/10.1177/1357633X15626650

Wade, V. A., Eliott, J. A., & Hiller, J. E. (2014). Clinician acceptance is the key factor for sustainable telehealth services. *Qualitative Health Research, 24*(5), 682-694. https://doi.org/10.1177/1049732314528809

Wade, V. A., Taylor, A. D., Kidd, M. R., & Carati, C. (2016). Transitioning a home telehealth project into a sustainable, large-scale service: a qualitative study. *BMC Health Services Research, 16*(1), 1-10. https://doi.org/10.1186/s12913-016-1436-0

Walsh, L., Hemsley, B., Allan, M., Adams, N., Balandin, S., Georgiou, A., Higgins, I., McCarthy, S., & Hill, S. (2017). The E-health literacy demands of Australia's my

Health Record: A heuristic evaluation of usability. *Perspectives in Health Information Management*, *14*(Fall), 1f-28.

Webster, J., & Watson, R. T. (2002). Analyzing the past to prepare for the future: Writing a literature review. *MIS Quarterly*, xiii-xxiii.

Westbrook, J. I., Braithwaite, J., Georgiou, A., Ampt, A., Creswick, N., Coiera, E., & Iedema, R. (2007). Multimethod evaluation of information and communication technologies in health in the context of wicked problems and sociotechnical theory. *Journal of the American Medical Informatics Association*, *14*(6), 746-755. https://doi.org/10.1197/jamia.M2462

Whittaker, S. L., Adkins, S., Phillips, R., Jones, J., Horsley, M. A., & Kelley, G. (2004). Success factors in the long-term sustainability of a telediabetes programme. *Journal of Telemedicine and Telecare*, *10*(2), 84-88. https://doi.org/10.1258/135763304773391512

Whitten, P., & Adams, I. (2003). Success and failure: a case study of two rural telemedicine projects. *Journal of Telemedicine and Telecare*, *9*(3), 125-129. https://doi.org/10.1258/135763303767149906

Whitten, P., Doolittle, G., & Mackert, M. (2005). Providers' acceptance of telehospice. *Journal of Palliative Medicine*, *8*(4), 730-735. https://doi.org/10.1089/jpm.2005.8.730

Whitten, P., Johannessen, L. K., Soerensen, T., Gammon, D., & Mackert, M. (2007). A systematic review of research methodology in telemedicine studies. *Journal of Telemedicine and Telecare*, *13*(5), 230-235. https://doi.org/10.1258/135763307781458976

Whitten, P., & Mackert, M. S. (2005). Addressing telehealth's foremost barrier: provider as initial gatekeeper. *Int J Technol Assess Health Care*, *21*(4), 517-521. https://doi.org/10.1017/S0266462305050725

WHO. (2020). *Global strategy on human resources for health: workforce 2030*. WHO Document Production Services. https://www.who.int/publications/i/item/9789241511131

WHO. (2021). *Ageing and health*. https://www.who.int/news-room/fact-sheets/detail/ageing-and-health

WHO Global Observatory for eHealth. (2010). *Telemedicine: opportunities and developments in Member States: report on the second global survey on eHealth*. https://apps.who.int/iris/handle/10665/44497

Williams, M. D., Rana, N. P., Dwivedi, Y. K., & Lal, B. (2011). Is UTAUT really used or just cited for the sake of it? a systematic review of citations of UTAUT's originating article. European Conference on Information Systems, Helsinki, Finland.

Wilson, B., Paunga, H., & Sharpe, S. (2021). *Telehealth as a mode of outpatient service delivery: A Pacific equity analysis*. https://www.countiesmanukau.health.nz/assets/About-CMH/Performance-and-planning/health-status/2021_Telehealth_as_a_mode_of_outpatient_service_delivery-Pacific_equity_analysis.pdf

Yarbrough, A. K., & Smith, T. B. (2007, Dec). Technology acceptance among physicians: a new take on TAM. *Medical Care Research and Review*, *64*(6), 650-672. https://doi.org/10.1177/1077558707305942

Yu, P. (2010). A multi-method approach to evaluate health information systems. *Studies in Health Technology and Informatics*, *160*(Pt 2), 1231. https://doi.org/10.3233/978-1-60750-588-4-1231

Zailani, S., Gilani, M. S., Nikbin, D., & Iranmanesh, M. (2014). Determinants of telemedicine acceptance in selected public hospitals in Malaysia: Clinical perspective. *Journal of Medical Systems*, *38*(9), 1-12. https://doi.org/10.1007/s10916-014-0111-4

Zanaboni, P., & Wootton, R. (2012). Adoption of telemedicine: from pilot stage to routine delivery. *BMC Medical Informatics and Decision Making, 12*(1), 1-1. https://doi.org/10.1186/1472-6947-12-1

Zhou, K. (2020). *How broad is broadband? An economic analysis on the digital divide through a case study of US cities* Princeton University]. http://arks.princeton.edu/ark:/88435/dsp01z890rx27n

Zhu, K., & Kraemer, K. L. (2005). Post-adoption variations in usage and value of e-business by organizations: cross-country evidence from the retail industry. *Information Systems Research, 16*(1), 61-84. https://doi.org/10.1287/isre.1050.0045

Zimlich, R. (2021). Your future telehealth program. *Optometry Times Journal, 13*(5).

