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Clinicians’ Perceptions of Telemedicine:
Opportunities and Barriers for Emergency Medicine

Julie Anne Mary Lucas

Thesis submitted in partial fulfilment of the requirement’s for the degree of Masters of Nursing, The University of Auckland, 2013
Abstract

With the centralisation of healthcare services internationally and in NZ it has become increasingly difficult to attract health professionals to rural and remote communities. This has meant populations in these areas face challenges accessing comprehensive healthcare. Politicians and executive management teams in health are looking for new and innovative ways to deliver sustainable, equitable healthcare to all. The World Health Organisation (WHO) and Information Technology (IT) group have been working together responding to the needs of communities with the integration of technology into healthcare facilities. Healthcare faces incredible challenges, not only in economics, but also with higher expectations of the public. Telemedicine is seen as a solution, as it can bring specialist care at a distance to rural areas through technology. However telemedicine has not integrated well into some areas of health such as emergency care and the West Coast of NZ is not exempt from this international issue.

The purpose of this study is to explore clinicians’ perceptions of telemedicine and the barriers and opportunities it may provide to a rural or remote Emergency Department. This is a descriptive study involving semi structured interviews with a purposeful sample of healthcare professionals working in emergency services for the West Coast District Health Board (WCDHB). The study also sought expert opinion from four sites using telemedicine in Queensland, Australia.

The results show clinicians could see potential benefits for the use of telemedicine in rural Emergency Departments, but lacked the understanding of how it could be integrated into their everyday work. Barriers identified were the reliability of Internet connections and speed; related to bandwidth; additional workload;
concerns that telemedicine might be a distraction from providing care; access to the technology when it is needed; patients’ perception of telemedicine and also concerns around privacy. Preparation carried out in Queensland, Australia prior to the implementation of telemedicine and the use of coordination centres seems to have assisted the integration of telemedicine into Emergency Departments in rural areas.

Thereby seeking the views and experiences of those clinicians working on the front line, along with expert opinion from Queensland, Australian counterparts, a comprehensive understanding is expected which will be used to inform telemedicine use within an Emergency Department in rural NZ.

With commitment and adequate resourcing, the barriers to telemedicine can be overcome, opening up the opportunity for people in rural and remote communities to gain, and sustain, equity of access to healthcare.
Acknowledgements

Firstly, I would like to dedicate this thesis to my late father Graham Edward Williams, who I know if he was here today would stand proud at this accomplishment.

Ahakoa te mokemoke o te haerenga, I noho pumou tou wairua ki toku taha i nga wa katoa Ki a eke ahau ki nga taumata Ko te mea nui ko nga tohu whakapakari i tuku mai e koe hei whakakaha atu i ahau

Ko tuku koha aroha teneimou

Without the help and support of the people around me this thesis would not be possible. My heartfelt thanks go to my wonderful girls, Amy, Callie and Emma who endured years of me ‘living-in’ my books, and of listening to my constant complaining, encouraging me to continue.

I would also like to thank my extended family and friends, without whom this journey would never have been possible. To my mother Gillian Williams, brother and sister who gave me the encouragement and support to venture from my position as an enrolled nurse to registered nurse, I thank you. A special thanks also to Robyn and Chris who have listened, supported and encouraged me through the last two years ensuring I take time for myself and enjoy the summers.

I owe my deepest gratitude to my supervisors Dr Michelle Honey and Dr Karen Day for their never ending support, inspiration and encouragement whilst guiding
me through this process. Also to my dear friends Janelle Mathieson, Donna Thomas, Carol Gaskell and Vicki Piner for all their help with editing and formatting. To my colleagues in the emergency and outpatient department, Grey Hospital a big thank you. Your encouragement, support and interest have not gone unnoticed. Also thank you for putting up with my absence on and off over the past two years. Special thanks go to my dearest friend Lynley McInroe who kept the place running in my absence.

To all the Participants in this study I thank you, without your assistance this research would not be possible and I am extremely appreciative. To the West Coast District Health Board and Canterbury / West Coast Emergency Care Coordination Team, for the support and patience you have shown me through this thesis, I hope this research will inform telemedicine in emergency services throughout NZ and will become embedded into everyday life in the future as a quality initiative.

Lastly, I would like to thank my very special friend and husband for his understanding, support, tolerance and love. I know it has been a tough two years, but I promise to make it up to you.
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Glossary

**E-Health**: Is an umbrella term that includes all electronic and communication methods which support healthcare practices such as telehealth, telemedicine and telecare.

**Telehealth** is described as a broader concept that includes not only the delivery of healthcare to individuals, but also administration and training. This can be delivered in real time, store and forward or pre-recorded information.

**Telemedicine** originated from the Greek ‘tele’, meaning at a distance, hence telemedicine is medicine at a distance. The WHO suggests that telemedicine is more clinically focused than telehealth.

**Telecare** means the use of telecommunication to provide healthcare and advice to patients in their homes.
## Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AFHCAN</td>
<td>Alaska Federal Healthcare Access Network</td>
</tr>
<tr>
<td>CEO</td>
<td>Chief Executive Officer</td>
</tr>
<tr>
<td>CHF</td>
<td>Congestive Heart Failure</td>
</tr>
<tr>
<td>CNM</td>
<td>Clinical Nurse Manager</td>
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<tr>
<td>COPD</td>
<td>Chronic Obstructive Pulmonary Disease</td>
</tr>
<tr>
<td>DHBs</td>
<td>District Health Boards</td>
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<tr>
<td>DRHM</td>
<td>Division of Rural Hospital Medicine</td>
</tr>
<tr>
<td>ECG</td>
<td>Electrocardiography</td>
</tr>
<tr>
<td>ED</td>
<td>Emergency Department</td>
</tr>
<tr>
<td>GP</td>
<td>General Practitioner</td>
</tr>
<tr>
<td>IT</td>
<td>Information Technology</td>
</tr>
<tr>
<td>MCNZ</td>
<td>Medical Council of NZ</td>
</tr>
<tr>
<td>MI</td>
<td>Myocardial infarction</td>
</tr>
<tr>
<td>MoH</td>
<td>Ministry of Health</td>
</tr>
<tr>
<td>NIHI</td>
<td>National Institute for Health Innovation</td>
</tr>
<tr>
<td>NZ</td>
<td>NZ</td>
</tr>
<tr>
<td>OECD</td>
<td>Organisation of Economic Co-operation and Development</td>
</tr>
<tr>
<td>RNS</td>
<td>Rural Nurse Specialists</td>
</tr>
<tr>
<td>RNZCGP</td>
<td>The Royal NZ College of General Practitioners</td>
</tr>
<tr>
<td>ST elevation</td>
<td>ST elevations refers to a finding on an electrocardiogram, wherein the trace in the ST segment is abnormally high above the isoelectric line</td>
</tr>
<tr>
<td>TV</td>
<td>Television</td>
</tr>
<tr>
<td>UK</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>USA</td>
<td>United States of America</td>
</tr>
<tr>
<td>WCDHB</td>
<td>West Coast District Health Board</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organisation</td>
</tr>
</tbody>
</table>
Chapter One: Introduction

I can’t change the direction of the wind, but I can adjust my sails to always reach my destination.

Jimmy Dean

Introduction

As we move through the 21st century, health providers grapple with the inequity of access to specialist services for communities in rural and remote areas. Patients with both acute and chronic conditions are finding it increasingly hard to access treatment. Hospitals and emergency services in rural and remote areas face special challenges attracting healthcare professionals, often, but not always, due to specialisation of services. Health workforce planning in many countries is still precarious, especially in areas where specialised services are not available (de Raad, 1998).

Centralisation of specialist services in urban regions throughout New Zealand (NZ) healthcare system has amplified the problem of inequity and sustainability of many smaller communities. In notes from the briefing to the Incoming Minister of Health, December 2011, it suggests the way forward is the continued use of technology to ensure sustainability for the future (Ministry of Health, 2009). An example of this is “Introducing IT to allow older people to remain independent in their own homes for longer” (Ministry of Health, 2012, p. 7).

Other challenges facing delivery of healthcare in today’s world are growing communities, socioeconomic conditions, patients’ expectations and the World
Health Organisation’s (WHO) requirement to deliver high quality health to all (Wootton, Craig, & Patterson, 2006). To add to the problems of delivering healthcare Wootton and Bonnardot (2010) state “there is the ethical imperative of trying to obtain quality healthcare in a resource-constrained environment” (p. 2). District Health Boards (DHBs) throughout NZ have no option but to move from the traditional ways of delivering healthcare which are no longer sustainable, to new models of care which meet the needs of their communities.

Furthermore, NZ must work towards integration of healthcare providers in this economic downturn. Providers are now in a position to look for new innovative ways to deliver healthcare whilst meeting best practice guidelines. Realising that changing will be difficult, perhaps impossible at times with the imposing burdens of today’s world; it is thought that recent advances in information and communication technologies have created opportunities for overcoming a number of these issues.

Emergency Departments have their own challenges to face in the 21st century. In 2005 the Division of Rural Hospital Medicine (DRHM), which was set up within the Royal NZ College of General Practitioners (RNZCGP), documented that there were a number of doctors working in small rural areas as generalists covering a broad scope of medical presentations in secondary level care (The Royal New Zealand College of General Practitioners, 2012). Many of these doctors had vocational issues and to solve this, in 2006, a working party for the Division of Rural Hospital Medicine lobbied the Medical Council of NZ (MCNZ) and won recognition of the new scope of Rural Hospital Doctors. This role was seen as a way to help small rural hospitals fill gaps in specialist services and cover an entire spectrum of medical presentations. However, there is some debate as to just how
far the new scope can extend (The Royal New Zealand College of General Practitioners, 2012).

According to the The Royal New Zealand College of General Practitioners (2012) there are many determinants that dictate the scope, such as geographic isolation, limited resources, and special cultural and sociological factors. Such is the commitment by DHBs and the Ministry of Health to improve healthcare delivery in smaller areas, rural doctors in Emergency Departments are now finding the solution to the problem is pushing them to the edge of their scope of practice. Support from specialists comes from afar, often in the form of advice at the end of a telephone. Telemedicine could help bridge the geographical gap, thus ensuring support for these doctors in a safe environment at the touch of a switch.

According to Moffatt and Eley (2011) advanced technology such as telemedicine is seen as a way of helping address these problems. Telemedicine however, has been slow to integrate into healthcare practice although it has been available for decades. It was hoped by many health clinicians, managers and politicians that telemedicine will become the acceptable method of delivering care in the future (Brennan et al., 1999).

Telemedicine, which is medicine at a distance, is generally linked to some type of technology such as the internet or a satellite link (Wootton & Bonnardot, 2010). It is often portrayed as the answer to the delivery of safe and better healthcare services with improved access for all (Bashshur & Shannon, 2009; Brear, 2006; Cisco Systems, 2009; Norris, 2002; Smith & Gray, 2009; Wootton & Bonnardot, 2010). Telemedicine has policy makers, legislators, practitioners and telecommunications experts all working together to create solutions to problems that have emerged within healthcare today (Bruhn, 1998).
Throughout this chapter there will be reference to rural and remote, urban and tertiary health services. Urban areas are areas where population density is more than 30,000 per square kilometre, whereas rural areas have a population density of 300 to 1000 per square kilometre (Statistics New Zealand, 2012a). However, it is recognised that population is not the only factor as main urban areas are generally situated in cities, have bigger hospitals, facilities and better infrastructure. Rural and remote areas are usually in the country where not all services are available. Generally rural and remote areas have smaller hospitals due to fewer requirements for beds and similarly there are fewer hospitals located in these areas. Tertiary healthcare refers to major hospitals that have the ability to provide a superior level of specialty care such as cardiology, trauma care and neonatal intensive care. These hospitals are generally situated in large cities throughout New Zealand such as Auckland, Christchurch and Dunedin. Recruitment and retention of specialists sees a lack of services to rural areas making equity of services increasingly difficult.

The West Coast District Health Board (WCDHB) is unique in New Zealand due to its sparse geographical area and isolated populations. The West Coast has always been complex due to funding issues and recruitment and retention of health professionals especially when medicine moved from generalist to specialisation. It is anticipated that the introduction of telemedicine will result in maintaining sustainable services for the population of the West Coast and attract health professionals such as rural specialist doctors to the area with the knowledge of being well supported. Despite telemedicine being reported as being helpful to meeting the needs of rural communities, to date telemedicine is underutilised throughout Emergency Departments and medical centres within the WCDHB.
With commitment and adequate resourcing, the barriers to telemedicine can be overcome, opening up the opportunity for people in rural and remote communities to gain, and sustain, equity of access to healthcare.

**Aim of the study**

The main purpose of this study is to obtain a clear understanding of the potential barriers to and the opportunities associated with telemedicine from the perspective of clinicians working at the front line in a rural setting. The aim is to be able to provide information that will support the increase utilisation of telemedicine in the Emergency Department of Grey Base Hospital which is on the West Coast of New Zealand within the WCDHB.

The objectives of this study are to:

1. Make recommendations to the WCDHB to ensure the smooth transition of telemedicine services in the Emergency Department, Grey hospital by the end of June 2013.
2. Increase the utilization of telemedicine by ensuring as a manager, staff are well informed and happy with the establishment of telemedicine in their department by the end of 2013.
3. Make recommendations towards having a system established in the Emergency Department that will work well for staff, with the correct resources to improve efficiency in a busy department.

**Background:**

July 2008 saw the announcement of an agreement to deliver the first global trial of CISCO Health Presence between Westport and Grey Base Hospital, 100
kilometres away. Attached to a report written by Peterkin (2009) was a press release on the trial which quoted a number of key people involved in the setting up of telemedicine on the West Coast of New Zealand. Kevin Hague, CEO at the time, stated that the “WCDHB was the centre of excellence in delivering healthcare to its population and the Board was dedicated to providing a service that suited the diversity of the West Coast” (Witts, 2008, p. 1). Furthermore, Hague reported that telemedicine would reduce the need for travel by patients and consultants and also reduce the need for transfer to tertiary hospitals within NZ, thus reducing related travel costs. Geoff Lawrie, CISCO NZ, in the same press release, suggested that CISCO was a key player in the delivery of affordable, safe and accessible healthcare (Witts, 2008).

During the pilot implementation an evaluation was carried out by the National Institute for Health Innovation (NIHI), University of Auckland, which has been helpful in establishing telemedicine services in the Outpatients Department on the WCDHB by setting up protocols and procedures, communicating with key people who would utilize telemedicine and also setting up co-ordinators in both Grey Base Hospital and Buller Hospital (Day, 2009; Kerr & Day, 2010). However, to date utilisation of telemedicine has not had the uptake as expected in areas such as the Emergency Departments. There are small pockets of work going on with telemedicine in areas such as Paediatrics, Oncology, Urology and Neonatal services. Paediatrics has been the most successful with the utilisation of a mobile telemedicine cart to perform ward rounds enabling Canterbury paediatricians to look at acute child admissions. The utilisation of telemedicine in the Emergency Department has not yet been fully established with a number of trials being
unsuccessful due to the arrangement of equipment, privacy and the length of time taken for a telemedicine consultation.

The West Coast District Health Board

The WCDHB serves a population of 31,326 according to (Statistics New Zealand, 2006) Figure 1 shows how this population is dispersed into three main areas; Buller, Greymouth and Westland. There is a slight population growth from 2006 to 2012 of 1,000 people living in these areas.

![Population of the West Coast](image)

Figure 1 West Coast Population

(Statistics New Zealand, 2012b)

Esplin (2008) suggests the population is projected to decline over the next twenty years, which will make it even more difficult to deliver health services with scarcity of population and geographical isolation. The land mass covers 2.3 million hectares, which is often portrayed as the distance between Auckland and Wellington (Esplin, 2008). The area of the WCDHB is shown in Figure 2. The other important factor that comes into play is that this region, which is almost 600 kilometres (km) long and 100km wide, has a population density of 1.3 people per square km whereas Auckland has a population density of 4000 people per square km. The West Coast attracts 1.14 million visitors per year which in turn affects
not only accommodation and tourist services, but also healthcare. The WCDHB consists of a level one, level two and level three-four hospital, as well as medical centres. A level one hospital is defined as a hospital with no specialist services and is similar to a healthcare centre although it may have hospital beds for aged care. The level one hospital is situated in Reefton. A level two hospital is defined as a hospital that has some visiting specialist services. These hospitals may have inpatient beds for continuing care and/or low-risk births; the level two hospital is in the Buller region, at Westport (Creech, 1999). Level three-four hospitals have some resident and visiting specialists’ services. This type of hospital is described as a secondary care facility, which is defined as one which can cater for most of the local population’s needs on a 24-hour basis (Creech, 1999). Greymouth has the only secondary level hospital on the West Coast; it is the base hospital for the region. It should be noted that the WCDHB has recently gone through restructuring and the base hospital no longer fits secondary hospital status under this definition due to the lack of Orthopaedic services. In today’s world the Grey Base Hospital would now fit under the terminology of a sub-acute category (Creech, 1999). However, with the use of telemedicine secondary hospital status could be reinstated.
Travel times to the base hospital vary depending on where the patient is located and the weather. Major traffic accidents and bad weather can disrupt transportation from anywhere between one to forty-eight hours (Esplin, 2008). This means that often the patients in these areas with no ability to move to a facility capable of providing the care needed. The base hospital is often placed in a situation where they cannot transfer patients to tertiary level care. High risk industries such as mining, farming, forestry and fishing are widespread throughout the West Coast thus adding to the burden of access to healthcare. Furthermore, like many areas throughout NZ, the population has a high percentage of elderly. It is projected that the existing percentage of elderly will increase by 84% in the next 17 years (Esplin, 2008).

Over the past decade the WCDHB has grappled with sustainability of their healthcare service for all the reasons above. General Practitioner (GP) cover has been inconsistent due to the transient life style of doctors, especially in areas such as Reefton, South Westland and Westport. There is an expectation on the West Coast by its population, that standards of healthcare should be no different from that delivered nationally (Peterkin, 2009). As a result, a telemedicine project was started in partnership with the Ministry of Health, WCDHB and CISCO identifying the advantages of developing a more sustainable future for primary healthcare in these areas (Kerr & Day, 2010).

