Chapter 1 Introduction and Thesis Overview

1.1 Thesis Title:

The application of telepharmacy as an enabling technology to facilitate the provision of quality pharmaceutical services to rural and remote areas of Australia.

1.2 Introduction

Australia's rural areas are characterised by small communities and towns spread over vast distances. The people of these communities and those who travel through them do not have ready access to quality pharmaceutical services that people living in cities and towns take for granted. Quality Pharmacy Services have been described as the dispensing, supply and distribution of medicines; the provision of knowledge and information about drugs, with the primary objective being the promotion and assurance of quality use of medicines (QUM); and the provision of pharmaceutical care, which involves pharmacists responding to patients' drug-related needs to assist them achieve their desired health outcomes.[1]

The map below, adapted from the National Key Centre for Social Applications of GIS at the University of Adelaide (GISCA) shows the coverage of pharmacies in Australia.[2]

Figure 1: Localities further than 80 km from a pharmacy – dark shaded areas (GISCA)

The dark coloured portions of the map indicate the areas further than 80 km from a pharmacy. As can be readily observed, there are large areas of the continent where there is limited or no ready access to a pharmacy.

Unfortunately, the availability of medicines in rural Australia still reflects old practice going back many decades.

Many rural communities do not have access to a pharmacy and, as shown in the image below, where prescriptions need to be dispensed, out dated pick up and return procedures are still being used. The procedure shown in the image below involves the placing of a prescription in a collection box in a rural supermarket. The prescriptions placed in the box are picked up by a bus driver and transported to the nearest pharmacy some 40 km away over roads that are often closed due to poor weather. The filled prescription medicines are then returned to the supermarket, either later in the day, the next day, or when weather conditions permit. This is a procedure replicated across many remote areas in the country. This thesis seeks to provide viable alternatives by studying the various opportunities available using modern information technology and automation techniques to provide quality pharmaceutical services to rural and remote communities in Australia.

Figure 2: Prescription Collection Box in a Supermarket – Rural Australia 2004

1.3 Thesis overview

As the above example illustrates, the provision of quality pharmaceutical services to rural and remote areas of northern Australia is a major problem. This is due to the vast distances across the top end of Australia, a shortage of pharmacists, and inadequate and poorly distributed pharmacy resources. This situation is even more critical in Aboriginal communities in rural and remote areas. Health Standards in rural and remote communities remain poor despite recent increases in funding. [3] The result is a higher mortality rate than that seen in urban communities. In the period 1997 to 1999, the number of deaths per 100,000 people was 20 per cent lower for males and 22 per cent lower for females living in metropolitan regions compared with remote areas.[4] A recent further study in 2005 by the Australian Institute of Health and Welfare (AIHW) has shown that there has been little change to these statistics.[5]

Hamrosi et al.[6] concluded that medication misunderstandings and non-compliance within the Aboriginal community frequently occur and that pharmacists may be well positioned to provide Aboriginal health workers with medicines information and patient education skills, to encourage the effective use of medicines within the Aboriginal community. Fiore et al.[7] also stated in their discussion on the support needs for supply nurses in rural and remote Queensland that ongoing support of nurses involved in the supply of medication is a necessity, as it affects the promotion of QUM. Without support or information of a practical nature, these nurses are left in a difficult professional position. Pharmacists are the key to providing this support, however, it is impractical to have pharmacists stationed in every rural clinic, therefore innovative ways must be found to provide such support. Information technology has the potential to provide a number of innovative solutions.

Currently a number of strategies such as patient air or road evacuation, referrals, visiting specialists and mobile health services such as the Royal Flying Doctor Service are used in an attempt to meet service gaps. However, these measures do not address the issue of staff shortages or the significant financial and social costs the patients may incur when transferred out of their community. From a client perspective, travelling long distances from a remote community to a city hospital for medical treatment can be a frightening experience.[8] Usually there are unknowns about the city hospital environment and the types of treatments that will be encountered. Familiar health professionals are no longer the healthcare providers. Family and friends are often not with the individual to advocate for them and provide support. Clients often don't want to leave their community.

In 1999 the Australian government introduced an initiative to provide Pharmaceutical Benefits Scheme (PBS) medicines via the provisions of Section 100 of the National Health Act of 1953 to Aboriginal Health Services. This initiative has had some promising results; an example of the application of Section 100 in the Tiwi Islands shows that a community owned pharmacy model may yield positive health outcomes for Indigenous communities. However, this solution remains problematic. As stated by Murray in an article in the Australian Prescriber in 2003, health professionals have serious concerns about the community pharmacy model. Murray found that that "in an increasingly litigious environment, medical practitioners and health service providers are rightly concerned about medicolegal implications and insurers are reluctant to cover 'illegal dispensing'".[9]

1.4 Study aims

The six primary aims of this thesis can be summarised as:

1. To ascertain the opinions of relevant healthcare professionals on the concepts of telepharmacy.
2. To identify the requirements of a telepharmacy system suitable for use in rural Australia, by examination of the literature and discussion with key stakeholders.
3. To develop a pilot telepharmacy system based upon the identified requirements.
4. To demonstrate the validity, accuracy and reliability of the telepharmacy system in dispensing a limited range of products locally and then remotely via telecommunications.
5. To identify an area of telepharmacy where there is a clinical need and which has broad support of the key professional stakeholders.
6. To demonstrate the applicability of telepharmacy to the identified area of clinical need by means of a trial involving volunteer patients.

Pilot studies play an important part in health research and provide information for the planning and justification for future randomised controlled trials.[10] Pilot and feasibility studies allow potential strategies to be tested and optimised to promote cost-efficiency.

Two pilot studies are presented in this thesis. The first, a pilot telepharmacy system based upon identified requirements; the second, a pilot medication review study using telepharmacy techniques. It

is postulated that the results from these pilot studies will provide important information necessary to justify future trials.

1.5 Study hypotheses

Throughout the work presented in this thesis, two specific hypotheses will be tested:

1. Healthcare professionals, specifically pharmacists, medical practitioners, nurses and healthcare workers, support the introduction of telepharmacy applications to communities who may have poor access to pharmacy services in rural and remote Australia.

   Specifically this can be stated as:

   a. Healthcare professionals support the proposition that telepharmacy can provide professional pharmacy services such as patient counselling to remote communities.
   b. Healthcare professionals support the proposition that it is feasible for pharmacists to conduct medication reviews using telepharmacy techniques.
   c. Healthcare professionals support the proposition that it is feasible to provide medication dispensing services, by remotely located trained assistants, under telepharmacy supervision by pharmacists.
   d. Healthcare professionals support the proposition that it is feasible to provide medication dispensing services, under telepharmacy supervision by pharmacists, by using remotely located dispensing machines.

2. The application of telepharmacy applications can be demonstrated by pilot studies.

   Specifically this can be stated as:

   a. Pilot studies using automated dispensing equipment can demonstrate the application of such equipment in a simulated environment.
   b. Pilot studies in a simulated environment can demonstrate the feasibility of conducting medication reviews using telepharmacy techniques such as video conferencing.

This thesis commences by introducing the current healthcare climate in rural Australia and the issues involved in providing and maintaining quality pharmaceutical services to underserved communities. The concept of telemedicine and its subset discipline, telepharmacy, is then introduced followed by a

brief historical overview of telemedicine and telepharmacy applications. A summary of present day technologies that drive the discipline precedes an evaluation of the requirements, through examination of the literature, patent applications and user specifications, for a telepharmacy service directed at improving equity and access to pharmacy services in rural and remote areas of Australia.

As preliminary work, informal interviews on remote pharmacy practices were conducted with pharmacists and healthcare workers in three locations: Cape York Peninsula, the Tiwi Islands and the west coast of Tasmania.

By way of introduction to the concept of telepharmacy applications, surveys of the four healthcare professional stakeholders in northern Australia were undertaken. Pharmacists and medical practitioners, as well as nurses and healthcare workers, were surveyed on the concept of telepharmacy and their opinions on the provision of pharmacy services to rural and remote communities via telepharmacy. A discussion of the surveys follows and implications for future directions of study are addressed.

The development of two variations of a pilot telepharmacy system designed to meet the key factors identified through this examination are then presented. This is followed by a review of the procedures used to test the system for accuracy and reliability via a remote connection equivalent to a Broadband Internet connection by using a local area network (LAN).

Two versions of pilot dispensing equipment were constructed, using information from the literature on the functionality of such equipment, adapted to the supply of Australian PBS type products and additional requirements specified by the Tiwi Health Board consultant pharmacist. The system was calibrated and tested for accuracy to determine the functionality of each part of the system.

Next, an application amenable to the use of telepharmacy, that of medication reviews, is introduced. This application was identified through the surveys of the four healthcare professional groups as one having broad support by all of those surveyed and is also an area of focus as a priority in the Fourth Pharmacy Agreement between the Commonwealth of Australia and the Pharmacy Guild.[11] The video conferencing facility developed for the dispensing machine was then modified to conduct a patient Medication Review trial to determine the effectiveness of the teleconferencing in providing detailed patient counselling. A medication review telepharmacy trial involving nine volunteer patients is detailed. The methodological construct and research framework is presented followed by the study results and a discussion of the findings of the study. Finally, a summary of the thesis and its implications in terms of the study aims and hypotheses is presented.

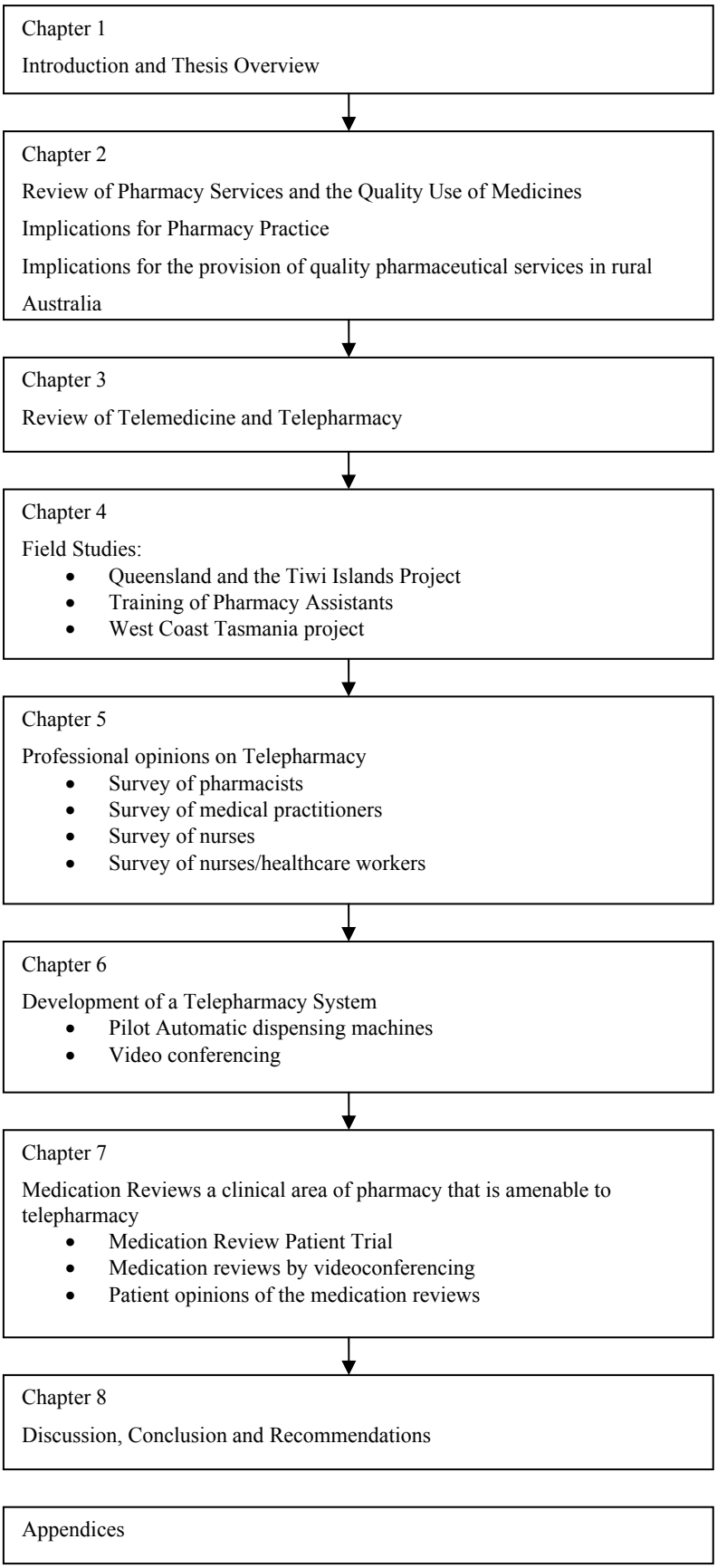

Figure 3: Graphical representation of the structure of the thesis

It is postulated that the results of this thesis will provide evidence for the efficacy of telepharmacy in conducting Medication Reviews in a controlled environment. If so demonstrated, these results may encourage the uptake of telepharmacy into pharmacy practice and in turn encourage pharmacists to use telepharmacy systems for other common pharmacy practices such as the supervision of pharmacy assistants and the use of automatic dispensing equipment, thus increasing the quality of pharmaceutical services for rural and remote communities without access to physical pharmacies. This has implications for the future provision of equitable and accessible pharmaceutical services in rural and remote communities.

The use of information technologies and telecommunications in the form of telepharmacy systems has the potential to make a dramatic difference to the provision of pharmaceuticals in rural and remote areas and may be a potential solution to many of the health care service difficulties in Australia relating to the use, or misuse, of pharmaceutical products.[12] Telepharmacy has the potential to improve health care by enabling the delivery of pharmaceutical services to isolated and remote patients and by establishing health networks that enhance the quality use of medicines.

Chapter 2 Review of Pharmacy Services

2.1 Pharmacy Services and Quality Use of Medicines

Accessibility to services is a crucial element of the economic and social well-being of Australians.[13] One of the key issues is inequality of access to services between the city and rural areas. A number of methodologies have been developed over the last two decades to classify Australia into zones representing degrees of remoteness.[14] These classifications have mainly been used to analyse the variation in patterns of service provision in non-metropolitan Australia and the underlying socio-demographic characteristics of the population living in this area. They have also been used as a basis for determining funding allocations in various programs that the Federal Government currently have in place. Of these methodologies, the Rural, Remote and Metropolitan Areas Classification (RRMA), developed in 1994, was widely adopted in government policy and legislation.[15] This chapter looks at the population levels and categorisation of remote regions in the context of the recognised health risk factor of 'rurality'.

Changes in pharmaceutical care and delivery of quality pharmacy services provides opportunities to alleviate some of the burden of 'rurality', a recognition that has led to a number of Government initiatives aimed at improving access to health services in remote regions. What is clear is the need for quality pharmaceutical advice and medication review. These initiatives and the implications for pharmaceutical prctice highlight the need for investigation into alternate service delivery.

2.1.1 Definitions of Rural and Remote Areas

Metropolitan centres in Australia are mostly located near or along the coast whilst the majority of the Australian continent consists of rural and remote areas. Between 1996 and 2001, the populations of major cities and inner regional areas grew by 7 per cent, while the populations in the other areas grew by less than 5 per cent.[5] In 2001, 87 per cent of the population lived in the major cities and inner regional centres, 10 per cent lived in outer regional areas, 2 per cent in remote areas and 1 per cent very remote areas. Males outnumbered females in the regional areas, substantially so in some age groups in remote areas. There were substantial differences in the age structure of the populations in each area. Children were proportionally more numerous in regional and especially remote areas.

There is also a significant population of Indigenous Australians, including Aboriginal and Torres Strait Islander people living in rural and remote areas. In 2001, the Indigenous population comprised approximately 2 per cent of the entire population in Australia. By way of contrast, 13 per cent of Indigenous populations lived in remote areas and 44 per cent in very remote areas.[5]

One of the methods used to classify remoteness is through the development of the Accessibility/Remoteness Index of Australia (ARIA). ARIA has been prepared by the National Key Centre for Social Applications of Geographical Information Systems (GISCA) in conjunction with the Commonwealth Department of Health and Aged Care.[16] ARIA is an index of remoteness for every population locality in Australia and has become a widely accepted measure of remoteness.[13] ARIA is based on l 1,338 population localities identified on the 1:250 000 topographic map series. The distance between each of these localities and the 201 service centres (larger populated localities with more than 5,000 people) in Australia was calculated. This index (in the PhARIA section of the website) shows that 0.9 per cent (approximately 156,000 people) of the Australian population live more than 80 kilometres from a pharmacy and Indigenous populations experience less accessibility to a pharmacy than non-Indigenous populations.

This is especially so in the Northern Territory where more than 60 per cent of the Indigenous population is located more than 80 kilometres from a pharmacy. Whilst this small percentage may give the impression that the Australian population is well served by pharmaceutical services, this is generally not the case in Outback Australia. In 2001, the Commonwealth Department of Health and Aged Care reported that there were 3,823 people per urban pharmacy and 4,104 per rural pharmacy. In Queensland there were 3,641 people per urban pharmacy and 4,056 people per rural pharmacy.[17] However, when one takes into account the small population base in the Outback compared to the urban areas, the area per person is very different. According to the 2001 Census data there are 2.1 people per sq. km in Queensland.[18] The largest population areas, the Brisbane and Moreton statistical divisions, have a combined 106 people per sq. km, showing that the rest of Queensland has only 0.7 people per sq. km. This factor is also reflected in the ARIA Index where a Category of 4 is used to represent “Moderately Accessible Areas”, a Category of 5 to represent “Remote” areas and a Category of 6 to represent “Very Remote” areas. The PhARIA website has a search facility to locate the specific measure of remoteness for the 4,926 pharmacies in Australia.[16] Except for pharmacies located along the eastern seaboard, most pharmacies in Queensland have an index number of 5 to 6, indicating their

geographic remoteness based upon the road distance people have to travel to reach a range of services.[19][a]

'Rurality' is an internationally recognised risk factor and, contrary to their diverse nature, rural communities worldwide share common problems in health status and in access to health care.[20] People in rural communities have poorer health status and greater needs for primary health care, yet they are not as well served and have more difficulty accessing health care services than people in urban centres.[21] In the United Kingdom ensuring equal access to good quality health care remains a core aim of the National Health Service and overcoming geographical barriers to access has been stated as one of the principal challenges for providing health services in remote and rural areas.[22] In Australia it is widely recognised that the health of rural residents is poor when compared with their urban counterparts. Life expectancies for males and females were highest in major cities and lowest in very remote areas.[5] The average life expectancy for males was 77–78 years and for females was 83–84 years in major and inner regional cities compared to 72 years for males and 79 years for females in Remote areas.

Indigenous males and females have been reported as having a life expectancy of 56 and 63 years, respectively, compared with 77 and 82 years, respectively, for all Australian males and females. Over 70 per cent of the excess mortality among Aboriginal people is accounted for by cardiovascular disease (26%), respiratory conditions (16%), injury and poisoning (15%) and diabetes (10%).[9] The striking feature of Aboriginal mortality is the massive excess of death in middle age - a profile almost without comparison in the world.

Acute morbidity patterns in Aboriginal primary health care include a marked excess of infectious diseases related to crowding and poor environmental health (skin and middle ear infections, rheumatic fever, trachoma). There are also high rates of sexually transmitted infections which the available evidence suggests is related to poor access to treatment rather than behaviour. Chronic morbidity is highly prevalent in Aboriginal communities. Diabetes affects about 10–30 per cent of adults, and the prevalence of end stage renal failure in many areas is 20-fold higher than in the general population and has been doubling every five years in northern and central Australia. There are regional variations in patterns of infectious diseases (such as trachoma) and substance misuse (for example intravenous drug use versus petrol sniffing), but patterns of chronic disease are reasonably consistent. Population

[a] Whilst providing excellent information, the PhARIA website is not infallible and when travelling through the Cape York Peninsula in August 2002, I discovered that there is a pharmacy in Weipa which is not listed on the website. This has since been corrected, but if analyses are to be made which require accurate town-by-town data, then the PhARIA data will have to be checked against other sources such as State and Territory Health Department databases.

mobility means that 'remote' conditions will often show up in urban areas and vice versa. The disturbingly high psychological burden of illness imposed by the despair, anxiety and depression reported in Aboriginal communities may also predict episodes of back pain.[23, 24] The greater socio-economic disadvantage experienced by Indigenous Australians exerts a disadvantage across a range of health conditions and the limited number of studies examining musculoskeletal conditions among Indigenous Australians suggest a high burden of illness associated with these conditions.[25] The following section looks at the changing role of pharmaceutical practice and the difficulties of providing service to remote communities.

2.1.2 Quality Pharmacy Services

Quality Pharmacy Services have been described as the dispensing, supply and distribution of medicines; the provision of knowledge and information about drugs, with the primary objective being the promotion and assurance of quality use of medicines (QUM); and the provision of pharmaceutical care, which involves pharmacists responding to patients' drug-related needs to assist them achieve their desired health outcomes.[1] The concept of quality also has to be considered from the point of view of the user. One definition of quality is anything that enhances the product (or service) from the viewpoint of the customer.[26] For example, a customer living in a rural area without easy access to pharmaceutical services or products has a very different viewpoint of what a quality pharmacy service is to that of a customer living in a city or town with, at least, a pharmacy or medical centre in every suburb.

The concept of Pharmaceutical Care first emerged in the 1970s in the USA as described by Hepler and Strand.[27] This approach focused on the caring aspect of the pharmacy profession, relegating the aspects of dispensing, supply and distribution of medicines to a minor role. Pharmaceutical care was a concept developed within the profession that defined the pharmacist's professional role in the health care system.[28] Roughead et al. also state, in their systematic review of the literature (1990-2002) on the value of pharmacist professional services in the community setting, that the focus of professional pharmacist services is to improve medication use and reduce medication misadventure.[29]

As May identified in his 16th November 1997 oration to the Society of Hospital Pharmacists of Australia, the loss over the last three decades to the pharmaceutical industry of "the pharmacists' historical role as compounders of materia medica removed the pharmacists' most obvious professional function", and "the repositioning of the caring role of the pharmacist at the heart of the profession offers a sound reason for the continued existence of the profession".[30] Whilst the concept of pharmaceutical care involves the pharmacist directly in helping patients to achieve their desired health outcomes, this goal is difficult to accomplish in rural and remote areas.

Traditionally the provision of patient advice and education is a free service and intimately tied to the dispensing or supply of medicines. In rural areas, because of the small population base, there is little financial incentive for a pharmacy to be established. A study by Casey in rural Minnesota, North and South Dakota, USA, identified that to continue providing geographic access to pharmacy services, rural pharmacies must maintain adequate staff and remain financially viable.[31]

Each State or Territory in Australia has a Pharmacy or Pharmacists Act, consistent with their responsibility for regulating the professions. While each Act covers relatively common ground on such matters as pharmacist registration, the professional and commercial practice of pharmacy, and the constitution and powers of regulatory authorities, they reflect local needs and conditions in each State and Territory.[32] The Commonwealth also has a regulatory interest through its National Health Act 1953. The Act sets out statutory requirements for the administration of the Pharmaceutical Benefits Scheme (PBS), including the power to determine which pharmacies may "supply" pharmaceutical benefits to the public, and where these may be located.[32]

The Queensland Pharmacists Registration Act 2001, as Amended,[33] states that "…a pharmacy practice is not carried on under the actual supervision and management of a pharmacist unless a pharmacist is personally present in the pharmacy". The other states and territories have similar requirements. Arguably, however, these requirements, when understood alongside the necessity for financial viability for pharmaceutical presence, places unacceptable limits on access to quality care.
In order to provide a quality pharmaceutical service to rural areas where there is no physical pharmacy, it will be necessary for the pharmacy profession and the relevant authorities such as the Commonwealth Government, State and Territory Pharmacy Boards, to separate the traditional dispensing and supply of medicines from the caring aspects of the APRA definition for Pharmacy Services.

A paradigm shift is therefore required from the traditional view that a pharmacist must physically be present when a medicine is supplied to the situation where pharmacists are able to provide high quality pharmaceutical care, even when remotely situated from the patient, by using information technology and telecommunications concepts. Before moving on to discuss the potential application of technology the following section provides a review of initiatives that have been undertaken in an attempt to improve access to quality healthcare.

2.1.3 National Medicinal Drug Policies

Countries around the world, stimulated by the World Health Organisation, are implementing national medicinal drug policies to ensure that essential, affordable drugs of acceptable quality, safety and efficacy are available to their country's population.

The Commonwealth of Australia established the Australian Pharmaceutical Advisory Council (APAC) and the Pharmaceutical Health and Rational Use of Medicines Committee (PHARM) in 1991 in an

effort to improve the use of medicines and further develop a National Medicines Policy. The activities of the Commonwealth government, based on the advice provided by APAC and PHARM, together with representative groups from all interested parties in healthcare, resulted in the establishment of the National Prescribing Service in 1998 and the National Medicines Policy in 2000.

The National Medicines Policy is based upon four central objectives within a framework of active and respectful partnerships, taking into account elements of social and economic policy.[34] The four central objectives are as follows:

- Timely access to the medicines that Australians need, at a cost individuals and the community can afford.
- Medicines meeting appropriate standards of quality, safety and efficacy.
- Quality use of medicines (QUM).
- Maintaining a responsible and viable medicines industry.

In the implementation of this policy, a National Strategy for Quality Use of Medicines has been produced.[34] The key focus of the Quality Use of Medicines is to ensure medicines are used:

- judiciously - ensuring that the best possible treatment plan is chosen;
- appropriately - ensuring that when medicines are needed they are carefully selected, managed, monitored and reviewed;
- safely - minimising misuse, overuse and under-use of medicines and taking appropriate actions to solve medication problems such as adverse events; and
- efficaciously - ensuring that medicines achieve the goals of therapy by delivering beneficial changes in actual health outcomes.[35]

The Quality Use of Medicines strategy described priority areas for activity over the three years (2000–2003) and outlined six essential building blocks for the Quality Use of Medicines. These building blocks were:

- policy development and implementation;
- facilitation and coordination of QUM initiatives;
- the provision of objective information and assurance of ethical promotion of medicines;
- education and training;
- the provision of services and appropriate interventions; and

- strategic research, evaluation and routine data collection.

APAC is the coordinating committee for the implementation of the QUM Strategy. APAC comprises interested parties representing the major partners identified in the National Medicines Policy. APAC's Strategic Plan for the period to 2005 was detailed under the four arms of the National Medicines Policy.[36] A study by Roughead et al. aimed at mapping all the quality use of medicines projects undertaken in Australia by capturing all the projects in a database and making them available via a website.[37] [b]

The progression and cascading of the National Medicines Policy and Strategies down to the provision of quality pharmaceutical services is encapsulated in recent studies on the Pharmacy Workforce, and the Third Community Pharmacy Agreement.[38]

The first of the recent workforce reports, Pharmacy Labour Force 1998,[39] identified the following issues:

- The number of pharmacists per 100,000 population declined by 13.8% between 1990 and 1996. This compared unfavourably with the USA and the UK, where increases in the number of pharmacists per 100,000 population were recorded.
- Australia was in the lower third of countries surveyed in the ratio of pharmacists to population.
- Postgraduate qualifications declined between 1996 and 1997.
- The ratio was only calculated per 100,000 population and did not take into account Australia's vast geographical area.