Appendix A Literature Search Strategy

1	mass communication/ (12200)
2	innovat*.ti,ab. (127987)
3	health care policy/ or health care system/ (220736)
4	health care reform.ti,ab. (4102)
5	1 or 2 or 3 or 4 (352655)
6	(model or models or theory or theories or framework* or guideline*).ti. (573379)
7	5 and 6 (14496)
8	telemedicine/ or telehealth/ or teleconsultation/ (28670)
9	(telehealth or telemedicine or health technology or health information technology).ti,ab. (22248)
10	8 or 9 (39921)
11	7 and 10 (328)
12	limit 11 to (english language and yr="2005 -Current") (301)

Appendix B Literature Search Strategy (Phase 01)

1	telemedicine/mt, og, st
2	telepathology/og, st
3	teleradiology/og, st
4	telerehabilitation/og, st
5	(telehealth or telemedicine).ti,ab,kf.
6	1 or 2 or 3 or 4 or 5
7	(New Zealand* or Australia* or United States* or Canada* or United Kingdom* or Sweden* or Norway* or Ireland* or Finland* or Denmark* or Germany* or Mexico* or Chile*).ti,ab.
8	communication barriers/
9	economics, medical/
10	Liability, Legal/
11	"Conflict of Interest"/
12	"Attitude of Health Personnel"/
13	Perception/
14	(barrier* or obstacle* or obstruct* or hindrance or roadblock or deterrent or challenge*).ti,ab.
15	(facilitator* or promot* or benefit* or improve* or support*).ti,ab.
16	(compatib* or connectivity or system requirement*).ti,ab.
17	8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16
18	(organi* or system or systems or institution*).ti,ab,kf.
19	6 and 7
20	17 and 19
21	18 and 20
22	limit 21 to (English language and yr="2005 -Current")

Appendix C Cover Letter for Emailing Survey Participants (Phase 02)

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Subject: You are invited to a research survey - **Framework to Assess and Enhance the Scalability of Telehealth Services across the District Health Boards in New Zealand**

Date (Insert Date)
Dear Participant (participant name)

I am Arun Sam Singh Selwyn Jebaraj, a PhD student at the University of Canterbury undertaking this survey as a part of my Doctoral studies. This study is done with the support of the Telehealth Leadership Group. I am collecting the data using a questionnaire to refine the framework which is developed using a literature review to assess and enhance the scalability of Telehealth services across the District Health Boards in New Zealand

I am inviting you to participate in this study by clicking on the link (a personalised Link would be generated using Qualtrics). Clicking on the link will take you to the **Information sheet** page, where you will find more information about this study. Following the Information sheet page, you will need to complete a **Consent form** page before starting to fill the survey questions. Your participation in this study is voluntary and you are free to withdraw your participation from this study at any time. The survey should take only 30 to 35 minutes to complete.

If you have any questions regarding the survey or this research project in general, please contact Arun Sam Singh Selwyn Jebaraj – PhD. Student at (Email –ast112@uclive.ac.nz/ contact number- +6433693434 or Supervisors Professor Ray Kirk at (ray.kirk@canterbury.ac.nz- T- +6433693702), Dr Karolyn Kerr at (Karolyn@illuminare.co.nz) and Pat Kerr- Researcher at the Telehealth Leadership Group at (pat@telehealthnz.co.nz- T- +6494159379)

Thanks
Arun Sam Singh Selwyn Jebaraj

Appendix D Information Sheet for Survey Participants (Phase 02)

Department- School of Health Sciences
Telephone: +6433693434
Email: ast112@uclive.ac.nz
27/09/2018
HEC Ref: HEC 2018/97

Framework to Assess and Enhance the Scalability of Telehealth Services across the District Health Boards in New Zealand

Information Sheet for the participant

I am Arun Sam Singh Selwyn Jebaraj, a PhD student at the University of Canterbury undertaking this survey as part of my doctoral studies. I am interested in knowing the current state of telehealth services across the District Health Boards in New Zealand. In this study, I am collecting the data using a questionnaire to refine the framework which is developed using a literature review to assess and enhance the scalability of telehealth services across the District Health Boards in New Zealand

You have been approached to take part in this study to better scale the current telehealth services across the District Health Boards in New Zealand. I have located your contact details through the Telehealth Leadership Group.

Your participation in the study would involve filling out the questionnaire relating to telehealth services used and/or provided by your organisation. The survey would take between 30 to 35 minutes to complete. The survey will be available online from 01 November 2018 to 30 November 2018. You will be asked to complete different types of online questions relating to telehealth services. You can leave the survey at any point in time before completing and could return to the same page by clicking the above link shared in the email. Clicking the submit button at the end of the survey sends the recorded responses to the researcher. However, if you wish to change the answers, upon request a retake survey link will be issued. This survey link starts the survey at the beginning, but the original answers are prepopulated and will enable to edit and replacing the original responses.

Participation is voluntary and you have the right to withdraw at any stage without penalty by simply closing the browser page at any time. You may ask for your raw data to be returned to you or destroyed at any point. If you withdraw, I will remove information relating to you. However, once analysis of raw data starts on 20 December 2018, it will become increasingly difficult to remove the influence of your data on the results.

The results of the project may be published, but you may be assured of the complete confidentiality of data gathered in this investigation. Your identity is not captured from any of the survey questions. The uploaded documents might capture your identity but will not be made public. To ensure anonymity and confidentiality, I will take particular care to guarantee the privacy of all the information I gather from you for this research. All the data collected from the survey will be securely stored, and only the researchers mentioned above will have the access to it. The information collected for the study will be securely stored on the password-protected computers at the University of Canterbury for ten years. The information gathered will be destroyed after ten years as per the policy of the University of Canterbury. A thesis is a public document and will be available through the UC Library.

Please indicate to the researcher on the consent form if you would like to receive a copy of the summary of results of the project.

The project is being carried out in partial fulfilment of the requirements for a PhD in Health Sciences by Arun Sam Singh Selwyn Jebaraj under the supervision of Professor Ray Kirk who can be contacted at ray.kirk@canterbury.ac.nz or Dr Karolyn Kerr who can be contacted at Karolyn@illuminare.co.nz or Pat Kerr from the Telehealth Leadership Group who can be contacted at pat@telehealthnz.co.nz. They will be pleased to discuss any concerns you may have about participation in the project.

This project has been reviewed and approved by the University of Canterbury Human Ethics Committee, and participants should address any complaints to The Chair, Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).