**Personal background**

I have been working as a health professional for the past 33 years, and a total of 18 years of that has been spent in the area of emergency nursing. I first started on the journey of post-graduate studies in 2006 and I must say that journey had no
pathway, but the need for knowledge and improvement in the service drove me to continue. In 2008 I became the Clinical Nurse Manager (CNM) of the Outpatients and the Emergency Department of Grey Base Hospital. As a clinician and manager in a rural setting I am faced with many challenges in my everyday work. One of those challenges, as head of a department, is to deliver a high standard of quality care to all.

My first introduction to telemedicine was in 2009 when I was asked where I would like to put an enormous amount of equipment. It was suggested that this equipment would be the answer to the medical staffing problems in one of our remote hospitals 105 km away. At the time there was a General Practitioner (GP) shortage in the area and that meant nurses were to work to the limit of their scope of practice with phone support from the Emergency Department doctors at the base hospital.

The telemedicine project, which started officially in 2008, was seen to be the solution to difficulties in providing sustainable healthcare in remote and rural areas of the West Coast. This project was fully supported by the Ministry of Health who worked in partnership with CISCO. CISCO Systems is an American based firm, who claim they are world leaders in providing a virtual face-to-face experience for patients and caregivers who are remote from each other (Cisco Systems, 2009).

I entered this research project with an open mind and a craving to find out more. However, I did have some preconceived ideas about telemedicine and why managers and vendors were having trouble getting clinician buy-in. Although there is much international literature on telemedicine, in its broadest sense, there is a scarcity of literature on the barriers to and opportunities of telemedicine in
Emergency Departments. My aim is to find out how telemedicine can assist clinicians in rural and remote areas within the Emergency Department setting.

**Language**

Clarity around the terminology utilised for describing any type of new technology is an important aspect. I found not only myself, but many healthcare professionals were confused when introduced to telemedicine, as many of the managers and vendors would use different terminology to talk about the same entity. There are many different modes and definitions that underpin technological terminology such as telehealth, telemedicine and telecare. For the purpose of this study I have included a glossary of commonly used terms which can be found on page ix. Chapter Two will explore the different terms found in the literature.

**Structure of the thesis**

The first chapter provides an overview of the study with a brief introduction to the WCDHB and the background of telemedicine to date in the Emergency Department at the base hospital. In addition it introduces the background of the author. The following chapters will include the literature, method, findings, discussion and conclusion of the study.

Chapter Two presents a synthesis of the national and international literature supporting the research relevant to the study. It must be noted that this is a thesis and not all literature available will be presented.
Following the literature review, Chapter Three discusses the research design and methodology used for this study. An outline of the qualitative descriptive methods is given along with ethical considerations. The Participant selection process, purposive sampling, is outlined and the consent process recorded. The interview process, followed by the data analysis using thematic analysis is also explained. Chapter Four presents the findings from the NZ Participants whilst Chapter Five describes the experience of health professionals working with telemedicine in Queensland. Chapter Six provides a discussion of the findings, and reflects on the literature, while Chapter Seven concludes the study by summarising the significant points, provides recommendations and areas for further research. The limitations of the study are also addressed within Chapter Seven.

**Summary**

Chapter One gives a brief summary of this study. It presents details of the WCDHB, the author’s personal background and the layout for the presentation of this thesis. Obtaining the thoughts from front line staff on the barriers and opportunities of telemedicine will provide the WCDHB with the necessary knowledge to consider the utilisation of telemedicine in the Emergency Department at Grey Base Hospital. Chapter Two will provide an overview of national and international literature looking at telemedicine, barriers, opportunities, and emergency services.
Chapter Two: Literature Review

“I do not believe that quality medical care can be provided without advanced information technology systems in the 21st century.”
-Robert Pearl

Introduction

This chapter will provide a critique and evaluation of international and national literature on telemedicine. The literature will inform the study on the barriers to and opportunities of telemedicine in rural and remote emergency services. Furthermore, it will identify and discuss definitions, drivers behind it and the opportunities and barriers to the utilisation of telemedicine. The process applied to the literature review will be explained first in this chapter.

This chapter will identify barriers to telemedicine which may prevent successful use throughout the West Coast District Health Board (WCDHB) emergency services. There has been a previous evaluation by the National Institute for Health Innovation (NIHI), University of Auckland of the West Coast project which has been helpful to the WCDHB (Kerr & Day, 2010). However, the utilisation of telemedicine has not had the expected uptake in areas such as Outpatients and the Emergency Departments. There are small pockets of telemedicine use such as paediatrics, oncology, urology and neonatal services. To date paediatrics are the most successful with the utilisation of a mobile cart on ward rounds which enables Canterbury paediatric specialists to provide input as necessary on any acute child
admissions. Paediatrics has also had success in Buller with an acute unwell child in the Emergency Department at Westport hospital. It should be noted that this particular department has only one bed. Interesting enough the only type of telemedicine that is embedded into everyday work is the use of tele-radiology.

**Process for Literature review**

The research question of telemedicine the barriers and opportunities in rural and remote Emergency Departments was broken up into concepts for the search. This included words such as telemedicine and Emergency Department, barriers, opportunities, rural and remote Emergency Departments. Subject headings and text words representing the following concepts were entered into each database:

1) Telemedicine
2) Rural and remote Emergency Departments
3) Emergency Departments and telemedicine
4) Opportunities and barriers of
5) Qualitative, quantitative, meta-analysis and systematic review
6) Quality definitions and fit for purpose.

A preliminary search was done electronically focusing on the databases CINAHL, AMED, Medline, EMBASE and Cochrane. Articles retrieved either discussed telemedicine or telehealth in broader fields. Secondly search phrases such as telehealth, telemedicine and Emergency Department were entered into the databases. A more extensive yet limited search using the words barriers and opportunities in telemedicine was undertaken which helped narrow down the articles. Search criteria narrowed articles to a 10 year period, those articles written
in English, and which were published in peer review journals. Google Scholar and PubMed were also searched using the concepts of barriers and opportunities in telemedicine and/or telehealth. Other articles were obtained through a snowballing effect where articles were selected from reference lists of articles read. Also included is grey literature extracted through pamphlets, government and health service documents. Four books were also utilised as a resource for this literature review; these were sourced from the Auckland University Library and these books focused on the history of telemedicine Books such as the essentials of telemedicine, the principles, policy and pitfalls and finally a book written on the assessment of telecommunications in healthcare, were also utilised and were relevant to informing my research. Once the appropriate literature was found, sorting began to decide whether these papers would address the research question and meet the inclusion criteria. A total of 127 articles were identified as meeting the criteria, but on closer inspection 30 were discarded, as they were not relevant for this review. Table 1 shows an example of selection criteria and process to evaluate literature identifying key themes and strengths and weaknesses.
Table 2: Criteria for Literature

<table>
<thead>
<tr>
<th>Name</th>
<th>Author</th>
<th>Design/Method</th>
<th>Publication/Country</th>
<th>Key themes</th>
<th>Strengths and weaknesses</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>CISCO Telepresence for Healthcare</td>
<td>(Cisco Systems, 2009)</td>
<td>Brochure/Case Study</td>
<td>America</td>
<td>Benefits of Telehealth. The importance of a high-quality effective communication system is vital. Telepresence enable faster decision making and problem solving, better collaboration, decreased misunderstanding due to cultural differences.</td>
<td>Bias high due to company doing own survey. Weak</td>
<td>2</td>
</tr>
<tr>
<td>West Coast Telehealth Project</td>
<td>(Esplin, 2008)</td>
<td>Report</td>
<td>NZ</td>
<td>Solution for sustainability in rural and remote areas. Benefits were improved access to specialist care, reduction of patient / health professional travel, saving of scarce resources, reduced cost. Improved care and outcomes</td>
<td>weak</td>
<td>1</td>
</tr>
<tr>
<td>A comparison of telemedicine with face-to-face consultations for trauma management</td>
<td>(Tachakra, Lynch, et al., 2000)</td>
<td>Observational Study</td>
<td>UK</td>
<td>200 patients were studied with accuracy of telemedicine consultations from 95% - 99%. The estimation of swelling was difficult due to the lack of depth perception. The use of camera rotated at 180 degrees in the transverse plane can help with this.</td>
<td>Strong</td>
<td>1,2,3,5,6,8</td>
</tr>
<tr>
<td>Impact of an electronic link between Emergency Department and family physicians: a randomized controlled trial</td>
<td>(Lang et al., 2006)</td>
<td>Randomized controlled trial</td>
<td>Canada</td>
<td>This article was more on electronic records so was excluded.</td>
<td>Strong</td>
<td>1,2,3,5,6,8</td>
</tr>
<tr>
<td>Performance of a wireless telemedicine system</td>
<td>(Tachakra, Banitsas, &amp; Tachakra, survey</td>
<td>UK</td>
<td></td>
<td>Equipment was heavy and large, needed to be plugged into the mains. The quality of the video deteriorated when there was movement of the trolley. Nurses were sceptical of the use</td>
<td>Strong</td>
<td>1,2,3,5,6,7,8</td>
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in hospital accident and Emergency Department (2006) and they were concerned about theft of the equipment.

<table>
<thead>
<tr>
<th>Evaluation of a pilot telemedicine network for accident and emergency work (E. M. Brebner, Brebner, Ruddick-Bracken, Wootton, &amp; Ferguson, 2002)</th>
<th>Pilot Study</th>
<th>UK</th>
<th>Telemedicine consultations in emergency medicine can be successful. Training in the use of equipment before the project began helped. Tele consultations take longer but that got better with time. Technically reliable, effective in reducing patient transfers and acceptable to clinicians.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong</td>
<td>1,2,3,5,6,7,8</td>
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Assessment Criteria – Quantitative & Qualitative: 1 Aims and objectives clearly stated. 2. Research design clearly stated. 3. Study based on random or pseudo random sample. 3. Criteria for inclusion/exclusion mentioned. 5. Sample size clearly defined. 6. Congruity between research methodology and question or objectives. 7 Participants and their voices are adequately represented. 8. Outcomes reliable and appear to flow from analysis.
Definitions

There has been a lack of clarity around the terminology utilised for describing this type of communication and technology. Anecdotally the author has observed a number of terms being used interchangeably and many people are confused when introduced to this new way of delivering healthcare. Managers and vendors alike would use different terminology when talking about telemedicine yet they were actually talking about the same entity. There are many different definitions that underpin this technological terminology such as e-health, telehealth, telemedicine and telecare. This definitions section will help clarify this.

E-health is a relatively new term which has been branded as an umbrella for the use of information technology to provide patient care (Roberts et al., 2010). According to Eysenbach (2001, p. 1) it was created in late 1990 as a “buzzword” utilised by marketing people and industry leaders in line with words such as e-commerce and e-business and meant “internet medicine”. A similar description was recognised by Della Mea (2001) who described e-health as the death of telemedicine, explaining that e-health should be considered as the health industry’s equivalent of e-commerce, with e-health being described as non-professionally driven whereas telemedicine was linked to medical professionals.

The term telemedicine originated from the Greek, “tele meaning at a distance, hence telemedicine is medicine at a distance” (Wootton et al., 2006, p. 4). Armstrong and Haston (1997) and Cary and Darkins (2000) elaborate suggesting that telemedicine is the use of two-way interactive communication which delivers and enables healthcare exchange between primary care and specialists over a distance. Furthermore, Bruhn (1998) suggests that telemedicine is not only the use
of interactive video communications, but also the use of telephone to perform consultations between health providers in separate geographical areas. Brennan et al. (1999) and Moffatt and Eley (2010) describe telemedicine as the use of information technology and modern telecommunications to deliver assessment, diagnosis, treatment, monitoring and education to patients no matter where they are located. However, there are slight differences between telehealth, telemedicine and telecare in that telecare provides healthcare and advice to patients in their homes (Norris, 2002).

Moffatt and Eley (2010) state telemedicine is the use of communications technology to provide healthcare to individuals at a distance. Additionally, Moffatt and Eley (2010) suggest that telehealth differs from telemedicine, due to its broader connotation. Telehealth includes not only the delivery of healthcare to individuals, but also administration and training for healthcare professionals. This can be delivered in real time, store and forward or pre-recorded information.

The World Health Organisation (WHO) has also made a distinction between telehealth and telemedicine suggesting that telemedicine is more clinically focused whereas telehealth has a broader aspect covering education, public and community health and epidemiology (Cary & Darkins, 2000). As technology evolves so does terminology. Nonetheless the basic fundamentals still apply; telemedicine and telehealth have the broader overlying arch that explains what is meant when healthcare and education are provided at a distance.

Tachakra, Uche, and Stinson (2002) use other terminology with similar meaning such as tele-consultation. This was in the context of supporting a minor accident and treatment service dealing with fractures; wound assessment and obtaining
general orthopaedic advice. Teleconsultation took place regularly with the use of tele-radiology.

Tele-radiology is a term utilised in medicine throughout many areas and one that most Emergency Departments are familiar with. A study undertaken by Armstrong and Haston (1997) explains tele-radiology in two parts, a high resolution PC and a film digitiser. Moreover, still images are transmitted and displayed for viewing in tertiary hospitals where radiologists are available for reading and annotation. On the other hand, it also allows the same within the remote community hospital. The use of tele-radiology has transformed the ability to conduct a consultation between Emergency Doctors in rural and remote areas to orthopaedic specialists in tertiary hospitals enabling patients to receive expert opinion on certain aspects of care. Health professionals can use enhancements such as image brightness, contrast and zoom to improve the image and get a more in-depth look at the films, enabling support to the remote emergency doctor with quick and clear instructions on care and treatment.

Telepresence is another term utilised throughout the healthcare sector. Telepresence is best described as the transport of health professional expertise to a remote site (Armstrong & Haston, 1997).
All articles agree that telemedicine, telecare and telehealth is the use of information technology and telecommunications to deliver healthcare at a distance (Bashshur & Shannon, 2009; Cary & Darkins, 2000; Emery, 1998; Norris, 2002; Wootton & Bonnardot, 2010). Below figure 3 is a summary of common language used and can be drawn on as a quick reference for the reader.
History

Remembering that telemedicine means medicine at a distance, (Bashshur & Shannon, 2009) it could be suggested then that the history of telemedicine can be traced back as far as communities communicating by smoke signals. Cary and Darkins (2000) suggest early examples of health at a distance can be traced back to the Bubonic plague, when transmission was by yellow flags and mounted signs to warn people to stay away. Norris (2002) conversely, dismisses these early ways of communication as his definition suggests a type of technology must be involved. The first telecommunications date back to the 1840s to 1920’s with telegraphy and telephony, followed by the radio in 1920 and television in 1950 (Norris, 2002). Therefore, the history of telemedicine may then only have started when communications technology such as the phone were invented in the 1840s. Implications of this view may be that an exceedingly important part of our history may be lost.

There are a few names worth a mention associated with the introduction of technologies enabling telemedicine. Alexander Bell, although controversial, was recognised for his contribution to telemedicine with the invention of the telephone (Cary & Darkins, 2000). There is documented evidence published in the Lancet Medical Journal, where it refers to a child who was diagnosed with croup via a telephone in 1897 (Cary & Darkins, 2000). Inventor Claude Chappe d’Auteroche and his four brothers developed the optical telegraph (Bashshur & Shannon, 2009). They were also seen as early pioneers of telemedicine. The optical telegraph, although patchy at times due to weather, paved the way for electrical
communication. Bashshur and Shannon (2009) acknowledge a significant landmark when Claude Shannon took electrical communication to a new level with the ability to not only transmit information but also to capture, process, store and retrieve it. Lastly, Willem Einthoven who in 1924 won the Nobel Prize in physiology, deserves a mention for his contribution to tele-cardiology when he discovered the mechanism of the electrocardiogram. Documented modern telemedicine is traced back to the Netherlands, where the first recorded successful transmission of heart sounds took place in the early 1900s. Radio consultations followed in Norway, Italy and France in the 1920s, 1930s, and 1940s mainly with people on ships or remote islands (Bashshur & Shannon, 2009). The 1950s saw the invention of transmission of radiological images by the United States of America (Bashshur & Shannon, 2009). From 1955 to 1964 the Nebraska Psychiatric Institute began transmission on a closed-circuit television between themselves and a state hospital 112 kilometres away (Norris, 2002; Wootton et al., 2006).

According to Norris (2002) the 1970s brought about the first commercial communications satellites which opened the door of opportunity. Satellites generated a great deal of telemedicine activity, especially throughout the United States (Cary & Darkins, 2000). Then interest in telemedicine waned due to the financial downturn, high cost of technology, poor quality of images and inability to interface with healthcare provision in the United States. Furthermore, promises that telemedicine would bring more effective and efficient healthcare did not always translate into medical acceptance and many early telemedicine pilot projects in the United States folded (Cary & Darkins, 2000).
1980 brought renewed interest in telemedicine due to a move from analogue to digital, enhanced computers and mobile phones (Norris, 2002). Despite the increase in activity continuing through to the 1990s, doubt continued to remain over the cost effectiveness of telemedicine within countries such as the United States (Emery, 1998; Norris, 2002). Although this type of healthcare delivery has been around for a long time the 21st century offers a more sophisticated way of providing this and growth of telemedicine, although slow, continues.

**Drivers of telemedicine**

Drivers of telemedicine can be broken down into two categories, technological drivers and non-technological drivers as shown by the table below (Norris, 2002).

Table 3: Drivers of telemedicine

<table>
<thead>
<tr>
<th>Non-Technological drivers</th>
<th>Technological drivers</th>
</tr>
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<tbody>
<tr>
<td>Geographical, access to Healthcare</td>
<td>Computing</td>
</tr>
<tr>
<td>Specialist services</td>
<td>Information technology</td>
</tr>
<tr>
<td>Financial</td>
<td>Telecommunications infrastructure</td>
</tr>
<tr>
<td>Demand on healthcare and longer life span of people</td>
<td>Network</td>
</tr>
</tbody>
</table>
Non Technological Drivers

As specialisation increases in medicine, rural areas find it more difficult to attract doctors to their regions. Inequity of access to specialist care in rural and remote areas is seen as a driver to telemedicine according to Smith and Gray (2009). Lack of access to specialist care can leave junior doctors filling the gaps and in some places, nurses. These staff may be expected to triage, treat and discharge patients after receiving inadequate telephone advice from specialists (Keane, 2009). With low patient volumes in rural hospitals it is difficult to provide cost effective and quality emergency care. As a result, in some areas, Emergency Departments are being staffed with Nurse Practitioners (NP) and / or physicians who are often passing through and have no commitment to the communities they provide healthcare too (Henderson, 2006). Telemedicine is seen as providing a viable alternative to these issues.