A study by the Department of Employment and Workplace Relations (DEWR) in 2002 found that there were national shortages of retail and hospital pharmacists in all states and territories.[40] The study also identified that there was a severe shortage of hospital pharmacists in New South Wales (NSW) and acute shortages of community pharmacists in Queensland regional areas. This indicates that the position has become more acute since the study by the Department of Employment and Workplace Relations and Small Business (DEWRSB) in December 1999 found that there were national shortages of retail and hospital pharmacists in all states except NSW.[41]

[b] Unfortunately the Quality Use of Medicines Map website appears to have been discontinued, or is under review, as it was not accessible when last viewed in September 2006.

A study by the Health Care Intelligence Pty Ltd (HCI) in 1999, reported that the market for hospital pharmacists may be nearly balanced by 2010, but there may be a shortage of community pharmacists.[42] The pharmacy workforce study, "A Demand Model for Hospital Pharmacists",[43] prepared for the Society of Hospital Pharmacists by Karen O'Leary and published in December 2001, reported that the main drivers for the demand for hospital pharmacists are:

- The National Medicines Policy.
- The implementation of the APAC guidelines which follow on from the National Medicines Policy.
- Increased emphasis on patient safety.
- The introduction of PBS dispensing in public hospitals.

These drivers were the reason for the HCI 1999 report coming to a set of different workforce conclusions to the O'Leary report. The O'Leary report summarises the demand for hospital pharmacists in the period to 2010 as follows:

- Approximately 310 qualified pharmacists are required immediately to fill positions currently vacant in hospitals across Australia.
- An additional 395 to 515 hospital pharmacists will be required in the period 2001-2006. This equates to at least 480 additional qualified pharmacists in this time period.
- An additional 715 to 1330 hospital pharmacists will be required in the period 2006-2010. This equates to at least 860 additional qualified pharmacists.

Parts of the O'Leary report are incorporated into the updated HCI pharmacy workforce report, "A Study of the Demand and Supply of Pharmacists, 2000-2010".[44] This report identifies workforce requirements for both community and hospital pharmacists. In Appendix 5 of this report, the Pharmacy Guild detailed a vision statement for the future, where it is envisaged that the role of the pharmacist will become increasingly focused on providing service rather than just supply of product. The Pharmacy Guild stated that the national roll-out of the Quality Care Pharmacy Program (QCPP) will result in there being a standardised requirement that all supply and dispensing of scheduled products be accompanied by professional counselling and/or advice and that there will also be a range of remunerated professional pharmacy and health care services. The provision of Medication Management Reviews (MMR) by pharmacists was the first example of this and it is envisaged that there will be many more such services provided which relate to the management of specific chronic

illnesses (disease states) or ongoing conditions such as diabetes, asthma, arthritis, incontinence and drugs/tobacco addiction.[45]

In order to facilitate this vision, the Pharmacy Guild stated that certain structural changes are needed to pursue this development effectively. In order to obtain remuneration for specific professional services, it was identified that the following issues need to be addressed:

- There needs to be a radical change in the work flow arrangements in the pharmacy to free up pharmacists' time to provide this range of additional services, e.g.: optimum use of pharmacy assistants trained in the dispensary area; dispensary computers to be relocated so the pharmacist can involve consumers in examining their medication regimens on screen while providing counselling about the medication being dispensed.
- Information technology (IT) systems need to be implemented to facilitate the provision and recording of services and care/management plans for consumers.
- Training programs must be implemented for pharmacists and pharmacy staff in relation to specific diseases or conditions to guarantee clinical competency and product knowledge and to ensure standardised protocols are followed.
- There needs to be an increase in the number of community pharmacists available to provide these additional services.
- Research is required to demonstrate the value and cost effectiveness of pharmacists providing these services; and possible sources of remuneration need to be investigated for these services, such as private insurance funds, Government or consumer fee for service.[44]

The HCI report was funded through the Third Community Pharmacy Agreement Research and Development Grants Program.[38] The Third Community Pharmacy Agreement between the Commonwealth of Australia and the Pharmacy Guild, which terminated on the 30th June 2005, committed the parties to achieving the ten following objectives:

1. Provision of a quality, personalised pharmacy service to the Australian community through a network of well distributed, accessible, and viable community pharmacies.
2. Increased access to community pharmacies for persons in rural and remote regions of Australia.
3. Continued development of an effective, efficient and well-distributed community pharmacy service in Australia taking into account the recommendations of the Competition Policy Review of Pharmacy and the objectives of National Competition Policy.

4. Greater financial stability for the parties to the Agreement through the introduction of risk sharing arrangements.
5. Identification and development of ways in which information technology can be used to improve medication management and more broadly to improve the Australian health care system for the benefit of the community.
6. Development of enhanced medication reviews, in cooperation with the medical profession, aimed at improving health outcomes and quality use of medicines for the Australian community.
7. Implementation of quality standards.
8. Coordination in the delivery of primary health care services and achievement of a multi-disciplinary approach to the provision of quality health and pharmacy services for all sections of the community.
9. A focus on achieving continued improvement in community pharmacy services provided to Aboriginal and Torres Strait Islander people.
10. Generally, the fostering of a stable and viable community pharmacy sector in Australia.[38]

The Fourth Community Pharmacy Agreement[11] between the Commonwealth of Australia and the Pharmacy Guild, which terminates on the 30th June 2010, comprises thirteen key points, which are summarised as follows:

1. Total funding package for pharmacy and wholesalers of $11.1 billion over five years to 30 June 2010.
2. Pharmacy and wholesaler remuneration restructuring which results in a decrease in the cost of the PBS of $350 million.
3. Reduced wholesaler margin to 7% and a $70 flat fee for items priced over $1,000.
4. A Community Service Obligation (CSO) funding pool of $150m p.a. payable to wholesalers who guarantee supply of PBS medicines to all Australian pharmacies within 24 hours.
5. Fee increases on 1 December 2005 and 1 July 2006.
6. Consumer Medicine Information (CMI) and Improved Monitoring of Entitlements (IME) payments will be included in the dispensing fee.
7. 10 cent payment for checking concessional entitlements, with review within 12 months to consider ongoing payment after 18 months.
8. Annual fee indexation that will not fully reflect pharmacy cost increases.
9. 10% pharmacy mark-up unchanged, but introduction of a $40 flat payment for items priced over $1,000.
10. Location rules retained and identified anomalies addressed.

11. No pharmacies in supermarkets.
12. Special new rules for pharmacies to relocate into smaller shopping centres (with a large supermarket), large medical centres and large one pharmacy towns.
13. Funding for professional pharmacy programs (including a Better Community Health program) which will provide:
    - Medication reviews.
    - Rural allowances and support.
    - Improved Indigenous access to community pharmacy services.
    - Dose administration aids for people at risk in the community.
    - Pilot programs to develop pharmacy's role in the care of asthma and diabetes.
    - E-health initiatives.
    - Review of PBS supplies to nursing homes and private hospitals.

Of special interest to the provision of quality pharmacy services to rural areas are the funding initiatives for professional pharmacy programs (including a Better Community Health program), which will provide medication reviews, rural allowances and support, improved Indigenous access to community pharmacy services, dose administration aids for people at risk in the community and E-health initiatives.

2.1.4 Implications for Pharmacy Practice

The dominant influence upon community pharmacists and pharmacy services will be the implementation of the Fourth Community Pharmacy Agreement. The Pharmacy Guild claims that this will create a strategic framework to elevate and uphold the professional status of community pharmacists and the potential for pharmacists to further integrate into the health system as key service providers. In the case of hospital pharmacists, the O'Leary report identifies three "activity streams" in the demand model for the hospital pharmacist workforce.[43] These activity streams are broadly described as Management, Policy and Procedures, Drug Distribution Services and Clinical Services. O'Leary reported that, based upon data from surveys of hospital pharmacists, on average:

- 16% of pharmacists' time is spent managing the drug and personnel resources of the service and hospital wide activities such as institutional drug policy management, quality activities and clinical trial management.

- 39% of pharmacists' time is spent on the acquisition, manufacture and dispensing of medications.
- 41% of pharmacists' time is spent providing clinical services to individual patients, drug information services and training and education.

The HCI 2003 Pharmacy Workforce Report made numerous recommendations. These included overseas recruitment, increasing graduate supply, strategies against wastage, re-entry strategies, training and labour substitution and pharmacy rationalisation. The following discusses these recommendations in more detail.[44]

2.1.4.1 Immigration

There is scope for increasing pharmacist immigration rates, albeit from only a small base. The report stated that the most rational approach would be to target overseas labour markets where the standards of training are acceptable as a short-term, stopgap solution. The immigration rates, particularly from the traditional source of migrant pharmacists, the UK, may also reduce in the future due to proposed changes in the registration requirements for pharmacists to be introduced by APEC in the future.

2.1.4.2 Graduate supply

Increased student intake into Schools of Pharmacy in 2003 and 2004 would provide the supply benefits sought in the medium term. A related strategy suggested by the National Pharmacy Workforce Reference Group (NPWRG) concerns the fast tracking of students. Although those who have related degrees can usually gain credit for part or all of first year, the introduction of professional skills into the first year curriculum, means that some science graduates need to attend a summer school to attain a first year credit. It is feasible to do a four year course in a shorter time – this is currently happening in Tasmania with respect to nursing, and could be investigated in relation to pharmacy.

2.1.4.3 Loss of Pharmacists from the Profession (wastage rates)

In the longer term, a reduction in wastage from the projected 3–7 per cent range down to 2 per cent per annum (or lower) is stated as being a desirable outcome. In the short term, the disproportionate number of pharmacists over sixty years of age remaining in the workforce will continue to result in net workforce loss. It is also claimed that relaxing barriers to pharmacy ownership may enhance female labour participation in the pharmacy workforce, however, the logic behind such an assumption is not clear.

2.1.4.4 Re-entry strategies

The NPWRG report noted that there is a huge pool of about 5,000 registered pharmacists not working in pharmacy. The NPWRG has suggested that an increase in re-entry rates would require:

- Research into the characteristics of "lapsed" pharmacists (age, gender, location, etc.).
- Their reasons for leaving the profession and the types of re-entry courses that would suit their needs.
- A national effort to provide innovative and flexible models for re-entry, including part-time training, on the job training, existence of infrastructure, etc.

2.1.4.5 Training and labour substitution

It is claimed that an increased emphasis on training and labour substitution may constitute an important parallel avenue in augmenting the supply of pharmacy services, through greater efficiencies in the use of a given stock of pharmacy labour. This may be possible through better and more appropriate use of pharmacy technicians in both community and hospital settings. There are many repetitive, manual tasks that technicians could do, thus freeing pharmacists for patient counselling. Currently the substitution of technicians for pharmacy labour is often piecemeal and is happening by default, due to the shortage of pharmacists.[41] Vocational training competency standards are in place for community pharmacy and there is a move in some states to require technicians to complete such courses. Clearly, for the role of technicians to significantly expand, uniform enforceable standards of practice, under the jurisdiction of regulatory authorities are required. There are also concerns with the piecemeal approach to training technicians in hospitals. Pharmacists need to be trained on how to supervise, support and teach technical personnel. This should be an important part of the pharmacy school curriculum. There should be enhanced use of technology to support a professional service role such as the electronic transmission of prescriptions and increased automation. Streamlining workflow practices in pharmacies to release the time of pharmacists for provision of cognitive services is also required.

2.1.4.6 Pharmacy Rationalisation

The NPWRG report has suggested that further amalgamation of community pharmacies, leading to the creation of larger pharmacies, would provide a better platform for the delivery of cognitive services, although it was noted that, in the past, closures meant some pharmacists leaving the profession altogether.

2.1.4.7 Pharmacist Training and Support in Rural and Remote Areas

Leversha et al. studied the provision of pharmacist training and support for rural pharmacy.[46] The rural area investigated was situated in Victoria and identified some interesting issues, when considered in conjunction with the National Medicines Policy. The study noted that healthcare professionals had limited knowledge of the Guidelines for Pharmacy Services for Residential Facilities, and this had led to some misunderstanding of the role of the pharmacist. Their findings highlighted that the shortage of pharmacists was a problem; as was the recruitment and retention of pharmacists in rural areas. Some pharmacists require up-skilling to provide clinical services and the role of the pharmacist as a member of the health-care team requires promotion. Pharmacy regulations that prevent the pharmacist from leaving the premises during working hours were also an issue since they limit the ability of the pharmacist to provide training to other healthcare professionals. This has since been amended in Queensland, where the Pharmacists Act (2001)[47] allows pharmacists to leave the premises for up to a period of one hour, without penalty. Research is required to gauge the effect of this change in the regulations. Formal continuing education for pharmacists is required and strategies need to be developed to cater for the lack of relieving staff in country areas. Leversha et al. noted that the preparation for the accreditation of residential care facilities represented an ideal opportunity for the pharmacist to become involved with the facility.

2.1.5 Medication Reviews

The increasing cost of the Pharmaceutical Benefit Scheme (PBS) over time focussed the Australian Government's attention on the increasing use of prescribed medicines.[48] There has also been increasing recognition of medication related problems. These include adverse drug reactions and treatment failures from suboptimal use resulting in increased use of health care resources, increased length of hospital stay, specialised services and primary care services. A study of Australian general practices between October 1993 and June 1995 provided an example of the necessity for introducing a method of reviewing medication use in the population. In this study of the 805 incidents reported, 51 per cent related to pharmacological management.[49] Of these, 30 per cent were as a result of an inappropriate drug being prescribed, 22 per cent were prescribing errors, and 13 per cent were for inappropriate dose being prescribed. A study in 2006 in New South Wales found that there were 125,000 adverse event notifications for the year to July 2006. Medication errors still accounted for 22,500 incidents (18 per cent).[50]

Medication-related problems cause a significant number of hospital admissions in Australia each year, and the financial cost of these admissions is substantial. A study by Miller in 2004 reported that of 8215 patients, 852 had an adverse event after using a medication and of these 71.9% were as a result of a recognised side effect and 27.1% were the result of either drug sensitivity, allergy, drug

interaction and overdose.[51] Poor patient compliance with medication regimes also has adverse effects on health and quality of life outcomes. It has also been suggested that patient medication compliance is an indicator of understanding of the medication information provided, and if it was useful to them.[52, 53] There are many potential causes for medication-related problems, including patient confusion or misunderstanding, particularly in the elderly and with patients whose home language is not English.[6, 54, 55] In the United Kingdom, a study by Holland et al. noted that twenty eight per cent of all prescribed drugs are consumed by 7% of the population over the age of 75 and 6.5% of hospital admissions have been shown to be related to adverse drug reactions, particularly in older patients.[56] Failure to follow doctors' instructions, lack of understanding of potentially negative drug interactions, and prescribers and/or pharmacists not having the full details of all medications that the patient is taking, including herbal or complementary medicines, those purchased over the counter or those prescribed by other doctors are also reasons for patient non-compliance.

Medication Review for nursing home residents was approved for funding in the 1992 Federal budget. This service has recently become known as Residential Medication Management Review (RMMR). Medication Reviews have also been remunerated as part of the Enhanced Primary Care Items introduced to the Medical Benefits Schedule in 1999 and home-based medication reviews have been available to veterans since 1994. The Australian National Medicines Strategy integrates the earlier Policy on QUM and provides a framework to achieve appropriate medication use and improved health outcomes. QUM Policy is aimed at optimising medicinal drug use and thereby improving health outcomes.

The Australian population is ageing, with complex chronic health conditions, and the resultant increasing medication consumption is associated with medication problems as well as benefits. As a result a large body of evidence, in Australia and overseas, has identified increasing medication problems with inappropriate consumption, adverse drug events, polypharmacy and drug compliance. Medication Management Reviews represent a policy response to these issues. The Community Pharmacy Agreement initiatives between the Pharmacy Guild and the Australian Government provided the opportunity to implement medication management services and the introduction of Enhanced Primary Care items provided a shift in the financing models for general practice. The current Fourth Community Pharmacy Agreement continues this initiative with increased funding. Medicines management is an initiative to identify and meet medication related needs and to identify, resolve and prevent medication related problems and improve health outcomes.

The Home Medicines Review (HMR) was introduced by the Australian Government in October 2001. The HMR initiative involves collaboration between general practitioners, pharmacists and consumers

and is designed to ensure that consumers obtain the maximum benefit from their medication regimen and that medications are used in the home as effectively and efficiently as possible. The HMR initiative involves an eligible patient agreeing with his or her general practitioner, that an accredited pharmacist will be asked to conduct a detailed review of all the medications the patient is using and how he/she is using them. Normally this involves the patient's preferred community pharmacy organising a home visit by the accredited pharmacist, who then prepares a report with relevant findings and recommendations, and forwards this to the general practitioner. At a subsequent visit the general practitioner discusses the HMR report with the patient and they agree on any steps required to improve the effectiveness of the medication regime.

Since HMRs were introduced by the Australian Government in October 2001, they have become an established feature of pharmacy practice in Australia with two main forms now in use – one based in nursing homes or aged care facilities, and one based in the patient's home. These medication management initiatives represent a response to these issues, and support the Quality Use of Medicines, a major element of Australia's National Medicines Strategy. The stated objectives of the HMR program are to:

1. achieve safe, effective and appropriate use of medicines by detecting and addressing potential medication-related problem/s that interfere with desired patient outcomes;
2. improve the patient's quality of life and health outcomes using a best practice approach, that involves a collaborative effort between the GP, pharmacist, other relevant health professionals, the patient and where appropriate, their carer;
3. improve patients' and health professionals' knowledge and understanding about medications; and
4. facilitate co-operative working relationships between members of the health care team, in the interests of patient health and well-being.[48]

The HMR service is a structured and collaborative health care service provided to a patient to ensure his/her medicine use is optimal and fully understood and that continuity of care is enhanced. The goal is to maximise the benefits the patient derives from his or her medication regimen and thus to improve both health and quality of life outcomes. The HMR may also involve roles for other allied health professionals, such as a community nurse, as well as the patient's carer(s).

The following steps occur in an HMR service:

- In an initial consultation the general practitioner assesses the need for a HMR, obtains patient consent, and asks the patient to nominate his or her preferred community pharmacy. The general practitioner provides the patient with a referral to the patient's preferred pharmacy together with relevant clinical information.

- The community pharmacy arranges for an accredited pharmacist to undertake a clinical assessment of the patient's medication management, preferably in the home. The accredited pharmacist and the patient's regular community pharmacist can be the same person. In order to claim HMR payments, the proprietor of a community pharmacy must first register with the Health Insurance Commission (HIC) to be an approved Service Provider. Many pharmacies have arrangements in place with one or more accredited pharmacist(s) to carry out patients' HMRs at an agreed rate of pay.

- The accredited pharmacist visits the patient and reviews his/her medications, including prescription medicines prescribed by the referring medical practitioner, herbal or complementary medicines, those purchased over the counter or those prescribed by other doctors and assesses their usage, storage and any other relevant issues. The accredited pharmacist provides a written report on the review to the medical practitioner.

- The medical practitioner then develops a medication management plan for discussion with the patient in a second consultation. During the second consultation, the medical practitioner ensures that the patient understands the reasons for any changes to their medication and is in agreement with such changes. The medical practitioner then provides the patient and the community pharmacist with a copy of the revised medication management plan. The community pharmacist may have further involvement in the implementation of a Medication Management Plan (MMP) developed by the medical practitioner. The role of the pharmacist here might involve providing or reinforcing advice and information about medications, aids and devices, and helping assess whether the changes made in the MMP have resulted in the desired outcomes for the patient.

The introduction of the HMR service has been supported by a national MMR Facilitator Program. This program involves a Facilitator working in most Divisions of General Practice to provide medical practitioners, pharmacists and other relevant healthcare professionals with information, advice and practical support in relation to the HMR. Each State or Territory branch of the Pharmacy Guild also

employs a State Facilitator to oversee and coordinate the Facilitator Program in their respective jurisdictions.

A 2003 randomised, controlled effectiveness study on medication reviews by Sorensen et al. in three states, Queensland, New South Wales and Western Australia reported that in total 54.4 per cent of recommendations were acted upon by the general practitioners participating in the study.[57] Follow up evaluations showed that 70.9 per cent of actions had positive outcomes, 15.7 per cent no effect and 3.7 per cent had a negative outcome. Polypharmacy is common in older patients because they tend to have more illnesses for which medications are prescribed. A study by Bolton et al. reported that the quality assurance activity of medication review accompanied by general practitioner education was associated with reduced polypharmacy and, in particular, the reduced use of benzodiazepines.[58]

The Urbis Review "Evaluation of the Home Medicines Review Program – Pharmacy Component"[48], reported that the number of accredited pharmacists increased from 1285 immediately after introduction of the HMR to 1597 in the April/June quarter of 2004. Since then the total number of accredited pharmacists has fluctuated slightly, with the most recent figure of 1595 the second highest recorded. As at May 2005, the total number of accredited pharmacists comprised around 13 per cent of employed community pharmacists in Australia. The largest numbers of accredited pharmacists are in NSW (some 36 per cent of the total) and Victoria (22%).[48] The Urbis Review revealed that in the course of the medication review process a large number of potential and unresolved medication and health related problems were identified.[48] Significant gains in compliance were reported in conjunction with overall consumer satisfaction with the service provided. However, the review found that the evidence for the effects on long term health outcomes of Medication Management Reviews conducted in the home setting was limited at this stage.

Rural and remote locations have a relatively low number of MMR accredited pharmacists and this has been identified as a problem in various areas of Australia. The difficulty of slow HMR responses by rural community pharmacies may result in medical practitioners being discouraged from making further referrals to these pharmacies.

The vast distances in rural Australia are another barrier to rural pharmacy participation in the HMR program. The delivery of HMRs programs to rural and remote areas presents different barriers and therefore require different solutions.[59] Pharmacists conducting home visits may be obliged to travel many kilometres, adding considerably to the cost of conducting the HMR. Prior to July 2004 pharmacies were not compensated for travel time. A rural loading can currently be claimed for HMRs involving a visit to the patient's home, varying with the distance involved. As noted in the Urbis

Review, the rural loading is calculated according to the location of the community pharmacy and not where the accredited pharmacist is based, meaning that if an external accredited pharmacist is employed to conduct the HMR rather than the local community pharmacist, in rural areas the participating pharmacy may still be at a financial disadvantage since the accredited pharmacist's travel costs to the local community pharmacy must be borne by that pharmacy. A review article in the Australian Journal of Pharmacy (AJP) by Boothman-Burrell noted that the HMR facilitator will often have to travel 5 to 6 hours by road to meet appointments in the Pilbara region of Western Australia.[60] Vaughan stated in an article in the AJP that the lives and health services of remote Aboriginal people are so different from the lives of the general Australian population that it is risky to assume that HMR will provide the same benefits.[61] However, Vaughan also noted that these issues do not make the provision of HMRs impossible in remote areas, but providing solutions to the disincentives would seem to be an imperative.

Key findings of a survey of pharmacy customers in the Riverland region, a rural area of South Australia, noted that 74 per cent of respondents were unaware of the HMR service, and for those who had heard about the service, their main source of information was the media or a pharmacist. Furthermore, none of the respondents had undertaken an HMR, but 84 per cent would be happy to accept an HMR if it was suggested to them by their general practitioner.[62] In an article to the AJP, Miller noted that 15 HMRs would need to be generated to cover the cost of a single visit by an accredited pharmacist to the Riverland region.[63]

In implementing the HMR initiative, it was reported in the Urbis Review that various strategies had been developed in an effort to overcome particular problems encountered. An example cited was in a country area where there was no accredited pharmacist available, arrangements had been made for a city based accredited pharmacist to travel to the area from time to time, to carry out a coordinated series of home visits. In Central Australia, HMR services were being provided for several remote Aboriginal communities by way of referrals from a city-based medical practitioner (who had formerly worked in the Centre and knew these communities) to an accredited pharmacist based in Alice Springs. The pharmacist then visited the communities and conducted medication reviews with the assistance of the local Aboriginal Medical Service, and on their premises.

The Urbis Review also noted that in consultation with National Aboriginal Community Controlled Health Organisation (NACCHO) and other stakeholders a number of issues relating to particular limitations of the HMR in relation to Indigenous people had been raised.[48] These were that Indigenous people face significant problems relating to lack of access to medications or inappropriate usage of them. Inadequately resourced Aboriginal Medical Services (AMSs) may also not see HMRs

as a high priority. Hamrosi et al.[6] reported a general lack of access to medications and frequent inappropriate use of medications due to limited understanding, literacy and information all of which lead to non-compliance with instructions.

Furthermore, the Urbis Review noted that various stakeholders, including some consumer representatives, suggested that a broader range of people should be able to initiate HMRs, for example, medical specialists, hospital staff, community nurses, practice nurses, physiotherapists, diabetes or asthma educators and indeed, most health workers who visit patients' homes. It was also suggested that there needs to be some additional option available where the patient does not wish to have an HMR organised through a community pharmacy, or where (as in rural areas) there are few if any community pharmacies registered to conduct HMRs. Other issues raised in the report were that the Business Rules could be modified to allow the medical practitioner to refer a HMR directly to an accredited pharmacist which would be more consistent with the kinds of referrals medical practitioners are accustomed to making. Alternatively, several stakeholders took the view that the 'original' HMR model, where the accredited pharmacist comes from within the community pharmacy, had much to recommend it in terms of ongoing pharmacy relationships with customers and their medical practitioners. There were several suggestions for the introduction of certain automatic 'triggers' for consideration of an HMR, such as consumers reaching the PBS safety net level, patients being discharged from hospital in certain circumstances, or patients commencing anticoagulant therapy.

The report also commented that conducting the HMR interview in the home appeared to provide the best possible opportunity for the accredited pharmacist to establish whether or not the consumer was using prescribed medications correctly and consistently, and whether there were any other factors (such as issues relating to use of over-the counter drugs, complementary or herbal products) which could raise matters of concern. However, given the relatively slow uptake of the program to date, the potential benefits of the HMR have so far been available to relatively limited numbers of consumers. The report stated that it is therefore essential to find ways of encouraging greater uptake of HMRs. The evaluation makes it clear that there are problems of access or appropriateness for particular sections of the population, including people living in rural or remote parts of the country. It was further noted in the report that a number of stakeholders stated that particular consideration needs to be given to developing an HMR model that will meet the needs of Indigenous people.