If you agree to participate in the study, you are asked to complete the consent form by clicking the "Continue" button. You need to check the tick boxes and click "Continue" button to complete the consent form and proceed to answer the questions of the survey. By clicking "Continue" you are indicating your consent to participate in the study.

Appendix E Consent Form for Survey Participants (Phase 02)

Department: School of Health Sciences
Telephone: +6433693434
Email:ast112@uclive.ac.nz

Framework to Assess and Enhance the Scalability of Telehealth Services across the District Health Boards in New Zealand

Consent Form for the participant

Please tick box the statement regarding each of the following:

- ☐ I have been given a full explanation of this project and have had the opportunity to ask questions.
- ☐ I understand what is required of me if I agree to take part in the research.
- ☐ I understand that participation is voluntary and I may withdraw at any time without penalty. Withdrawal of participation will also include the withdrawal of any information I have provided should this remain practically achievable.
- ☐ I understand that any information or opinions I provide will be kept confidential to the researcher, Ray Kirk, Karolyn Kerr, and Pat Kerr and that any published or reported results will not identify the participants or the organizations. I understand that a thesis is a public document and will be available through the UC Library.
- ☐ I understand that all data collected for the study will be kept in locked and secure facilities and/or in password protected electronic form and will be destroyed after ten years.
- ☐ I understand the risks associated with taking part and how they will be managed.
- ☐ I understand that I can contact the researcher Arun Sam Singh Selwyn Jebaraj at (ast112@uclive.ac.nz- T-+6433693434 or supervisors Ray Kirk (ray.kirk@canterbury.ac.nz- T- +6433693702), Karolyn Kerr (Karolyn@illuminare.co.nz), and Pat Kerr (pat@telehealthnz.co.nz, T- +6494159379) for further information. If I have any complaints, I can contact the Chair of the University of Canterbury Human Ethics Committee, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz)
- ☐ I would like a summary of the results of the project.
- ☐ By clicking "Continue" button below, I agree to participate in this research project.

Click the "Continue" button to complete the consent form to start answering the Questionnaire. You will find the "Submit" button, at the end of the questionnaire, and clicking the "Submit" button will display the message "You have now completed the survey. Thank you very much for your participation in the survey". Wwithdrawal of information after submission is practically impossible unless otherwise requested before 20 December 2018.

Appendix F Part 1 Survey Questions (Phase 02)

Click here for a full definition of telehealth.

Click here to know more about the survey.

Click here to know more about the NZ Telehealth Forum.

Completing the Survey

You can leave the survey at any point in time before completing the survey.

You can return to the same page by clicking the link shared in your email.

You will find the "Submit" button, at the end of the questionnaire which you should **only click** once your survey has been **fully completed**.

Consent page

Consent form

The Telehealth Leadership Group is conducting the survey in partnership with Sam Selwyn, a Ph.D. student at the University of Canterbury.

Click below "Consent Form" to download the form

Consent form- Click to download

I understand and **click** I Agree to participate in the telehealth Stocktake survey

○ I Agree

Organisational Information

Organisational Information

Please select the name of your DHB from the drop-down list below.

Part 1: Governance

Part 1a
Does your organisation have an appointed **clinical telehealth leader**?

◯ Yes ◯ No

Part 1b
Does your organisation have a **telehealth facilitator / programme manager**?

◯ Yes ◯ No

What FTE is this role

Part 1c
Does your organisation have any **protocols and guidelines** for using telehealth tools?

◯ Yes ◯ No

Part 1d
Does your organisation have any telehealth **strategies or policies**?

◯ Yes ◯ No

Part 1e
Does your organisation have a **governance group** that includes responsibility for telehealth?

◯ Yes ◯ No

Part 1f
Does your organisation provide **training to support** clinicians in the use telehealth?

◯ Yes ◯ No

Part 2 Videoconferencing (VC)

Part 2: Videoconferencing (VC)

Part 2a

Are you using video conferencing for

	Please Select Yes	No	Please describe Comments
Administrative and Management **meetings**?	○	○	
Clinical **Education**?	○	○	
Communications/meetings between **primary/NGO and secondary care?**	○	○	
Communications/meetings with **organisations outside health?** (eg, Corrections, Justice, Education)	○	○	
Other uses that are directly related to delivery of health or disability services?	○	○	

Part 2b

Are you using video conferencing for **Multi-Disciplinary Team Meetings?**

Any meetings involving case reviews, and care planning with clinicians and /or care teams in attendance. For example MDMs or MDTs

○ Yes ○ No

Part 2c

Are you using video conferencing for Services involving direct contact between **clinicians and patients,**

This may include whanau and/or carers

○ Yes ○ No

Part 3: Clinical activity- video conferencing for patient consultations

Part 3a

As you are using video conferencing for patient consultations

	Please Select Yes	No
Do you have a method of counting telehealth consultations (scheduled or unscheduled)?	○	○
If yes, are you using the Ministry of Health Telehealth Mode of Delivery Code and reporting on it? Click here to know more on the Telehealth Mode of Delivery code	○	○
Does the telehealth appointment code get entered into your patient management system to ensure appointments are accurately recorded / counted?	○	○
Are you aware of any new telehealth (clinician-patient consultation) services that will be initiated in the next 12 months? If yes, please list	○	○

Part 4: Clinical Activity – Video conferencing for MDM Meetings

Part 4: Clinical activity- video conferencing for MDM meetings

Part 4a

As you are using video conferencing for MDM / MDT meetings (as selected in Part 2b), Do you have **MDM/ MDT Co-Ordinator(s)**?

○ Yes ○ No

If yes, could you please specify their specialty and contact details

	Service area 1	Service area 2	Service area 3	Service area 4
Specialty(s)				
Name(s)				
Position(s)				

Part 4b

Do you have specific protocols for MDM / MDT meetings?