According to Duplantie, Gagnon, Fortin, and Landry (2007) there is increasing pressure from issues regarding access and availability of healthcare in Canada. Furthermore shortages of general practitioners and specialists are continuing to rise, especially in rural and remote areas. Telemedicine was identified as an effective strategy to address these issues. This was echoed by Sargeant, Allen, and Langille (2004); their study advocated that with the increase of support from telemedicine isolation was reduced for clinicians and morale improved, thus having a positive effect on recruitment and retention. However, they did suggest that there was a lack of rigorous evaluation done on telemedicine and how it affected retention and recruitment and this was a further area for research.
Emergency medicine can be variable in small rural hospitals, going from zero to ten patients within minutes. Furthermore, staffing levels are kept at a minimum with some departments staffed by one senior nurse and one doctor who care for the whole hospital. Patients may turn up unannounced to the nearest Emergency Department not aware of the level of care provided within that particular department (Keane, 2009). Telemedicine brings the specialist to these areas without them leaving the tertiary area they are employed in. This helps attract doctors who want the rural experience yet feel vulnerable as they are often the only doctor there.

Demand on healthcare is a concern for many countries in the Organisation of Economic Cooperation and Development (OECD). International literature shows an aging population which will have significant impact on the health and disability services in the future (Cornwall & Davey, 2004). However, advances in technology and labour costs could influence the spend of the health dollar (Cornwall & Davey, 2004). For this reason many countries such as USA, Canada, Australia and NZ are looking at different ways of delivering healthcare, including telemedicine. The table below shows the aging population predicted for NZ until 2031.
Table 4: Percentage of total population 65 and over, by age group, 2001

base and series 4 projections

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Percentage of population</th>
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<tbody>
<tr>
<td></td>
<td>2001</td>
</tr>
<tr>
<td>65–69</td>
<td>28.4</td>
</tr>
<tr>
<td>70–74</td>
<td>26.2</td>
</tr>
<tr>
<td>75–79</td>
<td>21.0</td>
</tr>
<tr>
<td>80–84</td>
<td>13.6</td>
</tr>
<tr>
<td>85 plus</td>
<td>10.8</td>
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</table>

Source: (Khawaja & Boddington, 2010)

The increase in the aging population will determine the way health is delivered in the future. Demand on health services continue to rise on an already stretched healthcare system as people live longer. Smith and Gray (2009) identify travel distance as a significant driver of telemedicine where communities are widely dispersed and isolated. Al-Qirim (2004) suggests telemedicine can provide fast and economical medicine to rural patients and save valuable time for both the patient and specialist in commuting large distances.

Military application would be one of the early uses of telemedicine and a non-technological driver (Wootton et al., 2006). They saw telemedicine as a way of providing a more efficient, first class healthcare to their force, ensuring their soldiers return to active duty as soon as possible.

More examples of non-technological drivers are extension of access to healthcare services and cost reduction (Field, 1996) although this is debated by some authors (Nobel, Coast, & Benger, 2005). Another driver is health policy and strategy, as governments look for ways to increase access to health without increasing the
locum spend. Finally home telecare which has been around since the 1990s, but is increasingly used throughout countries such as Australia, as a strategy by government to keep people in their homes rather than filling hospital beds (Norris, 2002).

**Technological Drivers**

As telemedicine advances and interest grows, so does the appetite for faster connectivity speed not only by healthcare workers but also the general public and big business (A. Smith & Armfield, 2011). This has resulted in market development where suppliers are increasing not only the amount of technology available but also competition is beginning to improve the product (Smith and Gray, 2009).

The ability to access equipment such as computers is seen as a challenge. Stronge, Rogers, and Fisk (2007) suggest when purchasing technology, consideration must be given to the design features, as they will differ depending on need. Having the right technology can support seamless interaction when delivering healthcare and ensure the success of telemedicine. A study conducted by Galli, Keith, McKenzie, Hall, and Henderson (2008) for delivery of emergency care using telemedicine, suggests the design of a system must be simple, easy to use, with the capabilities for assessment and treatment of emergency patients.

Transition from analogue to digital, lower costs in equipment, higher resolution monitors and the provision of more sophisticated advances in computing have been significant (Norris, 2002). Likewise this has seen the transformation from
copper wire based networks to fibre-optic cables. Australia and NZ are presently increasing networks throughout their countries to ensure availability of broadband to rural areas, not only for healthcare provision but also for the general public (Smith & Armfield, 2011). According to Moffatt and Eley (2011) technological drivers can also be seen as a barrier to utilizing telemedicine. Infrastructure such as poor internet access availability in rural areas can act as a barrier.

**Barriers**

Wootton et al. (2006) identify a number of barriers associated with telemedicine, such as the quality of health information delivered and the breakdown in relationships between health professionals, and health professionals and patients. Furthermore, there was concern over difficulties within the organisations with bureaucracy. McCrossin (2003) identified barriers such as planning and executive failure. Executive failure arises when the plan is sufficient, or when the actions taken do not follow the plan. Additionally, planning failure is when the plan is inadequate. Joseph, West, Shickle, Keen, and Clamp (2011) and Stronge et al. (2007) identified challenges in implementing telemedicine, naming staff scepticism and training as key. A lack of dedicated project management and recurrent funding issues were considered to be limitations of successful implementation. Care should be taken in an uncertain climate, such as healthcare, when introducing new methods of service such as telemedicine, as people usually favour the already known (McCrossin, 2003). Furthermore McCrossin (2003) suggests men are generally disbelieving of new things unless they have been well tested by experience. When introducing telemedicine Buck (2009) and Stronge et
al. (2007) suggest it is important to first consider the needs of the user, as success depends on the interaction between the user and the technology. Furthermore, Buck (2009) suggests that in order for telemedicine to be accepted the user must immediately understand what added value it will give and why it exists. Doctors’ perception of the usefulness of telemedicine was found to be a contributing factor of doctors acceptance of the tool (Buck, 2009). Recruiting the right patients and having technology that was compatible with telephone systems can be a challenge and in one study none of the organisations had long term strategic plans for telemedicine (Stronge et al., 2007).

Although mentioned in the previous section as a driver, technology can in fact be a barrier to telemedicine. The paper by Pryke (2012) suggests a problem when trying to utilize technology with the elderly, as there are still many elderly living in rural and remote areas that suffer from IT illiteracy.

In NZ there are 21 individual District Health Boards (DHB) with a population of nearly 4.5 million (Statistics New Zealand, 2012b). Many DHBs have clinical information systems and networks that are not compatible with other healthcare providers, in some cases in the same regions. Slow video access, poor picture quality and delay in sound have added to the struggle of integrating telemedicine into Emergency Departments (Parker, 2005). Moreover, staff in Emergency Departments work in a “fast paced environment were activity requires flexibility” (p. 70), and the perception is telemedicine technology will not lend itself to the diversity and pace needed. A report by Giordano, Clark, and Goodwin (2011) from Scotland recognises there are a number of lessons to learn when adopting telemedicine, such as ensuring that professionals are prepared to work differently as individual caseloads will not increase otherwise. Furthermore, ensuring that the
service needs are met by the technology requires proper analysis of how the model of care should look prior to buying equipment from vendors. If this is not done then the waste of expensive costly equipment can occur by underuse or no use at all (Parker, 2005).

According to Banks and Togno (1999) and Cary and Darkins (2000) delivering healthcare via telemedicine is still in its infancy in terms of defining the legal aspects. Furthermore, the wait and see approach to legal issues is considered high risk, putting patients and health professionals in a vulnerable position (Cary & Darkins, 2000). This was reiterated by Field (1996) and Wootton et al. (2006) who recommend there are three key areas for concern:

1. Potential liabilities to health professionals.

Al-Qirim (2004) investigated the current legal framework in NZ and found that regulatory bodies had not kept pace with telemedicine. Matters such as misdiagnosis due to the constraints of telemedicine could increase legal concerns, but also issues pertaining to privacy and patients’ security needed to be addressed. Norris (2002) rightly points out that a lot of these concerns or issues are also associated with conventional medicine however the at-a-distance aspect where someone in one country may be giving advice to a person in another country could potentially cause legal consequences if the patient suffers harm.

If attention is not given to detail such as standard protocols, setting of parameters for patients, scheduling, clinician and patient preparation, and ease of access to telemedicine facilities, then telemedicine is surely set to fail (Giordano et al.,
2011; Smith & Gray, 2009). Also the development of protocols between organisations in regards to appropriate responses, particularly with respect to provider liability and authority, should be clear prior to implementation of any telemedicine system (UniQuest, 2011). According to J. A. Brebner, Brebner, and Ruddick-Bracken (2005) and Gill (2012) there will be negative impact on telemedicine if clinical protocols are not developed. This notion is supported by Hayes, Duffey, Dunbar, Wages, and Holbrook (1998) who felt that without administrative policies telemedicine could fail and Peterkin (2009) who felt detailed discussions needed to take place about protocols and procedures when introducing telemedicine. One study by Benger (1999) described protocols as essential in any nurse led minor injuries unit when used for tele-consultations.

Furthermore, Benger (1999) advises when considering protocols four areas must be taken into account:

1. Management of specific conditions
2. Ordering and interpreting radiographs
3. Prescribing and dispensing medications
4. Conducting the tele-consultation itself.

Smith and Gray (2009) suggest proper funding must be given to a telemedicine project for administrative support and clinician incentives as does Giordano et al. (2011). Stakeholders from a study in Alaska identified areas of future issues such as sustainability due to dependence on funds (Lamar, 2004). The value of a telemedicine project has to be known otherwise it is a waste of resource according to Wootton and Bonnardot (2010). They suggest the value must be greater than
the conventional ways currently in place. Moreover, developing countries have reported some spectacular and costly failures with telemedicine. Examples of this can be found in South Africa and Malaysia where US$ 5.5 million was obtained for a telemedicine project and in the end only a few hundred cases were handled before it was withdrawn.

Keane (2009) gave an example of the impact on clinicians with paramedics using videoconferencing equipment for advice in acute trauma, where the paramedics complained as they felt they were being watched. Moreover, the system showed no cost benefit thus the conclusion was made that in the acute trauma setting there was little benefit of telemedicine except for providing feedback to the receiving centre so they could prepare for admissions. Although most research has been taken from pilot studies, an expectation is, telemedicine will in the future be seen in many Emergency Departments throughout the world (Keane, 2009). Regulatory issues were also identified such as privacy, confidentiality, licensing and technical standards. Furthermore they felt expansion issues would cause issues with quality due to an increased number of users impacting on connectivity and applications speed (Lamar, 2004). Wootton and Bonnardot (2010) acknowledged telemedicine had been utilised following disasters, and the experience of those attending these disasters felt that a more physical support was appropriate rather than virtual. Furthermore they felt it would be a similar situation to accident and Emergency Departments, as they will also have to cope with the chaos of disruption to communication and lack of resources.

A trial performed in a UK Accident and Emergency Department utilising a mobile cart showed little success, compared with conventional ways (Armstrong & Haston, 1997). According to Tachakra et al. (2006) problems with disturbances in
audio transmission occurred and of the four consultants and eleven nurses who
took part in the trial, eight out of the eleven nurses remained sceptical about its
use. The four consultants were positive in their initial comments, however, two of
the four offered constructive criticism such as teething problems need to be
corrected prior to using in consultations and system improvements were needed
(Tachakra et al., 2006). This study also explored the patients experience and
found half of the patients were anxious about the transmission of their data.
Tachakra et al. (2006) justified this by explaining that patients are normally
anxious about their health when entering the Emergency Department so their
anxiety was not necessarily directed on the telemedicine.

According to Nobel et al. (2005) telemedicine was comparable to face to face
consultations with results to patient care, however telemedicine was more
expensive. Reasons for the increased costs included: increased staff costs as you
need a clinician on each end of the link, the need for specialised equipment and
the staff from the main hospital requested follow-up appointments earlier than
those in routine assessments. This trial did not look at the cost of setting up the
infrastructure to support the technology which is something that should also be
factored in. Nevertheless, some rural and remote areas find it hard to recruit
medical personal and telemedicine may be the only alternative. Brennan et al.
(1999) found in their trial that six patients complained about the lack of a personal
touch and two people were disturbed at seeing themselves on the screen.
Furthermore, doctors, nurses and patients had difficulty hearing due to the
background noise level of the Emergency Department (Brennan et al., 1999).

A qualitative observational study of simulated medical emergencies carried out by
Bolle, Larsen, Hagen, and Gilbert (2009) looked at the use of virtual teams in
urban areas supporting staff in critical emergencies in rural areas and compared this to telephone conversations. The main focus of this study was on the teamwork, acknowledging teamwork is important to patient care and outcomes. Results of this study showed that the virtual teams disturbed workflow, added complexity and provoked a lack of confidence thus impeding patient treatment (Bolle et al., 2009).

**Opportunities**

Accessibility to healthcare is an important factor for rural and remote areas. Areas throughout the world face significant challenges with the tyranny of distance (Duplantie et al., 2007; Smith & Gray, 2009). Specialisation of services has posed a number of problems for health. Many policy makers and managers have grappled with this over the years. The World Health Organisation has written a statement on inequalities:

> “Health inequities are avoidable inequalities in health between groups of people within countries and between countries. These inequities arise from inequalities within and between societies. Social and economic conditions and their effects on people’s lives determine their risk of illness and the actions taken to prevent them becoming ill or treat illness when it occurs”

(World Health Organization, 2013).

Furthermore, governments and the economy affect health and health equity. So it is crucial that governments look at ways to reduce the gaps between rural / remote and urban communities (World Health Organization, 2013). In Canada the Quebec Ministry of Health identified telemedicine as an effective strategy to
improving accessibility of health services in remote areas (Duplantie et al., 2007). According to Wootton et al. (2006) opportunities for telemedicine to decrease gaps are endless, with easier access to specialists and decentralization of the healthcare sector enabling patients to stay closer to their homes and family. Norris (2002) agreed, suggesting there were clear benefits for patients in rural and remote areas where access to specialist advice was not available. According to Cary and Darkins (2000), although there may be medico-legal issues to resolve, patients believe there are benefits from access to medical advice from physicians with emergency room experience, so much so they are purchasing telehealth services themselves. In addition, Moffatt and Eley (2010), state that telemedicine has the ability to reduce the perception of isolation for healthcare professionals and an increase in education through video conferencing not only helps with recruitment and retention of staff in rural and remote areas, but also gives a sense of being part of a larger healthcare team (Moffatt & Eley, 2010).

Telemedicine will become an important mode of health care delivery by solving cost and demand for healthcare (Stronge et al., 2007). Stronge et al.,(2007) suggest that one of the critical factors for the increased demand is the shift in demographics, meaning the aging population over 65 years. A study by Keane (2009) suggested that telemedicine had a place in rural Emergency Departments, solving problems such as distance and communication. According to Bolle et al. (2009) telemedicine consultations improved communication between hospitals. Furthermore Ellis, Mayrose, and Phelan (2006) identified communication improved so much that the time of consultations decreased from on average of 24 minutes to 17 minutes. Henderson (2006) suggests telemedicine provides positive patient outcomes, is cost effective and provides user satisfaction. Moreover their
trial over two years with 10 Emergency Departments showed patients where extremely satisfied with their care, rating their overall experience at 85.6%. A study in the UK by (Tachakra et al., 2002) investigated the experience of telemedicine support of a minor accident and treatment service. The majority of patients seen were those with fractures or infections and the main reason for the consultations were for review. The study showed that teleconsultation prevented patients from being transferred unnecessarily for further care and telemedicine was an exceptional education device.

According to Parker (2005) telemedicine has the potential to support ambulance and helicopter transport, allowing Emergency Departments to prepare well for the arrival of patients. Telemedicine had also shown benefits to patients with coronary events when paramedics were linked to coronary care units and were able to provide pre-hospital thrombolysis whilst transporting patients to hospital (Keane, 2009).

Keane (2009) suggests there is evidence of increased success with diagnosis of patients seen by the Nurse Practitioners in minor injury units, when nurse phoned the consultant, then emailed through blood results, x-rays, ECGs and other images to obtain advice and support. Mair and Ferguson (2008) identified in their study that 80-85% of patients seen in minor injury units could have been managed by tele-consultation, rather than going to Emergency Departments.

Tachakra, Jaye, Bak, Hayes, and Sivakumar (2000) identified that telemedicine was feasible in trauma care. Their study utilised scenarios in advanced trauma life support and showed that telemedicine was a cost effective solution to providing good quality trauma care in hard to staff rural Emergency Departments.
Tele-radiology has been the most successful and more integrated type of telemedicine to date; in fact it has become part of normal everyday work. The images have 98.6% sensitivity compared with plain films that have a 100% (Keane, 2009). This means the images can be shared electronically and maintain a high quality. Telemedicine offers opportunities for filmless radiology, new and better triage and finally tele-surgery (Norris, 2002).

Ophthalmology also had success utilizing video conferencing and telemedicine. Rural areas sent images from the slit lamp to specialists in a main centre and this allowed staff to accurately and safely manage referrals, and in addition consultations did not take any longer than the conventional face-to-face (Keane, 2009). However, this was not reinforced by a study carried out in Scotland by E. M. Brebner et al. (2002) who suggested that tele-consultations took much longer. Benefits from that study showed 89% of patients were treated locally, thus there was a decrease in patient transfers. Out of 402 tele-consultations only 2% of remote healthcare professionals were dissatisfied with the experience, unfortunately the reasons for this dissatisfaction were not recorded (E. M. Brebner et al., 2002).