An interesting insight into the issues involving HMRs in rural situations was reported as a personal insight by Bhuiyan, a medical practitioner in Ouse, Tasmania.[64] Ouse is a small rural town in central Tasmania, 90 km northwest of Hobart. There is no pharmacy in Ouse and Bhuiyan, as the sole medical practitioner, also dispensed medications for the local community. In 2003, Bhuiyan organised for a

pharmacist to travel from Hobart to conduct HMRs. Despite his proximity to patients, and intimate knowledge of their medication, Bhuiyan reported that the HMRs raised his awareness of what medications his patients were *actually* taking and gave a valuable "peek" into his patients' bathroom cabinets.

2.1.6 Section 100

The Australian Institute of Health and Welfare report, "Rural, regional and remote health. A study on mortality Summary of findings"[4] stated that despite Aboriginal and Torres Strait Islander people having much poorer health, the rate of expenditure on them through the Pharmaceutical Benefits Scheme (PBS) system was a third of that for other Australians in 1998–99. The supply of PBS medicine to remote area Aboriginal and Torres Strait Islander Health Services (ATSIHSs) under section 100 of the National Health Act of 1953 (S100) is an initiative to improve health outcomes by improving access to PBS medicines. These are also known as special PBS arrangements (SPBSAs). For the purposes of this thesis SPBSAs will be referred to simply as S100.

S100 arose out of concerns about the supply of medicines to remote area ATSIHSs following a 1988 transfer of responsibility of funding from Federal Government to State and Territory governments.[65] Under S100, approved ATSIHSs in remote centres and other remote areas are able to order PBS medicine in bulk through local pharmacies, and supply them as needed to patients from an on-site dispensary at the ATSIHS. The scheme does not utilise the direct pharmacist-to-client relationship, which applies with usual PBS dispensing arrangements.

The usual co-payment associated with PBS medicine is not charged and the pharmacist remuneration structure is different. The removal of the co-payment has resulted in removal of the financial barriers to access to medicine for clients and the burden of meeting these costs where co-payments were paid by the ATSIHSs. Increased use of the PBS system to fund medicine has reduced disparities in PBS expenditure and has enabled funds previously spent on medicine to be redistributed to other areas of Aboriginal and Torres Strait Islander health.

S100 was introduced at the beginning of 1999 in community-controlled health services in remote areas. Memoranda of understanding (MOU) were subsequently signed with the State and Territory governments to enable State and Territory-operated remote ATSIHSs to participate. The MOUs address protocols, quality use of medicine (QUM), application of reallocated medicine budgets, calculation of budget reallocations and performance evaluation. The MOU only apply to State and Territory-operated services.

There are two main types of ATSIHS authorised under S100: community-controlled, and State and Territory controlled.

S100 was implemented for most State and Territory operated services in the same manner. The implementation of S100 in community-controlled services was less homogenous, but all services do share some basic characteristics.

In 2005, the Pharmaceutical Society of Australia (PSA) issued the "The Provision of Pharmacy Services to Aboriginal and Islander Health Services".[66] The PSA developed these Guidelines for pharmacists providing pharmacy services to Aboriginal and Islander Health Services (AHS). The PSA states that the "guidelines are designed to assist pharmacists to exercise their professional judgement in specific presenting circumstances and to promote a consistently high quality of service". The Guidelines describe the provision of pharmaceutical and cognitive services to AHSs as:

- the dispensing, supply and distribution of medicines;
- provision of information and advice about medications, with the primary objective being the promotion of QUM;
- support services to assist with medication management; and
- pharmacists responding (through the AHS) to clients' medication-related needs to help them achieve desired health outcomes.

The PSA notes that the services should be delivered to the relevant professional standard and in a manner that is culturally appropriate to Indigenous clients. The Guidelines cover the supply of pharmaceuticals, on site access at the AHS for the pharmacist, education of AHS Staff, the provision of drug information services, the supply of dose administration aids and the review of medication charts in an AHS. In addition the pharmacist should participate in committees of the AHS, arrange HMRs, participate in client counselling, monitor adverse drug reaction reporting and therapeutic drug monitoring and undertake drug usage evaluation activities. Also where applicable, the pharmacist should provide assistance with AHS accreditation processes and other quality use of medicines (QUM) activities and implement quality assurance and continuous quality improvement activities.

Thereafter the Guidelines specify six criteria which the pharmacist should comply with in the supply of S100 products to an AHS.

Whilst the Guidelines are comprehensive, they appear to represent more of a "wish list" than a realistic set of standards. Since there is no nationally accredited training program for AHS staff involved as dispensary assistants, it is difficult to see how even this requirement can be met. This issue is covered in more depth in Chapter 4.

The Kelaher report noted that pharmacists felt that the current level of remuneration under S100 was insufficient given the level of service provided.[67] One area that was seen as particularly problematic was the cost of the additional freight component. A number of ATSIHSs and pharmacists felt that the current rate did not sufficiently cover freight costs. The presence of visiting pharmacists was associated with greater increases in medicine utilisation, therefore such visits may foster more complete implementation of S100. Many pharmacists felt the administrative requirements of the support allowance were too demanding and the remuneration too poor. In many cases support that was provided was either at the cost to the pharmacist or cost to the ATSIHS.

The Kelaher report on S100 noted that medicine utilisation data showed strong evidence of increased claims overall and the use of a broader range of medicine over the life of the program. The report also found that the impact of S100 was somewhat greater for community-controlled services than State and Territory-operated services. The survey results and the case studies in the report both suggested that S100 had increased access.[67] ATSIHS surveys suggested that access was most improved in services where there was a doctor and that medicine utilisation increased more in services where pharmacists visited than in services where they did not.

2.1.7 Dose Administration Aids

Dose administration aids (DAAs) are a method for improving QUM by making it easier for patients to know what medicines to take and when to take them. DAAs work by placing doses in individual compartments based on the time they are to be taken. In DAAs, all of the medications to be taken at a given dose time are organised together, and the correct number of tablets or capsules required to make up the prescribed dosage are packaged together for that dose time. Thus, theoretically, using DAAs should help people to take their medications correctly and safely.

DAAs are widely used in Australia as a tool to assist with medication management in a variety of settings. There are a two primary policy drivers which have been responsible for the widespread proliferation of DAA use in Residential care facilities in Australia, these are the Quality Use of Medicines (QUM) Policy; and the 1997 Aged Care Act, which delineated accreditation standards that must be met by Residential Care Facilities.[1, 34, 68]

Current legislation in the States and Territories of Australia does not permit the preparation of DAAs, except under the direct supervision of a pharmacist, since this is classed as a dispensing operation. The logistical complications inherent in providing DAAs to rural and remote communities has resulted in either the withholding of DAAs, and supplying multiple medication packs to the patient, or the clinic staff preparing the DAAs "illegally".[9]

DAA use has the potential to positively impact in a variety of settings including assisting the elderly to maintain their independence, helping previously non-compliant patients to improve their levels of compliance, preventing some non-compliant patients from progressing to higher levels of care, savings in the cost of medication and health services provision resulting from increased compliance and better medication related management of disease states.[68] Medication misunderstandings and non-compliance within the Aboriginal community frequently occur. It is claimed that DAAs improve understanding dosage requirements and increase compliance in the taking of medicines in Indigenous settings.[6] A recent study has shown that a pharmacy care program, designed to improve medication adherence for patients with multiple chronic medical conditions, including hypertension and elevated cholesterol levels, and which included the use of DAAs, was associated with substantial and sustained improvements in medication adherence among elderly patients receiving complex medication regimes.[69, 70]

There are three main types of DAAs:

- Blister packs (commonly known as Webster packs) which come in different configurations but are essentially similar to the factory produced blister packs in which most solid dose medicines are supplied, except that each compartment may have multiple medicines with each dose regime in a separate blister. Most types can have a label with the patient's name and instructions attached. Blister packs remain intact if dropped and protect medicines from dust, but usually have to be prepared off-site and are often not sufficiently durable for use in remote settings.
- Compartmentalised containers (commonly known as Dosett packs) usually consist of some kind of plastic container with dividers between each compartment and a lid. In some cases labels can be slipped in the back container but these types of containers are usually difficult to label appropriately. Dosett style containers are prone to a number of problems. If they are dropped medicine can be shaken into the wrong compartment, they are muti-use and require proper cleaning when refilled; an expensive and time consuming process. Individual compartments are not sealed, leading to the possibility of ingress of dirt into the

compartments. Anecdotal evidence has indicated that the Dosett type boxes at rural clinics are commonly washed out and left in the sun to dry and often inadequately labelled or not labelled at all.

- Automated medication dispensing systems, for example MPS Healthstream compliance packettes, are generally not suitable for rural and remote locations due to the cost, and complexity, of the equipment.

Despite these problems the potential benefits of DAAs remain a strong incentive for their use.

Figure 4: DAA packaging (Webster® packs) in the Tiwi Islands[71]

Futuristic devices have also been suggested to improve medication compliance. Accenture's Centre for Strategic Technology Research has developed a smart medicine cabinet appliance which works by using camera and face recognition software which can identify different persons in the household and detect which product is being taken out by the use of Radio Frequency Identification (RFID).[72] RFID is an automatic data capture technology that uses tiny tracking chips affixed to products.

The above discussion demonstrates the initiatives under the National Medicines Policy, such as Medication Reviews, use of S100 provisions and DAAs have the potential to arrest some of the problems in Indigenous health due to 'rurality'. However, legal issues concerning the preparation of DAAs in rural and remote clinics, where there is no pharmacist, are a major obstacle in realising this potential. Training courses for AHWs on the preparation of DAAs and changes to existing legislation are required.

The following section discusses the necessity for additional methods to further extend these initiatives.

2.1.8 Implications for the provision of quality pharmaceutical services in rural Australia.

I believe that the implementation of the National Medicines Policy, leading to the provision of quality pharmaceutical services in rural Australia, requires investigations in the following key areas:

- Continuing education needs for pharmacists practising in rural Australia, including the requirements for up-skilling in such areas as clinical pharmacy.
- Research into suitable distance education methodologies, where relieving staff are unavailable, to allow the pharmacist to attend formal training courses at educational institutions online.
- The need for supervisory and management training where pharmacy technicians are employed in pharmacist support roles.
- The training needs for support staff in community and hospital pharmacy, such as pharmacy dispensing technicians, and the awareness of pharmacists of the formal qualifications available under the Australian Qualification Framework.
- The training needs for healthcare professionals, working in rural hospitals and clinics, where there is no pharmacist available and who provide pharmaceutical services; the applicability of the formal qualifications available under the Australian Qualification Framework.
- Research into the recruitment and retention of pharmacists working in rural and remote areas.
- Overseas qualified pharmacists to work in rural and remote areas. The development of competency standards leading to equitable assessments of overseas pharmacist qualifications in line with the requirements of the Australian Qualification Framework, leading to an update of the current APEC accreditation procedures to enable overseas trained pharmacists to enter the workforce in a more expeditious way rather than the one to two year period such accreditation currently takes to complete the procedures.[73]
- Recruitment of new graduate pharmacists to work in full time or relieving positions in rural and remote areas, using innovative strategies such as providing credit against Higher Education Contribution Scheme (HECS) obligations.[74]
- Research into Automation and Workflow Strategies such as:
    - Automatic dispensing equipment.
    - Pharmacists providing counselling by telephone or video conferencing.

- Shared medication management reviews between pharmacy technicians, community/hospital pharmacists and consultant pharmacists using video communication technologies.

The Pharmacy Guild states that the Quality Care Pharmacy Program (QCPP) will result in all dispensing and supply of scheduled products being accompanied by professional counselling and that there will also be a range of remunerated professional pharmacy and health care services. The provision of Medication Management Reviews by pharmacists is the first example of this type of initiative and it is envisaged that there will be many more such services provided which relate to the management of specific chronic illnesses or ongoing conditions, such as diabetes and asthma, as identified in the Fourth Pharmacy Agreement.[45]

Sunderland et al. identified in a 2005 study that rural communities value prevention advice and services and pharmacy is well placed to provide a valuable public health role, however, their role is currently being underutilised.[7] As discussed above, distance and the consequent limited financial viability of service provision in these remote areas suggests that in reality, it will be difficult to introduce these professional activities into rural and remote Australia, given the shortage of pharmacists. Indeed, the shortage of pharmacists in these areas has often resulted in the role of providing pharmacy services to rural and remote communities being shifted to medical practitioners, nurses, Aboriginal health care workers and other health workers.[75]

Murray noted in an article in Australian Prescriber[9] that only the Northern Territory and Queensland have provision for use of prescription drugs by Aboriginal health workers and that for Aboriginal health workers, training and accreditation in the use of medicines is of vital interest, because it is one of the few areas of health practice that is specifically regulated by statute. While legislation does not prevent Aboriginal health workers from assessing and treating patients, the Poisons legislation limits who is able to prescribe and supply medicines. The fact that prescribing activities are often outside the legal framework is a failure of health policy rather than a reflection on appropriate multidisciplinary practice. Legislative reform to cover such realities should not get caught up in territorial disputes between professional groups; the focus should be on how to ensure community access to and quality use of essential medicines. Withholding treatment is just not an option. In most remote settings, the caseload is heavy, the treatments are standard - the CARPA Standard Treatment Manual[76] is used throughout the Northern Territory, the margin of safety for most of the commonly used drugs is high and there is often no doctor or pharmacist available. A failure to initiate therapy promptly in the Aboriginal health setting often leads to serious adverse outcomes.

As noted by Fiore et al. in their article on the support needs of supply nurses in rural and remote Queensland, many communities in rural and remote Australia are without a pharmacist.[7] In these communities it is necessary for the local general practitioner and the registered nurse (supply nurse) at a hospital to supply medications, in addition to their existing duties. Many of those involved will have had little access to training or support programs to facilitate the supply process, or the unique counselling and drug information skills that contribute to the quality use of medicines (QUM).

Currently 65 out of 120 Queensland Health (QH) hospitals throughout rural and remote Queensland rely on supply nurses to provide medication services rather than pharmacists.[7]In 2001 with amendments to state legislation, Queensland Health announced a Quality Improvement and Enhancement Program (QIEP) to expand the scope of practice of Registered Nurses (RN) working in rural hospitals under the Health (Drugs and Poisons) Regulation 1996.[77] To achieve this, the existing Isolated Practice Course curriculum was reviewed and adapted to meet the needs of RNs working in both rural hospitals and isolated practice areas. The course was renamed the Rural and Isolated Practice Health (Drugs and Poisons) 1996 Registered Nurse Course. On completion of the course, RNs could apply to the Queensland Nursing Council (QNC) for an isolated practice areas and rural hospitals endorsement. Endorsed RNs or RIPRNs as they came to be called, would use specially designed policies and protocols (instead of a Medical Officer's order) to administer and supply certain Schedule Two (S2) poisons, Schedule Three (S3) poisons, Schedule Four (S4) restricted and Schedule Eight (S8) controlled drugs to outpatients presenting at their facilities. The RIPRN course is delivered throughout Queensland. The North Queensland Workforce Unit (NQWU) in Cairns is the authorised licence holder of the course with the QNC. RIPRNs use the standard treatments outlined in the Primary Care Clinical Manual[78] which is similar to the CARPA Standard Treatment Manual, but rather more detailed and comprehensive.[c]

National Policies aimed at reducing the inequality of health provision in rural and remote regions of Australia have identified key areas for improvement.

One area relates to increasing the graduate supply of pharmacists; others have included the wider use of Medication Reviews, the extension of S100 provisions to provide PBS products to Aboriginal communities, the increased availability of dose administration aids to increase patient compliance and the training of allied health professionals to take a greater role in pharmaceutical supply or dispensing.

[c]Personal discussions with rural RNs, familiar with both standard treatment manuals, indicate that many rural nurses and healthcare workers prefer the clear and simple layout of the CARPA Manual.

Each of these provides important steps in overcoming the rural-metropolitan health divide. However, commentators such as Murray[9] and Hamrosi[6] have noted the importance of pharmacists in preventing medication abuse, an area of great concern and cost in regional areas. While the potential exists, the prohibitive financial reality of service provision in many remote areas remains.

One of the ways that this barrier might be able to be overcome is through a greater uptake of technology among pharmaceutical professionals. The following chapter looks at the issues of telemedicine and its subset, telepharmacy, in Australia and overseas.

Chapter 3 Review of Telemedicine and Telepharmacy

3.1 Introduction

During the latter part of the twentieth century, information technology and telecommunications increased at a rapid rate. This has had profound effects upon the way in which healthcare is delivered in many countries. The manner in which consumers conduct their own research on medicines and diseases which affects both themselves and their families via the Internet has also changed considerably and consumers are now better informed and more demanding of healthcare professionals. There appears to be no limit, at this point, to the rapid advances in information technology and telecommunications. As computers reduce in size, whilst at the same time increase in power, there is little doubt that healthcare applications, which seemed to be mere science fiction just a short time ago, will become common place in the future.

Telepharmacy is not a technology in itself, but rather is the use of diverse technologies to provide pharmacy services at a distance. These technologies may include the telephone, facsimile, two way radio, e-mail, audio and video-conferencing, personal computer, intra/Internet, interactive satellite television and specialised imaging devices. A telepharmacy transaction can be conducted either in real-time or in an asynchronous fashion (i.e. store-and-forward) depending on the requirement, such as the recording of a medication review video conference and making this available to the patient's medical practitioner on an as required basis. Arguably, Australia's involvement with telepharmacy dates back to the 1940s. In 1942 the Royal Flying Doctor Service (RFDS) introduced a remote outpost medical chest.[79] In an emergency, the personnel at the outpost station contacted the RFDS by high frequency radio (HF) and medical personnel could instruct the outpost personnel to remove drugs from the medicine chest and administer these drugs to the patient.

This Chapter firstly briefly reviews the history of telemedicine and the telepharmacy applications which are a subset of these applications; the various means by which telepharmacy applications may be accomplished and, thirdly, telepharmacy experiences overseas and in Australia are discussed in some detail.

'Telemedicine' is derived from the Greek "tele" meaning "at a distance" and our existing word "medicine" derived from the Latin "mederi" meaning, "to heal". In 1967, Dr. Kenneth Bird created a two-way audiovisual microwave circuit that enabled physicians at the Massachusetts General Hospital

in Boston, MA to provide medical care to patients 2.7 miles away at the Logan International Airport Medical Station. Scientific papers were published documenting the results of over 1,000 patients that used the system.[80]

There are also a number of new terms using the prefix "tele" resulting in terms such as telepsychiatry, teleradiology, and telepharmacy. Telecommunications, bringing medical and health care services to patients regardless of their physical location, is the common element in all of these terms. The term "telepharmacy" is similarly derived from "tele" and our existing word "pharmacy" which has origins from the Greek "pharmacon" meaning "poison". The term telepharmacy is used frequently in this thesis.

The World Health Organization (WHO) has defined telemedicine as the delivery of health-care services, where distance is a critical factor, by health-care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, and for the continuing education of health-care providers as well as research and evaluation, in the interest of advancing the health of individuals and their communities.[81] Some descriptions use the broader term "telehealth" to indicate care beyond that provided in medical encounters (e.g., health education, health-related web sites and so on).[82]

Telemedicine is part of the larger concept, that of "eHealth". The WHO programme on eHealth for health-care delivery (eHCD) encompasses eHealth applications that directly support prevention, patient diagnosis and patient management and care. These applications include tele-consultations, tele-referrals, store and forward concepts (e.g. tele-radiology and tele-prescriptions), and electronic patient records (EPR). The WHO has defined eHealth as "the use, in the health sector, of digital data transmitted, stored and retrieved electronically in support of health care, both at the local site and at a distance."[83] The United States Health Resources and Services Administration has defined telepharmacy as the use of electronic information and communication technology to provide and support comprehensive pharmacy services when distance separates the participants.[84] This broad definition of telepharmacy will be used for the purposes of this thesis.

3.2 A brief history of Telemedicine

Telemedicine began in the 20th century in conjunction with advances in information technology.[85] Current telemedicine systems originated from developments in the manned space-flight programmes of the United States and the USSR and separately from the pioneering efforts of a few physicians

using off-the-shelf commercial equipment. The genesis of telemedicine represents the confluence of two parallel developments in information technology. The first of these was the manned space flight program development of sophisticated technologies for biomedical telemetry, remote sensing, and communication in space. The second application stemmed from the telecommunications industry in the private sector, which was subsequently expanded immensely with the growth of computer technology.[86]

In the space program, the monitoring of the human, system, and environmental components of space flight is essential to mission success. Nicogossan[87] stated that the database amassed by the National Aeronautics and Space Administration (NASA) during missions is derived from three contiguous components: preflight, in-flight, and postflight activities. In-flight monitoring is the combination of subjective and objective analytical methods that allow flight and ground personnel to sustain human health in the spaceflight environment. This in-flight monitoring generates data regarding human physiology during space flight in addition to other issues. Because pre- and postflight monitoring establish the critical baselines against which in-flight monitoring data are evaluated, in-flight monitoring parameters must be compatible with these baselines, and must be collected via minimally invasive, fully proven techniques. This approach to telemedicine has resulted in a notable record of health and safety during space flight. With the consultation assistance of ground controllers, in-orbit crews with pre-flight medical training are usually able to respond to unexpected events. Nonetheless, the number of critical measurements observed by ground controllers and astronauts during a mission has risen as mission complexity has increased.

The Soviet space program also pioneered significant developments in telemedicine. In October 1957 the Soviet Union launched Sputnik 1. A month later, November 1957, Sputnik 2 was launched with Laika, a dog, on board. This flight was the first time that telemetry was used to monitor physiological parameters in space. Technology evolved rapidly and permitted the first successful human space flight by Soviet cosmonaut Yuri Gagarin in April 1961. Space expeditions by both the USSR and the United States soon followed. The following Table provides summary information on Soviet space missions and their telemedicine applications.[88]

Table 1: Soviet space missions and their telemedicine applications

Years	Missions	Parameters measured	Comments
1961	Vostok	Cardiovascular, Pulmonary, O_2, CO_2, H_2O, Pressure	First human space flight - Gagarin
1961	Vostok-1	As above	Audio and limited video capability
1965	Voskhod-2	As above	
1975	Apollo-Soyuz Test Project	As above, Body fluids, Toxicology, Biomedical research	Intermittent measurement As indicated As required Audio and video capability
1980's	COSMOS- Bion Satelittes	As above	Rhesus monkeys
1990's	Shuttle/Mir	As above	Telemedicine used extensively, highlighted by a fire, loss of pressure and various medical events.
Doarn et al. Evolution of telemedicine in Russia: the influence of the space program on modern telemedicine programs.[88]			

Although NASA's telemedicine programs had to focus primarily on the astronaut's health and well-being, it extended to supporting humans in various remote, extreme environments. Since the early 1970s, NASA has been testing its telemedicine capabilities in terrestrial applications and providing feedback for its space operations.[89] The following Table provides summary information on NASA space missions and their telemedicine applications.

Table 2: NASA space missions and their telemedicine applications

Years	Missions	Parameters measured	Comments
1961-1963	Mercury	Cardiovascular, Pulmonary, O_2, CO_2, H_2O, Pressure	
1965 - 1966	Gemini	As above	
1968 - 1972	Apollo	As above	
1973 - 1974	Skylab	As above, Body fluids, Toxicology	Intermittent measurement As indicated
1981 - present	Shuttle	As above	
2000 - present	International Space Station	As above	
Nicogossian et al. Evolution of telemedicine in the space program and earth applications.[87]			

The shipping industry was an early user (around the 1920s) of telemedical services, since accidents can happen far out at sea.[90] In situations like this, emergency advice was called upon using radio. In the absence of medical personnel aboard sea bound vessels, medical information was requested and supplied via Morse code from the mainland.[85] This technique was quickly superseded by the use of radio and satellite when they became widely available.

In 1990, Maritime Health Services (MHS) in Seattle, USA, initiated an occupational health service that allowed the medical officer on board a northern Pacific fishing trawler to communicate directly with a physician as needed around the clock.[80] This telemedicine system, known as the Medical Consultation Network (MedNet), is a customized video communications application based on a video-conferencing system. Using the system, ocean-going vessels (or any remote site) can establish a live audiovisual link to an emergency physician at MHS. The Mermaid project is a European Union financed telemedicine project with global reach and 24 hour multilingual capability.[91]

Ship-to-shore Telemedicine is still practised today by radio, although some vessels now use high-bandwidth videoconferencing units. There have even been reports of ship-to-shore surgical consultations on US navy vessels. The telerobotic Zeus and da Vinci surgical systems permit solo surgery by a surgeon from a remote site. These telerobots hold the camera, replace the surgeon's two hands with robotic instruments, and serve in a master-slave relationship for the surgeon. Their robotic instruments simulate the motions of the surgeon's wrist, facilitating dissection.[92],[93]

The introduction of television had a major impact on the development of Telemedicine. In 1964, the University of Nebraska at Omaha used two-way closed-circuit television in the transfer of patient information to medical students and tested interactive video conferencing in mental health consultations. In another program, Native Americans received medical exams using a specially equipped van and two-way microwave communication to transmit radiographic and electrocardiographic images. This was one of the first interactive video links. The system was developed to facilitate education and training, to improve patient diagnosis and treatment by enabling specialist consultation, to foster collaborative research activity between the two sites and to utilise the state hospital resources in teaching at the psychiatric institute. [94] As previously mentioned, an application to exploit the versatility of television was located at the Logan Airport in Boston.[95] Developed by Dr Kenneth Bird, this system served to deliver 24 hour-a-day nursing and physician care to passengers and airport staff through a two-way audiovisual link. On a typical day an average of 50 patients were seen via the system. As well as video and audio data, information such as vital signs, electrocardiographs (ECGs), electroencephalograms (EEGs) and digitised microscope slide

images were sent via the Telemedicine system to the Massachusetts General Hospital where they could be reviewed by medical personnel. In a pioneering study, 1,000 patients were examined via the system with the conclusion that telediagnosis can be used to increase the availability of quality medical care.[95]

The start of Telemedicine in Australia is thought to be the North-West Telemedicine Project. This project was set up in 1984 to provide health care to people in five remote towns south of the Gulf of Carpentaria using 20 two-way and 20 one-way (television-receiver only) satellite earth-stations. The communities were linked to the Mount Isa Base Hospital and the Royal Flying Doctor Service and were supplied with conference telephones, facsimiles and freeze-frame transceivers. Evaluations of the project demonstrated that the technology improved the health care of remote communities while reducing health care costs.[96]

Psychiatry was one of the first specialties in Australia to experiment with videoconferencing as a means of providing clinical services to rural areas. Most states and territories in Australia now have some experience with psychiatric services via video-link. South Australia has some of the most advanced telepsychiatric services, with more than 2,000 patients seen and psychiatrically assessed using telemedicine since the inception of the programme.[97]

3.3 Telemedicine today

The lack of telecommunications infra- structure has been a major impediment to the extension of telehealth in rural Australia, particularly in areas such as north Queensland. In 1998, community groups, non-government organizations and government departments were consulted regarding the need for improved telecommunications in north Queensland and how this could be addressed through funding via Networking the Nation (NTN), an initiative of the Commonwealth government. As a result of these consultations, Networking North Queensland (NNQ) was developed as a collaborative project involving a number of health service providers, including the Queensland Ambulance Service, the Blue Care nursing organization, the Divisions of General Practice and the Queensland Health department. NNQ was a project to improve the health outcomes of people living in rural and remote north Queensland by increasing their access to telecommunications.[98]

The primary objective of this component of the project was to provide basic, reliable videoconferencing to facilitate the delivery of health and other services, distance education, family support and business services. Videoconferencing facilities were installed in 21 communities in north

Queensland, the majority being rural or remote communities. Ten remote sites located at least 2 hours from an urban centre were chosen for analysis of videoconferencing usage and community access.[98]

Table 3: Ten remote sites located at least 2 hours from an urban centre in Queensland

Community	Facility	Staffing	Population	Travel time to nearest urban area
Burketown	Clinic	1 RN	220	5
Camooweal	Clinic	1.5 RNs	258	2
Chillagoe	Hospital	1 RN	150	3
Cow Bay (Daintree)		4 teachers	500	2.5
Croydon	Hospital	1 RN	223	8
Dajarra	Clinic	1 RN	203	2
Doomadgee	Hospital	6 RNs; 2 GPs	754	5
Georgetown	Hospital	1 RN	298	6
Karumba	Clinic	2 RNs; 0.5 GPs	1043	6
Normanton	Hospital	6 RNs; 2 GPs	1328	6
Watson J, Gasser L, Blignault I, Collins R. Taking telehealth to the bush: lessons from north Queensland.[98]				

The 1990s saw great advances in digital communications, digitisation processes and data compression technologies. This enabled the development of telemedical applications that could function without the use of high cost satellites or other expensive communication methods. The diminishing cost of personal computers combined with the advent of the Internet led to the popularity of low-bandwidth PC based videoconferencing as a medium for telemedical applications. Another factor influencing the spread of Telemedicine was a shift in health care attitudes, which began to recognise that medical care in rural areas was inequitable.