○ Yes ○ No

Part 5: Technical Infrastructure

Part 5: Technical infrastructure. If using video conferencing(VC):

Part 5a

Who are your video conferencing **service provider**(s) for **hardware-based units**?

	Please Select Yes	Please Select No	Please describe Comments
Dimension Data (Cisco)	○	○	
Spark (Cisco)	○	○	
Vivid (Polycom)	○	○	
Own Infrastructure: Please specify	○	○	
Other: Please specify	○	○	

Part 5b

Who are your video conferencing **service provider**(s) for **software-based solutions**?

	Please Select Yes	No	Please describe Comments
Dimension Data (Cisco Jabber)	○	○	
Spark (Cisco Jabber)	○	○	
Telesmart (Vidyo)	○	○	
Vivid (Polycom Real Presence)	○	○	
Zoom.US (Zoom)	○	○	
Connect NZ (Zoom)	○	○	
Own Infrastructure: Please specify	○	○	
Other: Please specify	○	○	

Part 5c

Identify types and number of video conferencing solutions. Complete sections below or provide your own list if easier.

	Type (ie Make, model)	**Number** (units/licences)	Notes Please des
Hardware-based units for example Cisco or Polycom units. These may be in fixed rooms or mobile 'AV' trolley			

	Type (ie Make, model)	**Number** (units/licences)	Notes Please des
Specialist clinical carts. These are possibly battery powered, may have additional clinical camera(s) etc			
Computer-based units running software such as RealPresence, Jabber, Zoom, Vidyo etc			
Mobile devices (smartphones and tablets) equipped an App based VC client			

Part 5d

If you are using video conferencing units:

	Please Select Yes	Please Select No	Please describe Comments
Do you have a centralised **booking system** for **room-based** VC equipment?	○	○	
Do you have a centralised **booking system** for **VMR virtual meeting rooms**?	○	○	
Do your VC systems meet international and NZ HISO **interoperability** standards? (HISO 10049.1:2014 Videoconferencing Interoperability Standard)	○	○	

	Please Select Yes	No	Please describe Comments
Does your available **VC capacity** meet the current demands from your organisation?	○	○	
If no, do you have an **investment plan** for the current unmet demand and future growth?	○	○	
Do you provide **Help Desk** and technical support for your VC users, If Yes, who provides it?	○	○	

Part 5e

The Ministry of Health is implementing a centralised directory of VC addresses of hardware-based endpoints across the provider networks. This information, however, doesn't necessarily indicate all of the sites which are used for telehealth services. Can you identify the geographic sites that you interact with for patient consultations, ward rounds, MDM/MDTs etc.

Please include the location and town/city, for example, Queen Street Medical - Timaru, or Lakes District Hospital - Queenstown, or patients homes - Northland.

Part 6: Other telehealth technologies and services

Part 6: Other telehealth technologies and services:

Part 6a

Are you using, or planning to use:

	Please Select Yes	No	Please describe Comments
Telemonitoring for remote support of patients? For example those with chronic conditions?	○	○	
mHealth / smartphone **applications** for health and wellness or for remote patient support, including virtual reality and rehab games?	○	○	
mHealth / mobile applications or weblinks for accessing or **updating clinical information**?	○	○	
Telehealth (videoconferencing) links with **GPs**?	○	○	
Telehealth (videoconferencing) links with **health professionals**?	○	○	
Telehealth (videoconferencing) links with **patients**?	○	○	
	Yes	No	Comments
Telehealth links with **other organisations**? (For example Corrections, Justice, Education)	○	○	
Therapeutic technologies which deliver interventions remotely for improved outcomes?	○	○	

	Please Select Yes	No	Please describe Comments
Social media to communicate with patients/patient groups?	○	○	
Chat bots or similar form of AI (artificial intelligence) to communicate with patients?	○	○	
Other, such as email or phone consultations?	○	○	

Part 7 Telehealth Benefits

Part 7: Telehealth benefits:

As you are providing telehealth services:

	Please Select Yes	No	Please describe Comments
Are telehealth applications and services **promoted** in your organisation for example in newsletters websites and at events?	○	○	
Have you conducted formal / structured **evaluation**(s)?	○	○	

Part 8 Barriers to uptake.

Part 8: Barriers to uptake:

Part 8a

The NZ Telehealth Forum is working to overcome telehealth barriers.

Do you see any barriers to uptake of telehealth?

○ Yes ○ No

Part 8b

Are any of the following barriers to uptake for existing or possible services?

	Please Select Yes	Please Select No	Please describe Comments
Clinical support and concerns about clinical accountability?	○	○	
Patient acceptance?	○	○	
Patients not having access to devices?	○	○	
Patients not having access to fast internet?	○	○	
Insufficient infrastructure or investment For example facilities, technology, licenses?	○	○	
Appropriate re-imbursement models at individual or organisational level?	○	○	
Standards or protocols / guidelines for care pathways?	○	○	
	Yes	No	Comments

	Please Select Yes	No	Please describe Comments
Senior management and planning/funding acceptance (or understanding) of the telehealth value proposition?	○	○	
Business case / feasibility study required for scalability of telehealth	○	○	
Adequate technical support?	○	○	
VC interconnectivity with other networks?	○	○	
Quality of video?	○	○	
Availability of equipment and room at time of requirement	○	○	
Other? (Please describe)	○	○	

Part 9 NZ Telehealth Forum and Telehealth Leadership Group support

Part 9:NZ Telehealth Forum and Telehealth Leadership Group support

Part 9a

Current support available

	Please Select Yes	No	Please describe Comments

	Please Select Yes	No	Please describe Comments
Have you used the resources available through the NZ Telehealth Forum and the Telehealth Resource Centre website? (case studies, protocols, policies, procedures, technical advice, support, etc)	○	○	
Did you find the resources useful?	○	○	

Part 9b

What type of support would be helpful to your organisation?