Lamar (2004, p. 9) agreed stating that “34% of providers noted that telemedicine prevented patient travel”. Ellis et al. (2006) suggests that telemedicine assisted in decision making when deciding which type of transport should be utilised and where the patient should be received, such as at either a territory hospital Emergency Department or a more local one.
Several groups utilised telemedicine for first aid advice to offshore boats and remote island communities from local Emergency Departments (Keane, 2009). This was shown not only to improve outcomes but also had some cost benefits as it averted unnecessary helicopter transfers to local hospitals. Oil rigs have a high rate of chest pain presentations and telemedicine has been used successfully to seek advice and have ECGs reviewed (Keane, 2009). Oil companies have invested in a lot of telemedicine equipment as they can see the health benefits for their staff and cost savings when avoiding unnecessary transfers.

Telemedicine has also been used successfully to support early thrombolysis in the field. As telemedicine increases in rural and remote areas, it is thought that confidence can be developed GP and Rural Nurse Specialists (RNS) to carry out thrombolysis on patients with ST elevation myocardial infarction (MI) pre hospital (Keane, 2009). Although one might argue that the gold standard has changed and most areas have moved away from thrombolysis and on to angioplasty, in the case of rural or remote areas where transport is at least two hours away, thrombolysis has been shown to improve health outcomes as there is a reduction in complications (Keane, 2009).

A project carried out by the Alaska Federal Healthcare Access Network (AFHCAN) showed that there was a dramatic improvement in medical personnel retention in isolated areas due to telemedicine, because of the opportunities not only for patient consultations but also for education and training (Lamar, 2004). They felt as long as the tele-communications were available setting up remote clinics with carts would also give access to specialists and physicians in urban areas (Lamar, 2004).
Heath, Salerno, Hopkins, Hertzig, and Caputo (2009) who looked at paediatric critical care telemedicine in rural Emergency Departments suggested it is feasible to provide subspecialty care for paediatrics through telemedicine. Furthermore, Heath et al. (2009) recognised that many rural hospitals did not have the specialised equipment or support to deal with children with life threatening illnesses. These illnesses are relatively uncommon but have the potential for high morbidity and mortality. Their trial involved 63 telemedicine consultations in 10 rural Emergency Departments, with supervision given to the critical care transport team on twenty five cases. This study found an improvement in patient care by 89% (Heath et al., 2009). Smith and Gray (2009) also saw benefits when utilizing telemedicine with paediatric presentations, however, they found it most useful for mobile or wireless videoconferencing. That study highlighted that parents found it less stressful and more convenient to see specialists through telemedicine. Furthermore, parents felt there were cost savings from not having not to travel to a larger hospital for care (Smith and Gray (2009).

Quality of patient care was improved as depicted by Bolle et al. (2009) who suggested telemedicine consultations improved communication between hospitals and their teams and patients are seen sooner by specialists, which has a positive result on outcomes. A Quantitative analysis of a pilot study completed in the Hunter Valley region of New South Wales concluded that patients suffering from Chronic Obstructive Pulmonary Disease (COPD) and Congestive Heart Failure (CHF) had significant improvements in their care with the use of telemedicine (Fanning, 2010).

Wootton et al. (2006) claim that telemedicine will improve efficiency, quality, access problems and finally decentralize the healthcare sector enabling patients to
stay closer to their homes and family. Faster and easier access to medical knowledge, better diagnostic service and enhanced communication between healthcare providers are also benefits recognized by these author’s. Fanning (2010) identified that the use of home based monitoring systems would keep people in their homes healthier and this would have a substantial impact on access problems and efficiency of hospital systems.

Tele-education provides benefits for health professionals. Providing health professionals working in rural and remote with continuing education can seem insurmountable (Mahadevan, Muralidhar, & Shetty, 2011). Figures released in a US study showed 19 million people living in rural areas with just nine percent of the nation’s physicians practicing in these areas (Zollo, Kienzle, Henshaw, Crist, & Wakefield, 1999). Professional isolation has been seen as a barrier to recruitment and retention due to the diminished access to professional development and education. Zollo et al. (1999) felt one approach to sustaining telemedicine and helping with professional isolation would be to expand the role of telemedicine to include interactive continuing medical education (CME) broadcasts to rural and remote areas. This was reiterated by Mahapatra, Mishra, Kapoor, and Singh (2009) whose study realised the potential of telemedicine to supply CME to healthcare professionals living in remote areas. According to Curran (2006) tele-education has been around for a number of years delivering health education to rural health professionals. With advances in technology and the role out of broadband communications the ability to deliver a far superior health education service to sparsely populated regions is a reality (Curran, 2006; Mahadevan et al., 2011). There are many benefits from utilizing tele-education for
rural and remote health professionals such as reduced costs and travel, interpersonal connections not only nationally but also internationally, skill development, reduction in feeling isolated, minimising staff absence and enhanced patient care. However Sargeant (2005) points out there are also challenges, for example, technological challenges relating to equipment meeting the needs of the user and having appropriate support for its use, and challenges created by local healthcare and social environments.

Summary

This chapter has provided an overview of the current literature pertaining to telemedicine. The literature indicates there seems to be continuing debate over the true cost effectiveness of telemedicine due to lack of published results on this topic. It includes definitions, the history and drivers (technological and non-technological barriers and opportunities). There remains some confusion on terminology however telemedicine seems to be the most popular term in use at this stage. The next chapter describes the method utilised to answer the research question for this study.
Introduction

This chapter will provide the detail and rationale for the research design and process utilised to meet the study’s aim. This is a descriptive study involving semi structured interviews with a purposeful sample of health professionals working in emergency services for the West Coast District Health Board (WCDHB). The study also included site visits and sought opinions of experts from Queensland, Australia.

Aim of the Research

The primary aim of this study is to identify the barriers and opportunities for telemedicine in the Emergency Departments of rural and remote hospitals.

Timeline for the study

Timelines are an important part of the research project. It is well known that researchers can underestimate the time it takes for each step of the process. Firstly, consideration was given to the amount of time to complete the study. Secondly, the process was mapped out with a start and finish time, working backwards.
**Background**

Whilst there is much literature written on telemedicine in different disciplines there is very little written on the perceptions of clinical staff utilizing the tool in rural emergency services. Additionally, most of the research provided looks at pilot studies or simulation trials carried out overseas. There is a lack in NZ based research looking at the barriers and opportunities of telemedicine in Emergency Departments. The driving force behind this research was the lack of studies done previously on this particular topic and the need for increased utilization in the Emergency Department, Grey Hospital. The ability to share this study and findings with other Emergency Departments throughout NZ is essential to this research in the hope it will inform good decision making for telemedicine implementation and improve patient outcomes in rural and remote areas.

**Research Methodology**

Research is a process where the researcher systematically takes steps to acquire new knowledge through enquiry. According to Gerrish and Lacey (2010) it is important to be transparent when exploring, discovering, confirming and understanding data. Moreover, qualitative research fits nicely within an interpretivist tradition meaning information is gathered and then interpreted based on assumptions of human behaviour and social processes. The researcher usually has his or her underlying preconceptions which may guide the process of enquiry (Walsham, 1995). According to Frankel and Devers (2000) there are three key differences between qualitative and quantitative research design. The first is qualitative research design is often inductive, which means it is used to describe peoples meanings and experiences. The researcher wanted to learn from front line
staff working in rural and remote emergency services their perceptions of telemedicine. Secondly qualitative research is often flexible and can be dynamic. To allow new information and questions the researcher had an interactive approach that was flexible thus modifying the data gathering process based on the analysis. Although a design was utilised for the research to improve efficiency and successful functioning, flexibility is the key to success of this type of research. Finally, Frankel and Devers (2000) suggest the qualitative process is non-linear and non-sequential, meaning the researcher must not only take note of the text but also human behaviour, such as body language.

According to Rich and Ginsburg (1999) quantitative researchers suggest that qualitative research is lacking scientific rigor, however in health it is acknowledged there are benefits for both methods as the qualitative approaches allows for human elements. Furthermore, both methods have their strengths and limitations as no research is flawless or complete.

Gerrish and Lacey (2010), suggest there are four elements that are used to judge the trustworthiness of a qualitative study these are presented in Table 5 below.

<table>
<thead>
<tr>
<th>Credibility</th>
<th>Is the way a researcher represents the views of the Participant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transferability</td>
<td>Can the finding be transferred to similar situations</td>
</tr>
<tr>
<td>Dependability</td>
<td>This relates to transparency of the research process</td>
</tr>
<tr>
<td>Confirmability</td>
<td>Data, findings and interpretation are clearly linked</td>
</tr>
</tbody>
</table>

Careful consideration was given to the way information was interrupted ensuring the findings were a true representation of the participants’ views. Although this study did not represent all the views of all who work in emergency services for
the WCDHB a rich source of data was collected and could be utilized in similar rural emergency department. The research process has been presented in this study thus providing transparency and the findings, data and interpretation are linked within the Chapter Six.

**Design of research**

According to Bickman and Rogg (1998) research design in qualitative research should be a reflective process through every stage of study, which means the researcher needs to be flexible and non-sequential in the approach to allow for new developments. However, this does not mean there is no design, rather it means that the design does not follow traditional designs as it requires broader and less restrictive models (Bickman & Rogg, 1998). For these reasons the model presented here shows the five components of the design (figure 4).

![Five components of research](image)

The goal of this study is to influence the utilization of telemedicine in the Emergency Department of Grey Base Hospital. Generally when all researchers embark on a study, they have some preconceived ideas of what issues might relate
to the problem. These may be influenced by previous studies, literature, own experiences and or theories. The researcher hypothesized, that the implementation of telemedicine was key to improving utilization. Learning the perceptions of the barriers and opportunities of telemedicine from health professionals who will be using it in their work will identify issues that may become a barrier to use. Once this has been completed the researcher needs to decide what methods to use to collect and analyse the data. Keeping the research question at the centre of the process the study used semi structured interviews with clinical staff, and site visits as the most appropriate way to achieve the goals of the study. Using a conceptual framework kept the researcher on task and provided validity of the study by ensuring Participants interviewed was all given the same opportunity to answer questions and present their views.

**Ethics**

Ethics approval is essential to any research study. Its sole purpose is to protect and respect research Participants’ rights. Ethics approval ensures that consent is acquired prior to initiation of Participant contact and to ensure confidentiality is maintained. Bennison (2008) suggests once ethical approval has been given, the researcher has an ethical responsibility to protect five rights of the Participants:

- The right to self determination
- The right to privacy
- The right to anonymity and confidentiality
- The right to fair treatment
- The right to freedom from harm.
Careful consideration was given to the rights of Participants in this study as the researcher is the manager of the Emergency Department at the WCDHB. To minimise risk, assurance was given to anyone participating in the study that their participation would remain completely separate from their work and performance (self determination and fair treatment). If anyone participating in the survey at any time felt uncomfortable then they were referred to the Employee Assistance Programme EAP service on the West Coast. Participants also had the ability to withdraw at any time from the study without effecting their work (freedom from harm). Interviews were timed to fit into busy work schedules and flexibility was given to those who could be called upon to work at the time of the interview. In addition to considering the rights of direct Participants, the role of management was also taken into account.

Consent was obtained from the West Coast District Health Board (WCDHB) Acting Chief Executive Officer (CEO) and the Service Manager for secondary services and community services. A letter was sent out to management of the WCDHB asking permission to interview their staff on their premises (Appendix B). Once approval was given, consent forms were sent (Appendix C) out to potential Participants with a Participant information form (Appendix D). Those who replied were asked if they had read the information form and signed the consent and if so, did they have any further questions.

When Participants were interviewed, the researcher went through the procedure reiterating that the interview would be recorded. To ensure that each Participant felt comfortable, the researcher gave them the opportunity to stop at any time. Participants were given the right to see the transcript of their interview and make changes.
The signed and returned consent forms (in order to protect anonymity and confidentiality) will be locked in a secure environment during the study and for a further five years after completion of the study. Any electronic information will be kept at the WCDHB on a password protected computer, and reports will have de-identified information from Participants and at no time will any reports have any information from patients information.

Prior to the commencement of this study Ethics approval was sought and obtained from the National Ethics Committee (Upper South A). URB/11/EXP/050 (Appendix A) and the study then proceeded to the next step.

**Setting**

Participants were interviewed in a place of their choice. Most felt comfortable to be interviewed at work in an office. One chose an outpatient room as they felt it was quieter and they could concentrate better on the questions being asked. Two Participants were interviewed out of work hours, by Skype, in their own homes. Demographics of the Participants are presented in the following chapter.

**Sample**

Direct line managers of Participants also received letters (Appendix B), explaining what the study was and asking for permission to interview their staff on DHB premises. Once permission had been received invitations were sent to the identified population (Appendix C & D). Key individuals were targeted as they were considered to be able to provide a rich source of data. A total of twelve interviews were held with Participants who accepted the invitation. This included six doctors and six nurses, all with varying degrees of expertise in emergency
medicine. The sample was purposively sought for this study. Participants were chosen by area and type of work as it was important to get the perceptions of health professionals that will be utilizing telemedicine in their workplace. This sample may not be representative of the whole WCDHB population. No Participants were employed at the WCDHB knowing that telemedicine might be utilised in their areas. All these Participants worked in emergency medicine and most had more than one role within their contracts. Interviews took place over a period of six weeks. Site visits and discussions were held with experts in Queensland, Australia three months later over a period of two days. The aim of including Australia site visits was to obtain better understanding of how telemedicine works in emergency services. A further four health professionals working for Queensland Health, Australia agreed to be visited and to share their experience. Again this was a purposive sample as the researcher sought expert opinion from professionals who were utilizing telemedicine in emergency services. Gerrish and Lacey (2010) suggest that calculating sample size in qualitative research comes down to two things resources available and the practicality of attaining the sample.

**Data Collection**

Qualitative researchers are directed towards discovering the who, why, what and where of experiences thus the data techniques are normally aimed at open ended individual or group interviews (Sandelowski, 2000). According to Gerrish and Lacey (2010) interviews are amongst the most thrilling and captivating way of collecting data in nursing research, this explains why interviews are the most commonly used primary data collection methods for qualitative research. Semi structured interviews were conducted with six doctors and six nurses between
March and May 2012. An interview guide was utilised as a prompt to ensure the interview kept on topic. The interview guide (Appendix E) had a list of questions to prompt the researcher ensuring that all themes and topics were covered. However, there was enough flexibility to ensure the Participant was able to express their views. Following up on key points caused the researcher to prompt and probe where necessary. The interviews were audio-taped, transcribed and additionally, field notes were utilised as a means of collecting data. This was an important part of ensuring detailed analysis could continue.

**Data analysis**

Data was analysed using a qualitative four step process simultaneously with the data collection (Gerrish & Lacey, 2010).

1. Once the data was collected, tapes were listened to and transcribed and notes were studied to increase familiarisation with the data.

2. Key issues, concepts and themes were identified. Analytic themes were made evident through patterns that reoccurred. This is a type of qualitative coding where data is rearranged into groups to facilitate comparisons (Gerrish & Lacey, 2010).

3. Data was lifted from their original context and charted according to themes. Each theme had a major heading with sub headings underneath. The data was synthesised and abstracted from all Participants.

4. Guided by the original question, maps were utilised to determine associations between themes.
Summary

This chapter has described the aim of this qualitative research. The research process was described in accordance with a qualitative approach. Interviews semi-structured and site visits formed the basis of data collected to inform the research. Ethical approval and its importance were discussed. An explanation of the process for data analysis leads to the findings. Chapter Four presents the NZ findings from the interviews.
Chapter Four: Findings from NZ Interviews

Introduction

It is hoped this study will inform better utilization of telemedicine in the base hospital Emergency Department on the West Coast. As highlighted in Chapter One the West Coast faces particular issues because of its remoteness, sparse population and the weather patterns. Thus there are many reasons to improve utilization of telemedicine in emergency services. First the Participants will be described including gender, age, ethnic group, profession, years of practice and years in emergency medicine. The next section illustrates the findings from interviews which will be presented under themes. Each theme has several sub themes, and uses Participant quotes to illustrate the front line staff perceptions’. For the purpose of this chapter quotes from Participants will be written in italics. A summary of the chapter concludes the findings from NZ.

Participants

There are three emergency services in the WCDHB. One Emergency Department is a secondary level care hospital (with some specialist services on site); the other is a rural level one hospital, which means this hospital has no specialists on site. The final emergency service is provided by the Rural Nurse Specialist (RNS) team in South Westland. An invitation to participate in this study was sent to 22 staff who work in emergency services throughout the WCDHB, with 12 agreeing to be interviewed.
Participants comprised six doctors and six nurses, all with varying degrees of expertise in emergency medicine. Six of the staff interviewed came from the base hospital; the others came from outlying areas. The demographic characteristics of the sample are presented in Table six. A total of nine females and three males were interviewed. Eight respondents identified themselves as NZ European; no Participant identified themselves as Maori. Two Participants were English and two American. Six Participants were over the age of 40 years, five Participants had spent more than four years in emergency medicine. The majority of Participants worked full time in emergency medicine. No one withdrew from the study.

Table Six: Demographic characteristics of respondents

<table>
<thead>
<tr>
<th>Participants</th>
<th>Gender</th>
<th>Age</th>
<th>Ethnicity</th>
<th>Profession</th>
<th>Years of Practice</th>
<th>Years in Emergency Medicine</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Female</td>
<td>40-60</td>
<td>NZ European</td>
<td>ED Nurse</td>
<td>36</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>Female</td>
<td>40-40</td>
<td>NZ European</td>
<td>ED Nurse</td>
<td>16</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>Female</td>
<td>60-70</td>
<td>NZ European</td>
<td>ED Nurse</td>
<td>39</td>
<td>24</td>
</tr>
<tr>
<td>4</td>
<td>Male</td>
<td>30-40</td>
<td>English</td>
<td>Doctor</td>
<td>11</td>
<td>9</td>
</tr>
<tr>
<td>4</td>
<td>Female</td>
<td>40-40</td>
<td>American</td>
<td>Doctor</td>
<td>20</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>Male</td>
<td>30-40</td>
<td>NZ European</td>
<td>Doctor</td>
<td>14</td>
<td>8</td>
</tr>
<tr>
<td>7</td>
<td>Female</td>
<td>60-70</td>
<td>American</td>
<td>Doctor</td>
<td>34</td>
<td>31</td>
</tr>
<tr>
<td>8</td>
<td>Female</td>
<td>60-70</td>
<td>NZ European</td>
<td>Rural Nurse</td>
<td>41</td>
<td>16</td>
</tr>
<tr>
<td>9</td>
<td>Male</td>
<td>60-70</td>
<td>English</td>
<td>Doctor</td>
<td>30</td>
<td>4</td>
</tr>
<tr>
<td>10</td>
<td>Female</td>
<td>40-40</td>
<td>NZ European</td>
<td>Doctor</td>
<td>14</td>
<td>7</td>
</tr>
<tr>
<td>11</td>
<td>Female</td>
<td>40-60</td>
<td>NZ European</td>
<td>Clinical Nurse Specialist</td>
<td>26</td>
<td>11</td>
</tr>
<tr>
<td>12</td>
<td>Female</td>
<td>30-40</td>
<td>NZ European</td>
<td>Clinical Nurse Specialist</td>
<td>14</td>
<td>2</td>
</tr>
</tbody>
</table>
**Themes**

Five main themes were identified from the thematic analysis; these themes were further divided into sub-themes which are shown in Figure 5. Each theme is now described in detail.