The Australia and New Zealand Telehealth Committee have suggested that some additional drivers for the recent uptake of telehealth are an increase in the number and proportion of older people due to the maturation of the "baby boomers", which has led to an increase in potentially preventable chronic disabling conditions.[96] There has also been a paradigm shift from treatment to prevention and care. Health care of the future will progressively address the management of chronic conditions rather than responding to acute illness. The number of people going to hospital will continue to diminish. Over time health care is likely to be delivered at work or at home. Improved imaging techniques and knowledge will increase the capacity to provide care in the community and improved information technology and communications accompanied by reducing costs will lead to increased telehealth potential. Increased capacity to diagnose and treat disease are also adding pressures to reduce health care costs. Increased consumer demands and consumer education leading to empowerment in choices

about their own health care will also drive the uptake of telehealth applications as will a declining rural population combined with diminishing national boundaries.[99]

Regardless of the specific driving factors at work, an increase in the number of telemedical programs and consultations is occurring each year, especially in the industrialized countries such as Japan, USA, Australia and Scandinavia. In 1993, at the start of the Telemedicine boom, there were just 10 Telemedicine projects using interactive videoconferencing technology in the United States. Since then, the number of Telemedicine consultations has approximately doubled each year. In the US in 2002 there were over 200 programmes in over 30 specialities.[85] A survey of Telemedicine activity in the USA found that 48,194 non-radiology teleconsultations were performed in 2003, from 157 Telemedicine programs. [82] The most popular specialty was radiology, followed by mental health, ophthalmology, cardiology and dermatology. These specialities accounted for over 70 per cent of all teleconsultations. Data from the Telemedicine Information Exchange Website[d] indicates that approximately 70 per cent of all teleconsultations utilised interactive video with the remainder using store-and-forward or non-video interactive technologies and demonstrates the continuing growth in USA telemedicine programs.

The best evidence for the effectiveness of telemedicine is in medical specialties for which verbal interactions are a key component of the patient assessment, such as psychiatry and neurology.[82] Various psychiatric and neurological assessments can be administered effectively via interactive videoconferencing. Likewise, treatments administered in these specialties via telemedicine appear to achieve comparability with face-to-face care. It can probably be concluded that medical care administered via interactive videoconferencing can achieve results that are comparable to their in-person counterparts.

[d] http://tie.telemed.org/

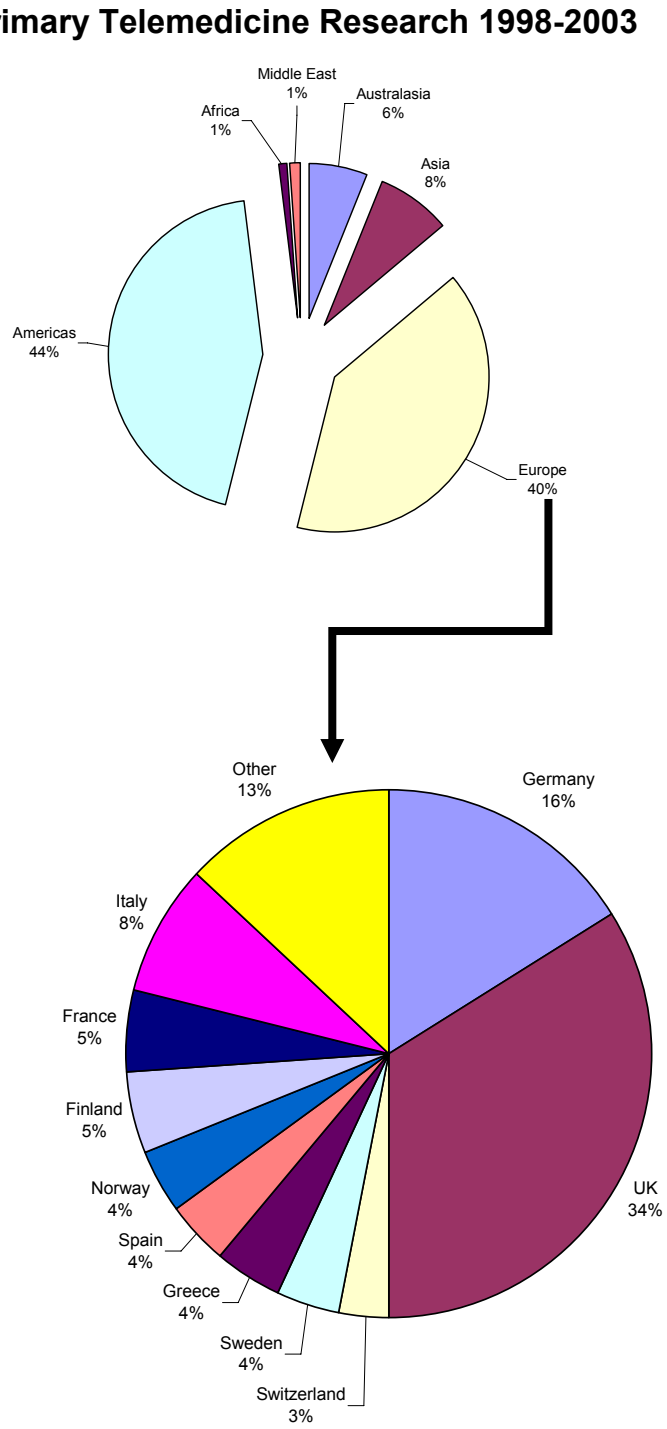

Figure 5: Primary Telemedicine Research

Craig and Patterson[85] identified the origins of the papers published in two specialised telemedicine journals: Journal of Telemedicine and Telecare and Telemedicine Journal and eHealth. 1998 – 2003 (n = 2952). Craig and Patterson also identified 52 telemedicine programmes in 2002 outside of the USA, with Canada (10), Australia (9) and the UK (9) being the major contributors. [85]

3.4 Telepharmacy systems

3.4.1 Communication

The majority of telemedicine data is nowadays transmitted through terrestrial digital and analogue telephone networks or global system mobile (GSM), either directly or via Internet and the remote sites usually rely on satellite links. High frequency (HF) radio is still available and used worldwide. Many communication devices are commercially available to the pharmacist for the purpose of telepharmacy consulting. When selecting the appropriate equipment for an application, a number of factors must be considered. These include the type of information to be transmitted (text-only, audio, still images, video, telemetry), the required speed of transmission and the total quantity of information to be transmitted.[95] Important parameters to be considered in the selection of a communication system are:

- coverage requirements: local or regional;
- availability: permanent or temporal;
- modus and urgency of information transfer: real-time, store-and-forward;
- minimal and maximal up-link/down-link bandwidths;
- transmission protocols and compatibility with multiple senders/receivers;
- data encryption and safety;
- cost per equivalent amount of transmitted information, and
- overall system costs, that is purchase and cost of telecommunications traffic.[100]

The financial costs relating to both the purchase of equipment and ongoing telecommunications fees must be considered when selecting infrastructure for telepharmacy. The success or failure of a telepharmacy system can largely depend on the correct selection of technologies that are appropriate to the specific requirements of the application.[101] For example, a telepharmacy project may be established on the assumption that all types of information will be required to be transmitted across a link. This may lead to disproportionately high set-up and running costs, which may not be justified by use of the system. The following sections will consider the various equipment and peripherals available, with reference to their telepharmacy application and cost.

3.4.2 Audio

Voice transmitted by telephone or radio is the most common and widely accepted technology used to facilitate communication.[102] The wide availability and low cost of the telephone lends itself to extensive use in today's health care system. The telephone has changed from a dial-and-talk instrument to a universal multimedia access tool.[103] Computer-linked telephones using Voice over Internet Protocol (VoIP) can perform with most of the functionality of the standard telephone at substantially lower cost. The public telephone system commonly connects the telephone via copper wire. Voice communication can also be conducted via HF radio, VHF or UHF radio. However, fibre optic cable, microwave circuits or satellite generally connect major centres.

3.4.3 The facsimile

The facsimile machine operates across the ordinary public telephone system and is inexpensive to purchase. The first facsimile machines became available in 1962. The wider availability of facsimile machines in the 1990s greatly aided communication through the ability to send an exact copy of any written communication.[104] The facsimile machine has contributed to communication in health care by its ability to send a copy of any written communication, anywhere in the world. The facsimile is a relatively secure mode of communication as it uses the standard public telephone system network for transmitting information. The public telephone system is a 'point-to-point' network service which minimizes the ability of a third party to intercept the data en route. In addition to this, cryptographic methods can be employed to scramble messages. Under current legislation, pharmacists are not allowed to dispense against a copied, faxed or emailed prescription.

3.4.4 Videophones

Videophones have an advantage over the conventional telephone in that they enable real time video as well as standard telephony. They are a relatively cheap, stand-alone product designed to be similar to use to a standard telephone. Videophones communicate over the low-speed public telephone system network and generally produce a low quality image at quarter Common Intermediate Format (CIF) resolution (176 pixels by 144 lines) at 8-15 frames/s.[99] Telepharmacy studies conducted in Australia using videophones have not been particularly successful, although there are some encouraging

developments in other fields.[75],[105] A Brisbane based study describing the positive use of video phones to support paediatric palliative care has shown promising results.[106] However, the availability of new third generation (3G, also called Next G™ by Telstra) mobile telephone networks will place the capability to conduct personal videoconferences in the hands of the general population. The availability of these networks in rural and remote areas is still likely to be an issue, however, the coverage should be far wider than ADSL broadband because the 3G network will replace the current CDMA network. It is expected that 3G networks will initially be introduced with speeds of 500-1100 kbits/sec, well suited to video conferencing applications.[107]

3.4.5 The personal computer

The most versatile low-cost piece of equipment to facilitate telepharmacy transactions is the personal computer (PC). The PC can send many types of telepharmacy information such as text, audio, still images, video and telemetry, through the use of peripheral devices. For example a low cost Web Internet camera (webcam) and microphone can add videoconferencing to a personal computer. A telepharmacy video consultation, in its simplest form, can take place, using a PC equipped with webcam and microphone. Additional devices such as digital cameras, bar code scanners and printers can also be attached.

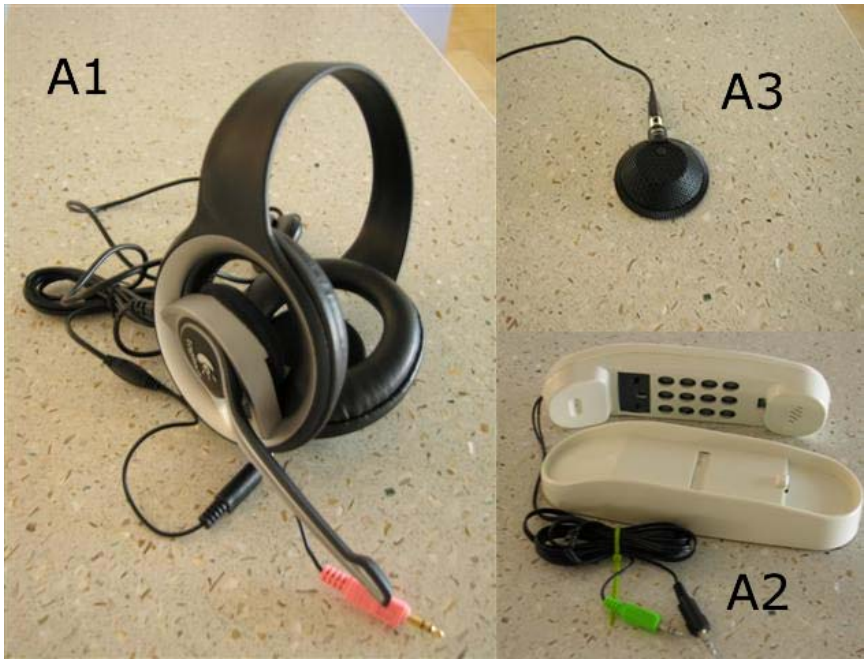

Figure 6: Example of peripheral devices for the personal computer.

A1: headset microphone ; A2: a telephone style handset for use with a PC;

A3: a conference style microphone

Figure 7: D. Example of bar code reader.

Figure 8: C. Web camera example (Logitech Quickcam Sphere)

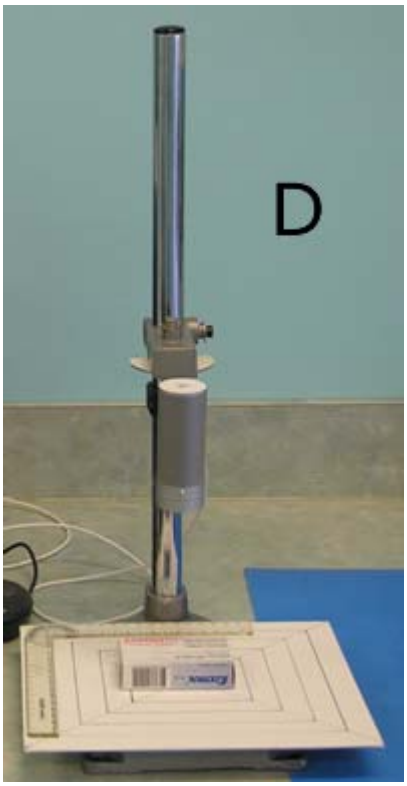

Figure 9: D. Data (image) acquisition device on stand

The installation of a bar code reader can be one of the simplest methods of increasing quality assurance in a telemedicine application that requires verification of the product. A report by Oren et al. in 2003 identified seven controlled studies on bar code implementation.[108] After bar code implementation, error rates decreased from 1 per cent to 0.2 per cent and one study identified a significant reduction in medication errors associated to bar code reading compared to keyboard entry.[108]

PC Software can be tailor-made to suit the requirements of the specific application. For example, software can be designed to enable text-only applications, applications with still pictures or applications with full videoconferencing functionality. The versatility of the software also enables the development of other features such as imaging equipment to assist in the telepharmacy consultation. Many standard low-cost video conferencing applications are available such as Microsoft NetMeeting and Apple Computer's iChat. The major consideration in using standard web based video conferencing software is the theoretical possibility of hacking into the video stream and thereby gaining access to private information. At present, of the common programmes available, only Apple computer's iChat has the ability to encrypt the video conference.

Four telepharmacy transactions that can be easily conducted on the personal computer will be considered: electronic mail, store-and-forward telepharmacy and videoconferencing.

3.4.5.1 Electronic mail (eMail) and Instant Messaging

eMail, similar to the facsimile machine, enables the transmission of information across large distances with the added ability of being able to attach files such as images. With the growth of the Internet during the 1990s, eMail was rapidly adopted in healthcare applications. In many telemedicine applications eMail has been successfully employed across a diverse variety of specialties. However, under current legislation pharmacists are not allowed to dispense against an emailed prescription in Australia. Instant messaging differs from eMail in that it is an always on facility. As long as the user is signed into the instant messaging service text and files can be exchanged. Examples of commercial instant messaging services are Microsoft Messenger and iChat. Instant messaging can also be set up securely via a virtual private network (VPN).

3.4.5.2 Store-and-forward

Store-and-forward is an asynchronous technique where information is first acquired and stored on the local computer before it is transmitted to the receiving site. There are two main benefits of this method; firstly, the person recording the information and the person receiving it do not need to be viewing it at the same time and the information can be reviewed later at the convenience of the receiving party. Because the data are not sent immediately data compression techniques can be used. Data compression is a method that reduces the size of a file, enabling less time to transfer the file and therefore resulting in reduced data transmission costs. Store-and-forward techniques, while very popular in the areas of radiology[103], cardiology[109] dermatology[82] and pathology[110] have also become popular in many other areas of telemedicine.

An example of store-and-forward technology in telepharmacy is where a technician at a remote site creates an image of both the label generated at the central pharmacy and the label of the prepackaged medication that was retrieved from the storage container for inspection by the central pharmacist. By means of store-and-forward technology, both images can be transmitted along the network and maintained in the central pharmacy's database.[111]

3.4.5.3 Videoconferencing

Videoconferencing is a dual/multiple audio-visual connection that can be employed for all kinds of meetings that requires visualization in addition to the transmission of sound. The participants are geographically separated, but they can still hear and see each other and is particularly useful in health care situations where face-to-face interaction is required. Videoconferences can be conducted between two or more locations. Multiple participant videoconferences (MCU) are often organized by third party providers.[112] The substantially lower cost of PC based videoconferencing over videoconferencing units has led to its increased popularity for telemedical consultations.

Videoconferencing software such as Microsoft's Netmeeting product and Apple Computer's iChat enable any PC with a connection to the Internet, a low-cost Web camera (less than AU $200) and a microphone (less than AU $100) to conduct a videoconference to virtually anywhere in the world. Whilst videoconferencing via a PC may be cost effective and simple to acquire, it is technically more difficult to set up and operate than commercial videoconferencing units. For some PC applications (typically Microsoft based web chat software), a more detailed knowledge of software systems and telecommunications is required and therefore such factors must be considered when purchasing telepharmacy equipment. It is also necessary to consider security and confidentiality issues when using Internet based videoconferencing, as many PC videoconferencing software packages do not support data encryption.[113] The exception to this is Apple Computer's iChat software which has inbuilt encryption for use over the Internet, although this then limits the participants to using the Apple Computer servers. However, PC based videoconferencing has been used extensively to provide telepharmacy services.[103] The North Dakota,[114] Texas[111] and Washington state[115] projects in the United States (described later) used either PC based videoconferencing or commercial videoconferencing facilities.

Commercial videoconferencing equipment is generally installed in a studio or dedicated office, and in the past was expensive, and quite complicated to operate. The wide acceptance of videoconferencing technology and development of new teleconferencing units has resulted in considerably less expensive and easy to use options. Commercial teleconferencing units can be purchased for less than AUD 10,000.[116]

The following provides an example of a commercial set top videoconferencing unit. This unit connects to a standard LCD television to enable videoconferencing. [116]

Figure 10: Example of a set top videoconferencing unit (PolyCom Corp)

Videoconferencing units consist of three basic components: a screen, communication equipment (camera, microphone and speakers) and a video software codec. Codecs compress and decompress data. The word codec is a shortening of the term Compressor/Decompressor. Compressing a data stream or a file reduces its data rate. It reduces the bandwidth required for transmission or broadcasting and the amount of space required for storage. Before the data can be used, though, it has to be decompressed. Both phases of a codec's work can be carried out in hardware, in software or a combination of both. IP based videoconferencing has emerged as a common communications interface and standard provided by manufacturers in their traditional Integrated Services Digital Network (ISDN) based systems. Business, government and military organizations still predominantly use H.320 and ISDN for videoconferencing. Due to the popularity and relative low cost of the Internet, and broadband in particular, there has been a strong growth and use of H.323 protocol. This protocol has the advantage that it is accessible to anyone with a high speed Internet connection, such as Digital Subscriber Line (DSL).

Although hardware videoconferencing units are more expensive than PC based videoconferencing systems, they are also more appropriate for room-based videoconferencing when many participants are involved. The units may also include peripheral devices such as document cameras, or other data acquisition devices.

Generally ISDN is still the communications network of choice for commercial videoconferencing units. However with the introduction of DSL Internet protocol (IP) based systems, DSL has become more popular due to the wide distribution and low-cost of Internet communications. Dedicated videoconferencing units are considered more secure than PC based videoconferencing due to the use of ISDN and other 'point-to-point' communication methods.

Table 4: International Telecommunication Union (ITU) Protocols[102]

Protocol	Description
H.320	The standard for public switched telephone networks (PSTN) or VTC over integrated services digital networks (ISDN) basic rate interface (BRI) or primary rate interface (PRI). H.320 is also used on dedicated networks such as T1 and satellite-based networks. Used by Microsoft NetMeeting.
H324	The standard for transmission over Plain Old Telephone System (POTS), or audio telephony networks. Poorer quality pictures because of restricted bandwidth.
H.323	The standard for video over Internet Protocol (IP). This same standard also applies to voice over IP (VoIP).
T.120	A family of protocols which allow computer supported cooperative working in conjunction with videoconferencing.
H.264, MPEG-4 Part 10	A digital video codec standard which is noted for achieving very high data compression. It was written by the ITU-T Video Coding Experts Group (VCEG) together with the ISO/IEC Moving Picture Experts Group (MPEG) as the product of a collective partnership effort known as the Joint Video Team (JVT). Used by Apple for iChat.

3.4.5.4 Communications infrastructure

With all telepharmacy systems, a telecommunications service is required to transmit data from one point to another. There are two basic communication services: dial-up (dial-on-demand) or dedicated connections. Dial-up services include the public telephone system, Integrated Services Digital Network (ISDN), cellular telephone services and some satellite connections. Dial-up services require the users to initiate a process in order to use the service, as opposed to dedicated connections where a permanent connection exists between respective locations. Dedicated communications included

services such as DSL, cable Internet services, microwave links and satellite.[99] Asynchronous Digital Subscriber Line (ADSL) is a variation of DSL, where the upload and download speeds differ.

Some of the factors that must be considered when choosing a transmission channel include the type of information to be transmitted; text, audio, still images or video, the required access and flexibility of the connection, the reliability of the service, the speed at which data must be transmitted (bandwidth) and the telecommunication costs.

Table 5: Summary of the available bandwidth of various types of communication networks.

Available Bandwidth				
	Cable	ADSL	Wireless	Satellite
Speed	Speeds for Cable Standard are up to 8Mbps/256kbps and speeds for Cable Extreme are up to 17Mbps/128kbps	Speeds range from 256/64kbps to 1500/256kbps	Speeds range from 256/64kbps to 512/64kbps	Speeds range from 256kbps/dial-up to 800/128kbps
How does it work?	Uses a cable modem connected to the Telstra / Foxtel cable	Uses an ADSL modem connected to a phone line but doesn't tie it up	Uses a wireless modem that connects to the Wireless Broadband (1xEV-DO) network, or a wireless mobile card, inserted into a laptop, that connects to the Wireless Broadband and Telstra CDMA 1x networks	Uses satellite for all downloads and dial-up (1-Way Satellite), ISDN (Broadband Regional Connect) or satellite (2-Way Satellite) for uploads
http://my.bigpond.com/internetplans/broadband/pricing/ Accessed 5th July 2006				

Peterson and Anderson[117] noted that both the pharmacy computer data and the video conferencing signal can be transmitted over the Internet using DSL lines at 512 K bandwidth. Unfortunately, because ADSL typically operates with different upload and download speeds, the quality of service cannot always be guaranteed and there is no way to know in advance whether the transmission will be acceptable or not. Peterson and Anderson also stated that, on occasion, when the service has been disrupted between sites preventing the pharmacist from using the video conferencing system, the pharmacist must resort to calling the remote site and conducting the patient consultation by telephone.

3.5 Telepharmacy: an enabling technology

Telepharmacy represents a unique and innovative way to deliver pharmacy services to rural areas incorporating all the safe practices offered by the traditional mode of delivery. Potential benefits to the rural communities include restoring access to health care, pharmacy services and pharmacists, and improving the chances of recruiting or retaining pharmacists in rural communities, as well as providing new clinical training sites for pharmacy students for teaching them how to deliver pharmacy services to rural communities in a unique way.[114]

3.5.1 Telepharmacy models

There are a number of telepharmacy initiatives already in full operation in the United States, using a variety of models. In North Dakota,[114] the telepharmacy sites are full-service pharmacies that have complete drug inventories including over-the-counter and prescription drugs, health and beauty aids, as well as other up-front general merchandise. The telepharmacy sites provide the same services as traditional pharmacies including filling prescriptions and performing both medication reviews and patient counselling. The telepharmacy sites satisfy North Dakota Board of Pharmacy regulations for pharmacy practice in the state. The processes used for filling a prescription at the remote sites are the same as traditional pharmacy services except that the pharmacist, technician, and patient are not present at the same site. Telepharmacy uses state-of-the-art technology allowing a licensed pharmacist at a central location to supervise a pharmacy technician in the dispensing of pharmaceuticals at a remote site through audio and video computer links.