	Please Select Yes	No	Please describe Comments
Generic guidelines?	○	○	
Awareness raising presentations for your organisation?	○	○	
Presentations at events held by industry and sector groups?	○	○	
Case studies?	○	○	
Advice specific to your organisational needs?	○	○	
Advocacy at local, regional and national levels?	○	○	

	Please Select		Please describe
	Yes	No	Comments
Other? (Please describe)	◯	◯	

Part 9c

Would you like to be contacted with a follow-up interview to share your experiences in providing telehealth services

◯ Yes ◯ Maybe ◯ No

Review

Do you want to review your answers?

Select "YES" and click "NEXT" to review the answered questions

Select "NO " and click "NEXT" to SUBMIT the survey

Click the "BACK" button to go back, edit any answers

◯ YES ◯ NO

Click "Next" to move to Next page/ Click "Back" to edit the previous page.

Powered by Qualtrics

Appendix G Part 2 Survey Questions (Phase 02)

Click here for a full definition of telehealth.

Click here to know more about the survey.

Click here to know more about the NZ Telehealth Forum.

Completing the Survey

You can leave the survey at any point in time before completing the survey.

You can return to the same page by clicking the link shared in your email.

You will find the "**Submit**" button, at the end of the questionnaire which you shou
only click once your survey has been **fully completed.**

Consent form

The Telehealth Leadership Group is conducting the stocktake survey in partnershi
with Sam Selwyn, a Ph.D. student at the University of Canterbury

Click below "Consent Form" to download the form.

Consent form- Click to download

I understand and **click** I Agree to participate in the telehealth Stocktake survey

Organisational Information

Please select the name of your DHB from the drop-down list below.

Please choose the major group that your specialty / service belongs to:

Adult & Women's Health	Allied Health	Ambulatory & Clinical	Mental Health	Paediatrics
○	○	○	○	○

1. Please select the specialties/services for which you are completing the survey. Include those where you have used telehealth in the past, you currently use telehealth, or you plan to use telehealth in the near future.(Based on the above questions. all the relatiing specialties/services were displayed)

2. Please select all the types of telehealth interactions that your specialties/services use. Include those that you have used in the past, you currently use, or you plan to use in the near future.2.

☐ First Patient Contact	☐ Clinical Image	☐ Nurse Clinics
☐ Follow up Appointment	☐ Clinical to Clinician	☐ Remote Monitoring
☐ Acute Assessment	☐ Multi-disciplinary meetings	☐ Education

1. Phase of Implementation

For each of the types of interaction and service areas, please select the **phase of implementation** for your department1.

2. Total Number

For each of the types of interaction, please **estimate the total number** of telehealth interactions in the last 6 months

3.Percentage

For each of the types of interaction, please **estimate the percentage** of contacts are made by using telehealth?

4. Patient/Participants Location

For each of the types of interaction, please select the **primary location where the patient or other remote participants are located. Please note other less frequently used locations in comments.** For example, when patients are seen most often in DHB hospital, but sometimes in an aged care facility or in the home.

Telehealth Benefits

How did you hear about telehealth?	
What value did you see in telehealth?	
Why did you decide to invest in telehealth?	
Did you complete Business Case or Pilot?	
Are you tracking delivery of clinical or financial KPIs, and / or service quality and patient satisfaction?	
Have the benefits you thought you would get been realised?	
What were the unintended consequences or benefits?	
Do you have any anecdotal **examples** or observations about the benefits?	
Please describe the current or planned use of telehealth in your service area.	
Please describe any interesting examples of the use of telehealth in your service area.	
Please provide any key names of the staff who are involved in telehealth who would be willing to share their experiences and learning of using telehealth?	
Please describe any issues or barriers that are limiting your service/professions in using telehealth. What is needed to overcome these barriers?	

Would you like to be contacted with a follow-up interview to share your experiences in providing telehealth services?

○ Yes ○ Maybe ○ No

Complete

Appendix H Semi-Structured Interview Guide (Phase 03)

Semi-Structured interview guide

After the introduction, respondents will be asked broad questions with minimal prompting to continue responding with their experiences and own words. A series of more specific prompt questions as described below will be used when needed to fill in the gaps or ask for more detail in the response.

Part I- Interview Introduction
An introductory part covering the below-mentioned areas will be asked before the data gathering part of the interview begins. Respondents will be:

1. Reminded about the purpose of the interview on the uptake and sustainability of telehealth services.
2. Asked about consent/their interest to continue with the interview and reminded they could withdraw their participation at any time as mentioned in the information sheet.
3. Assured on the confidentiality of the data and asked if they have any questions at this point, and a verbal consent is taken.

Part II- Telehealth Service Description
Starting with some introductory questions on telehealth services you are/were involved with.
For the purposes of this study, we define Telehealth as:-
Prompts for more description, if needed:

- How would you define telehealth services?
- What is your role with regards to telehealth services?
- When did you start using, and how many years have you used this technology?
- When did the telehealth program/services start- Is it still operating? If not, when did it cease operating?
- What types of services are/were delivered?
- What different sites are/were included in the services? (ie, DHB, patient home, GP)
- Does your organisation/ staff utilize the current telehealth services?

Part III- Factors affecting telehealth update
Could you please describe how telehealth services were developed and implemented and were able to continue operating?

Prompts for ongoing services:

- Could you please explain some of the important factors that enabled telehealth services to start operating?
- Could you please think of any important barriers? Any examples of how you dealt overcoming the barriers
- Did the services change over time- e.g. the way it operated? Types of services provided,
- Did the services grow/upscaled over time or shrink over time? If yes, could you explain the factors affecting the uptake of the service?
- If yes, could you please describe/example on how you/they dealt with it?
- Were they any unexpected challenges? If yes, how did you/team overcame the difficulties?
- How well do you see the current telehealth services could be sustainable for more uptake?
- Could you please explain the factors- that will hinder/enable sustainability?
- How do you see future telehealth services developing, and do you think any additional support/efforts are needed to ensure sustainable telehealth services?