<table>
<thead>
<tr>
<th>Theme</th>
<th>Sub Theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>Legal/ethical aspects of care</td>
</tr>
<tr>
<td></td>
<td>Patient’s perception</td>
</tr>
<tr>
<td></td>
<td>Protocols and guidelines for use</td>
</tr>
<tr>
<td></td>
<td>What the need is and how it is to be utilised</td>
</tr>
<tr>
<td></td>
<td>Knowing the team on the other end</td>
</tr>
<tr>
<td></td>
<td>Buy in from clinicians</td>
</tr>
<tr>
<td>Implementation</td>
<td>Set up accessibility</td>
</tr>
<tr>
<td></td>
<td>Privacy</td>
</tr>
<tr>
<td></td>
<td>Cost</td>
</tr>
<tr>
<td></td>
<td>Co-ordinator - micro managed</td>
</tr>
<tr>
<td></td>
<td>Bandwidth – coverage</td>
</tr>
<tr>
<td></td>
<td>Type of technology</td>
</tr>
<tr>
<td>Skills - Training</td>
<td>Loss of skills – gaining in others</td>
</tr>
<tr>
<td></td>
<td>Time and follow up</td>
</tr>
<tr>
<td></td>
<td>Access to additional training and education</td>
</tr>
<tr>
<td>Opportunities</td>
<td>Support</td>
</tr>
<tr>
<td></td>
<td>Efficient specialist care</td>
</tr>
<tr>
<td></td>
<td>Decreased cost of travel</td>
</tr>
<tr>
<td></td>
<td>Increased quality of care</td>
</tr>
<tr>
<td></td>
<td>Sustainability</td>
</tr>
<tr>
<td>Barriers</td>
<td>Reliability</td>
</tr>
<tr>
<td></td>
<td>Time - Workload</td>
</tr>
<tr>
<td></td>
<td>Change</td>
</tr>
</tbody>
</table>

*Figure 5 – Initial themes and sub themes*

**Knowledge**

A lack of knowledge was a recurring theme from nurses situated at the base hospital in Greymouth. An example of this is shown below by one Participant who stated, “I don’t know a lot about telemedicine, but what I do know is that the
equipment has not been used since being in the department”. This was reiterated by another nurse (Participant 1), again working at the base hospital stating

“Very little, other than an outlying area can dial in using telemedicine and the patient can be seen on the screen and the doctor on the other end can see the patient and decide what to do”.

Those nurses who worked in more rural and remote areas had a greater understanding than those working in the base hospital as shown by the following quotes. Participant 2 stated,

“It provides a better service for integrated health. It saves the patient and the health professional a lot more time and they can have a better service and it’s a lot more convenient”.

This was followed by a statement from Participant 8 who also had a greater understanding than her counterparts at the base hospital.

“It’s an electronic means of face to face communication with health professionals in remote areas. I see it as an adjunct to the way we communicate now. The person we are consulting with can now visualise and see what we are dealing with. It is an added advantage, where interpretation can be subjective it clarifies that really”.

When doctors were asked about their knowledge and understanding of telemedicine, they seemed to have a better understanding than nurses. This time the knowledge deficit between rural and remote and base doctors was not so great. This was displayed by the following statements. Participant 7 stated,

“It’s a tool that’s looking for increasing use in medicine. Used with varying success, I haven’t really worked in a place where it has been up and running in that form. Digital radiography was mentioned as a type of
telemedicine but I’m not exactly sure, it is not my understanding. I think of telemedicine as a telephone with pictures rather than just pictures you can’t talk to pictures. I feel it works ok in outpatients”,

and Participant 11 stating, “I think it’s using some type of audio visual for the provision of patient care”. Their rural counterparts showed a similar knowledge stating, “It is the ability to transmit images or data to someone who is not on the same site or the same country”, (Participant 9) and Participant 10 stated:

“The essence of telemedicine is that you are communicating with someone at a distance. It could be a consultant that you want information from but they are at another place. Over the time I have been a health professional it has evolved to what we have today which is the use of internet, mobile phones, Skype or video conferencing”.

Concerns around legal and ethical aspects of care and protocols and procedures were raised by only one Participant, who stated they felt comfortable using telemedicine particularly now protocols and procedures were written, however this Participant was still concerned about how the Medical Council viewed telemedicine as a means of consultation. This was depicted by Participant 9 who was unsure asking, “What's the legal side of it as well, is it the same as the telephone?”

A lack of clarity around how patients might feel about telemedicine was highlighted. For example, one nurse stated, “You know, I don’t think I would feel happy if I was in the last stages of my life and people were watching me die on a TV screen.”
Many Participants stated that in order to get buy in from clinicians it was important to know the team you are working with. An example of this was a quote from Participant 4,

“A major barrier to use is you might not know the person on the other end and they might not know you and your ability. You will never get buy in from clinicians as staff may not feel comfortable putting trust in people they have never met”.

Participant 1 felt it was extremely important to know the team they would be working with, stating “everyone needs to know who they are talking to and where they are from”. The Participant felt it helped the ease of conversation, creating a better atmosphere, and also gave a perspective of the conditions each was working under.

Empowering people with knowledge is imperative if change is to be received in a positive manner. Findings from the interviews relating to the understanding and knowledge of telemedicine vary from area to area and also from doctors to nurses. Deficits in understanding telemedicine were identified in this study. Along with knowledge about telemedicine a further issue related to the implementation of telemedicine.

**Implementation**

Issues related to the implementation of telemedicine identified in the study were, when setting up equipment it was important to staff to have the equipment in close proximity to the work place, or it could be a distraction from caring for the other patients in the department. An example of this came from Participant 4, who stated, “The less intrusive it is, the better. If it’s just there in close proximity and
you can quickly flick it on, then that is handy. This was reiterated by Participant 8, who stated,

_I really can’t say it is in a good position. If it’s too far away, that will take the doctors out of the department to somewhere else. Do we need them out of the department when we have something major going on, I don’t think so. It would have to be close to the doctor that is going to use it though._

The staff also expressed concerns about privacy for their patients, although they did admit that privacy is always a challenge in Emergency Departments anyway. This is because most Emergency Departments have a number of cubicles without solid doors, that people are always coming and going and it is a fast paced environment. Participant 4 stated,

_There is always an issue with privacy in the Emergency Department whether it is with telemedicine or face to face, until we get sound proof curtains it will always be an issue. It’s not a very sound proof department; everyone can hear everything that’s going on. That’s an on-going problem for any patient getting treated in the Emergency Department and not just in our ED either._

One staff member thought of telemedicine “as purely a cost saving measure where the DHB saved on transport for patients and travel cost for the specialist”. This may be true but cost and sustainability of a service is paramount in any health service throughout the world.

Some clinicians felt that having a coordinator running telemedicine was the answer and they gave the example of paediatrics, where all they had to do was turn up at the right time. The patient was there, the specialist was on the other end
and the equipment was on and ready to use. It saved time and was a good example of how they thought it should work.

The type of equipment was also an important factor for clinicians when thinking about implementing telemedicine. Many Participants felt if the equipment was not easy to use or did not work properly then people would lose interest in using it, thus telemedicine would be of no use at all. Others felt the equipment needed to fit into their style of work, that it needed to be fit for purpose. Participant 9 sums up the barriers of telemedicine equipment by stating,

“You have to have user friendly technology that everyone involved knows how to use and it needs to be accessible to all, reliable and the people on the other side of the fence also has. To have all of these things”.

Another Participant expressed their views on equipment by saying, “Flexibility is important in the Emergency Department; simple to use and reliable. So if you are turning it on and it takes ages to boot up or there is a 70% chance that it is going to work, then telemedicine will not get utilized”.

Implementation is a significant aspect of any change process. It is important to listen to those who are going to use the equipment and get it right the first time otherwise equipment may sit without use. Having the right equipment for an area that is easy to use and cost effective was considered important by most participants in this study. Issues relating to skills were also highlighted by staff.

**Skills**

One clinical staff member was concerned that the introduction of telemedicine would result in loss of skills as demonstrated in the following viewpoint that
“A potential risk to doctors will be a loss of skills. Doctors can succinctly describe a patient’s condition in as few words as possible and this skill might be eroded. It’s not necessarily a disadvantage but it is inevitable that people will lose the skill to present a case concisely. It could create a lazy handover culture”. How often do you hear a doctor describing an x-ray to a consultant now days with digital radiology they don’t have to explain what they are seeing. They just don’t seem to handover anymore”.

Others saw telemedicine as an opportunity to increase skills allowing the ability to keep higher acuity patients in rural areas with the help from specialists in tertiary hospitals.

Training to develop necessary skills on the use of telemedicine was a concern to all Participants. Most thought that training should not only happen at the initial implementation but on a continuing basis as staff are more mobile these days. Some rural areas have a high turnover which means a new doctor or nurse may not know how to use the equipment and this in turn will lead to neglect of telemedicine. On a more positive note, participants could see opportunities for additional training and education by utilizing telemedicine to connect to grand rounds in tertiary hospitals and education sessions provided by individual departments. Staff could identify other opportunities for telemedicine in their workplace, pointing out numerous benefits for themselves and patients.

**Opportunities**

Advantages raised by many Participants were better support for patients and clinical staff, more efficient use of specialist’s time, better quality of care, lower
travel costs and improvement in sustainability of services. These are shown below with illustrative quotes:

Participant 4 states:

“If you don’t have a specialist on the floor and you are in Greymouth, given our weather, it could help guide the doctor on the floor with the steps he should be taking to ensure patients get good care and the best outcomes for the patient”.

Another participant stated: “Support from specialists you don’t have locally is a really good. It is like a safety valve, knowing someone is there to support you”.

Other opportunities were identified in statements as follows:

“There would be savings on cost of travel and time for both patients and doctors. It is a more informative way to communicate when distance is involved. The ability to see the patient in real time ensures the senior person can make an informed decision on treatment and diagnosis”.

‘Potentially I would have better links with specialists, it would be educational for me to have that type of support, rather than to be going off what I think is best and not knowing what might be up to date and current medicine. It would be a useful teaching tool”.

Quality of care was raised by participants, an example of this by Participant 2, who said; “The ability to have various consultants that are specialised that we don’t have here at your fingertips is a definite benefit”.

Another participant suggested telemedicine would be great for doing peer reviews and educational conferencing with rural staff. However, this participant said they
found it hard to concentrate when they could not see the person delivering the education session. They went on to say,

“Sometimes you can prevent patient transfers to Christchurch, that’s a cost effective thing, because you’re not doing unnecessary transporting. What you are doing is monitoring the patient close to home instead via the link that helps with sustainability of rural services as well”.

Staff could see definite benefits for telemedicine, but to balance these views it is imperative to also understand the barriers.

**Barriers**

Change process is a sequence of steps or activities that managers follow to ensure staff resistance is managed when introducing new technologies, processes or organisational change (Berg, 2001). Participant 10 seemed to agree with the literature when stating, “Staff need to relax and not be suspicious of the new technology, and they need to use it to their advantage.”

If the change process does not go smoothly people can become sceptical, dismissing reasons for change as did one of the Participants who stated, “Telemedicine is this generation’s answer to everything”; others were more cautious: “Don’t bring telemedicine into the service until you can provide me with a clear problem that telemedicine can solve and a description of how telemedicine is going to solve the problem”.

Other concerns were around specialists. Staff perceptions were that telemedicine might replace certain specialities on the coast such as surgeons on site which could potentially harm patients. Participant 6 explained this by saying, “it’s really important to use it as an adjunct rather than replacing anyone”.
Reliability and bandwidth coverage for fast and consistent use of technology was of concern to all participants. Examples of this are shown in illustrative quotes below:

Participant 11 “We need to have the proper IT equipment and the proper bandwidth to go with it. Even now there is a slight delay in Buller and that has to stop as it makes it terrible to work with. They said they upgraded the system but it is still not good”.

Participant 11: came up with some solutions saying, “Make sure there are enough units and that they are available. Ensure that the IT system is up to grade and that IT support is available 24/7”.

Participant 7 was not able to see it work in emergency situations due to reliability stating,

“You have to be able to connect so what I mean is, the person you are connecting to has to have the technology where they are. Most areas such as South Westland do not have the infrastructure to ensure the technology will work, so really you have to do scheduled things rather than acute emergency situations”.

This was reiterated by Participant 12, who stated,

“The weather and the equipment are definitely barriers. Whether the DHB has the money to fund the satellite to get better service, I am not really sure. but that is what we seem to need down south. Power is also a problem; we have a lot of power cuts, again due to weather, although one site does have a generator, however the other five clinics do not.”
Time constraints and workload were also seen as a barrier, as depicted by Participant 3 who stated:

“Time constraints depending where it is sited is a concern. If it’s in the middle of the ED then it could be distracting for those people using it, there is only one doctor on per shift and I see it as time consuming”.

Participant 2 agreed stating,

“Taking the ED doctor out of the Emergency Department is a risk within itself to the other patients in the department. I assume the telemedicine equipment would be set up in an area that is secure and private, not in the ED area. The other hospital has to have time as well, to answer the call. A lot of people are pulled in different ways so adding more to their loads can be difficult, you will end up running people ragged”.

Barriers that have been highlighted by Participants are real and should not be ignored. They indicate area to be addressed prior to the implementation of telemedicine to ensure, a smooth change process.

**Summary**

Overall, the participants in this study did not have a good understanding of telemedicine and lacked the knowledge on how it was to be used in their workplace. All, except two Participants, felt they had no involvement in the implementation of telemedicine in emergency services on the West Coast and their lack of engagement was notable. However, their perception of whether they would use telemedicine or not did not solely relate to this, but rather their knowledge and education around telemedicine in general.
All Participants agreed that there would be benefits for not only their patients but also themselves in terms of the additional support that could be available. Potential barriers identified by Participants were reliable internet connections and speed, related to bandwidth; additional workload; that telemedicine might be a distraction from providing care; access to the technology when it is needed; patient’s perception of telemedicine and also concerns around privacy issues.

This study illustrates the perceptions of clinicians’ working at the front line of emergency healthcare in a rural setting. These findings suggest that although implementation of telemedicine was not seen as important, knowing what telemedicine can do for the patient and how it is to be used is perceived as very important. While this chapter revealed the findings from the NZ part of the study, the following Chapter describes the findings from the Australian arm of the study, which draws on expert opinion from uses of telemedicine in Queensland.
Chapter Five: Queensland Australia

Introduction

This chapter provides further insight into the barriers and opportunities of telemedicine in rural and remote emergency services, by utilizing the information gathered from visiting different sites in one state in Australia, Queensland. The first section provides a brief history and demographics of information. A comparison is then made highlighting the differences between NZ and Queensland. This is followed by the method, findings, discussion and finally a summary. For the purpose of this chapter, and in keeping with the terminology utilised in Queensland, reference will be made to telehealth and telemedicine, both having the same meaning.

History

Australia has always been a leader in telemedicine, with their involvement dating back to early times with the use of Morse Code by the Australian Royal Defence Force (Lovelock, 2011). Much of Australia is challenged by dispersed populations, geographical complexities and indigenous communities. According to UniQuest (2011) Queensland, one Australian state, initiated telehealth services in 1995 with two main providers Queensland Health and the Centre for Online Health. Telehealth was thought to have the potential to distribute health services more efficiently and with greater equity. It was also seen as a way to provide better access and would benefit patients not living in metropolitan areas and provide reliable support for clinicians working in rural and remote locations (UniQuest, 2011).
Queensland Demography

Queensland is a state of Australia as shown in Figure 6. It occupies 1.27 million square kilometres and is the second largest state in area following Western Australia (UniQuest, 2011). The land spreads 2400 kilometres in length (Briney, 2011). Figure 7 shows Queensland, the main urban areas and gives an indication of where tertiary hospitals are situated throughout Queensland. Queensland’s population is most concentrated in the south east corner which includes Brisbane, Toowoomba and the Sunshine and Gold Coasts. Cairns, Townsville, Mackay, Rockhampton, Bundaberg, and Mount Isa are other significant regional towns within Queensland (Office of Economic and Statistical Research, 2012).

According to (Office of Economic and Statistical Research, 2012), the population of Queensland was 4,599,360 in 2011, after growing by 1.7 per cent over the year. That growth is expected to continue at the same rate over the next few years.