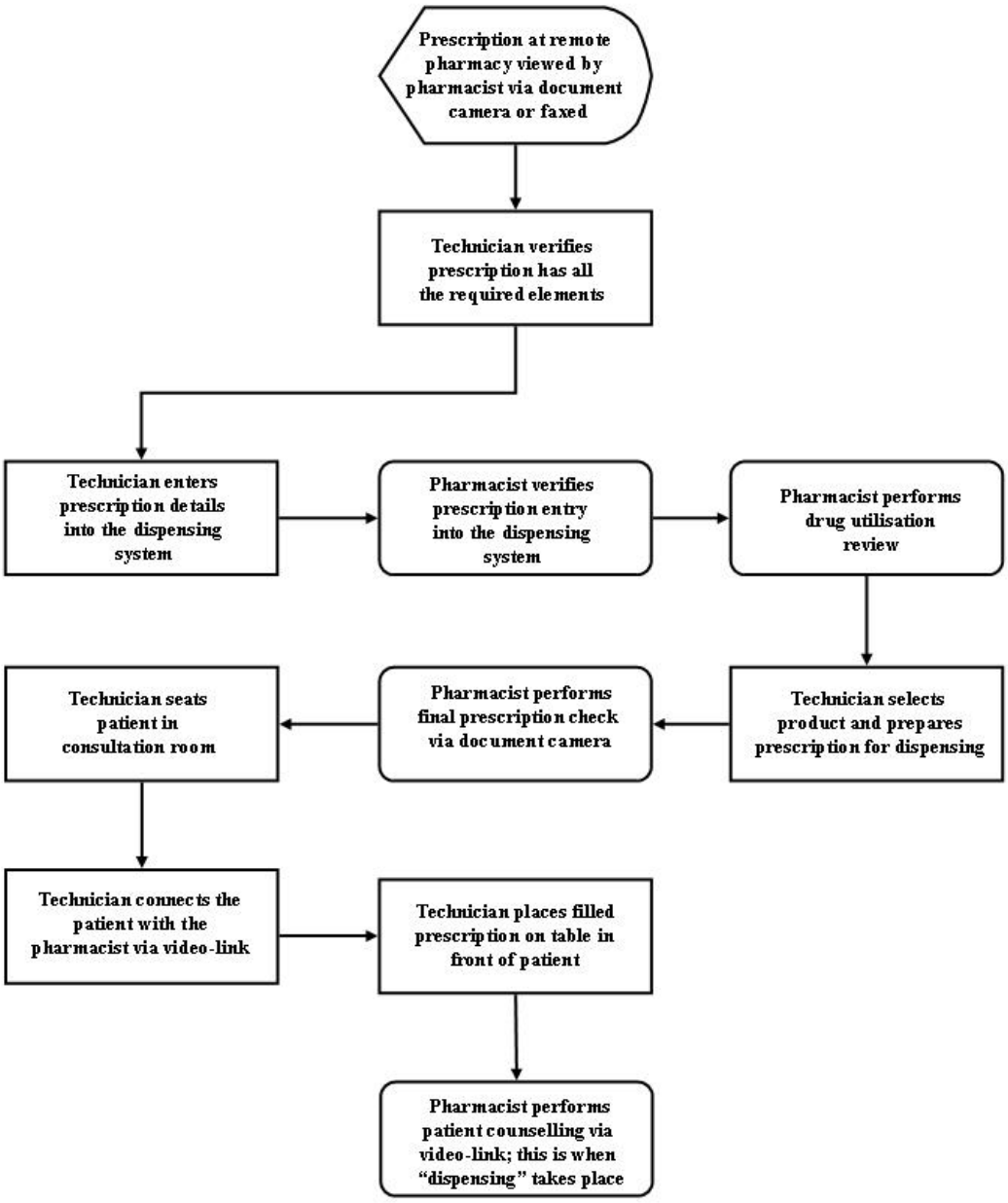

Figure 11: North Dakota Telepharmacy Flow Chart

Pharmacies are allowed to use pharmacy technicians to assist in the process of filling prescriptions as long as they are directly supervised by a licensed pharmacist. North Dakota pharmacists felt there was no reason that this supervision could not occur at a distance using modern technology links. They took

action on this premise, resulting in North Dakota being one of the first states to pass administrative rules that allow pharmacies to operate in certain remote areas without requiring a pharmacist to be present. The North Dakota State Board of Pharmacy has established "Telepharmacy Rules" to define guidelines for practitioners on how telepharmacy can be safely practiced.[5] In this model, a patient takes their prescription to the remote pharmacy site and gives it to the registered pharmacy technician, who prepares the prescription for dispensing by the pharmacist. The pharmacist reviews the patient's medication profile for drug interactions and other potential problems before examining digital pictures of the completed prescription for accuracy via videoconferencing equipment. Once the pharmacist has approved the prepared prescription, the pharmacy technician brings the patient to a private consultation room for counselling by the pharmacist on the proper use of their medication. Patient education counselling is required by the North Dakota Board of Pharmacy for all patients receiving telepharmacy services and also takes place via videoconferencing. Patient confidentiality is assured throughout the processing of their prescription. The pharmacist is ultimately responsible for proper preparing and dispensing of medications.

Washington State[115] has a rule allowing remote dispensing devices. In this model the remote medication dispensing and patient-education process involves several steps. From the remote clinics the prescription is electronically transmitted to the base pharmacy. The pharmacist at the base site processes the prescription and, once satisfied with the data, transmits an electronic command to the remote site, readying the remote automatic dispensing (ADDS) machine to release the specific medication and print the label. An authorised person at the remote site (pharmacy technician or provider) logs into the system and then instructs the ADDS cabinet to dispense the medication and scan the bar code. The package bar code is verified and a label is printed. The label's bar code is also scanned and the label is attached to the package. Visual verification of the medication and label and counselling of the patient is accomplished via a two-way videoconferencing system. The pharmacy technician escorts the patient to the counselling room containing the communication equipment. At remote sites, where physicians or nurse practitioners dispense the medication, label verification and counselling are performed locally by that individual or via the two-way videoconferencing system by the pharmacist. In these situations, the decision to have the pharmacist counsel the patient is generally at the discretion of the physicians or nurse practitioners.[115]

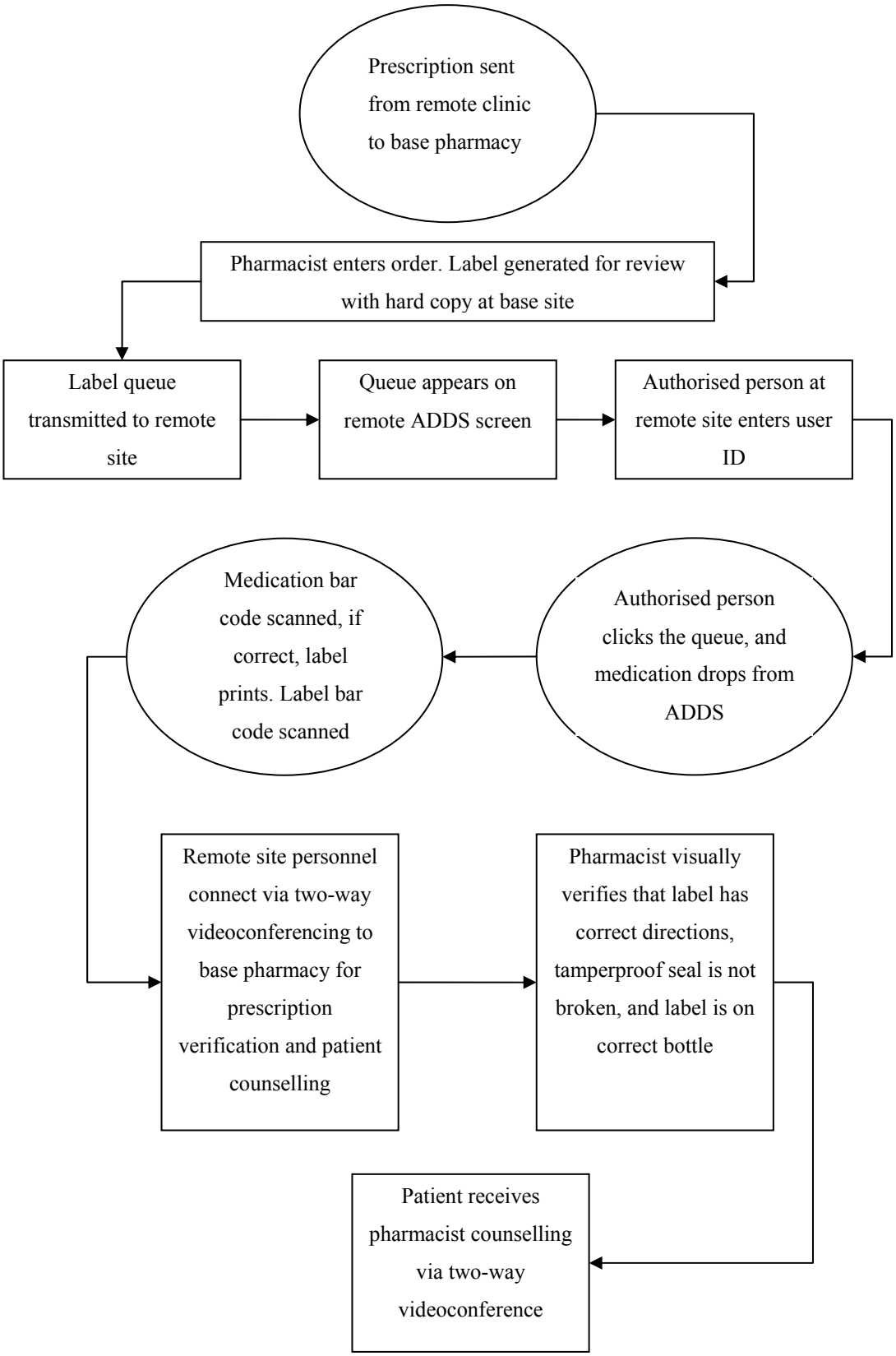

Figure 12: Washington State Telepharmacy - Clifton et al. - Provision of pharmacy services to underserved populations via remote dispensing and two-way videoconferencing.[115]

Other states in the USA have adopted their own models. Nebraska has a dispensing model that delegates prescription processing to non-pharmacist healthcare professionals.[114] Arizona has approved off-site verification of prescriptions, and in other states, such as Minnesota and Iowa, telepharmacy requests are approved on a case-by-case basis. Pilot projects are also under way in other parts of the USA. The Texas Tech University Health Sciences Center[111] is conducting a telepharmacy pilot program providing pharmacy services to the western portion of the state. Since conducting its first telepharmacy consult in September 2002 from Turkey, Texas, by July 2003 there had been more than 390 prescriptions filled in Turkey using the telepharmacy system. The availability of this technology has enhanced the community's timely access to pharmacy services. Prior to telepharmacy, residents had to travel an hour each way to fill prescriptions. In addition to bringing pharmacy services to the community Texas Tech University Health Sciences Center (TTUHSC) School of Pharmacy uses the system as a training tool for its students.[118]

Alaska is conducting a demonstration project that uses remote drug dispensing machines to provide medications to patients in nine rural areas and helps health care workers better track inventory. Participating rural clinics fax prescriptions to the Alaska Native Medical Center (ANMC) in Anchorage, where a pharmacist sends a command via computer to secure drug dispensing machines at the clinics. The system uses bar codes to track which drugs are dispensed, allowing ANMC to monitor who takes what drug and when. The bar coding technology is also claimed to reduce the chance of prescription errors and drug interactions. Each dispensing machine's contents differ.[114]

A study by Keeys et al. described a night time telepharmacy service at Sibley Memorial Hospital in Washington D.C. which commenced in 2001.[119] The services provided included prospective review of medication orders by a pharmacist, drug information and clinical pharmacy consultations under contract. Feedback by hospital staff was mostly favourable and nursing leaders exhibited strong and consistent support for the service. The chief nursing officer noted that prior to the telepharmacy service, night nursing supervisors were expected to provide medication order review and drug information services that would otherwise be performed by pharmacists. Nurses and physicians called the telepharmacy service for drug information questions or to obtain clinical pharmacy consultations.

A system developed by Pharmacy Plus in Bristol UK is an example of the use of video supervision to supervise the sale of medicines and dispensing of prescriptions from a remote site.[120] This system has raised some important issues that are particularly relevant to the Australian situation, since Australia essentially follows the UK in the implementation of pharmacy rules and regulations. The Medicines Act in the UK requires that pharmacy or prescription-only medicines can only be sold or supplied under the supervision of a pharmacist. In the UK the Medicines Act does not specifically state that the

pharmacist has to be physically present in the pharmacy to do this. However, the Medicines Act does require that a pharmacy is under the personal control of a pharmacist when it comes to the sale of medicines. This requirement for personal control is completely separate from that for supervision of the sale and supply of medicines other than general sale list medicines. In spite of this, the Royal Pharmaceutical Society has given the system some cautious support.

The situation in Australia still requires clarification and none of the State or Territory Pharmacy Boards has taken the step of directly addressing distance dispensing under telepharmacy. The following statement by the Pharmaceutical Society (PSA) is essentially silent on the issue of telepharmacy:[121]

> "PSA recognises that distance dispensing is the only practicable alternative where a person does not have access to pharmacy services via reasonable means (e.g. living in a remote or isolated area, or unable to visit a pharmacy through indisposition). Prescriptions dispensed in this manner must comply with all relevant legislation and procedures endorsed by State Pharmacy Boards. Pharmacists have an obligation to do all that is reasonably necessary to make contact by telephone or other means with the client, to counsel and offer information. The consistently high standard and quality of care that pharmacists would normally be expected to deliver must not be compromised".

3.5.2 Telepharmacy in Australia

As mentioned in the introduction, Australia's involvement with remote dispensing dates back to the 1940s. In 1942 the Royal Flying Doctor Service (RFDS) introduced a remote outpost medical chest. A variation of this medical chest is still in use with approximately 50 drugs (including narcotic pain relievers and antibiotics) included. The grey-enamelled chests contain five closely packed trays containing eighty-five items plus a St John's First Aid manual and a simple anatomical chart.[122]

Figure 13: RFDS Medical Chest (1)

Figure 14: RFDS Medical Chest (2)

The anatomical chart enables a caller to describe the location of a pain or injury, while the doctor refers to a copy of the same chart as he listens to the symptoms. The contents of the chest, including bandages and dressings of various types and sizes, hypodermic syringes, a scalpel, dressing scissors, a kidney dish and a catheter, have been chosen to cover the greatest possible number of ailments and injuries with the smallest of items. The contents are under regular review by the RFDS Federal Medical Committee and there have been frequent changes over the years. A numbering system was adopted to prevent mistakes. All the drugs, ointments, powders and other medicaments are numbered, and the rate of change may be judged by numerous breaks in the sequence of numbers. They begin at 5a and then jump to 8,10,15a, 18, and so on up to 107. Whenever an item was dropped from the chests its number was eliminated to avoid confusion. A large clearly-printed chart lists each item by number and then by the tray in which it reposes: A, B, C, D, or Bottom. Articles such as bandages and instruments are named and not numbered. There are approximately 1,300 RFDS medical chests in remote outposts in Australia, including 750 in Queensland.[e] In an emergency, the outpost personnel contact the RFDS and then RFDS medical staff will inform the authorised remote outpost personnel, by telephone or HF radio, which drugs to remove from the chest (using a code number) and how to appropriately administer the drug to the patient.[(79)]

There have been several telepharmacy studies conducted in Australia. An evaluation was undertaken in 2002 to assess the effectiveness of a pilot videophone service in Victoria between a private pharmacy practice in Bairnsdale and a registered pharmacy depot in Omeo. This pilot project was undertaken by the Pharmaceutical Society of Australia with the assistance of the Monash University School of Rural Health, from a grant provided by the Victorian Department of Human Services.[(105)] The overall finding of the evaluation was that the project was successful in demonstrating that pharmacy advice and consultations can be delivered effectively by videophone.

A second study, carried out by Nissen and Tett in Queensland, was less successful. In this study, videophones were again used as a communication tool. Significant technical and logistics difficulties were encountered, but despite these, the pharmacists and other health professionals taking part in the study all felt that telepharmacy had a potential role in activities such as case conferencing, patient counselling, support for new graduates working in rural locations, providing recommendations on over-the-counter medication and distance dispensing.[(75)]

These conclusions were further confirmed by a survey of pharmacists on telepharmacy conducted by Wai Yan Lee in 2005 (see Chapter 4).[(123)] The community pharmacists servicing rural and remote

[e] Personal communication, Sally Mitchell, RFDS Cairns, July 2006.

areas around Australia were generally in favour of using telepharmacy to improve the delivery of healthcare, patient counselling, medication reviews and allowing pharmacies to function as hub sites to service surrounding outlying communities without access to physical pharmacies. Most of the respondents openly expressed their views about telepharmacy. In particular, the group of respondents who serviced rural and remote zones, where there is no access to physical pharmacies, were generally enthusiastic about the prospect of providing pharmaceutical care to remote localities using telepharmacy.

Legitimate issues and concerns were raised about this new approach to pharmacy practice. These included the need for proper regulations and legislation, technology limitations and the costs of implementing and maintaining the system. Other concerns were the time taken for a telepharmacy event, location issues and education and training for pharmacists and other healthcare personnel taking part in telepharmacy activities.

These concerns are not unique to telepharmacy and in other professions, such as physiotherapy, similar concerns have been raised. However, there have also been some considerable successes. An example of one of these successes was a prospective randomised controlled trial conducted by Russell[(99)] in Queensland to assess the treatment efficacy of a physiotherapy telemedicine system. The research model chosen for this study was the rehabilitation of 65 subjects who had undergone total knee replacement surgery. Randomised assigned participants, in either a traditional face-to-face therapy group or a telemedicine rehabilitation group, received treatment over a six-week period. The results of this study demonstrated that the rehabilitation outcomes produced via the telemedicine system were similar to those achieved in the traditional manner. The telemedicine therapy was found to produce greater improvements in a number of functional outcome measurements and a high level of satisfaction was expressed by participants who received treatment via the telemedicine method.

3.5.2.1 The Importance of Pharmacist Involvement

In Lee's 2005 survey a little over 50 per cent of pharmacists currently servicing remote areas indicated that they were interested in using telepharmacy to conduct Home Medication Reviews (HMRs) for rural and remote communities. Since HMRs are a key priority in the Fourth Pharmacy Agreement, this has the potential to provide a significant and important service to rural and remote communities, which would normally require such reviews to be conducted by visiting pharmacists (see flow diagram below).

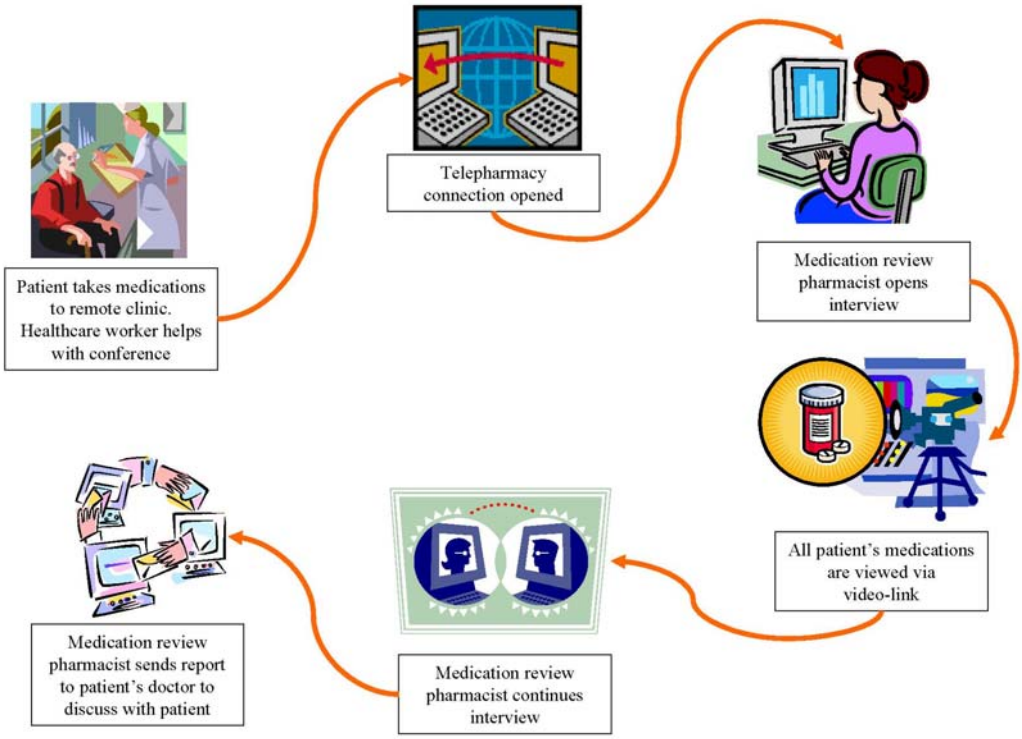

Figure 15: Possible Telepharmacy applications: Medication Reviews via video-link

Whatever model of telepharmacy is implemented it is important that it includes and retains the active role of the pharmacist in the delivery of pharmacy services to achieve the highest quality of care for rural communities and for the protection, safety, and welfare of the public related to the use of pharmaceuticals.[114] Pharmacist involvement is essential for patient counselling and medication reviews. Exclusion of the pharmacist could potentially increase risks to the patient, leading to a higher incidence of medication errors, adverse events, excessive drug costs, and uncontrolled disease. Examples of models that often exclude pharmacists, particularly in providing patient counselling, include Internet pharmacies and models that delegate the pharmacist's duties to other health professionals such as nurses and healthcare workers. Such models are commonly found in rural and remote Australia at present.

A wide range of telepharmacy equipment now exists and this equipment is in daily use in countries such as the USA. Communication links have improved to a level where it is feasible to conduct remote pharmacy operations.

Table 6: Examples of Rural Dispensing Models

Dispensing Stages	United States Rural Telepharmacy Model Examples		Australian Rural Clinic Model (no local pharmacist)
	Washington State	North Dakota	
Prescription	Electronically sent to pharmacist from the rural clinic by Technician	Prescription from rural pharmacy viewed by pharmacist via document camera or telefax	Prescription read by nurse or healthcare worker (HCW) and stored locally
Prescription Entry and Verification	Pharmacist enters details into dispensary system from electronic copy of prescription	Technician enters details into dispensary system. Pharmacist verifies entry via dispensary system	Nurse or HCW enters details into dispensary system or completes manual record
Dispensing Process	Technician activates automatic dispensing system to dispense the prescription	Technician prepares the prescription for dispensing by the pharmacist under the pharmacist's supervision via video link	Nurse or HCW dispenses the prescription
Dispensing Verification	Product bar code is read and the dispensed product is verified by the pharmacist via video link	The dispensed product is verified by the pharmacist via document camera	The prescriber verifies the dispensed product (various procedures)
Patient Counselling	Patient Counselling is conducted by the pharmacist via video link as required	Patient Counselling by the pharmacist via video link as required. *This is when dispensing is deemed to have occurred*	Patient Counselling is conducted by pharmacist via telephone or by prescriber, nurse or HCW as required

3.5.3 Pharmacy Automation

Information technology is employed in a number of applications in pharmacy practice. These applications range from dispensing software solutions to full automation systems.

3.5.3.1 Dispensing software

Computerised dispensing systems are now universally employed throughout Australian pharmacies. These systems maintain a database of patients. On entry of prescription details the system checks for dispensing errors, potential drug interactions and prepares labels according to current regulations. Most dispensing systems also maintain a database on current consumer medication information and allow the pharmacist to print out a patient leaflet as necessary. Based upon a national survey of pharmacists in 2005 WiniFRED seemed to be the most widely used dispensing system with 34.1% respondents using it; other dispensing systems, which were still being commonly used, include Locke (19.5%), Amfac (15.2%), Aquarius/Simple (12.0%) and MINFOS (8.5%).[123] With the exception of Locke, these systems are integrated into the online PBS claiming system and allow pharmacies to submit a claim to Medicare Australia each time a PBS/RPBS medicine is dispensed.[124]

3.5.3.2 Dispensing equipment

The invention and production of automated dispensing machines in the United States in the 1980's brought hopes of reduced rates of medication errors, increased efficiency for pharmacy and nursing staff, ready availability of medications where they are most often used (the nursing unit or inpatient ward), and improved pharmacy inventory and billing functions.[125]

3.5.3.3 Features of Automatic Dispensing Machines

Automated dispensing machines are drug storage devices or cabinets that electronically dispense medications in a controlled fashion and track medication use. The machine's principal advantage lies in permitting technicians and nurses to obtain medications for patients at the point of use. Most systems include security measures that require user identification and passwords. In hospital settings, internal electronic devices track nurses accessing the system, track the patients for whom medications are administered, and provide usage data to the hospital's financial office for the patients' bills. Re-

stocking of these automated dispensing systems can be by centralised or decentralised pharmacies, or in some case, by authorised contractors. In a hospital setting, centralised pharmacies prepare and distribute medications from a central location; decentralised pharmacies reside on nursing units or wards, with a single decentralized pharmacy often serving several units or wards and usually receiving their medication stock and supplies from the hospital's central pharmacy. More advanced systems provide additional information support aimed at enhancing patient safety through integration into other external systems, databases, and the Internet. Some models use machine-readable code for medication dispensing and administration. There are three distinct groups of automated dispensers available:

- Unit dose repacking systems for inpatient and outpatient dispensing, the latter being used by some specialist units (e.g., psychiatry) to promote compliance;
- Ward-based automated dispensers which can have a dual role of giving a high degree of security as well as aiming to reduce the risks of medication administration errors;
- Pharmacy-based original pack dispensers, some of which are also used for ward stock box picking.[126]

In all of the automated systems, the stock database and mechanical movements are governed by software which normally sits on a separate, dedicated computer. The stock levels of the system database can be interrogated to determine the presence and quantity of items stocked and the stock location points. The pharmacy's inventory control system is usually connected to the automated dispensing system through an interface that allows the pharmacist to control the dispensing process. Once a product is selected, packs are usually transferred to the requesting station by some sort of transport system. Depending on the layout of the pharmacy involved, a combination of mechanised conveyors and gravity feed chutes may be used. Conveyors may include "dropoff" arms, which direct travelling packs to a particular delivery chute. Software controlling the conveyors may reside on the same PC as the main system or be managed separately.[126] In the United States a number of these type of units have been adapted for remote operations.[115]

Freeborn commented in the British Hospital Pharmacist Journal in 2000, that the role of comprehensive "near patient" pharmacy service will eventually need some help from new technologies such as automated dispensing in order for this role to be successful.[127] Automated dispensing devices have become increasingly common in hospitals in the United States to either supplement or replace unit-dose distribution systems in an attempt to improve medication availability, increase the efficiency of drug dispensing and billing, and reduce errors.[125] A national survey of drug dispensing and administration practices indicated that 38 per cent of responding hospitals used

automated medication dispensing units and 8.2 per cent used machine-readable coding with dispensing.[128] Approximately seventy five per cent of respondents stated that their pharmacy was centralised and of these centralised pharmacies, 77 per cent were not automated. Hospitals that did have automated centralised pharmacies reported that greater than 50 per cent of their inpatient doses were dispensed via automated systems. Half of all responding hospitals used a decentralised medication storage system. One-third of hospitals with automated storage and dispensing systems were linked to the pharmacy computer. Importantly, about half of the surveyed hospitals reported drug distributions that bypassed the pharmacy including floor stock, borrowing patients' medications, and hidden drug supplies. Telepharmacy is spreading in community settings in the USA and it has been noted that few states in the USA prohibit the practice of pharmacy with data, voice and video links and many pharmacy boards see technology as a powerful boost.[129, 130]

Experience at the Wirral Hospital Trust in the United Kingdom, indicates that the introduction of automated dispensing equipment reduced dispensing error rates from 15.7 to 7.7 per 100,000 items dispensed.[131] Fitzpatrick further commented in an article in the Hospital Pharmacist that staff time released from dispensing due to the introduction of automation can then be used to deliver more patient-centred activities.[132] A 2005 report in Hospital Pharmacy indicated that automation will shape the future of hospital pharmacy and there are now more than 50 hospitals in the UK with automated dispensing systems and a further 30 are planning to implement automated systems in the near future.[133]

In Australia, the few hospitals that use automation employ a combination of unit dose and original pack dispensing. An evaluation of automated drug distribution system in an Australian teaching hospital by Martin et al. identified the potential benefits to pharmacists of using such equipment, amongst others, as the ability to make use of pharmacy technicians rather than pharmacists, thus allowing pharmacists to spend more time in clinical involvement and review of medication.[134, 135]

Information supplied by the suppliers of the Pyxis® range of equipment[f] indicated that there were only seven hospital sites using Pyxis® automated equipment in Australia. These sites have 91 Med Units installed and 66 supply units. The only rural location to have these units installed is Townsville General Hospital with 27 units, including 13 main ward units.