Arun Sam Singh Selwyn Jebaraj

Prompts for closed services:

- Could you please describe, what factors caused the services to be ceased and how did the services end?
- Were there any efforts taken to keep the services operating?

Part IV: More specific prompts

The below-mentioned questions will be used only if the respondent has not mentioned these areas earlier.

Human Context

1- What is the level of acceptance of your staff/team and their willingness to use the current/proposed telehealth services?

2- What is your opinion on the availability of internal/external experts and resources to implement, operate and maintain the current/proposed telehealth services?

Organisational Context

1- Could you please describe how well the telehealth strategy and plans (e.g.., change management plan, risk management plan), aligns to the mission, vision and needs of your organisation.

2- Can you please give examples of how the support and commitment of the organisation influence the adoption of the current/future telehealth programs more efficiently? (i.e., required modifications on the resources, HR policies, business processes/care pathways)

Technical Context

1- What has your experience been with essential ICT characteristics, namely the availability of equipment, technical support, Interoperability, complexity/system installation, quality and performance of the telehealth applications/services? Is it costly, time-consuming, effective, or ineffective?

2- Do you think that computer literacy influences the adoption of new telehealth technologies and are there any skills or competencies that you feel enhance one's ability to use Telehealth?

Financial Context

1. Could you please share your thoughts on the economic feasibility of the proposed/current telehealth applications?
2. Do you think the current telehealth services are/were cost-effective compared to traditional interactions to the patients? Could you please describe with an example?
3. Do you think the organisation has adequate availability of funding/financial support to implement, operate and maintain the current/proposed telehealth services? If not, how would you fund the current telehealth services?

External Environment

1. Could you please explain the external support from government- clearly defined legislation (policies and regulations) to coordinate the access and uptake of telehealth services
2. Availability of efficient vendors and suppliers to provide the required ICT equipment at affordable prices
3. Reimbursement for the telehealth applications – the decision to uptake telehealth

<u>Part V- Concluding question</u>

Of all the above-discussed factors, which ones do you think are/were most important for the up-take of telehealth services across your organisation?

Prompted for more specific information on the factors that influenced the outcomes

Have you got anything else to say? If I have any additional questions to ask you later, would you be willing to be contacted again?

Your responses will be transcribed and sent to you for review. You are free to add or otherwise amend your transcription. You are asked to return this to me by 01 June 2019.

Thank you very much for your time!

Appendix I Cover Letter for Emailing Survey Participants for Follow-up Interviews

(Phase 03)

SAMPLE E-MAIL FOR CONTACTING THE POTENTIAL PARTICIPANTS

UC UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Subject: You are invited to an Interview, which is a follow-up from the Survey - **Framework to Assess and Enhance the Scalability of Telehealth Services across the District Health Boards in New Zealand**

Date(Insert Date)

Dear Participant (Participant name)

I am Arun Sam Singh Selwyn Jebaraj, a PhD student at the University of Canterbury undertaking this interview as a part of my Doctoral studies. This Invitation is a follow-up request for an interview, based upon your willingness to be further contacted as noted in the survey conducted in 2018 along with the support from the Telehealth Leadership Group. I am collecting the data using a semi-structured interview to refine the framework which is developed using a literature review and the survey conducted in 2018 to assess and enhance the scalability of Telehealth services across the District Health Boards in New Zealand.

Please find attached the information sheet and the consent form detailing more information about the study. If you wish to participate in this study you are requested to sign the consent form, scan and email it back to the researcher. If requested a hard copy of the consent form along with a return envelope with the UC researcher address will be sent to you for completing the consent form. Once completed please send back the envelope along with the signed consent form.

Following your consent, you will be invited by email to set up a 60-minute interview either using Zoom/Skype or face-to-face (Christchurch based) at your convenience. The Interview will involve an audio-recorded semi-structured interview about the use of Telehealth and all information will be kept confidential. Your participation in this study is voluntary and you are free to withdraw your participation from this study at any time.

If you have any questions regarding the interview or this research project in general, please contact Arun Sam Singh Selwyn Jebaraj – PhD Student at (Email –ast112@uclive.ac.nz- T- +6433693434) or the supervisors Professor Ray Kirk at (ray.kirk@canterbury.ac.nz- T- +6433693702), Dr Karolyn Kerr(PhD co-supervisor), at (Karolyn@illuminare.co.nz T- +6494159379).

Thanks

Arun Sam Singh Selwyn Jebaraj

Appendix J Participant Information Sheet (Phase 03)

PARTICIPANT INFORMATION SHEET

Department- School of Health Sciences
Telephone: +6433693434
Email: ast112@uclive.ac.nz
18/02/2019
HEC Ref: [HEC 2019/07]

Framework to Assess and Enhance the Scalability of Telehealth Services across the District Health Boards in New Zealand

Information Sheet for the participants

I am Arun Sam Singh Selwyn Jebaraj, a PhD student at the University of Canterbury undertaking this survey as part of my doctoral studies. I am interested in knowing the current state of telehealth services across the District Health Boards in New Zealand. In this study, I am collecting the data using a semi-structured Interview to refine the framework which is developed using a literature review and the survey conducted in 2018 to assess and enhance the scalability of telehealth services across the District Health Boards in New Zealand

You have been approached to take part in this study as a follow-up request for an interview, upon your willingness to be further contacted as noted in the survey conducted in 2018 along with the support from the Telehealth Leadership Group. Your participation in the study would involve a 60-minute audio-recorded semi-structured interview answering questions relating to Telehealth services used and/or provided by your organisation. The interview will be set up during the period 15 March 2019 to 30 April 2019. All the audio-recorded responses will be transcribed and sent to you for review. You are free to add or otherwise amend your transcription. You are asked to return this to me by 01 June 2019.