(Elcock, 2012) described the healthcare of Queensland as highly decentralised with high death rates from trauma; in fact 2.4 times greater for rural areas than urban areas. The challenge for Queensland is to provide equitable, effective and safe healthcare and retrieval services.
Table 7. Comparisons to NZ Demography

<table>
<thead>
<tr>
<th></th>
<th>NZ</th>
<th>Queensland</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Population</strong></td>
<td>4,327,944 July 2012</td>
<td>4,537,721 September 2012</td>
</tr>
<tr>
<td><strong>Population growth rate</strong></td>
<td>0.86%</td>
<td>1.50%</td>
</tr>
<tr>
<td><strong>Urban population</strong></td>
<td>86% of total population</td>
<td>23.8% total population</td>
</tr>
<tr>
<td><strong>Land mass</strong></td>
<td>270,000 km2</td>
<td>1,722,000 km2</td>
</tr>
<tr>
<td><strong>Indigenous population</strong></td>
<td>15% NZ Maori</td>
<td>28% Aboriginal</td>
</tr>
</tbody>
</table>

As can be seen in Table 7, the majority of the statistics between NZ and Queensland are different. Queensland’s total land mass is 6.4 times larger than NZ’s, with only 23.8% of the population living in urban areas, whereas NZ’s population is more concentrated in urban areas. This is significant when comparing sustainable models of care. NZ has a projected growth rate of 0.86%, whilst Queensland’s growth is projected to increase by 1.5%. Similarities are the current population and indigenous people with both NZ and Queensland having less than 30% indigenous people (Statistics New Zealand, 2012b).

**Method**

In order to provide a wider range of clinician’s perspectives and expert opinions, contacts were sought through emails, health professionals and people who worked in the field of telemedicine. Key informants included a senior Emergency Nurse (ED) nurse who had moved from Australia to NZ recently and the Nurse Manager of the Queensland Coordination Centre for both telehealth and the Royal Flying Doctors service, the Director of Nursing and Midwifery (DONM) of Proserpine Hospital in north Queensland and finally, the Director of State Wide Telehealth Services. Although these key informants do not represent the whole population they provide rich data to understanding the barriers and opportunities of telemedicine in rural and
remote Emergency Departments in Queensland. Site visits and semi-structured and unstructured interviews took place with these informants in September 2012. With permission from the key informants interviews were audio taped and field notes were taken. The first stage of data analysis involved familiarisation with the data by listening to the tapes. In the second stage the audio tapes were transcribed verbatim. Following this the transcripts were then divided into meaningful components.

**Findings**

Table 8 represents the key informants and sites visited throughout Queensland. All key informants had worked with telemedicine at either a clinical or management level. One informant an Emergency Nurse interviewed in NZ had worked and utilised telehealth in emergency and outpatient services throughout a number of places in Queensland. This nurse had 13 years of emergency nursing experience and 10 years working in rural and remote locations using telemedicine. So the expertise was of varying degree and from all areas of the health structure.

<table>
<thead>
<tr>
<th>Organisation/Site</th>
<th>Key Informant</th>
<th>Characteristics</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mount Isa Hospital</td>
<td>Senior Emergency Nurse</td>
<td>Mount Isa Hospital</td>
<td>Key informant in New Zealand</td>
</tr>
<tr>
<td>State wide Telehealth services</td>
<td>Director</td>
<td>Health Services Support Agency</td>
<td>Herston, Brisbane</td>
</tr>
<tr>
<td>Coordination centre for telehealth and Rural Flying doctors</td>
<td>State Medical Director</td>
<td>Retrieval Services Queensland, Emergency Services Complex</td>
<td>Kedron, Brisbane</td>
</tr>
<tr>
<td>Proserpine Hospital</td>
<td>Director of Nursing/Facility Manager</td>
<td>Whitsunday Health Service</td>
<td>Proserpine, Queensland</td>
</tr>
</tbody>
</table>

Table 8: Key Informants
Informant 1: Senior emergency nurse:

When asked about her experience with telemedicine this informant answered:

“There was a great need for it, so when it came we wanted it. There had also been discussions for the previous two years about telemedicine, prior to it coming, with other clinicians who were using it. We had visits to other areas to see how it worked. It’s another clinician there in real time almost, standing at the end of the bed and we needed that at times.”

As a staff member at the front line of emergency nursing, this informant identified specific benefits of having telemedicine in their department. One benefit was the education and background work carried out by the coordination centre in Brisbane prior to the introduction of telemedicine. Prior to the arrival of telehealth the coordination centre set up links to the retrieval teams, but they also set up links by telephone with other teams already using telehealth. This was in the hope of getting clinicians enthusiasm up but also so relationships would be formed. Teams took road trips to meet those who were joining on to the network, again improving collegial relationships. According to this informant there were definite benefits having this preparation work done prior to implementation of telemedicine. Knowing the team at the coordination centre, whom clinicians would be working with, proved valuable, in getting buy in from front line staff. Relationships had also been formed and knowledge of skills and expertise for front line staff built trust within the team. This informant shared the view that one should “embrace telemedicine as your best friend” and suggests “telemedicine is similar to having another colleague in the room”. Furthermore, she stated that:
“Having someone on the other end of telemedicine well rested and thinking clearly when your staff are tired and exhausted provides you with the confidence you’re doing the right thing for that patient”.

The preparation prior to the introduction of telemedicine was an important step to ensure telemedicine would get the utilization it needed in order to deliver safe and accessible healthcare. When asked, do you feel telemedicine equipment was in a good position to use? And what should others consider when placing telemedicine equipment? The informant felt the equipment needed to be easy to use “a flick of a switch and a quick telephone call to let the team know you want them” and cameras instead of monitors or carts were definitely considered invaluable in small Emergency Departments. This was due to carts and monitors taking up room and often getting in the way when working with patients. This informant felt that if telemedicine was not close to where the doctors and nurses were working then there would be a reluctance to use it. Also it was necessary to place equipment so it would not get in the way of staff when dealing with emergencies. She was adamant that placing cameras on the wall and ceilings worked well for Emergency Departments.

There was almost a type of excitement that went with this quote in her voice, “Embrace it.” This shows that telemedicine had been an essential part of her everyday work and without it she would not have felt supported in her role in the Emergency Department.

When asked how telemedicine had benefited this informant’s patients she commented:

“The patient got all interventions required as opposed to some things we may not have thought about. It was almost like having a check list
and someone running through it with you. Furthermore, the weather also added to the need for telemedicine; going into Bundaberg or Brisbane with the thunder storms you can’t always move the patient to a tertiary hospital. Even Dubbo or Orange can be difficult to get into at times for the flying doctors.”

There was also a feeling that outcomes were improved once telemedicine was installed and transport was easier to sort, as the retrieval team could see the patient and knew what clinicians were needed to collect the patient safely and in what type of transport. When asked about collaboration the view was that Queensland Health had communicated well with staff.

“The coordination team went about asking clinicians what their needs were before bringing telemedicine to the area. Staff were provided with a networking group and the team bringing it in were enthusiastic, so sold it well. Then the team followed up with two annual road trips a year. Introductions also broke down barriers to using telemedicine.”

Finally, when asked what advice you would give to someone looking at telemedicine informant one suggested:

“The key to success was in the introduction. Telemedicine should be embraced as it will end up being your best friend when working without specialists in your area. It allows for networking and new collegial relationships which is important when working with a small team”.

There was a lot of forward planning with this example of telemedicine. The collegial relationships built through networking and annual road trips proved to be a benefit when introducing telemedicine in Queensland. Staff embraced the
new way of working due to the enthusiasm of the team promoting it. The Queensland Coordination Centre was a key factor to success in this example and a description of this follows in the report from a site visit.

**Site 1: State wide telehealth services (Support Services)**

During the past 15 years integrated communication centres have been set up throughout Queensland with the help of State-wide Telehealth Services. This is a commercial business unit which has supported the retrieval services in Queensland and rural and remote areas in many Queensland towns. According to the director, Queensland Retrieval Service is a centralised group of clinicians who manage air retrieval and give urgent clinical management through telemedicine, to patients who may require transfer to a tertiary hospital. These clinicians are made up of Specialist Emergency Department (ED) physicians, who are registered with the Australian College of Emergency Medicine (ACEMS), and emergency nurses. The clinicians are capable of coordinating retrieval and providing medical support through telehealth links.

At any time a patient in a rural or remote area can attend an Emergency Department with a trauma or medical emergency and know that retrieval services will support the doctor and nurse at the ED by telehealth. The coordination centre establishes a video link and interacts with the clinician at the scene identifying if the patient needs to be transferred and also supporting the team who may feel they are out of their depth. Another benefit of this is when a decision is made to transfer the patient to another facility the team has all the information needed to ensure the patient goes to the right level of hospital that offers those services required.
Site 2: Coordination Centre for telehealth and Rural Flying doctors

According to the State Medical Director of Queensland Retrieval Services the Queensland Coordination Centre is linked to 110 resuscitation rooms around Queensland with the ability to video bridge with six sites at once. There are two hubs around the cities of Townsville and Brisbane. Elcock (2012) suggests there is a need to have a single point of contact with consultants providing skilled and well-timed assistance. Clear benefits of having this single point of contacts are:

- The ability to provide the right retrieval team for the patient
- The right mode of transport is chosen for retrieval
- Specialists services are available in time critical emergencies

This seemed to add to the success of telemedicine in Queensland.

The coordination centre is broken into two areas;

1. Adult health in the front
2. Paediatrics and Obstetrics/Gynaecology at the back.

Nurses and doctors are trained with the appropriate skills to answer telehealth calls. For example, you may have a nurse trained in paediatrics answering the paediatrics calls. She in turn hands over to an emergency physician if she considers the call critical. The emergency physician will then get a paediatrician on a three way link, if the situation requires it. There are 14 Full Time Equivalent (FTE) nurses working in the coordination centre who take the majority of the calls, around 50 per day. The coordination team transfer 20,000 people per year and 4,000 of those are children requiring specialist care.
A 24 hour service is provided with a medical coordinator in the north in Townsville and one in the south situated at the Queensland Coordination Centre in Brisbane. A constraint of telehealth is the breakdown of relationships between nurses in the south and the team in the north. The south is more tertiary driven, with a greater population and shorter distances and the nurses at the coordination area do not necessarily know the capabilities of the hospital or medical centre they are video linking with. When the nurses take the call at the coordination centre, they are cognizant that Townsville recognizes the capabilities of the staff situated in the rural and remote areas so a three way link is established to ensure the patient gets the right care provided.

Telehealth, in this example, does not support any consultation that requires hands on assessment or procedural treatments. It is used as a tool to support and consult with health professionals to provide expert opinion on a patient’s status and assist with retrieval if needed. Of course the success of telehealth relies on the appropriate resources being available at each end of the consultation. If the resources are not there then telehealth could fail. Areas that have done very well in telehealth are chronic disease management such as diabetes, mental health, endocrinology, respiratory and heart failure. The Queensland Coordination Centre deals with approximately 14,000 paediatric, surgical follow-up and maternity telehealth consultations per year.

Queensland has a clinical services capability framework which scores the level of Intensive Care Unit (ICU). The level of ICU determines the acuity of the patient that can stay in that ICU. However, with wireless ability and the use of telehealth carts ward rounds can be provided with specialist input which has allowed higher acuity patients to stay in their regions. An example of this is in (ICU) where the intensivists at the tertiary hospital establish a video link to assess patients in remote hospitals that
have no specialists on site. This has enabled ventilated patients to stay close to family and in their region. These intensivists, through telehealth, can make changes to management plans and even suggest change to settings on ventilators. In the sub-acute setting, telehealth is growing as it optimises unnecessary transfers.

A barrier at the moment is the funding model in Queensland which does not follow the patient but the provider. Places which would not normally have high acuity patients like Harvey Bay and Bundaberg are now able to keep these patients due to telehealth. Higher acuity patients normally stay in beds longer, thus the hospital incurs higher costs, and nurses and doctors may need to work overtime to care for them. Furthermore, poor access to beds also causes concern as these patients who would have traditionally gone to ICU are now being kept in the wards.

Benefits are up-skilling of staff through exposure to intensivists on regular basis. Staff who would not normally have the opportunity to deal with higher acuity patients now have that ability, and with the support of the intensivists they have increased knowledge. An increase in confidence in caring for these patients has provided a positive outcome and is due to the increased support given through telehealth. This in turn has increased retention and employment opportunities have improved due to the ability to care for higher acuity patients.

**Site 3: Visit to Rural area in the North**

Proserpine is a small rural town which serves a population of 3,390, with 24.9% of the population aged under 17, and 21.9% aged 60 years and over (Statistics New Zealand, 2006). The town is situated on the Bruce Highway, Queensland, along the banks of the Proserpine River in the Whitsundays area. Its main industry is sugar and cattle farming, although it should be noted that gold mining was a large earner for the
population until the 1960s when the local mine closed. The town consists of two public schools, one catholic primary school and one hospital. This hospital is the main hospital for the Whitsundays; Figure eight shows the area this hospital covers.

![Figure 8: Whitsundays, Queensland](image_url)

Proserpine hospital which consists of 53 beds, five of which are the ED, serves a population of 18,000 and covers surrounding areas such as the Whitsundays Islands, Airlie Beach and Bowen. In the ED their one resuscitation bay is connected to telemedicine, while acute primary care, obstetrics and paediatrics utilize a mobile cart for ward rounds.

Approximately 10,000 people use the emergency and outpatient service per year. The closest tertiary hospital is Mackay, approximately two hours away by road. Staffing consists of rural generalist doctors who generally have diplomas in some type of speciality, for example surgery or obstetrics and gynaecology. They have no specialists on site so rely on telemedicine, for not only outpatient care, but also acute care. The hospital is set up as a teaching hospital which means they not only have medical students but also nursing students. The Full Time Equivalent (FTE) nursing
staff is fifty nine. Their staffing is relatively stable according to the facility manager, with no locums working at the hospital at the time of the visit.

Barriers to telehealth were discussed, the first being staff perceptions. An example of this was when health professionals did not feel comfortable with telehealth, then they often put their apprehension onto the patient and for this reason telehealth does not get utilised. Telehealth was set up on most of the Whitsunday Islands, however staff left and the replacement staff following did not understand or have the knowledge around telehealth to use it. This reinforces the importance of continuously training new staff. Health professionals are more transient these days and in areas like the Whitsundays the population is also transient. Finally an example was given on equipment and upgrades. When undertaking unit upgrades it was considered important to ensure new equipment is hardware compatible with equipment utilised in other areas to ensures the ability to call in to other telehealth providers. Equipment needed upgrading in some areas of the Whitsundays, but unfortunately these areas did not communicate with their colleagues which lead to a number of areas not actually able to use telehealth. Furthermore, this became problematic for Queensland Telehealth who lost the ability to connect remote areas to specialist services and equipment sat idle.

When asked what the potential benefits of telehealth were for Proserpine, the following list was identified:

1. Convenience and cost effectiveness for patients and staff.
2. Assessment by specialists prior to transfer.
3. Twenty four hour cover, not limited to office hours.
4. Mobile units can be utilised for ward rounds.
5. Ease of access to tertiary level care by specialists.
6. Staff satisfaction and retention.

**Discussion**

These findings confirm previously published literature on, not only the barriers to telehealth in equipment and hardware compatibility but also the obvious need to move forward with technologies and changing models of care to provide improved access to health services for everyone (Duplantie et al., 2007). Opportunities such as ease of access to specialists who may reside in a different location, but also staff and patient satisfaction are in keeping with the literature (Smith & Gray, 2009). Literature suggests that the true costs of telehealth have not fully been researched and this is an area of future research (Nobel et al., 2005). Training for not only the implementation of telehealth but also on a regular basis proved important to ensure the continual use of telehealth and this was also expressed by Joseph et al. (2011) and Stronge et al. (2007). Coordination centres are a relatively new concept which needs further investigation, but certainly feedback was positive from staff utilizing the service. Front line staff saw benefits for time critical calls due to the availability of the service 24 hours per day, seven days a week. Furthermore, having the flight retrieval team integrated into the coordination centre meant the flight team on board were matched to the needs of the patient and retrieval times were more efficient.

**Summary**

Following analysis of the first interview it was obvious that although there were similarities between Queensland and New Zealand, there were also differences. As Table 7 shows there are differences in land mass which could have a bearing on the need for telehealth in NZ. By the time sick people reached tertiary
hospitals in Queensland their condition could deteriorate to being critically unwell due to the distances and therefore travel time.

Queensland introduced the concept of telemedicine into their remote areas long before any implementation. The utilization of a State wide telehealth service and co-ordination centre which was attached to the flying doctors meant a smooth transition from traditional ways of delivering healthcare to innovative ways using telehealth.

A further difference is that NZ is not expecting the population growth that Queensland is and a higher percentage of people in NZ live in urban areas unlike Queensland, where the majority live in rural and remote areas which drives the need for telehealth services to ensure equity of healthcare services. However although NZ is very different to Queensland some key points can be transferred.

The transient nature of the medical staff and specialisation are problems encountered by not only Queensland but also NZ. This leaves rural and remote areas covered by locum ED Doctors or GPs, who are required to cover not only the medical centre but also the hospital. Having telehealth in these areas offers an effective and efficient service when providing not only specialist assessments but also with the coordination centre allowing good decision making when deciding what type of transport is needed and where to transport to.

The site visits and interviews indicate that telehealth in Queensland is embedded into the culture of everyday business. This is possibly due to the coordination of services and the implementation of telehealth, with large aspects of change management, such as building relationships, going on prior to the arrival of telehealth. While it is
suggested that not all consultations can be provided by telehealth, it is clear many
can. The success of telehealth is due to the recognised needs in rural and remote
areas where specialist services are not on site. Some key points can be applicable to
NZ, however, until the true cost of setting up these types of services is known NZ
may struggle with the concept of a coordination centre. The next chapter will bring
the findings from the NZ interviews and Australian site visits together and compare
these with the literature.
Chapter Six: Discussion

Introduction

This study sought to describe clinicians’ perceptions of telemedicine looking at the barriers and opportunities. The interviews with 12 clinicians in NZ rural emergency services and four key informants in the field of telemedicine in Queensland provided valuable information which has the potential to improve the utilization of telemedicine throughout rural NZ emergency services and departments. Findings from this study were not different to those illustrated in the literature review, yet still managers and health professionals grapple with the ability to get telemedicine integrated into everyday life in ED throughout the rural community. Throughout this chapter the findings will be compared to previous studies and strengths and weaknesses will be discussed. The findings will be considered for their importance to policy makers, managers and clinicians. The strength of this study is that the barriers to the uptake of telemedicine have been identified which provides a wealth of knowledge to improve utilization of telemedicine in rural Emergency Departments throughout NZ.