There is little information listing automated dispensing units installed in commercial use in community pharmacy in Australia, although several suppliers of automated dispensing equipment

[f] Email communication, 7th April 2004, S. Feeley, Pyxis Corp

have website presences or agents listed in Australia. The Business Review Weekly (BRW) reported a trial using a prototype machine in Victoria in 2006.[136] This article also reported that the Pharmacy Guild believed that "pharmacists are opposed to the concept of dispensing medicine by machine". Chapters 4 and 6 further discuss the opinions of pharmacists on automation and telepharmacy.

A by-product benefit of telepharmacy is its application in education and training. An innovative training model has been reported for the training of pharmacy students in telepharmacy in Texas USA. The reasons for implementing this model are stated as follows:

- To establish a pharmacy model utilizing technology in rural areas that would demonstrate that distance need not impair the pharmacist's ability to deliver pharmaceutical care and products; such a model that demonstrates implementing pharmaceutical care in rural areas through telecommunications technology would be appealing to a pharmacy student as a clerkship training site.
- To prepare pharmacy students for expanded roles in community pharmacy practice implementing concepts of remote dispensing.
- To highlight business aspects of a functioning telepharmacy system between an independent pharmacy and a rural health clinic.
- To clarify the acceptability of remote faculty supervision to accrediting bodies and regulatory compliance agencies.[137]

3.6 Chapter summary

Telepharmacy is the use of various technologies to deliver a range of pharmacy services over distance. Among its many applications is the ability to deliver pharmacy services to isolated and remote patients, reduce professional isolation, assist in the delivery of education resources, decrease unnecessary referrals and establish pharmacy networks that enhance the quality of pharmaceutical services to rural and remote areas.

Despite the long history of remote access to medical aid in Australia, dating back to the 1940s with the introduction of the outpost medical chests by the RFDS, there has been little uptake of more advanced telepharmacy applications. Where telepharmacy applications are used, such as the RFDS medicine chest, this typically does not involve pharmacists in rural and remote areas in Australia.

The Pharmacy Boards of the States and Territories have restrictive rules which preclude the practice of pharmacy without the physical presence of a pharmacist. The result of these rules is that pharmacy services in many rural and remote areas of Australia have been delegated to healthcare personnel such as nurses and healthcare workers.

Over the past few decades, hospitals in the US and continental Europe have migrated towards unit dose dispensing and automation has become an integral part of this form of supply. In contrast, hospitals in the UK have opted for original pack dispensing, a system that requires a different type of machine.[126] In Australia, the few hospitals that use automation employ a combination of unit dose and original pack dispensing.

In a comment to the Journal of Pharmacy Practice and Research in 2005, Bohr stated that "pharmacists should play a greater and more assertive role in health information technology by becoming the champions of electronic medicine management systems".[138] Unfortunately, unless pharmacists become more proactive in this regard, it is likely that other health professionals will take over this role. For example, a National Health Call Centre Network is due to be established which will give callers round-the-clock access to qualified nurses who will assess symptoms over the phone using clinical decision making software.[139] It is important that pharmacists are involved in such a Call Centre so that medication related issues are referred to pharmacists rather than allowing requests for medicine information to be answered by nurses who are not trained to handle such queries.

Automation is virgin territory in community pharmacy in Australia. The experience gained from telemedicine applications has yet to be translated into telepharmacy initiatives in Australia. As noted by Reed, "telemedicine complements existing healthcare networks by bringing services to those who might otherwise not receive care".[140]

The following chapter details preliminary research undertaken to discover the applicability of automation and telemedicine in Australia.

Chapter 4 Field Studies

Preliminary investigations into areas with a perceived need for additional pharmaceutical care were undertaken. Field studies were conducted in three rural and remote areas of Australia. These areas included Far North Queensland, the Tiwi Islands, and western Tasmania. These preliminary investigations raised a number of very useful issues including the need for an assessment of stakeholder support for telepharmacy, additional training systems, and associated support issues.

For a variety of reasons, discussed below, investigation into these areas was discontinued; however, the issues raised provided a foundation for later research and so a brief explanation of each is provided.

4.1 Far North Queensland

Informal discussions conducted in Far North Queensland (Cape York Peninsula) during 2003 indicated that:

- Nurses dispensed medications, without any supervision by pharmacists, under delegated orders by medical practitioners.
- A pharmacist at Cairns Base Hospital was theoretically available, but there appeared to be little formal consultation.
- There was no formal Medication Review program for patients at risk.
- DAAs were well regarded, but logistical difficulties made their use problematic.
- The staff were familiar with the use of video conferencing and most clinics were part of the Networking North Queensland program.

Whilst there was no indication that there were any irregularities in the supply of medications through these clinics, it appeared that there was little input into use of medications by pharmacists and this area should be addressed if quality pharmaceutical services were to be made available to all Australians.

It is likely that the Quality Use of Medicines strategy of ensuring that medicines are used judiciously, appropriately, safely and efficaciously cannot be implemented if the supply of medicines to patients does not include the input of a pharmacist.

Figure 16: Cape York Peninsula Clinic and Dispensary - no pharmacist available.

4.2 Tiwi Island Health Board and Birdsville

A preliminary visit was undertaken to the Tiwi Islands in July 2003 with the purpose of exploring the possibility of undertaking research studies on the Tiwi Islands. The Tiwi Islands are situated north of Darwin, Northern Territory, Australia. There are four clinics on the Tiwi Islands serving a population of approximately 2,500 people. The Tiwi Islands Local Government oversees the management of all communities on the Tiwi Islands. Four Community Management Boards, representing Nguiu, Pirlangimpi, Milikapiti and Wurankuwu, advise the Tiwi Islands Local Government about the running of their communities. Each community has a clinic. The two major clinics at Bathurst Island (Nguiu) and Mitchell Island (Pirlangimpi) were visited. Discussions were held with the senior medical practitioner on Bathurst Island (Dr Penny Roberts-Thomson), consultant pharmacist (Mr Rollo Manning) and a senior Aboriginal Health Worker (Ms Linda Pupangamirri), involved in dispensing and preparation of Webster packs at Nguiu Pharmacy (Bathurst Island) and other Aboriginal Health Workers and a RN. Thereafter discussions were held with the CEO of the Tiwi Health Board (Mr Bill Barclay) at the head office in Darwin.

The result of these meetings was the definition of a research project on the Tiwi Islands which would involve:

1. The identification of the training needs for healthcare professionals, working in rural clinics, where there is no pharmacist available and who provide pharmaceutical services to the local population;

2. Conduct focus groups of patients and healthcare workers to determine the level of patient compliance in taking their medication as well as customer satisfaction with the level of service they are receiving.
3. Conduct a survey of existing training courses in pharmaceutical services available which would be suitable for rural healthcare workers.
4. Conduct a gap analysis – competencies in existing training courses versus required competencies identified in the survey of training needs and procedures.
5. Propose or develop training courses for these healthcare workers.
6. Propose solutions to deficiencies (if any) identified in procedures and work practices in the provision of pharmaceutical services:
    - Quality Control/Assurance.
    - Automation of work procedures.
    - Medicine information services.
    - Pharmacist counselling services – personal, telephone or video conferencing.
    - Provision of training.

The proposal also included the provision for developing a recognised training and assessment program for pharmacy technicians working in rural and remote Indigenous communities, authorised by the appropriate health authority (the Tiwi Health Board in the case of the Tiwi Islands) and then the training delivered to the dispensing staff. The surveys and focus group interviews were to be repeated 6 to 12 months after the identified changes were implemented and training completed to determine the effectiveness of the changes.

A research proposal was subsequently submitted to the James Cook University Human Ethics Committee requesting approval to conduct the research as detailed above. Approval to conduct the research was received in August 2003 from the Tiwi Health Board. See Appendix A.

During the period of August to November 2003, the situation regarding pharmacy assistant training in Australia was investigated.

4.2.1 Pharmacy Assistant training programs - the Australian Qualifications Framework

The Tiwi Islands project had, as one of its key objectives, the development of an Indigenous pharmacy assistant training programme which would be a nationally accredited qualification. This qualification

was to be specifically tailored to the needs of rural and remote communities such as the Tiwi Islands. Experience in a Victorian private hospital has indicated that, in recent years, pharmacy technicians have increased their administrative and clinical roles and that with adequate training and supervision pharmacy technicians are capable of undertaking many of the routine tasks currently performed by pharmacists, allowing pharmacists to concentrate on their clinical role.[141]

The Australian Qualifications Framework (AQF)[142] is a national framework for all education and training qualifications in Australia. There are twelve qualifications in the AQF. Six of these are relevant to the Vocational Education and Training (VET) sector. The twelve qualifications are listed in the following table.

Table 7: The Australian Qualifications Framework (AQF)

Schools Sector	VET Sector	Higher Education Sector
		Doctoral Degree
		Masters Degree
		Graduate Diploma
		Graduate Certificate
		Bachelor Degree
	Advanced Diploma	Advanced Diploma
	Diploma	Diploma
	Certificate IV	
	Certificate III	
	Certificate II	
	Certificate I	
Senior secondary certificate		

Other than the program for Rural and Isolated Practice Registered Nurses[77] discussed in Chapter 2, there were no formal training programs for healthcare workers involved in the supply of pharmaceuticals in rural and remote areas where there is no physical pharmacy.

The AQF ensures national consistency for all vocational education and training areas in the VET sector, therefore it is highly desirable that any course considered for the training of pharmacy assistants be part of the AQF.

There are two Training Packages listed under the AQF for the training of pharmacy assistants. The term “Training Package” is a misnomer, since the Training Package lists the Units of Competency, and the packaging rules for each qualification. The Units of Competency includes a Unit descriptor,

which briefly describes what the unit is about, a list of Elements that comprise the Unit of Competency and the Performance Criteria for each Element. There is also a Range Statement that provides advice on how to interpret the scope and context of the unit of competence and an Evidence Guide which identifies the critical aspects, underpinning knowledge and skills to be demonstrated to confirm competence. The Training Package does not, however, include any training materials and therefore, if they are not available from a commercial or government source, they must be developed for each Unit of Competence.

The first of the Training Packages available for pharmacy assistants is the WRP02 Community Pharmacy Training Package.[143] Training materials for this Training Package are available from the Pharmacy Guild on a commercial basis.

There are four Certificates in Community Pharmacy. Certificate I in Community Pharmacy is designed to reflect the role of entry level employees working in the Pharmacy Industry under constant supervision. This qualification recognises the small business nature of the industry and the need for multi-skilling. The breadth, depth and complexity of knowledge and skills would prepare a person to perform a range of varied activities or knowledge applications where there is a clearly defined range of contexts in which the choice of action required is usually clear and there is limited complexity in the range of options to be applied. To achieve the Certificate I in Community Pharmacy, learners are required to complete all eight (8) Core units of competency, which are "Meet and greet pharmacy customers", "Accept prescriptions for dispensing", "Work effectively within the pharmacy industry", "Apply point of sale handling procedures", "Perform routine housekeeping duties", "Apply safe working practices" , "Minimise theft" and "Operate retail equipment". The Certificate II in Community Pharmacy is designed to reflect the role of employees who work with some degree of autonomy within a defined range of skilled operations, usually within a range of broader related activities involving known routines, methods and procedures, where some discretion and judgment is required. To achieve a Certificate II in Community Pharmacy learners must complete 26 competencies comprised of 23 Core Units of competency and 3 Elective Units.

The Certificate III in Community Pharmacy is designed to reflect the role of employees who operate independently with limited supervision within a broad range of varied contexts that may be complex and non-routine. This qualification provides the opportunity to specialise in a range of areas in the pharmacy under the supervision of the pharmacist in the provision of advice or recommendations to patients on medicines and medicinal products. The entry requirement for the Certificate III in Community Pharmacy is completion of the 23 core units of Certificate II in Community Pharmacy. To achieve a Certificate III in Community Pharmacy, 12 competencies must be completed.

The Certificate IV in Community Pharmacy is designed to reflect the role of employees who require breadth, depth and complexity in planning and initiating alternative approaches to skill or knowledge applications across a broad range of management requirements, evaluation and co-ordination. It incorporates self-directed application of knowledge and skills, with substantial depth in some areas where judgment is required such as planning and selecting appropriate staff, training staff, merchandising, recommending/providing products and services and equipment for self and others. Within the context of the Community Pharmacy industry, advice and information about medicines and medicinal products is provided to patients under the supervision of the pharmacist. The completion of the three core units of Certificate III in Community Pharmacy is a pre-requisite for Certificate IV in Community Pharmacy. To achieve a Certificate IV in Community Pharmacy 12 competencies must be completed.

Many of the available training programs from the Pharmacy Guild are not suitable for rural healthcare workers because they are focussed on training assistants in community pharmacies. However, some of these units could be adapted to meet the needs of rural healthcare workers, particularly since the Pharmacy Guild has developed many of the training materials.

The second Training Package, and the closest training program that would meet the needs of the needs of rural healthcare workers is the Certificate III in Health Service Assistance (Hospital/Community Health Pharmacy Assistance) HLT31402. This qualification covers workers who provide a range of varied assistance tasks to pharmacists in hospital and community health settings, and the common occupational title is pharmacy assistant. This qualification is not applicable to retail pharmacy workers. The Certificate III in Health Service Assistance (Hospital/Community Health Pharmacy Assistance) comprises 15 compulsory units.

In the case of the HLT31402 Certificate III, the only training unit that would not be directly suitable for rural healthcare workers is the Small scale compound/ manufacture pharmaceutical products. The unit “Assist with prescription preparation” is only partly applicable and would require modification.

The Pharmacy Board of Victoria states that Pharmacists may employ persons as dispensary assistants / hospital pharmacy technicians only if they have satisfactorily completed a course for dispensary assistants / hospital pharmacy technicians in their chosen area of practice (e.g. hospital or community pharmacy).[144] The courses approved by the Board are the above two courses above (WRP02 Community Pharmacy Training Package, Certificate III in Community Pharmacy (Dispensary) and

HLT31402 Certificate III and in Health Service Assistance (Hospital/Community Health Pharmacy Assistance).

4.2.2 Training of Indigenous Pharmacy Assistants

The Kelaher et al. report on the Evaluation of PBS medicine supply arrangements for Remote Area Aboriginal Health Services[67] stated that the level of dispensary training that Aboriginal health workers (AHW) received varied between States and Territories. AHW training in NT, NSW, SA and WA had some pharmacy components, limited to one or two modules at more advanced levels (III and IV) of AHW training. The report noted that training Units in supplying medicine need to be included in AHW training, and that pharmacy subjects should be established as a specialist area in AHW training throughout Australia. It was widely agreed that more in-service training was needed for AHWs to overcome the current lack of formal pharmacy training.

A number of Aboriginal and Torres Strait Islander Health Services (ATSIHS) have developed training initiatives for their health workers. Walgett Regional Aboriginal Medical Service (WAMS) have undertaken specific pharmacy technician training. The ATSIHS and the pharmacist currently fund this training. ATSIHWs believed that funding should be provided for all ATSIHSs to train AHWs in pharmacy and that S100 funds should be used to subsidise education and training. The report noted that the Tiwi Health Board believed that appropriate and recognised Aboriginal pharmacy technician training courses should be developed. In ATSIHSs in NT, senior AHWs had the same role as RNs in the pharmacy, with both supplying pharmaceuticals in conjunction with the requirements of the CARPA Standard Treatment Manual. A respondent from the Tiwi Health Board to the authors of the report stated that having local Tiwi people involved in the dispensary ensured much better feedback and increased not just adherence but overall quality management.

4.2.3 Implications for training Pharmacy Assistants on the Tiwi Islands

After discussions with the consultant to the Tiwi Health Board, it was decided that additional training units covering rural operations, including the operation of telepharmacy video conferencing systems and the preparation of patient unit dose packages (DAAs commonly referred to as Dosett or Webster packs, discussed in Chapter 2) were required.

A principal requirement of the project was that training should be nationally recognised. Since there were no Registered Training Organisations in the Northern Territory authorised to deliver the Certificate III in Health Service Assistance (Hospital/Community Health Pharmacy Assistance), it was agreed that such a training program would be established.

As a result a Registered Training Organisation (RTO), called HealthStar Training Network was created by the researcher in 2003 and was subsequently awarded registration as an RTO in December 2003 (Provider Number 30988) and authorised to deliver a nationally accredited Certificate III in Health Service Assistance (Hospital/Community Health Pharmacy Assistance).

Unfortunately the Tiwi Health Board was placed under administration in December 2003 and all research was cancelled. Subsequently the Tiwi Islands project was abandoned.

4.3 The Birdsville Project

The Shire of Diamantina's population is 315, of whom 109 live within the township of Birdsville and 100 in Bedourie. However, during the main tourist season (April to October) the population of Birdsville swells with over 35,000 people who travel through the Shire to experience the "Birdsville Track" and the "Birdsville Races". This migration puts enormous pressure on the infra- structure and facilities in the town. Many of these visitors have not experienced the remoteness of inland Australia and are ill-prepared when travelling in the area.

4.3.1 Health Services

A nursing service was begun in Birdsville in 1923 by the Australian Inland Mission with the original hospital located 200m from the current site.[145] The original clinic was built in 1953 and was home to two remote area registered nurses. During the dry season only one RN services the health needs of the community. The Birdsville Clinic has video conferencing facilities but little else in the way of telemedicine. There is currently no mobile phone coverage in the Shire. With the anticipated growth rate and the huge increase in Birdsville's population during the dry season there is demonstrated need to provide pharmacy services to the existing and transient communities of Birdsville and Bedourie. The nearest available pharmacies, excluding the flying doctor chest and basic stocks held at the Clinic are Port Augusta (800 km), Charleville (850 km), Longreach (700 km) or Mt Isa (700 km).

The project for the Health Centre originally proposed that the establishment of a pharmacy in Birdsville would provide an ideal opportunity to:

- establish a telepharmacy service, which would allow a pharmacist to be employed during the busy tourist season (winter months) and
- remote supervision by a pharmacist situated in a major centre such as Mt Isa during the summer months.

Although a new medical clinic in Birdsville was completed in September 2005, funding did not permit the incorporation of the two above objectives into the project. However, the Mayor of the Diamantina Shire Council foreshadowed future funding requests at the opening of the medical centre by the federal Minister for Local Government and the project may well proceed in the future when funding is available.[146]

4.4 West Coast Tasmania Study

4.4.1 Project Rationale

As detailed in Chapter 2, pharmacy workforce reports show that there is likely to be a shortage of pharmacists in Australia for some time. This shortage is most acute in rural and remote areas, with many of these communities throughout Australia characterised by a lack of access to a pharmacist, due to the difficulties of recruiting pharmacists to these areas. There is a desperate need for innovative means of delivering pharmaceutical care and promoting the quality use of medicines by people living in rural and remote parts of Australia. The application of information and communication technology (ICT) represents an innovative and cost-effective solution.

4.4.2 Project Outline

The key aim of this project was to provide remote rural and regional communities with access to Pharmaceutical services via broadband technology. The project's goals were defined as:

- Develop and test a product that allows pharmacists and patients at geographically disparate locations to communicate via a live video feed, and dispense medications without the need for in-person face-to-face contact.

- Develop the technology to facilitate a seamless interaction between pharmacist and the remote patient.
- Deliver training from the Launceston General Hospital and the University of Tasmania to remote and rural locations.
- Evaluate the effectiveness of broadband in delivering pharmacy services to remote communities.
- Evaluate the impact on the workflow of pharmacists dispensing to patients at a remote location.

A large number of rural and regional communities are unable to attract qualified pharmacists and other primary health care professionals, and therefore suffer from the inability to receive first-rate medical services. Through the use of broadband, this project planned to deliver pharmacy services to these communities. Secondly, the opportunity to deliver training to pharmacists and students at the remote locations was also a planned outcome of this project.

For the purposes of a trial, the project team identified Queenstown on Tasmania's West Coast as the trial site. Queenstown was to be the key pharmacy in the region, servicing towns such as Strahan and Zeehan via the remote dispensing technology. In addition to this, training was to be delivered from the University and LGH to pharmacists at the Queenstown Medical Union Pharmacy, and potentially Strahan.

A field trip was undertaken during June 2004 and a number of key opinion leaders were interviewed on their views regarding the remote dispensing project. These interviews appear in Appendix E. Unfortunately due to unforeseen circumstances the West Coast Tasmania project plans were modified. As a result the main outcome of the project eventuated as a National Survey of Pharmacists' Knowledge of and Attitudes towards Telepharmacy conducted by Lee.[123]

4.5 Survey of Pharmacists on Telepharmacy

A total sample of 516 pharmacies in rural and remote areas across Australia with PhARIA (Accessibility and Remoteness Index of Australia) number ranging from 3 to 6 were chosen to be included in the national survey conducted by Lee in 2005. The list of these pharmacies was obtained by permission from the Pharmacy Guild of Australia (PGA). The pharmacies were randomly selected from the PGA's database of rural pharmacies. The pharmacies selected for this survey were quite

evenly distributed throughout all the States and Territories in Australia to minimise any possibility of obtaining biased results from the survey. Lee reported that out of the 516 surveys sent out, 169 forms were returned.

Of the surveys returned a total of 165 (response rate of 32 per cent) questionnaires were analysed with an overall consensus in favour of telepharmacy, with 73 per cent of respondents agreeing that telepharmacy could potentially improve provision of healthcare in rural and remote areas by pharmacists. Respondents, particularly who were servicing outlying communities with no access to physical pharmacies, expressed strong interest to use telepharmacy capabilities to deliver pharmaceutical care to the rural and remote community. In addition a little more than 50 per cent of respondents currently servicing remote areas were interested in using telepharmacy capabilities to conduct Home Medication Reviews (HMRs) for the rural and remote community, as opposed to only 15 per cent of respondents not servicing these areas who expressed interest. A majority (67 per cent) of respondents thought that pharmacies using telepharmacy could act as hub sites to service adjacent remote areas, while a high 85 per cent of respondents strongly agreed that using telepharmacy would be a better option compared to Internet and mail order pharmacies. However, Lee noted that results obtained from the survey could be slightly biased due to the possibility that many respondents were already familiar with telepharmacy.

Respondents also raised some concerns about key issues relating to the use of telepharmacy in rural and remote pharmacy practice. The main concerns mentioned were:

- regulations and legislation,
- time constraints,
- high costs,
- education and training,
- technology limitations and
- location.

Lee concluded that despite the limitations of telepharmacy, there is still potential for incorporating telepharmacy into rural and remote pharmacy practice in Australia. There are areas of improvement for the system to work safely, effectively and efficiently. From the survey, Lee made some recommendations, which included:

- a panel of mentors to regulate the system,

- guidelines to practice with telepharmacy capabilities,
- proper legislation and liability,
- government subsidy and
- an education and training program for patients, pharmacists and other health practitioners.

4.6 Chapter Summary

The Tiwi Islands project included the provision for developing a recognised training and assessment program for pharmacy technicians, working in rural and remote Indigenous communities. Accordingly an extensive review of the available pharmacy assistant training programmes indicated that the two recognised nationally accredited training packages, the first developed by the Pharmacy Guild for community pharmacy and the second by Community Services and Health Training Australia were only partially suitable for the training of rural and remote pharmacy assistants. In order to provide a recognised Certificate level qualification to pharmacy assistants, a requirement of the Tiwi Pharmacy Board, at least two additional Units would have to be developed, particularly if telepharmacy training were to be included in the qualification. Unfortunately the placing of the Tiwi Health Board into administration halted any further research on the Tiwi Islands. The Birdsville project also did not eventuate because the new Health Clinic did not include the pharmacy that was originally proposed for the project. The Tiwi Island project did, however, provide much useful information on the requirements and specifications for a rural Australia telepharmacy model (see Chapter 6) and insight into the training requirements for rural and remote pharmacy assistants.

The West Coast of Tasmania project's first goal was to develop and test a product that allows pharmacists and patients at geographically disparate locations to communicate via a live video feed, and dispense medications without the need for in-person face-to-face contact. The second goal was to develop the technology to facilitate a seamless interaction between pharmacist and the remote patient and the third goal was to deliver training from the Launceston General Hospital and the University of Tasmania to remote and rural locations. The fourth goal was to evaluate the effectiveness of broadband in delivering pharmacy services to remote communities and the final goal was to evaluate the impact on the workflow of pharmacists dispensing to patients at a remote location. As part of this project, a national survey of pharmacists was conducted to ascertain the knowledge of and attitudes to the concept of telepharmacy.

Although this project also did not proceed to completion, much useful technical information was gained on video conferencing from project partner, Telstra, and on dispensing software from another project partner, Phoenix Software.

The results from the national survey of pharmacists provided an excellent insight into the positive attitudes of pharmacists towards telepharmacy, particularly in the areas of the provision of pharmaceutical information and the conducting of medication reviews via video conferencing.

The preliminary field studies undertaken in Queensland, the Tiwi Islands and western Tasmania revealed the necessity for further analysis of health care providers' attitudinal responses to the possibilities of telepharmacy and therefore the possible uptake of technology. Accordingly, the three following Chapters in this thesis originate from the information gained from the above projects.

Chapter 5 Professional Opinions on Telepharmacy

5.1 Introduction

The field studies carried out on the Tiwi Islands, in Queensland and in Tasmania indicated that there was a wide range of opinions regarding the applicability of telepharmacy to Australian conditions. A more definitive research programme was necessary to establish the opinions of the key stakeholders; pharmacists, medical practitioners and nurses/healthcare workers, preferably those working in rural areas of Australia. The following chapter details research into the opinions of healthcare professionals on the concepts of telepharmacy.