Participation is voluntary, and you have the right to withdraw at any stage without penalty. You may ask for your raw data to be returned to you or destroyed at any point. If you withdraw, I will remove information relating to you. However, once analysis of raw data starts on 15 June 2019, it will become increasingly difficult to remove the influence of your data on the results.

The results of the project will be published, but you may be assured of the complete confidentiality of data gathered in this investigation. Your identity is not captured from any of the interview questions. To ensure confidentiality, I will take particular care to guarantee the privacy of all the information I gather from you for this research. I will also take care of the information to ensure that either the participant or the organization cannot be recognized by others in presentation or publications of the findings. All the data collected from the Interview will be securely stored, and only the researchers mentioned above will have access to it. The information collected for the study will be kept in locked and secure facilities and/or in password-protected electronic form and will be destroyed after ten years. The information gathered will be destroyed after ten years as per the policy of the University of Canterbury. A thesis is a public document and will be available through the UC Library.

Please indicate to the researcher on the consent form if you would like to receive a copy of the summary of the results of the project.

The project is being carried out in partial fulfilment of the requirements for a PhD in Health Sciences by Arun Sam Singh Selwyn Jebaraj under the supervision of Professor Ray Kirk who can be contacted at ray.kirk@canterbury.ac.nz or Dr Karolyn Kerr(PhD co-supervisor) who can be contacted at Karolyn@illuminare.co.nz.They will be pleased to discuss any concerns you may have about participation in the project.

This project has been reviewed and approved by the University of Canterbury Human Ethics Committee, and participants should address any complaints to The Chair, Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).

If you agree to participate in the study, you are asked to read the attached consent form and requested to sign the consent form, scan and email it back to the researcher. If requested a hard copy of the consent form along with a return envelope with UC researcher address will be sent to you for completing the consent form. Once completed please send back the envelope along with the signed consent form.

Appendix K Consent Form for Participating in the Semi-Structured Interviews (Phase 03)

Department: School of Health Sciences
Telephone: +6433693434
Email:ast112@uclive.ac.nz

Framework to Assess and Enhance the Scalability of Telehealth Services across the District Health Boards in New Zealand

Consent Form for the participant

Please read the statement regarding each of the following:

- ☐ I have been given a full explanation of this project and have had the opportunity to ask questions.
- ☐ I understand what is required of me if I agree to take part in the research.
- ☐ I understand that participation is voluntary, and I may withdraw at any time without penalty. Withdrawal of participation will also include the withdrawal of any information I have provided should this remain practically achievable.
- ☐ I understand that the interview is audio-recorded, and I'll be given a chance to review my transcribed audio-responses for any amendment before 01June 2019.
- ☐ I understand that any information or opinions I provide will be kept confidential to the researcher, Professor Ray Kirk, and Dr Karolyn Kerr and that any published or reported results will not identify the participants or the organizations. I understand that a thesis is a public document and will be available through the UC Library.
- ☐ I understand that all data collected for the study will be kept in locked and secure facilities and/or in password-protected electronic form and will be destroyed after ten years.
- ☐ I understand the risks associated with taking part and how they will be managed.
- ☐ I understand that I can contact the researcher Arun Sam Singh Selwyn Jebaraj at (ast112@uclive.ac.nz- T-+6433693434 or the supervisors Ray Kirk (ray.kirk@canterbury.ac.nz- T- +6433693702), Karolyn Kerr, co-supervisor (Karolyn@illuminare.co.nz), for further information. If I have any complaints, I can contact the Chair of the University of Canterbury Human Ethics Committee, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz)
- ☐ I would like a summary of the results of the project.

- ☐ By signing below, I agree to participate in this research project.

Name:______________________________Signed:____________________________Date:________________

Appendix L Approval Letter - Ngāi Tahu Consultation and Engagement Group (Phase 02)

Ngāi Tahu Consultation and Engagement Group

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Thursday 16 August 2018

Tēnā koe Arun Jebaraj

RE: Framework to Assess and Enhance the Scalability of Telehealth Services across the District Health Boards in New Zealand

This letter is on behalf of the Ngāi Tahu Consultation and Engagement Group (NTCEG). I have considered your proposal and acknowledge it is a worthwhile and interesting project and you are clear about how you ought to take participants' (cultural) needs into account if and when applicable.

Given the scope of your project, no issues have been identified and further consultation with Māori is not required.

Thank you for engaging with the Māori consultation process. This will strengthen your research proposal, support the University's Strategy for Māori Development, and increase the likelihood of success with external engagement. It will also increase the likelihood that the outcomes of your research will be of benefit to Māori communities. We wish you all the best with your current project and look forward to hearing about future research plans.

The Ngāi Tahu Consultation and Engagement Group would appreciate a summary of your findings on completion of the current project. Please feel free to contact me if you have any questions.

Ngā mihi whakawhetai ki a koe

Henrietta Latimer (on behalf of the NTCEG)

Kaiarāhi Maori Research
Research & Innovation | Te Rōpū Rangahau
University of Canterbury | Te Whare Wānanga o Waitaha
Phone +64 3 369 0143, Private Bag 4800, Christchurch | Ōtautahi
henrietta.latimer@canterbury.ac.nz
http://www.research.canterbury.ac.nz |

Appendix M Approval Letter - New Zealand Telehealth Leadership Group (Phase 02)

NZ TELEHEALTH
FORUM & RESOURCE CENTRE

27 September 2018

To whom it may concern

New Zealand Telehealth 2018 Stocktake Survey

In 2014 the Telehealth Leadership Group and the Ministry of Health conducted a telehealth survey. This 2018 survey is a follow up using the previous stocktake as a benchmark. The survey will track overall uptake since 2014, identify areas of innovation and excellence as well as learnings and benefits that can be shared to increase the uptake of telehealth.

Partnership with Arun Sam Singh Selwyn Jebaraj
Sam Selwyn is undertaking research on Telehealth, and this is aligned and overlaps with our own survey. We are delighted that we can partner with Sam to complete a joint survey.