Barriers

The need for telemedicine must be determined by the needs of a population, and not by politics or cost in order for it to succeed (Wootton & Bonnardot, 2010). The implementation process has been highlighted as a barrier to telemedicine, not only in the NZ and Australian components of this research but also in the literature (Joseph et al., 2011; Keane, 2009; Stronge et al., 2007). According to Wootton et al. (2006) there are examples of failed telemedicine projects all over the world often due to
poor implementation. Although telemedicine can provide definite opportunities for staff and patients alike, if the implementation is not streamlined with adequate planning then telemedicine is likely to fail. Implementation of telemedicine are now discussed more fully.

**Training and Knowledge**

Firstly, lack of training and knowledge were identified in the implementation as barriers to use. In the NZ component most interviewed felt they did not have a good knowledge of telemedicine, whereas Participants from Queensland did, but felt that the training needed to be continuous as people left and new staff coming in did not have the knowledge to continue its use. Continuous training was identified by Field (1996) and Wootton et al. (2006) who suggested that training was vital and telemedicine users must not only be trained well but also be supported both technically and professionally or this could lead to poor use. Participants in this study felt information technology illiteracy was a barrier to success, and this is important because of the increase in the aging population including an aging health professional population. Older staff are known to not necessarily have the ability to nor feel comfortable using new technology and generally like to work in the known, traditional ways of providing healthcare and Pryke (2012) suggested this was more pertinent in rural and remote areas.

With training comes knowledge. Knowledge can be defined in management as the “discipline of enabling individuals, teams and entire organisations to collectively and systematically create, share and apply knowledge, to better achieve their objectives”, (Young, 2008, p. 1). Knowledge is critical to the success of telemedicine, and is discussed by Norris (2002) who suggested it does not matter about the expertise of the professionals, training should not only be done initially, but also on a continuous
basis, as it ensures the well-being of staff and patients. Research shows the success of any project, relies on people’s participation in processes and decision making with the wider group (Stronge et al., 2007; Tachakra & Rajani, 2002; Wootton et al., 2006). In addition, this wider group must have a say in the final decision otherwise people’s time and money are wasted and interest is lost (Cary & Darkins, 2000). Including people is particularly important when faced with an uncertain climate, as when a change such as telemedicine is introduced, people tend to stick to what they know, never really trusting new things unless they are well tested and proven (McCrossin, 2003).

Secondly, equipment that is not fit for purpose, suitable for the area, and with the required functions, is another potential barrier to utilization. The international definition of fit for purpose is as follows: The totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs (Newton, 2006).

What this means is a quality service is one which is fit for purpose and which satisfies the users requirements. Fit for purpose links closely with quality and can further link to quality in healthcare. According to (Ader, Berensson, Carlsson, Granath, & Urwitz, 2001) quality is the degree to which desired outcomes are met. Quality can be divided into three main categories; structure, process and outcomes (Newton, 2006). Structure includes material resources such as facilities, equipment and money (Newton, 2006). Findings from both components of the study discussed equipment. Participants in the NZ study felt the equipment they had been supplied for telemedicine was unsuitable for use in their department, whereas their Queensland counterparts thought the equipment they had worked for them. Literature suggests in order to ensure the correct equipment is installed the decision needs to be
made in conjunction with the user and must meet their requirements (Buck, 2009; Stronge et al., 2007). Although, requirements determined by the user may cost more initially. Norris (2002) advises it is well worth paying the extra to ensure acceptance and success of the service it is to provide. One study illustrated a well set up emergency room that had equipment fit for purpose which included a wall mounted camera with pan/tilt/zoom/focus control which was remotely controllable by both the transmitting and receiving ends (Tachakra, Jaye, et al., 2000). However, Tachakra, Jaye, et al. (2000) did report in a resuscitation scenario there were some difficulties getting the whole view of the patient without disturbing staff. Another problem arose when Queensland needed a change in equipment was needed in the Whitsundays. This came about due to new staff being employed who did not have the knowledge to make decisions. Reliability of equipment, although seen as a key to the success of telemedicine, is also highlighted as a potential barrier (Hayes et al., 1998; Nobel et al., 2005; Wootton & Bonnardot, 2010). With any equipment comes the technical infrastructure to enable its use, and this is discussed next.

**Infrastructure**

Reliability and bandwidth coverage go hand in hand and are crucial to enabling the operation of telemedicine (Chaudhry et al., 2006). Australia, with the government’s help, invested money in infrastructure enabling fast broadband, thus attaining reliability in the broadband needed to utilize telemedicine. New Zealand is still in this process with their Ultra-Fast Broadband Initiative (Ministry of Health, 2012). The initiative, which is a government programme, will bring fibre optic technology to homes, schools, hospitals marae and businesses throughout NZ but is not expected to be finished until 2020 when 90 percent of schools and hospitals are expected to be connected (Ministry of Health, 2012). The fibre optic cable was tested recently in
South Westland with a flood in January 2013. South Westland not only lost the Wanganui Bridge but also the fibre-optic cable was washed out. This resulted in loss of phone, cell, internet and emergency calls and communities were completely isolated (Fairfax NZ News, 2013). Findings from this study raised concerns around reliability of broadband connectivity.

**Time and Workload**

Time and workload was seen as a barrier by all NZ Participants in the receiving base hospital, however outlying areas such as Buller and South Westland did not agree. Nor did their Queensland counterparts, who found telemedicine calls were no longer than calls made by telephone. It must be noted that Queensland have two coordination centres set up to take calls from all rural and remote centres, and the centre does not have the interruptions an Emergency Department may experience. Literature found tele-consultations took about the same time as conventional ways of delivering healthcare Keane (2009). Whereas J A Brebner, Brebner, and Ruddick-Bracken (2006) and Moffatt and Eley (2010) found tele-consultations did distract from workloads and added more pressure, especially for rural and remote doctors who have higher workloads than their urban colleagues. Time scheduling was a problem as well according to Hayes et al. (1998) when trying to organise nurses in emergency rooms with scheduled telemedicine consultations proved near impossible. However, literature suggests that increased workload is not necessarily due to the teleconsultation but more to patients remaining in the remote facility longer (Brooks, 2012; Ellis et al., 2006). A study by Westbrook et al. (2008) suggested there was an increase in workload with telemedicine and there was a general lack of recognition of this. Furthermore, Westbrook et al. (2008) felt it could hinder sustainability of the service.
Legal and Ethical issues

Legal and ethical issues were cited as barriers amongst NZ Participants and this is mentioned in the literature (Al-Qirim, 2004; Cary & Darkins, 2000; Field, 1996; Norris, 2002), but this was not discussed by the Queensland Participants. The Medical Council of NZ (MCNZ) has offered advice to doctors using telemedicine in clinical practice, stating that there are advantages however there are also “inherent risks in providing medical advice when a physical examination of the patient is not possible” (MCNZ, 2006, p. 1). Thus there is good reason for NZ health professionals to be wary. Furthermore, health professionals practicing in NZ “must consider issues of privacy, security and the sensitivity of health information” and remain within the regulation of the Privacy Code 1994 which states “the health sector must ensure the protection of individual privacy” (MCNZ, 2006, p. 1).

Protocols and Guidelines

As pointed out by Al-Qirim (2004) regulatory bodies need to keep up with the legislation related to telemedicine in order for it to succeed and have easy clear guidelines that state the legal standing. Having protocols and guidelines for use of telemedicine is one way to avert some of the scepticism of health professionals (Benger, 1999; Cary & Darkins, 2000). Findings from this study show that detailed discussion and the development of protocols and policies played an important part in sustainability of telemedicine. Study Participants in NZ agree that having protocols and guidelines would enhance the use of telemedicine for them.

Important factors swaying the success of telemedicine is clinician buy in. This is dependent on social influences such as behaviours, cultural beliefs and people’s perceptions. (Söderholm & Sonnenwald, 2010). Issues relating to this were
mentioned by many study participants both in NZ and Queensland. A smooth change process depends on clinician buy in and people perceptions. Change process will be discussed later in this chapter.

**Opportunities**

This study suggests that telemedicine can be a factor that influences recruitment and retention of health professionals in rural and remote areas by supplying additional support. This support could be in the form of education sessions, training or teleconsultation by providing a second opinion or knowing if to transfer a patient or not. However, literature seems to provide limited support for this implying telemedicine does not greatly influence recruitment and retention (Ferguson et al., 2003; Sargeant et al., 2004). Literature does however concur that, telemedicine is valued by staff as being clinically supportive, and that it can help enhance positive professional relationships by facilitating contact with peers (Bashshur & Shannon, 2009; Brear, 2006; Norris, 2002; Wootton et al., 2006). Likewise literature suggests that telemedicine does not impact recruitment or retention but there is a real threat telemedicine could be used as a substitute for specialists in rural or remote areas (Duplantie et al., 2007).

Training and education are seen as opportunities for telemedicine by all study participants. They thought having the ability to connect to colleagues in urban areas would prove invaluable to staff living in rural and remote areas as it would give them an opportunity to discuss and debate cases. Similarly the informants from Queensland agreed that telemedicine could enhance staff training and education. Education and training was also highlighted in the literature as an opportunity that comes from telemedicine for staff working in rural and remote areas (Curran, 2006; Mahadevan et al., 2011; Sargeant, 2005; Zollo et al., 1999). Highlighted benefits
were reduced costs and travel, interpersonal connections not only nationally but also internationally, skill development, prevention of feeling isolated, minimized staff absence and enhanced patient care (Curran, 2006; Mahadevan, Muralidhar, & Shetty, 2011; Sargeant, 2005; Zollo, Kienzle, Henshaw, Crist, & Wakefield, 1999).

Cost and decreased travel for staff were emphasised as opportunities from the people interviewed throughout this study, although increased costs related to the equipment and running costs was also seen as a barrier for some Participants. Literature suggests that the true cost of telemedicine is not really known due to the short length of time advanced telemedicine has been utilised (Brear, 2006). In fact two studies suggested telemedicine was not cost effective at all. One study on minor injuries considered the location and the setup of telemedicine may have been the catalyst for increasing costs (Nobel et al., 2005); and the other study in emergency care found a need to increase staff and technical resources which increased costs (Söderholm & Sonnenwald, 2010). From the patients’ perspective however, the literature supported the findings from the study suggesting that patient travel requirements plus travel related costs were reduced (Brear, 2006; Peterkin, 2009). Literature also found benefits in decreasing patient transfers and patient’s visits to hospital/secondary services due to telemedicine assisted triage by a home health nurse (Benger, 1999; Hayes et al., 1998).

Inequality of healthcare services were not mentioned by participants in the first instance; in this study however a small number of staff did see benefits when asked about how they saw telemedicine fitting into the new model of care. Participants thought the ability to access specialist care through telemedicine in situations not often encountered, such as paediatric resuscitations, would be a definite bonus not only to themselves, but also the patients. This is in keeping with the literature which
suggested telemedicine had definitive benefits to inequalities caused by specialisation and distance (Kerr & Day, 2010). Additionally inequalities in healthcare throughout rural and remote areas would be bridged and an increase in efficiencies within healthcare services would be expected (Chaudhry et al., 2006).

Quality of healthcare is at the forefront of any change process. This study found that the Participants thought the use of telemedicine would improve the quality of care and outcomes for patients living in remote areas, as small communities can find it hard to staff medical centres and rural hospitals with doctors, and may leave nurses to run after-hours services. NZ Participants, from areas surrounding the base hospital felt telemedicine would improve decision making with assessment, diagnosis and treatment and support them, providing the confidence to carry out their duties. This is reiterated by literature which lists benefits quality of care as: enhanced monitoring of patients, reduction of medication errors, efficiency such as time and a decrease of potentially inappropriate care (Chaudhry et al., 2006). Additionally as mentioned above, education and training can also improve quality of care for patients (Pedley, Brebner, Rowlands, Palombo, & Ferguson, 2003; Söderholm & Sonnenwald, 2010).

Other opportunities not mentioned by Participants in this study but found in the literature were, improved communication and collaboration through images, increased interaction between team members (Bolle et al., 2009; Söderholm & Sonnenwald, 2010), and a decrease in admission rates, combined with an increase in discharges for moderate trauma patients (Westbrook et al., 2008).

Language

There are many definitions that are available for use when discussing technology for distance medicine. Literature suggests that e-health is now becoming the umbrella
term for this type of delivery of healthcare (Della Mea, 2001; Eysenbach, 2001). However, e-health is still a relatively new word created in the 1990s and older terms such as telehealth, telemedicine and telecare still have their place in today’s health organisations. Clarity around terminology when introducing new technology needs to be considered to avoid confusion. Managers, leaders and technicians should all determine the terms to be used and be consistent throughout the process. If this is not possible then they should at least make staff aware of what the terminology means.

**Change**

Empowering a partnership approach when trying to implement organisational change, such as introducing telemedicine, is fundamental to ensuring everyone involved has the knowledge required to make that change. Findings from the NZ Participants indicate that they all had a good understanding of the concept of telemedicine but lacked the knowledge on how it was to be used in their workplace. Participant’s perception of whether they would use telemedicine, or not, related to their knowledge and education around telemedicine. Applying the principles of taking staff along with you when implementing new technologies, could prevent lack of knowledge in this instance. Moreover, when staff are not empowered with knowledge about a change, they tend to resist, relying on the premises or norms developed through experience, organisational culture, training and socialisation (McWilliam & Ward-Griffen, 2006). Rogers (1995) gives a good example of how to implement change through diffusion of innovation. According to Rogers (1995) in order to implement change first someone has to have an innovation which is communicated to others and a discussion takes place. Rogers, (1995) recommends a five step process then takes place.
1. **Knowledge** is parted and person becomes conscious of innovation and how it may function.

2. Person is **persuaded** to a favourable or unfavourable response to the innovation.

3. A **decision** is made to go or not to go with the innovation

4. Person **implements** innovation

5. **Conformation**, person evaluates innovation.

Without knowledge people cannot answer questions such as, will this benefit me or my patients in my work? These were not answered for the health professionals of the West Coast. However, findings from the Queensland health professionals showed the knowledge they had gained prior to the implementation of telemedicine into their everyday work life was invaluable and was one of the keys to the successful implementation and use of telemedicine.

Most study Participants from NZ, felt they had not been adequately involved in the implementation of telemedicine. This is the opposite to the Australian Participants who felt very involved in the implementation phase of telemedicine, which was considered excellent and the most important factor to improving utilization. Literature suggests the change process should be followed with attention given to involving everyone and that telemedicine implementation is best served by having a project manager to ensure this happens.

**Summary**

This discussion points out relevant detail to improving telemedicine in rural and remote Emergency Departments. Chapter 7 will draw on this chapter to provide recommendations to improve utilization of telemedicine on the West Coast.
Chapter 7: Conclusion

Introduction

This descriptive study has provided research based evidence on the barriers and opportunities of telemedicine in a rural or remote emergency service. The study explored 12 NZ clinicians’ perceptions, gathered information from Australian site visits and staff and provided a synthesis of national and international literature. This chapter presents conclusions, limitations and recommendations for further research.

Findings from the study

Findings from this study illustrate telemedicine can be an effective way of delivering healthcare for rural and remote Emergency Departments. Employing the latest IT systems in rural and remote hospitals will respond to the needs of communities who at present have difficulty accessing specialist services. More importantly the use of such technologies can have measurable benefits for the population.

Social and technical challenges can be a barrier to, the use of telemedicine in Emergency Departments. This study highlights the significance of a good implementation process, ensuring that people involved in the delivery of telemedicine are well informed from the very beginning. Building relationships with those who will be assisting in the smooth implementation of telemedicine is vital in getting clinician participation (Caltienne Ltd, 2003; McWilliam & Ward-Griffen, 2006; Rogers, 1995). The use of a telemedicine coordinator to drive the implementation process and use of telemedicine was found to be essential. This role
should involve communication with the receiving and dispatching hospital. Equipment should be easy to access and fit for purpose ensuring it meets the needs of the department.

The true costs of telemedicine are still not yet fully established, nevertheless, over a period of time, with the decrease in patient travel and associated costs, telemedicine could possibly show cost related savings (Nobel et al., 2005). The findings from this study support the potential saving in travel time for staff and patients.

Emergency Departments can be unpredictable which can make telemedicine services difficult to establish. Supplying a telemedicine system that is conducive to the specific department could possibly be a solution to this. Telemedicine technology must be easy to use, with the ability to establish fast and reliable connections. Consultations should take no longer than those traditionally done by phone and interruptions to communication and video systems should be minimised. Therefore, having the correct resources and infrastructure is imperative to the sustainability of telemedicine in rural and remote Emergency Departments.

The findings from this study indicates that technology elicits a number of challenges throughout all EDs and the perceptions of clinical staff working with telemedicine need to be taken seriously in order for telemedicine to be sustainable. Education and training must continue through the years as new technology and staff join the team. EDs are well known for their unpredictability and chaotic work conditions thus establishing telemedicine into this type of specialty will always be a challenge. To add to these challenges, the WCDHB is currently changing the model of care by orthopaedic cover being provided from Canterbury District Health Board (CDHB). This has meant the WCDHB no longer meets the requirements of a secondary level hospital status. Telemedicine however could change this by providing orthopaedic
cover 24 hours a day, seven days a week. As discussed in previous chapters these findings recommend telemedicine as an effective way to provide specialist cover, and for the WCDHB bringing the hospital back to a secondary level status is important when factoring in this hospital is the base hospital for a large region. Planning and implementation for Emergency Departments need to be different from ward or outpatient areas that work in controlled environments. This will not be as cost effective in the short term but the long term benefits should compensate initial costs, and sustainability will be more likely (Norris, 2002). Emergency services are still in their infancy with telemedicine use due to the complexity of the area. Additionally, often rural and remote areas are staffed at a minimum and telemedicine can be seen as a distraction and addition to staff workloads. Decisions on services for any Emergency Department should not be budget, nor politically driven, but must be patient centred.

This study indicates benefits from having a nationally driven service. Sustainability of any service is paramount and health professionals have the responsibility to spend the tax dollar wisely. Such a centre it would mean resources would not be wasted and a good cohesive working relationship would be established within our small country. Telemedicine in rural Emergency Departments is not well researched and this is an area that is likely to grow as smaller community hospitals look at alternate ways to providing equitable health services.