The following methods of data collection are applicable for social science (in this case pharmacy practice) research investigations:[147]

1. The examination of published literature.
2. Semi structured face to face interviews with key participants.
3. Postal questionnaires for self completion by participants.
4. Direct observation.
5. Formation of focus groups.

Surveys on the Internet are another method that has become easier over the past few years and this communication medium allows surveys to be conducted through self-administered questionnaires and data can be collected electronically.[148] This methodology was used for the survey of Nurses and Healthcare workers detailed in the following section. It has been suggested that the future use of e-mail surveys in selected circumstances is promising, because the majority of physicians have Internet access and acknowledged interest in participating in e-mail surveys.[149]

The examination of published literature was undertaken and this is detailed in the previous Chapters. Semi structured face to face interviews were conducted with pharmacists, medical practitioners and nurses/healthcare workers on the Tiwi Islands, northern Queensland and Tasmania. The opinions were quite disparate and in some cases non intuitive. For instance, a pharmacist in rural Tasmania was so opposed to the notion of remote video supervision of a remotely located nurse that she refused to even entertain the notion of participating in a telepharmacy trial. A nurse in remote northern Queensland was of the opinion that telepharmacy was essentially a waste of time as she was quite capable of

dispensing medicines and answering any questions her patients may have on those medicines. It should be noted, however, that in the case of the Tasmanian pharmacist, she had less than two years of post qualification experience and had yet to build up her confidence in her professional abilities. In the case of the remote northern Queensland nurse, she was a highly experienced Rural and Isolated Practice Registered Nurse (RIPRN) with an abundance of professional confidence.

The rural medical practitioners interviewed were supportive of telepharmacy and were only wary of the remote dispensing automation concepts, mainly because of the sophistication of the technology. The general opinion of medical practitioners interviewed was that any increment in the quality of service to rural and remote populations could only be an advantage.

The third method of data collection, that of using questionnaires, was the method employed to gather the opinions of the key stakeholders. The principal advantage of the postal questionnaire method is the ability to collect large amounts of data at minimal cost. This is especially true when the sample population is widely dispersed geographically, as it is in northern Australia. The other advantages of questionnaires are:[147]

- All respondents complete the questionnaire at approximately the same time. This prevents any distortion of the results due to the passage of time, which can occur when many people are interviewed by a small number of interviewers.
- The questionnaire is impersonal. That is, there can be no observer bias, provided that the questions are structured in as unbiased a way as possible and are unambiguous.
- It is possible for the questionnaire to be filled at the recipient's convenience. If the recipient is busy, they have the opportunity to complete it when it is suitable for them.
- All respondents have exactly the same questions, in the same order, using the same words. This is unlikely to be the case in an interview where interviews can anticipate questions and supply answers in advance of a set question. In addition, an interview format can lead to the interviewee offering responses which they feel may “please” the interviewer rather than the most honest or objective response.
- Questions can be either open ended or closed ended. Open ended questions leave space for the recipient to write a reply, whereas closed questions require the respondent to select one or more responses. It is possible to combine the two types of questions by giving a series of responses but leaving space for comment if the respondent finds the available responses inappropriate.

- Questionnaires can be designed for recipients to fill in within a very short period of time. The questions can be designed so that the recipient has only to circle or tick a response and in some cases is not required to give any qualitative information.

Closed questions can be designed to answer questions based on extent, strength or conviction of an emotion or feeling. Closed questions can also be used to rank a list of variables in order of importance or occurrence by the respondent. It is often more important to create closed questions and divide people along an imaginary line rather than capture every nuance of opinion. This facilitates the analysis of results, as the population of respondents can be separated into distinct, heterogeneous groups.

Open ended questions allow respondents to qualify their answers and give reasons for their views. However, although open ended questions are harder to analyse they can be important when dealing with beliefs. Some analysis is possible by content analysis, where the number of times a particular point is made is counted. As a rule, closed questions are used when the alternative replies are known, limited in number, and clear cut. Open-ended questions are particularly suitable for complex issues where the range of replies is not known. Open-ended questions inevitably use more space and make the questionnaire less appealing to recipients. However, they can be useful in pilot studies for collecting a full range of views or opinions.

Questionnaires suffer from a number of disadvantages. These are:

- The danger of a poor response rate through the indiscriminate use of questionnaires. It is important to explain to the recipient in a covering letter or on the questionnaire the nature of the study and reasons it is considered important to the researcher. It is also useful to describe the context in which the results of the study will be used and positive effects it may have for either the researcher or recipient. Many questionnaires ascertain information of a sensitive nature from the recipient and it is important to stress that the confidentiality of respondents will be ensured and no individual respondent identified.
- Poor response rates can drastically reduce the validity of results, as can a sample of respondents who are not representative of their population. The validity of data must be questioned when either only a few responses have been obtained, or when only a small percentage of the sampled population has responded. For the results of a survey to be useful, the numbers involved should be relatively large and should represent a large proportion of the total sample.

- It is difficult to ask in-depth questions, as this risks an increase in non-response due to complexity and a greater amount of time needed to complete the questionnaire. This can lead to a lack of detailed information in the results.
- There is always the possibility of people marking the wrong box accidentally. It seems likely that this constitutes only a small source of error in a well laid out questionnaire.
- Completing a questionnaire requires the recipient's time without providing any immediate benefit. The researcher can however, stress potential long-term benefits for the recipients as mentioned above.
- There is a need to translate shorter technical language into longer everyday speech, which all recipients can understand. This reduces the number of questions that can be asked, or increases the length of the questionnaire, with the attendant risk of a discouraging response.
- There is a high degree of self selection in response. That is, recipients who have strong feelings about the subject of the questionnaire are more likely to respond than are recipients who are indifferent to the subject.
- The greatest problem of surveys is undoubtedly that of non response. This phenomenon varies with the sample population, depending on factors such as the literacy of the population and the level of interest in the subject around which the survey is based. Response rates are also influenced by the design of the questionnaire, its appearance and the text of the accompanying letter. The inclusion of a reply envelope is essential and sending a second mailing to non responders if possible will also serve to increase the response rate.[150]

The survey questionnaires in this thesis were used to ascertain the opinions or responses of the key professional stakeholders. The surveys of pharmacists and medical practitioners employed the use of postal questionnaires. Because of the difficulty in obtaining a suitable mailing list, the methods used for the nurse/healthcare worker group comprised an Internet online form and asking nurses at the Royal College of Nursing annual conference to complete the questionnaires. The medication review trial detailed in Chapter 7 used a questionnaire at the end of the video conference to ascertain the patient's impressions of the telepharmacy process.

In this thesis a combined closed and open question format was used in the surveys to obtain the opinions of the healthcare professionals on telepharmacy.

5.2 The Surveys

5.2.1 Introduction

Four surveys of health practitioners were undertaken to ascertain the opinions of these professionals on the concepts of telepharmacy. Two of the surveys, of pharmacists and medical practitioners, involved the use of postal questionnaires. The third survey, of nurses, was administered at the Royal College of Nursing 2006 conference held in Cairns, North Queensland and the fourth survey, of nurses and healthcare workers, was an Internet download.

Each survey comprised two sections. Section 1 had eight general questions and dealt with the demographics of the professional sample (e.g. gender, years in practice, population where the professional practised, and the postal code where practising). The postal codes were further analysed and coded into ARIA Codes (see Chapter 2) in order to provide a means of classifying the respondents into rurality groupings. The remainder of Section 1 of the survey form comprised questions relating to the supply of medications to rural and remote areas and Aboriginal Health Services. The final general question investigated the availability of ADSL Broadband telecommunications in the area where the professional practised. Section 1 for the Pharmacist survey also had two additional questions relating to medication reviews. These questions enquired of the pharmacist group if the respondent was accredited to conduct HMRs and, if the respondent was not accredited, if they thought it feasible to collect the information to allow an accredited pharmacist to prepare a medication review report.

The second section of the survey dealt with the professional's opinions on telepharmacy. There were eight general questions in Section 2 and these comprised three groups. The first group (three questions) related to questions concerning professionals' opinions on the feasibility of using telepharmacy to provide services and counselling. The second group (two questions) was concerned with professionals' opinions on the feasibility of using telepharmacy to conduct Medication Reviews by telepharmacy. The final group of the general questions (three questions) dealt with the professionals' opinions on remote dispensing using telepharmacy techniques. As in Section 1, there were two additional questions for the pharmacists' group. These two questions related to the interest of the pharmacist in providing telepharmacy services.

Section 2 used the Likert scale to measure attitude and provided a range of responses to the given statements. There were five categories of response from 1 = strongly agree to 5 = strongly disagree. Likert scales fall within the ordinal level of measurement where the response categories have a rank

order, but the intervals between values cannot be presumed equal.[151] The Likert scale was devised by Likert in the 1930's and has the advantage that it can look interesting to respondents and people often enjoy completing a scale of this kind.[147] Commonly used statistical computer programs typically convert categorical results into number formats in order to calculate the statistics. According to Jamieson[151]methodological and statistical texts are clear that for ordinal data one should not employ the median or mode as a "measure of central tendency" because the arithmetical manipulations required to calculate the mean and standard deviation are inappropriate for ordinal data where the numbers generally represent verbal statements. However, as Jamieson then goes on to note, this is commonly ignored in many published manuscripts and that it has become common practice to assume Likert-type categories constitute interval-level measurements. In the analyses that follow, these observations are acknowledged and non-parametric statistical methods are employed. For comparison of proportions analysis of data analysis of data using the chi-square test was conducted and a *P*-value of below 0.05 was considered to be statistically significant. Relationships between variables were investigated using Mann-Whitney *U*-test and the Kruskal-Wallis analysis of variance for independent groups of samples.

The survey responses were treated anonymously and confidentially, and data from all the respondents were pooled. The completed survey forms were scanned into a PC equipped with a Hewlett Packard scanner and Remark Office OMR 6 (Principia Products, Gravic Inc., Malvern, U.S.A.). The Remark software automatically tabulated the data based upon the parameters specified in the scanning process. Data consisting of categorical variables were analysed with the Remark Statistical reporting function and SPSS® 14.0 for Windows (SPSS® Inc., Chicago, U.S.A.) and Microsoft Excel 2003.

Each of the four surveys was analysed individually and then the data for the common 16 questions identified above were combined and the appropriate non-parametric procedures computed. Chi-squared tests were run on the categorical data using the crosstabs method. Categorical data were converted to numeric data to enable the Mann-Whitney U and the Kruskal-Wallis tests to be computed where appropriate.

Where additional comments written by the respondents were included, these were transcribed and analysed separately.

5.2.2 Survey of Pharmacists in Northern Australia on Telepharmacy

5.2.2.1 Methods

A total sample of 269 pharmacies in rural and remote areas in northern Queensland (Postal Codes of 4605 (Murgon) and above, Northern Territory and Western Australia Postal Codes 0801 and above), were chosen to be included in the survey. The list of these pharmacies was obtained from the James Cook University School of Pharmacy data base. All pharmacies meeting the Postal Code criteria above were selected for the survey.

The survey forms were addressed to "The Pharmacist" and were mailed out to 269 pharmacies on the list. The James Cook University Human Ethics Committee had given approval for the survey to be carried out as a low risk study for ethics approval application, support for the survey was also obtained from the Pharmacy Guild of Australia and the survey was issued a Survey Certificate (No.656) (see Appendix A).

Each 3-page survey form (refer to appendix B1) was attached with a cover letter, an U.S.-published article on the North Dakota Telepharmacy Project (see Appendix F) and a reply-paid envelope. The cover letter explained the purpose of the survey, which was to assess the opinions of pharmacists working in rural and remote parts of northern and central Queensland, Northern Territory and northern Western Australia and provide a brief introduction to telepharmacy. The article on the North Dakota Telepharmacy Project, which accompanied the survey was chosen because it gave a detailed description of a telepharmacy project in North Dakota and details of other telepharmacy projects in the United States and would assist pharmacists unfamiliar with the concepts of telepharmacy to better understand what the survey was about. Approval was obtained from the publisher to copy this article and disseminate it as part of the survey (see Appendix F).

The respondents were given one-month's time to complete and return the survey and an incentive to enter into the draw for an iPod (valued at $300) to encourage return of the survey forms prior to the due date was also included. Supplementary Human Ethics Approval was obtained authorising this incentive (refer to Appendix B). Because of the incentive, and the simple design of the survey form, it was considered unnecessary to send out a follow-up reminder letter. A study on postal survey response rates of pharmacists conducted in New South Wales by Paul et al. concluded that "A moderately sized

monetary incentive is able to achieve a significant increase in response rates for retail pharmacists, thereby reducing potential bias in the sample".[152]

The survey form comprised two main sections (refer to Appendix B1).

The first part of the survey was aimed at collecting information about the demographics of the pharmacist sample (e.g. gender, number of years of experience in pharmacy practice, location of practice (Post Code), population of the practice location and whether or not the pharmacist offered healthcare services to rural and remote areas without physical access to pharmacies and if the pharmacist planned to provide these services in the future.

The first part of the survey also asked questions relating to the supply of S100 services to Aboriginal and Islander Health Services; whether the pharmacist was accredited to conduct Medication Reviews or, if not accredited, whether the pharmacist thought that it was feasible to collect the data required to send on to an accredited pharmacist to prepare a medication review report and finally if the pharmacist has access to broadband ADSL in their practice.

The second part of the survey form was concerned with pharmacist's opinions about using telepharmacy as part of pharmacy practice. The questions required responses of "Strongly Agree", "Agree", "Neutral", "Disagree" and "Strongly Disagree". The issues canvassed included the pharmacist's opinions regarding the potential of telepharmacy to improve healthcare in rural and remote communities by providing professional pharmacy services such as patient counselling and medication reviews. Other questions included the pharmacist's opinions on delivering pharmacy services in rural and remote areas, by supervision of trained assistants by video link and the operation of remote automated dispensing machines. A free format section was also included in the form to enable the pharmacist to express his/her opinions about telepharmacy.

5.2.2.2 Results

Out of the 269 surveys sent out, 99 forms were returned (response rate of 37 per cent) and were analysed. 12 of the analysed survey forms had some unanswered questions, but were included in the analyses.

5.2.2.2.1 Profile of the respondents

Of the 99 respondents 55 per cent were males and 45 per cent were females (refer to Table 9 for a summary of Section 1 responses).

The respondents were heavily weighted towards a high degree of experience, with 70 per cent listing more than 10 years of experience. Of the four experience groups in the survey, 30 per cent had less than 10 years experience, 20 per cent had 10 to 19 years experience, 26 per cent had 20 to 29 years experience and 23 per cent had more than 30 years experience. From the data obtained, of the three population groups being serviced by the rural pharmacists surveyed, the majority (67%) were servicing towns of more than 10,001 people.

5.2.2.2.1.1 Location:

The location of the respondents reflects the targeted nature of the survey. The following table shows the distribution of respondents grouped by Pharmacy ARIA Categories (PhARIA), the index of pharmacy locations. The index results, ranging from 0 (high accessibility) to 12 (high remoteness), have been divided into the 6 category classification system as follows:[2]

Table 8: Pharmacist Respondents by PhARIA

Pharmacy ARIA Categories	Percent of respondents
Category 1 - Highly Accessible	0%
Category 2 - Accessible (Group A)	10%
Category 3 - Accessible (Group B)	50%
Category 4 - Moderately Accessible	21%
Category 5 - Remote	10%
Category 6 - Very Remote	9%

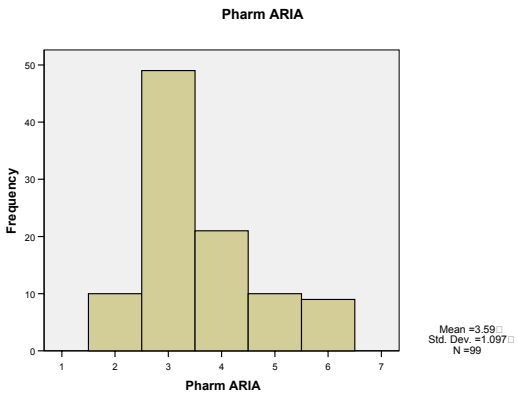

Figure 17: Pharmacy respondents by PhARIA area where they practice.

Considering the advantages that could be extended to rural and remote communities without access to physical pharmacies, a relatively low proportion of the respondents (33 per cent) supplied pharmaceutical services to these areas.

Even fewer of the respondents (13 per cent) provided S100 pharmaceutical services to Aboriginal Health Services (AHS), and only 10 per cent were planning to offer pharmaceutical services to rural and remote communities in the future.

Two questions were included in the survey on medication reviews. In the first of these questions, 27 per cent of the respondents indicated that they were accredited to conduct medication reviews. This corresponded to the 23 per cent of pharmacists accredited to conduct medication reviews reported in the Lee National Telepharmacy Survey conducted in 2005.[123] The second specific pharmacist question asked, if the pharmacist was not accredited, did the pharmacist think it feasible to interview a patient and collect the requisite information to be sent to an accredited pharmacist to prepare a Medication Review. A majority of respondents (55 per cent) thought that this was feasible, although 20 per cent thought this question was not applicable and 9 per cent were unsure.

On the question if Broadband ADSL was available in the area where the pharmacist practiced the vast majority (93%) of the respondents indicated that it was available in the area where the pharmacist practised.

Table 9 Summary of Responses - Pharmacist Survey Section 1

Variable	%	n
Gender		
Male	54.5%	54
Female	45.5%	45
Years of Practice		
LT 10 yrs	30.3%	30
10 to 19 yrs	20.2%	20
20 to 29 yrs	26.3%	26
MT 30 yrs	23.2%	23
Population of town/city where practising		
LT 5000	15.2%	15
5001 to 10000	18.2%	18
MT 10001	66.7%	66
Pharmacist provides pharmacy services in any rural and remote areas, where there are no physical pharmacies.		
Missing	1.0%	1
No	65.7%	65
Yes	33.3%	33
Pharmacist provides S100 services to any Aboriginal and Islander Health Services, where there is no physical pharmacy.		
NA	3.0%	3
No	81.8%	81
Unsure	2.0%	2
Yes	13.1%	13
If pharmacist does not provide pharmacy services in any rural and remote areas, where there are no physical pharmacies, does pharmacist plan to offer services to these areas in the future:		
Missing	6.1%	6
NA	19.2%	19
No	37.4%	37
Unsure	27.3%	27
Yes	10.1%	10
Broadband ADSL available where pharmacist practices		
Missing	1.0%	1
No	3.0%	3
Unsure	3.0%	3
Yes	92.9%	92
Pharmacist accredited to conduct Medication Reviews		
No	72.7%	72
Yes	27.3%	27
If pharmacist is not accredited, does pharmacist think it feasible to interview a patient and collect the requisite information to be sent to an accredited pharmacist to prepare a Medication Review		
Missing	6.1%	6
NA	20.2%	20
No	10.1%	10
Unsure	9.1%	9
Yes	54.5%	54

Section 2 of the survey form was dedicated to questions about the pharmacist's opinions on telepharmacy. A series of ten questions were posed and the respondents asked to rate their response to the question using the rating scale "Strongly Agree", "Agree", "Neutral", "Disagree" and "Strongly Disagree" (refer to Table 10 for a summary of responses).

The first question in this section asked if the pharmacist thought that telepharmacy can improve the provision of health care by pharmacists to rural and remote communities, who may have poor access to health services. The majority of the respondents were supportive of this question: 32 per cent strongly agreed and 61 per cent agreed. Only 5 respondents disagreed and none strongly disagreed.

The second question in this section asked if the pharmacist thought it feasible to use telepharmacy to provide professional health care services, like patient counselling, to remote communities. The majority of the respondents were supportive of this question: 28 per cent strongly agreed and 59 per cent agreed. Only six of the respondents (6 per cent) disagreed and one strongly disagreed.

The third question asked if the pharmacist would be interested in using telepharmacy capabilities in his/her pharmacy to deliver health care to remote areas without pharmacies. Of the respondents 19 per cent strongly agreed and 31 per cent agreed. However thirty five of the respondents (35 per cent) were neutral, nine of the respondents (9 per cent) disagreed and four strongly disagreed.

The fourth question asked if the pharmacist thought that medication reviews (e.g. HMRs) could be carried out by using telepharmacy. Of the respondents 16 per cent strongly agreed and 44 per cent agreed. However twenty one of the respondents (21 per cent) were neutral, sixteen of the respondents (16 per cent) disagreed and two strongly disagreed.

The fifth question asked if the pharmacist thought that medication reviews, carried out by using telepharmacy, would require the help of a trained person or healthcare worker in the remote location to assist the patient during the review. The majority of the respondents were in favour of a trained remote assistant (86 per cent agreed or strongly agreed). Of the respondents 42 per cent strongly agreed and 43 per cent agreed. Twelve of the respondents (12 per cent) were neutral, two of the respondents disagreed and none strongly disagreed.

The sixth question asked if the pharmacist would be interested in offering a medication review service to residents in outlying areas using telepharmacy capabilities at his/her pharmacy. The majority of the respondents were in favour of a trained remote assistant (86 per cent agreed or strongly agreed). Of the respondents 15 per cent strongly agreed and 26 per cent agreed. However forty one of the respondents (41 per cent) were neutral, eleven of the respondents (11 per cent) disagreed and five strongly disagreed.

The seventh question asked if the pharmacist thought there was potential for pharmacies using telepharmacy to act as a site to deliver pharmacy services (e.g. dispensing by trained assistants under

video supervision) to remote areas without pharmacies. The majority of the respondents were in favour of using a trained remote assistant to deliver pharmacy services under video supervision (71 per cent agreed or strongly agreed). Of the respondents 17 per cent strongly agreed and 55 per cent agreed. However five of the respondents (5 per cent) were neutral, twenty of the respondents (20 per cent) disagreed and three strongly disagreed.

The eighth question asked if the pharmacist thought there was potential for a Call Centre, operated by pharmacists, using telepharmacy, to provide professional health care services like patient counselling, to rural and remote communities when the local pharmacy is closed. The majority of the respondents were in favour of using a Call Centre, operated by pharmacists, to provide professional health care services to rural and remote communities when the local pharmacy is closed (73 per cent agreed or strongly agreed). Of the respondents 16 per cent strongly agreed and 57 per cent agreed. However, twelve of the respondents (12 per cent) were neutral, ten of the respondents (10 per cent) disagreed and four strongly disagreed.

The ninth question asked if the pharmacist thought there was potential for a Call Centre, operated by pharmacists, using telepharmacy, to dispense prescriptions for rural and remote communities when the local pharmacy is closed, by operating a remote automated dispensing machine situated in a secure area. Only a minority of the respondents were in favour of using such a Call Centre to provide dispensing services to rural and remote communities when the local pharmacy is closed (30 per cent agreed or strongly agreed). Of the respondents only 7 per cent strongly agreed and 23 per cent agreed. However twenty seven of the respondents (27 per cent) were neutral and the majority of the respondents were not in favour of such an approach (42 per cent): thirty two of the respondents (32 per cent) disagreed and ten strongly disagreed (10 per cent).

The final question asked if the pharmacist thought there was potential for a Call Centre, operated by pharmacists, using telepharmacy, to deliver pharmacy services to remote areas, without pharmacies, by operating remote automated dispensing machines situated in a secure area such as the local medical centre. Only a small majority of the respondents were in favour of using such a Call Centre to provide dispensing services to rural and remote communities where there is no local pharmacy (43 per cent agreed or strongly agreed versus 33 per cent who disagreed or strongly disagreed). However, twenty four of the respondents (24 per cent) were neutral.

Table 10: Summary of Responses - Pharmacist Survey Section 2

Variable	%	n
1. Pharmacist thinks that telepharmacy can improve the provision of health care by pharmacists to rural and remote communities, who may have poor access to health services.		
Strongly Agree	32.3%	32
Agree	60.6%	60
Neutral	2.0%	2
Disagree	5.1%	5
2. Pharmacist thinks that it is feasible to use telepharmacy to provide professional health care services, like patient counselling, to remote communities.		
Strongly Agree	28.3%	28
Agree	58.6%	58
Neutral	6.1%	6
Disagree	6.1%	6
Strongly Disagree	1.0%	1
3. Pharmacist thinks that medication reviews (e.g. HMRs) could be carried out by using telepharmacy.		
Strongly Agree	16.2%	16
Agree	44.4%	44
Neutral	21.2%	21
Disagree	16.2%	16
Strongly Disagree	2.0%	2
4. Pharmacist thinks that medication reviews, carried out by using telepharmacy, would require the help of a trained person or healthcare worker in the remote location to assist the patient during the review.	42.4%	42
Strongly Agree	43.4%	43
Agree	12.1%	12
Neutral	2.0%	2
Disagree		
5. Pharmacist thinks there is potential for pharmacies using telepharmacy to act as a site to deliver pharmacy services (e.g. *dispensing by trained assistants under video supervision*) to remote areas without pharmacies.	17.2%	17
Strongly Agree	54.5%	54
Agree	5.1%	5
Neutral	20.2%	20
Disagree	3.0%	3
Strongly Disagree		
6. Pharmacist thinks there is potential for a Call Centre, operated by pharmacists, using telepharmacy, to provide professional health care services like patient counselling, to rural and remote communities *when the local pharmacy is closed.*		
Strongly Agree	16.2%	16
Agree	56.6%	56
Neutral	12.1%	12
Disagree	10.1%	10
Strongly Disagree	4.0%	4
Missing	1.0%	1

Variable	%	n
7. Pharmacist thinks there is potential for a Call Centre, operated by pharmacists, using telepharmacy, to dispense prescriptions for rural and remote communities *when the local pharmacy is closed,* by operating a remote automated dispensing machine situated in a secure area.		
Strongly Agree	7.1%	7
Agree	23.2%	23
Neutral	27.3%	27
Disagree	32.3%	32
Strongly Disagree	10.1%	10
8. Pharmacist thinks there is potential for pharmacies using telepharmacy to deliver pharmacy services to remote areas, *without pharmacies,* by operating remote automated dispensing machines situated in a secure area such as the local medical centre.		
Strongly Agree	5.1%	5
Agree	37.4%	37
Neutral	24.2%	24
Disagree	23.2%	23
Strongly Disagree	10.1	10
9. Pharmacist would be interested in using telepharmacy capabilities at his/her pharmacy to deliver health care to remote areas without pharmacies.		
Strongly Agree	19.2%	19
Agree	31.3%	31
Neutral	35.4%	35
Disagree	9.1%	9
Strongly Disagree	4.0%	4
Missing	1.0%	1
10. Pharmacist would be interested in offering a medication review service to residents in outlying areas using telepharmacy capabilities at his/her pharmacy.		
Strongly Agree	15.2%	15
Agree	26.3%	26
Neutral	41.4%	41
Disagree	11.1%	11
Strongly Disagree	5.1%	5
Missing	1.0%	1

5.2.2.3 Further Analysis

The data consisting of categorical variables were analysed with SPSS® 14.0 for Windows (SPSS Inc., Chicago, U.S.A.), using appropriate non-parametric statistical functions, such as “Frequencies” and “Crosstabs”, along with the Pearson Chi-square and Kruskal-Wallis test. Table 11 reveals information about the gender differences between respondent pharmacists. There were significant differences ($P<0.05$) in the responses to two of the questions (indicated by the shaded areas in the Table).