Each organisation will nominate a person to complete the survey on behalf of the organisation. I will share these details with Sam who will sending the survey from Qualtrics. We are very pleased that Sam will assist in the collating and analysing the results. Based on the results we will publish a wholistic report, and Sam will complete his own specific research report.

If you have any questions, please contact me directly.

Kind regards

Andrew Panckhurst
andrew@mobilehealth.co.nz
0272221002

Appendix N Approval Letter - Univerity of Canterbury Human Ethics Committee

(Phase 02)

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

HUMAN ETHICS COMMITTEE

Secretary, Rebecca Robinson
Telephone: +64 03 369 4588, Extn 94588
Email: human-ethics@canterbury.ac.nz

Ref: HEC 2018/97

3 October 2018

Arun Sam Singh Selwyn Jebaraj
Health Sciences
UNIVERSITY OF CANTERBURY

Dear Arun

The Human Ethics Committee advises that your research proposal "Framework to Assess and Enhance the Scalability of Telehealth Services Across the District Health Boards in New Zealand" has been considered and approved.

Please note that this approval is subject to the incorporation of the amendments you have provided in your email of 28th September 2018, **and the following:**

Please remove the statement "without your prior consent" from the Information Sheet (annexure 3), as you have promised participant confidentiality.

Best wishes for your project.

Yours sincerely

pp. R. Robinson

Professor Jane Maidment
Chair
University of Canterbury Human Ethics Committee

University of Canterbury Private Bag 4800, Christchurch 8140, New Zealand. www.canterbury.ac.nz

F E S

Appendix O Approval Letter - Ngāi Tahu Consultation and Engagement Group (Phase 03)

Ngāi Tahu Consultation and Engagement Group

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Thursday 24 January 2019

Tēnā koe Arun Jebaraj

RE: Framework to Assess and Enhance the Scalability of Telehealth Services across the District health Boards in New Zealand.

This letter is on behalf of the Ngāi Tahu Consultation and Engagement Group (NTCEG). I have considered your proposal and acknowledge it is a worthwhile and interesting project and you are clear about how you ought to take participants' (cultural) needs into account if and when applicable.

Given the scope of your project, no issues have been identified and further consultation with Māori is not required.

Thank you for engaging with the Māori consultation process. This will strengthen your research proposal, support the University's Strategy for Māori Development, and increase the likelihood of success with external engagement. It will also increase the likelihood that the outcomes of your research will be of benefit to Māori communities. We wish you all the best with your current project and look forward to hearing about future research plans.

The Ngāi Tahu Consultation and Engagement Group would appreciate a summary of your findings on completion of the current project. Please feel free to contact me if you have any questions.

Ngā mihi whakawhetai ki a koe

Henrietta Carroll (on behalf of the NTCEG)

HCarroll

Kaiarāhi Maori Research
Research & Innovation | Te Rōpū Rangahau
University of Canterbury | Te Whare Wānanga o Waitaha
Phone +64 3 369 0143, Private Bag 4800, Christchurch | Ōtautahi
henrietta.latimer@canterbury.ac.nz
http://www.research.canterbury.ac.nz

Appendix P Approval Letter - University of Canterbury Human Ethics Committee

(Phase 03)

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

HUMAN ETHICS COMMITTEE

Secretary, Rebecca Robinson
Telephone: +64 03 369 4588, Extn 94588
Email: human-ethics@canterbury.ac.nz

Ref: HEC 2019/07

4 March 2019

Arun Sam Singh Selwyn Jebaraj
Health Sciences
UNIVERSITY OF CANTERBURY

Dear Arun

The Human Ethics Committee advises that your research proposal "Framework to Access and Enhance the Scalability of Telehealth Services Across the District Health Boards in New Zealand" has been considered and approved.

Please note that this approval is subject to the incorporation of the amendments you have provided in your email of 26th February 2019.

Best wishes for your project.

Yours sincerely

Dr Dean Sutherland
Chair
University of Canterbury Human Ethics Committee

Appendix Q List of Clinical Services from the Five Clinical Specialties (Phase 02)

Adult / Women's	Paediatrics	Mental Health	Allied Health	Ambulatory & Clinical
Adult Emergency	Cardiac	Acute Mental Health Inpatients	Audiology	Audiology
Cardiology	Child Development	Child, Adolescent & Family Mental Health	Cardiac Physiology	Dermatology
Cardiothoracic	Child Emergency	Community and Outpatient Mental Health – adult	Counseling	Endocrinology
Critical Care	Child Psychiatry	Crisis Team	Hospital Pharmacy	Genetic Services
ENT	General Paediatrics	Early Intervention (In Psychosis)	Nutrition / Dietetics	Immunology
Gastroenterology	General Surgery	Eating Disorders	Occupational Therapy	Pain Management
General Medicine	Endocrinology	Forensic & Rehabilitation Inpatients & Community	Physiotherapy	Regional Public Health
Gerontology	Gastroenterology	Intellectual Disability	Podiatry	Rheumatology
General Surgery	Haematology & Oncology	Maori Mental Health	Psychology	Sexual Health
Gynaecology	Home Health Care	Maternal Mental Health	Speech Language	Other ________________
Haematology	Infectious Diseases	Pasifika Health Mental Health	Social Work	
Infectious Diseases	Intensive Care Unit	Psychiatric Liaison	Other ________________	
Intensive Care	Nephrology	Psychogeriatrics		
Haemophilia	Neurology	Other ________________		
Neurology	Neurosurgery			
Neurosurgery	Neonatal			
Oncology	Otorhinolaryngology (ORL)			
Ophthalmology	Orthopaedics			
Orthopaedics	Palliative Care			
Palliative Care	Respiratory			
Renal	Other ________________			
Respiratory				
Trauma				
Urology				
Vascular Surgery				
Other _________				