The following recommendations were generated from this study and are directed towards the organisation, clinical practice and also suggest areas for further research.

**Recommendations for clinical practice**
1. Ensure protocols and guidelines for the use of telemedicine are available and they set out clear rules in a framework which managers and clinicians must comply with. This will ensure safe practice for telemedicine consultations.

2. Ensure that regulatory bodies affected by telemedicine within NZ are well informed throughout the process and determine their views on this model of care prior to implementing telemedicine.

3. Establish the right place for the equipment; ensuring the use of telemedicine will have the least disruption to medical teams and patients.

4. Ensure appropriate staffing levels are available from the outset as workloads will increase in rural and remote areas.

**Recommendations for the organisation**

1. Health professionals need to define and drive the need for telemedicine, not politicians or budgets.

2. Empower staff with knowledge and training, not just initially but continuously.

3. Supply appropriate resources which may be costly to start with but can add value for sustainability.

4. Ensure the infrastructure is consistently reliable before rolling out telemedicine.

5. Have a backup system for telemedicine consultations in areas known to have problems with weather to ensure safety of patients and staff.

6. Change processes needs to be managed in a careful and considerate way.

7. Clarity around terminology needs to be determined prior to the introduction of new technology.
**Recommendations for future research**

1. As the true costs for telemedicine have not been established, this is an on-going area for research to establish the cost benefit for patients, staff and health services.

2. The use of telemedicine in trauma and ED is always going to be precarious due to the unpredictability of emergency services, listening to health professionals that work in the area of emergency services needs to be a priority for any implementation phase to ensure a smooth change process.

3. The use of coordination centre for NZ and the costs associated with this need to be carefully considered as time spent establishing a telemedicine consultation may distract from care of other patients in the department and cause frustration for front line staff.

**Limitations**

This study has the potential to inform NZ on how to establish and sustain telemedicine in the Emergency Departments in rural and remote areas. Although the study had a relatively small sample size, a range of clinicians participated and shared openly.

The Australian component of the study only drew on Queensland, and while this is very informative, it does not represent the wider experience of Australia which may be more diverse. This study cannot be generalized due to the small sample size and the purposive sampling. However, the purposive sample provided a rich source of data.
Dissemination of research findings

Two years ago there was some debate between the Emergency Departments in both Christchurch and Grey Hospital about telemedicine. The prime reason for the debate was that clinicians could not see any benefit for their patients in establishing video consultations. When presenting to the Board of the WCDHB how collaboration was going between departments a promise was made to the Board that the researcher would feedback her findings on telemedicine once she had finished her thesis. A report will be written and this will be presented with a hard copy of the thesis to the Board within the next three months.

September, 2012 a paper was submitted to the Health Informatics NZ (HINZ) conference. This paper was accepted (Appendix F) and the researcher presented her preliminary findings. The paper won the Best Student Paper Award. This paper is now published on the World Wide Web. Additionally, the abstract was sent to the management of the WCDHB and feedback to staff who participated in the study. A presentation to staff followed.

Within the next six months it is hoped further papers will be written and submitted to journals and conferences.

Conclusion

The purpose of this study was to identify the opportunities and barriers in emergency medicine, with the hope of improving utilisation of telemedicine in the Emergency Department, Grey Hospital, WCDHB. The study provides a good understanding of staff perceptions of the barriers and opportunities of the use of telemedicine in rural
and remote emergency services in order to achieve this. Interviews were held with staff, not only at Grey Hospital, but also outlying areas within the DHB. Also site visits and interviews with key informants, staff working with telemedicine in Queensland, Australia, were included. Findings from this study stress the importance of using a change process, managing resources and having them in place prior to implementation of telemedicine, having the right equipment ‘fit for purpose’, and ensuring it is coordinated by someone, is imperative to the success of telemedicine.

New Zealand is a small country in comparison to Australia, and so setting up a coordination for provincial NZ seems a sound way of providing Emergency Departments with the support they need at the flick of a switch.

“Treat your patients well and make a difference to their day, strive to improve quality, ensure dollars are spent wisely and most of all remember technology can become your friend if you let it.” Julie Lucas
Appendices

Appendix A    Ethics approval
Appendix B    Consent form for management, requesting to interview
Appendix C    Participant consent forms
Appendix D    Participant information form
Appendix E    Interview guide
Appendix B  Consent form for management, requesting to interview

School of Nursing
FACULTY OF MEDICAL AND HEALTH SCIENCES

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01 November 2011

Consent form - West Coast District Health Board CEO and Service Managers

This form will be held for a period of ten years

Exploring Telemedicine use in the West Coast District Health Board Emergency Department, barriers and opportunities to improve utilization

Researcher: Julie Lucas (Masters Student Auckland University), Ph: 037626557 or 0212762377
Supervisors: Dr M Honey and Dr K Day

I agree to support staff in taking place in this study. I also support Julie Lucas with her research on Telehealth.

I have read the Participant information sheet regarding telemedicine use in the Emergency Department and have had the opportunity to ask questions and am satisfied with the answers provided.

I understand the information gathered will be treated confidentially and will not be identifiable in any reports or publications that come from the research.

I agree to the audio recording and transcription of employees interviews and understand that I will not be given the opportunity to view transcripts or hear audio recordings of any interviews or notes due to staff privacy.

I agree to some or all of the interviews taking place on West Coast District Health Board (DHB) premises.
If a staff member feels uncomfortable at any time and wants to withdraw completely from the research, then he/she can do so and none of the information collected will be utilised in the study.

I agree to the secure storage of data for ten years at the West Coast DHB.

I understand that any information or recommendations following the research will be made available to my organisation.

I know who to contact if I have any questions about the study or want to discuss any aspects of it.

I hereby consent to this research being conducted at the West Coast DHB involving staff members who consent to participate.

I wish to receive a summary of the study realising that it may be a long time before its available. YES/NO

My email address: Julie.lucas@westcoastdhb.health.nz

I __________________________ (full name) hereby support the participation in this research of employees at the West Coast DHB.

Signature:____________________________________
Date:____________________________________

Statement of Approval

APPROVED BY THE UNIVERSITY OF AUCKLAND HUMAN PARTICIPANTS ETHICS COMMITTEE ON ......... for (3) years, Reference Number ...../......
Appendix C  Participant Consent Forms
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01 November 2011

Consent form – Health Professionals

This form will be held for a period of ten years

Exploring Telemedicine use in the West Coast District Health Board Emergency Department, barriers and opportunities to improve utilization

| Researcher: Julie Lucas (Masters Student Auckland University), |
| Ph: 037626557 or 0212762377 |
| Supervisors: Dr M Honey and Dr K Day |

I agree to participate in the interviews.

I have read the Participant information sheet regarding telemedicine use in the Emergency Department and have had the opportunity to ask questions and am satisfied with the answers provided.

I understand the information gathered will be treated confidentially and will not be identifiable in any reports or publications that come from the research.

I have been given the opportunity to discuss this research with someone of my choice. I have had enough time to consider participating in the research.

I understand that at any time during this study, I can withdraw and it will have no effect on my position or work and none of the information collected from me will be utilized in the study.

I understand that I will not be able to withdraw after 30th May 2012.

I understand my participation is voluntary and there is no compensation.

I know whom to contact if I have any questions or want to discuss any concerns.

I agree to the audio recording and transcription of my interview.
I understand the information collected will be kept in a secure place for ten years at the West Coast DHB.

I understand that any information or recommendations following the research will be made available to my organisation.

I hereby consent to being interviewed for this research.

I wish to receive a summary of the study realising that it may be a long time before its available. YES/NO

My email address: Julie.lucas@westcoastdhb.health.nz

I __________________________ (full name) hereby support the participation in this research of employees at the West Coast DHB.

Signature:____________________________
Date:_________________________

Statement of Approval

APPROVED BY THE UNIVERSITY OF AUCKLAND HUMAN PARTICIPANTS ETHICS COMMITTEE ON ………… for (3) years, Reference Number …../……
Appendix D  Participant Information Form

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Participant Information Form

Researcher: Julie Lucas (Masters Student Auckland University),
Ph: 037626557 or 0212762377
Supervisors: Dr M Honey and Dr K Day

Introduction:

This study will explore the barriers and opportunities of telemedicine to identify recommendations to ensure better utilization of the equipment already installed. People who have an association with the Emergency Department on the West Coast and those rural Emergency Departments who are utilizing telemedicine in Australia rural Emergency Departments are being invited to participate. Julie Lucas will be in charge of this study.

Julie has 32 years of experience as a nurse, firstly enrolled in 1979 and then as a Registered nurse in 1996. Since completing my diploma in health science, endorsed in nursing. She has worked in the Emergency and Outpatient Departments, Grey Base Hospital and completed my expert level PDRP as a senior emergency nurse. Following 10 years on the floor, she then moved onto managing the Emergency and Outpatients Departments for the West Coast DHB, where she is today.

You are invited to take part in an interview about your experience and perceptions of telemedicine. Your opinions will be an essential contribution to the study. This information sheet will help any answers you may have about the study but if you have any further questions then please contact the person above.

What will happen if I take part?

Your participation in this study is voluntary (your choice). You will be contacted by Julie Lucas, face-to face or by phone to arrange a time to conduct an interview. The location convenient to you will be set at that time. The interview will range from approximately 30 minutes to one hour to complete. I will ask you questions about your experiences and perceptions of telemedicine and what you feel maybe some barriers and opportunities to use.
If you agree, the interview will be audiotape. If you agree to being taped, you can choose to have the audio-recorder turned off at any time; field notes will also be taken. The information gathered will then be transcribed. At any time, you have the right to withdraw from the study or request the information recorded or to review. You do not have to participate. Choosing to participate or not, will not affect your workloads or your future work relationship.

All identifying material will be removed so the information you provide will be anonymous. The information received will be kept in a locked cupboard or on a password protected computer at Grey Base Hospital.

**About the study:**

The West Coast District Health board continues to struggle financially to obtain a sustainable healthcare system for the future. As an initiative to help with sustainable healthcare on the West Coast, telemedicine was introduced in 2009 as part of a pilot scheme working with CISCO Telepresence. It was seen as a way to ensure that the right care is given to our population in the right place, by allowing clinicians in outlaying rural areas to assess and treat patients in their home town, with the support of senior consultants through video/audio linkage. This saw the implementation of telemedicine equipment into the Outpatient and Emergency Departments at Grey Hospital. To date the technology sits in both the departments with minimal use. As the Clinical Nurse Manager for these departments, I have decided to explore why this model of care has not been utilized to its full potential.

This research aims to explore the barriers and potential opportunities of telemedicine. This will achieve a better understanding to why clinicians are reluctant to utilize telemedicine as a means of networking with consultants and specialist in territory hospitals and ultimately improving patient outcomes.

Inclusion criteria will be healthcare professionals from the WCDHB and two Australian sites who are currently utilizing telemedicine in Emergency Departments in collaboration with tertiary hospitals.

Audiotapes and field notes will be used as a means of collecting data. Using a type of thematic analysis the data will then be transcribed and organised into groups or themes focusing on what is said by the Participants (Gerrish & Lacey, 2010).

Expected outcomes from this qualitative research are to make recommendations to clinicians, managers and the board of the WCDHB ensuring better utilization of telemedicine.

**Benefits, Risks and Safety**

Telemedicine is delivery of care at a distance. This research aims to find out the barriers and opportunities telemedicine produces from Health professionals who are expected to use this equipment. The benefits from this research will be improved understanding into telemedicine use in the Emergency Department, whilst providing better utilization.

There may be inconvenience participating in interviews; however, I will do my best to keep this to a minimum. A time and place for the interviews will be made at your convenience as not to disrupt your workloads. If you feel uncomfortable at any time throughout the interview, you have the right to withdraw from the study and information collected will not be used in the research.

**General**

If you have any questions about the study, please ask the contact person at the beginning of the information sheet. You do not have to answer all questions asked of you and if you
wish to read the information collected, then this will be made available within a four-week period from time of interview. Following the four weeks, the data collected will be used for analysis. I plan to publish and present the results of this study so other rural hospitals throughout NZ can benefit from the learnings. If you want a copy of the research then please circle, yes on the consent form.

Confidentiality
Returned consent forms will identify the Participants I will interview for my study. However they will be kept in a secure locked cupboard in my office at the WCDHB. Any Electronic information will also be kept at the WCDHB on my password protected computer. Any reports will have de-identified information from Participants and at no time will any reports have any information from patients data. Interviews will be audio recoded so nothing said is missed. This information will then be transcribed by myself and with the help of my supervisors.

Compensation
There will be no compensation for taking part in this study. If you have any queries regarding your rights as a Participant in this study, then you may wish to contact the health and disability advocate.

Free Phone: 0800 377 766 to contact an Advocate.

Web site for more information: http://www.hdc.org.nz/

Statement of Approval. This study has received ethical approval from Upper south A Reginional Ethics Committee, which reviews southern regional studies.
Appendix E    Interview Guide

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Interview Guide

Exploring Telemedicine use in the West Coast District Health Board Emergency Department, Barriers and opportunities to improve utilization.

I would like to ask healthcare professionals (e.g. nurses, doctors and others who use videoconferencing equipment in their clinical work) questions about their experiences and what they think might be potential barriers and opportunities when using telemedicine.

Introduction:

1. How long have you been working as a health professional and in the area of emergency medicine?

Telemedicine:

1. What do you know about telemedicine?
2. What is your understanding of telemedicine?

Experience of Telemedicine:

1. What experience if any have you had with telemedicine? E.g. implementation into the service, training and how they were resolved. 
2. If you have used telemedicine in your workplace, was it easy to use?
3. Was the use of telemedicine more time consuming than face-to-face consultations?

Possible Benefits:

1. To what extent do you think it benefited your patients?
2. What do you see as benefits of telemedicine in your workplace?

Possible Barriers:

1. What are the barriers to you using telemedicine?
2. Did the people in your organisation collaborate with you on telemedicine when it was introduced? How was this done?
3. Do you feel telemedicine equipment is in a good location to use?
4. What should others consider when placing telemedicine equipment?

Conclusion:

1. Knowing what you know now about telemedicine, what would you do differently in bringing telemedicine into your service? What advice might you give me?
2. Is there anything else you would like to share about telemedicine?
Clinicians’ Perceptions of Telemedicine Opportunities and Barriers for Emergency Services: Interim Findings of a Descriptive Study

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Abstract

Telemedicine has the potential to provide more accessible health care to people in rural and isolated communities. This paper presents early findings of a qualitative descriptive study exploring the opinions of West Coast clinicians about telemedicine. The aim of the study is to determine what the clinicians see as the barriers and opportunities for telemedicine in the emergency departments of rural and remote hospitals throughout the West Coast District Health Board. Eleven specialists and nurses working in emergency care services were interviewed using a semi-structured interview lasting up to one hour. Initial findings indicate five themes (knowledge, implementation, skills, opportunities and barriers), each with a number of sub-themes. The participants did not always show a clear understanding of telemedicine, and had somewhat cautious ideas about the benefits telemedicine could bring, along with concerns that telemedicine would change practice. The next step with this research is to visit two Australian emergency care centres where telemedicine is considered to be part of everyday care, and learn how barriers were overcome and opportunities leveraged for successful use of telemedicine in emergency services.

1. Introduction

There are many challenges facing equitable delivery of health care to meet the World Health Organisation’s (WHO) requirement to deliver high quality health to all, especially in isolated and rural communities [1,2]. With this in mind, District Health Boards throughout New Zealand have no option but to move from the traditional ways of delivering healthcare to innovative modes, such as telemedicine, to better meet the needs of their communities. There are a number of definitions utilised when describing telemedicine. This can be confusing to many clinicians when implementing this new type of healthcare delivery. Norris suggests telemedicine is medicine delivered at a distance which is enabled by information technology (IT) and telecommunications such as the internet or a satellite link [3]. Furthermore, it is often portrayed as the answer to the delivery of better healthcare services with improved access for all [3-8].

Over the past decade the West Coast District Health Board (WCDHB) has grappled with providing equitable and sustainable health care services for their population because of the reasons above and also because of a lack of medical staff [9]. The aim of the research reported in this paper is to understand West Coast clinicians’ perceptions of the opportunities and barriers telemedicine may offer the emergency department.

2. Telemedicine

Telemedicine interest is increasing throughout the western world, particularly with the transition from analogue to digital, lower costs in equipment and higher resolution monitors and the provision of more sophisticated advances in computing [3]. This has seen the change from copper wire based networks to fibre-optic cables. Australia and New Zealand are presently increasing networks throughout their countries to ensure availability of broadband to rural areas [10]. Norris [3] suggests that drivers of telemedicine can be broken down into two categories, technological drivers, such as discussed above, and non-technological drivers. Non-technological drivers include aspects such as dispersed
of specialists via a growing network between the tertiary centre in Christchurch and the West Coast. Telemedicine is a vital aspect of this collaborative service as it allows clinicians on each side of the South Island to utilise technology (largely videoconferencing) to plan patient care. There has been a previous evaluation by the National Institute for Health Innovation (NIHI), University of Auckland and the Simpi Group, of the West Coast project [17]. However, the utilisation of telemedicine has not had the uptake expected and particularly in the emergency services.

telemedicine in emergency care services throughout New Zealand. This exploratory study is the first step in examining the barriers and opportunities in implementing telemedicine for emergency services in remote areas of New Zealand.

7. Conclusion

The WCDHB is unique in New Zealand due to its sparse geographical area and isolated populations, thus it has always been difficult to retain and recruit health professionals. It is hoped the introduction of telemedicine will help retain staff because of increased education and support. Despite telemedicine being reported as being helpful to meeting the needs of rural communities, today telemedicine is underutilised throughout emergency departments in the WCDHB. There are many opportunities such as improved access to specialist care, lower costs in travel and time, yet to be realised. Telemedicine lends itself to a more equitable and sustainable healthcare provision for the future. The next step in this study is to visit two Australian health services where telemedicine is being used successfully in emergency care to both observe the use of telemedicine in an emergency service and interview clinicians working in those environments. The analysis of these visits, plus the incorporation of the New Zealand interviews, will be used to develop recommendations to guide the implementation of telemedicine for emergency services in the West Coast.

8. References


References


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