Question 3 of the Pharmacist Survey asked the population area in which the pharmacist practised in three different groupings; less than 5,000 people, 5,001 to 10,000 people and greater than 10,000 people.

The situation for population area in which the pharmacist practised (Question 3) was, however, found to be significant indicating in this sample group surveyed more male pharmacists practised in remote areas than female pharmacists (Chi-square= 7.2, df =2, P = 0.028).

The second question that was found to be significant was Question 6, the provision of S100 services to AHSs (Yates' Correction for Continuity Chi-square= 4.6, df =1, P = 0.032) indicating that there was a difference in the sample group surveyed and that more female pharmacists supplied S100 services than male pharmacists. However, caution needs to be exercised in interpreting these results since only 13 of the 99 pharmacists surveyed indicated that they were involved in the supply of S100 services to AHSs.

Table 11: Responses to Pharmacist Survey by Gender - Pearson Chi-Square Tests

Question	**Value**	**df**	**Asymp. Sig. (2-sided)**
Years of Practice	1.228	3	.746
Population of town/city where practising	7.187	2	.028
PhARIA where practising	1.643	4	.801
Pharmacist provides pharmacy services in any rural and remote areas, where there are no physical pharmacies.	2.506	1	.113
Pharmacist provides S100 services to any Aboriginal and Islander Health Services, where there is no physical pharmacy.	4.605	1	.032
If pharmacist does not provide pharmacy services in any rural and remote areas, where there are no physical pharmacies, does pharmacist plan to offer services to these areas in the future	.541	1	.462
Broadband ADSL available where pharmacist practices	.466	1	.495
Pharmacist accredited to conduct Medication Reviews	.309	1	.578
If pharmacist is not accredited, does pharmacist think it feasible to interview a patient and collect the requisite information to be sent to an accredited pharmacist to prepare a Medication Review	.050	1	.822
Pharmacist thinks that telepharmacy can improve the provision of health care by pharmacists to rural and remote communities, who may have poor access to health services.	3.182	2	.204

Question	Value	df	Asymp. Sig. (2-sided)
Pharmacist thinks that it is feasible to use telepharmacy to provide professional health care services, like patient counselling, to remote communities.	0.894	2	.640
Pharmacist thinks that medication reviews (e.g. HMRs) could be carried out by using telepharmacy.	.667	2	.717
Pharmacist thinks that medication reviews, carried out by using telepharmacy, would require the help of a trained person or healthcare worker in the remote location to assist the patient during the review.	.092	2	.955
Pharmacist thinks there is potential for pharmacies using telepharmacy to act as a site to deliver pharmacy services (e.g. *dispensing by trained assistants under video supervision*) to remote areas without pharmacies.	1.653	2	.438
Pharmacist thinks I think there is potential for a Call Centre, operated by pharmacists, using telepharmacy, to provide professional health care services like patient counselling, to rural and remote communities *when the local pharmacy is closed*.	3.915	2	.233
Pharmacist thinks there is potential for a Call Centre, operated by pharmacists, using telepharmacy, to dispense prescriptions for rural and remote communities *when the local pharmacy is closed*, by operating a remote automated dispensing machine situated in a secure area.	1.182	2	.554
Pharmacist thinks there is potential for pharmacies using telepharmacy to deliver pharmacy services to remote areas, *without pharmacies,* by operating remote automated dispensing machines situated in a secure area such as the local medical centre.	0.971	2	.615
Pharmacist would be interested in using telepharmacy capabilities at his/her pharmacy to deliver health care to remote areas without pharmacies.	.034	2	.983
Pharmacist would be interested in offering a medication review service to residents in outlying areas using telepharmacy capabilities at his/her pharmacy.	.201	2	.904

The data were then further analysed by ARIA. The ARIA variable was collapsed into two categories; urban and rural (ARIA 1 and 2 for urban and ARIA 3-6 for rural). The results appear in Table 12 below. There were only two questions which resulted in a significant difference ($P < 0.05$), as shown in the shaded areas of the table. These were the population of the town/city where practising and the question which asked if medication reviews, carried out by using telepharmacy, would require the help of a trained person or healthcare worker in the remote location to assist the patient during the review.

The results (Figure 18) reveal that 56 per cent of rural pharmacists practise in rural locations with a population greater than 10,001, in an ARIA classified areas of 3-6. Eighteen per cent practise in towns with populations between 5001 and 10,000 and 15 per cent in populations below 5000. The remaining

pharmacists, (10 per cent) classified as urban by ARIA numbers 1 and 2 practise in areas with a population greater than 10,001.

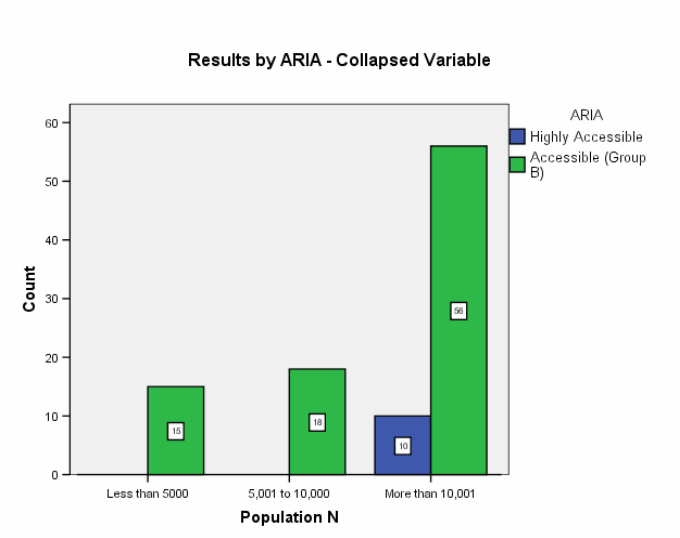

Figure 18: Pharmacist survey-Population of the town/city where practising by ARIA group.

The results of the question asking if medication reviews, carried out by using telepharmacy, would require the help of a trained person or healthcare worker in the remote location to assist the patient during the review show that 89 per cent (Figure 19) of pharmacists in rural areas believed that an assistant would be required. The urban group indicated that 40 per cent of respondents thought that an assistant would be required. However, this is from a very small base of only 10 pharmacists.

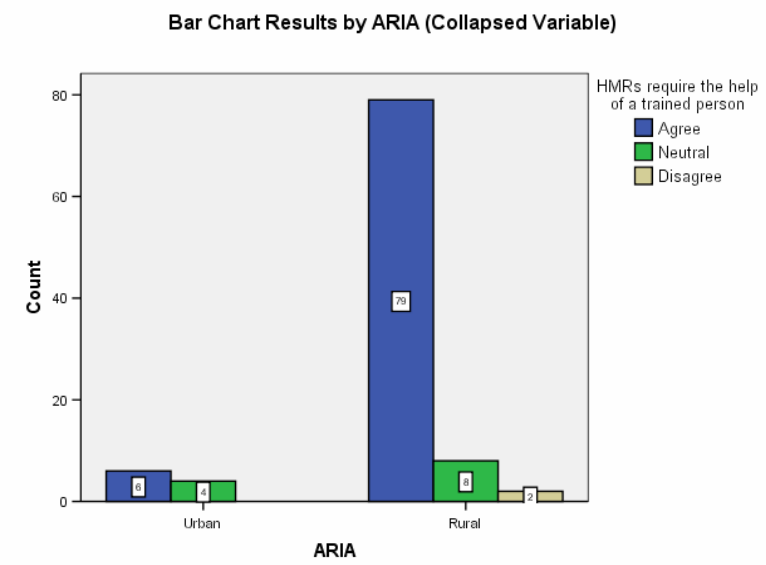

Figure 19: Pharmacist survey-Medication reviews, carried out by using telepharmacy, would require the help of a trained assistant, by ARIA group.

Table 12: Responses to Pharmacist Survey by ARIAGrouping - Pearson Chi-Square

Question	Value	df	Asymp. Sig. (2-sided)
Gender	0.94	1	0.332
Years of Practice	0.042	1	0.838
Population of town/city where practising	5.287	1	0.021
Pharmacist provides pharmacy services in any rural and remote areas, where there are no physical pharmacies.	0.198	1	0.657
Pharmacist provides S100 services to any Aboriginal and Islander Health Services, where there is no physical pharmacy.	0.479	1	0.489
If pharmacist does not provide pharmacy services in any rural and remote areas, where there are no physical pharmacies, does pharmacist plan to offer services to these areas in the future	0.362	1	0.547
Broadband ADSL available where pharmacist practices	0.718	1	0.397
Pharmacist accredited to conduct Medication Reviews	0.041	1	0.839
If pharmacist is not accredited, does pharmacist think it feasible to interview a patient and collect the requisite information to be sent to an accredited pharmacist to prepare a Medication Review	0.859	1	0.354
Pharmacist thinks that telepharmacy can improve the provision of health care by pharmacists to rural and remote communities, who may have poor access to health services.	0.743	1	0.389
Pharmacist thinks that it is feasible to use telepharmacy to provide professional health care services, like patient counselling, to remote communities.	0.021	1	0.885
Pharmacist thinks that medication reviews (e.g. HMRs) could be carried out by using telepharmacy.	0.073	1	0.787
Pharmacist thinks that medication reviews, carried out by using telepharmacy, would require the help of a trained person or healthcare worker in the remote location to assist the patient during the review.	6.911	1	0.009
Pharmacist thinks there is potential for pharmacies using telepharmacy to act as a site to deliver pharmacy services (e.g. *dispensing by trained assistants under video supervision*) to remote areas without pharmacies.	0.007	1	0.934
Pharmacist thinks I think there is potential for a Call Centre, operated by pharmacists, using telepharmacy, to provide professional health care services like patient counselling, to rural and remote communities *when the local pharmacy is closed*.	0.032	1	0.859

Question	Value	df	Asymp. Sig. (2-sided)
Pharmacist thinks there is potential for a Call Centre, operated by pharmacists, using telepharmacy, to dispense prescriptions for rural and remote communities *when the local pharmacy is closed*, by operating a remote automated dispensing machine situated in a secure area.	0.002	1	0.962
Pharmacist thinks there is potential for pharmacies using telepharmacy to deliver pharmacy services to remote areas, *without pharmacies,* by operating remote automated dispensing machines situated in a secure area such as the local medical centre.	0.24	1	0.624
Pharmacist would be interested in using telepharmacy capabilities at his/her pharmacy to deliver health care to remote areas without pharmacies.	0.015	1	0.903
Pharmacist would be interested in offering a medication review service to residents in outlying areas using telepharmacy capabilities at his/her pharmacy.	0.758	1	0.384

The data were then further analysed by experience groups. The experience variable was collapsed into two categories; less than 10 years experience and more than 10 years experience. The results appear in Table 13 below. There were four questions which resulted in a significant difference ($P < 0.05$), as shown in the shaded areas in the table. These were:

- Pharmacist thinks that it is feasible to use telepharmacy to provide professional health care services, like patient counselling, to remote communities (Figure 20).
- Pharmacist thinks that medication reviews (e.g. HMRs) could be carried out by using telepharmacy (Figure 21).
- Pharmacist thinks there is potential for a Call Centre, operated by pharmacists, using telepharmacy, to dispense prescriptions for rural and remote communities when the local pharmacy is closed, by operating a remote automated dispensing machine situated in a secure area (Figure 22).
- Pharmacist thinks there is potential for pharmacies using telepharmacy to deliver pharmacy services to remote areas, without pharmacies, by operating remote automated dispensing machines situated in a secure area such as the local medical centre (Figure 23).

Table 13: Responses to Pharmacist Survey by Experience Grouping - Pearson Chi-Square

Question	Value	df	Asymp. Sig. (2-sided)
Gender.	1.067		0.302
Population of town/city where practising.	1.001		0.317
PhARIA where practising.	0.832		0.362
Pharmacist provides pharmacy services in any rural and remote areas, where there are no physical pharmacies.	0.941		0.332
Pharmacist provides S100 services to any Aboriginal and Islander Health Services, where there is no physical pharmacy.	0.039		0.843
If pharmacist does not provide pharmacy services in any rural and remote areas, where there are no physical pharmacies, does pharmacist plan to offer services to these areas in the future	0.337		0.562
Broadband ADSL available where pharmacist practices	0.622		0.43
Pharmacist accredited to conduct Medication Reviews	2.416		0.12
If pharmacist is not accredited, does pharmacist think it feasible to interview a patient and collect the requisite information to be sent to an accredited pharmacist to prepare a Medication Review	1.788		0.181
Pharmacist thinks that telepharmacy can improve the provision of health care by pharmacists to rural and remote communities, who may have poor access to health services.	6.288		0.012
Pharmacist thinks that it is feasible to use telepharmacy to provide professional health care services, like patient counselling, to remote communities.	4.595		0.032
Pharmacist thinks that medication reviews (e.g. HMRs) could be carried out by using telepharmacy.	6.659		0.01
Pharmacist thinks that medication reviews, carried out by using telepharmacy, would require the help of a trained person or healthcare worker in the remote location to assist the patient during the review.	1.343		0.247
Pharmacist thinks there is potential for pharmacies using telepharmacy to act as a site to deliver pharmacy services (e.g. *dispensing by trained assistants under video supervision*) to remote areas without pharmacies.	0.496		0.481
Pharmacist thinks I think there is potential for a Call Centre, operated by pharmacists, using telepharmacy, to provide professional health care services like patient counselling, to rural and remote communities *when the local pharmacy is closed*.	2.978		0.084

Question	Value	df	Asymp. Sig. (2-sided)
Pharmacist thinks there is potential for a Call Centre, operated by pharmacists, using telepharmacy, to dispense prescriptions for rural and remote communities *when the local pharmacy is closed*, by operating a remote automated dispensing machine situated in a secure area.	5.339		0.021
Pharmacist thinks there is potential for pharmacies using telepharmacy to deliver pharmacy services to remote areas, *without pharmacies,* by operating remote automated dispensing machines situated in a secure area such as the local medical centre.	12.423		0
Pharmacist would be interested in using telepharmacy capabilities at his/her pharmacy to deliver health care to remote areas without pharmacies.	0.037		0.847
Pharmacist would be interested in offering a medication review service to residents in outlying areas using telepharmacy capabilities at his/her pharmacy.	0.214		0.644

The questions which showed significant differences were further analysed as shown in the following Figures 20-23.

Figure 20: Pharmacist thinks that it is feasible to use telepharmacy to provide professional health care services

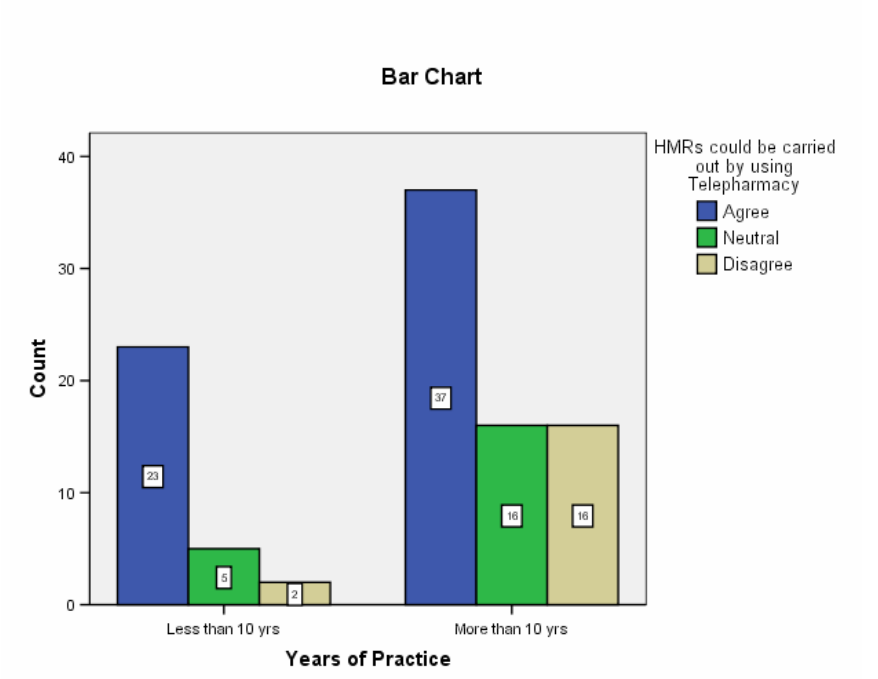

Figure 21: Pharmacist thinks that HMRs could be carried out by using telepharmacy.

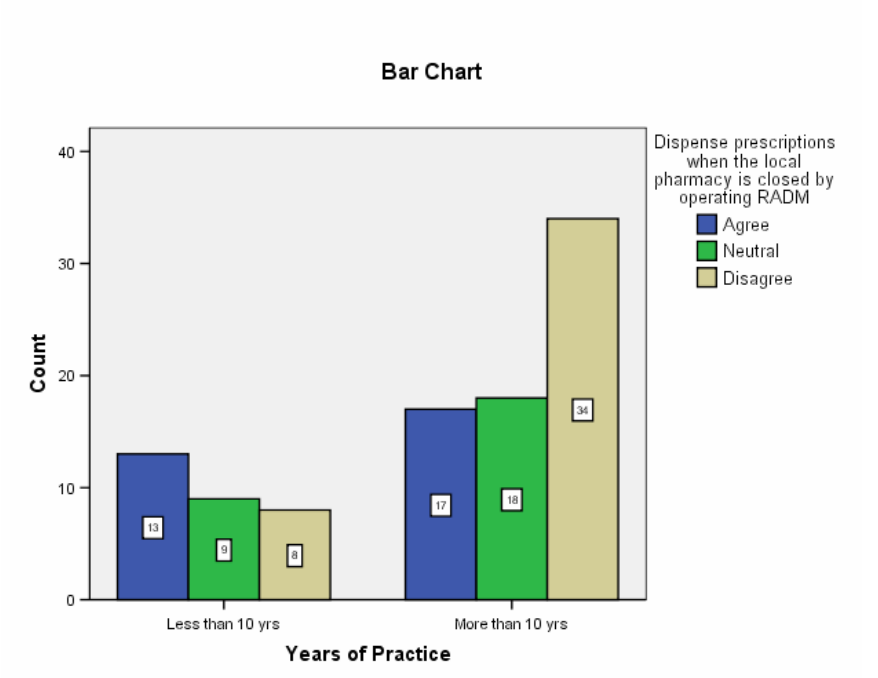

Figure 22: Pharmacist thinks there is potential for a Call Centre, operated by pharmacists, using telepharmacy, to dispense prescriptions for rural and remote communities when the local pharmacy is closed.

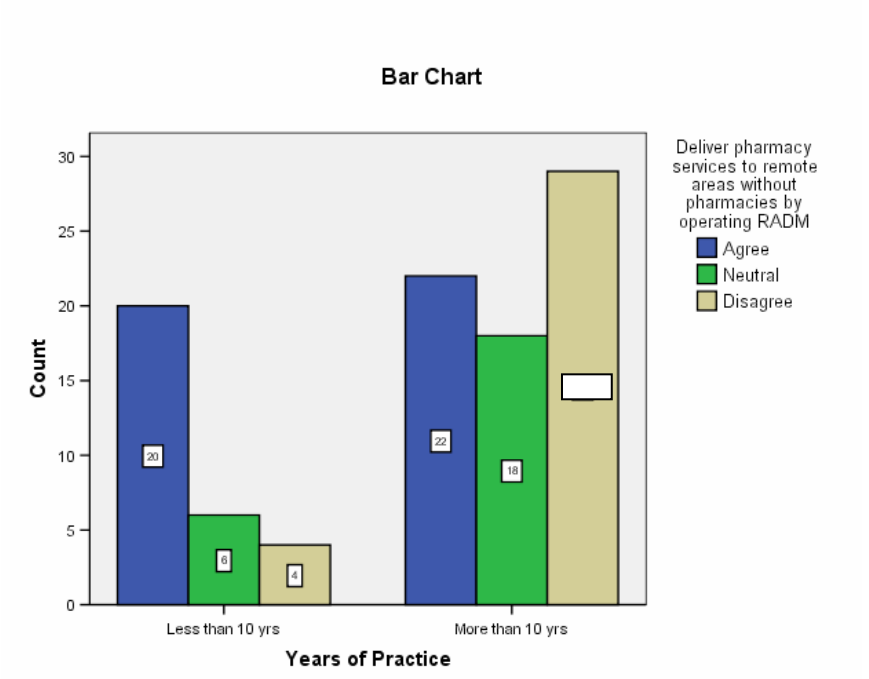

Figure 23: Pharmacist thinks there is potential for pharmacies using telepharmacy to deliver pharmacy services to remote areas, without pharmacies.

5.2.2.4 Discussion

The results from the survey of Pharmacists indicated that there was no significant difference in opinions on telepharmacy between male and female pharmacists (Section 2 questions). There were two identified gender differences in Section 1 responses; the population areas where female pharmacists practised was different to male pharmacists and more female pharmacists indicated that they supplied PBS S100 services to AHSs, albeit on a low sample base of only 13 respondents; 10 female and 3 male. This is an interesting finding and should be followed up in future research. There were also two identified differences when analysed by ARIA, although the values on analysis were too small to yield any worthwhile results.

The data analysed by years of experience did, however, reveal some interesting differences. On the question of whether the pharmacist thought it feasible to use telepharmacy to provide professional health care services, like patient counselling, to remote communities (Figure 20), the younger group (less than 10 years experience) were unanimous in agreeing with the proposition, whilst the older group (more than 10 years of experience), whilst still positive (81 per cent), showed some reservations.

On the question of whether the pharmacist thought that medication reviews (e.g. HMRs) could be carried out by using telepharmacy (Figure 21), 77 per cent of the younger group agreed with the question, whilst 54 per cent of the older group agreed.

The differences in opinion between the two age groups became more apparent in the next two questions. On the question of whether the pharmacist thought there was potential for a Call Centre, operated by pharmacists, using telepharmacy, to dispense prescriptions for rural and remote communities *when the local pharmacy is closed*, by operating a remote automated dispensing machine situated in a secure area (Figure 22), 40 per cent of the younger group agreed, but only 25 per cent of the older group agreed with the proposition. The final question revealed a significant difference in opinion between the age groups on the question of if the pharmacist thought there was potential for pharmacies using telepharmacy to deliver pharmacy services to remote areas, *without pharmacies*, by operating remote automated dispensing machines situated in a secure area such as the local medical centre (Figure 23). The results show that 67 per cent of the younger group agreed with the proposition, whilst only 32 per cent of the older group agreed.

This difference in opinion may reflect the relatively lower risk averse attitude of the younger group or perhaps the difficulty that the older pharmacist group may have with technology when compared to the younger group. The older pharmacist group's opinion may also be influenced by previous failed attempts to use technology. Whatever the underlying reasons for the difference in opinion, it is nevertheless interesting that the majority of the older pharmacist group do not support the use of remote automated dispensing machines, even where there is no pharmacy. This may indicate a lack of understanding by the older pharmacist group of the medication issues confronting communities in rural and remote Australia.

5.2.3 Survey of Medical Practitioners in Northern Queensland on Telepharmacy

5.2.3.1 Methods

A total sample of 609 medical practitioners in rural and remote areas in northern Queensland (Postal Codes of 4700 (Rockhampton) and above), were chosen to be included in the survey. The list of these medical practitioners was purchased from the Queensland Board of Medical Practitioners. All medical practitioners, with addresses published on the Register and meeting the Postal Code criterion above were selected for the survey. The format chosen for the survey was a postal survey, with a stamped envelope included for the return of the forms. A Victorian study in 2003/4 showed that postal surveys of medical practitioners had superior response rates to telephone interviews.[153]

The survey forms were addressed to the name of the medical practitioner as specified on the Register and were mailed out to 609 medical practitioners on the list. The James Cook University Human Ethics Committee had given approval for the survey to be carried out as a low risk study (refer to Appendix A for ethics approval application).

As per the pharmacist survey, each 3-page survey form (refer to Appendix B2) was attached with a cover letter, an U.S.-published article on the North Dakota Telepharmacy Project (refer to Appendix F) and a reply-paid envelope. The cover letter explained the purpose of the survey, which was to assess the opinions of medical practitioners working in rural and remote parts of northern and central Queensland and provide a brief introduction to telepharmacy. As with the survey sent to pharmacists, the article on the North Dakota Telepharmacy Project accompanied the survey—chosen because it gave a detailed description of a telepharmacy project in North Dakota and details of other telepharmacy projects in the United States and would assist medical practitioners unfamiliar with the concepts of telepharmacy to better understand what the survey was about. Approval was obtained from the publisher to copy this article and disseminate it as part of the survey (refer to Appendix F).

The respondents were given one-month's time to complete and return the survey and an incentive to enter into the draw for an iPod (valued at $300) to encourage return of the survey forms prior to the due date was also included. Supplementary Human Ethics Approval was obtained authorising this incentive (refer to Appendix A). Because of the incentive, and the simple design of the survey form, it was considered unnecessary to send out a follow-up reminder letter.

The survey form had two main sections; most of the questions were similar to those included in the pharmacist survey to enable comparison.

The first part of the survey was aimed at collecting information about the demographics of the medical practitioner sample (e.g. gender, number of years of experience in medical practice, location of practice (Post Code), population of the practice location and whether or not the medical practitioner offered healthcare services to rural and remote areas without physical access to pharmacies and if the medical practitioner planned to provide these services in the future. The first part of the survey also asked questions relating to the supply of S100 services to Aboriginal and Islander Health Services and if the medical practitioner has access to broadband ADSL in their practice.

Section 2 of the survey form was concerned with the medical practitioner's opinions about using telepharmacy as part of pharmacy practice. The questions required responses of 'Yes', 'No', 'Unsure', and 'Non Applicable'. The issues canvassed included the medical practitioner's opinions regarding the potential of telepharmacy to improve healthcare in rural and remote communities by providing professional pharmacy services such as patient counselling, and medication reviews. Other questions included the medical practitioner's opinions on delivering pharmacy services in rural and remote areas, by supervision of trained assistants by video link and the operation of remote automated dispensing machines.

A free format section was also included in the form to enable the medical practitioner to express his/her opinions about telepharmacy.

5.2.3.2 Results

Out of the 609 surveys sent out, 104 forms were returned. However, 3 of the surveys were returned blank where the medical practitioner had indicated on the form that he was retired. Therefore, a total of 101 (response rate of 17 per cent) survey forms were analysed. Seven of the analysed survey forms had some unanswered questions, but were included in the trial analyses.

Question 1, asked the gender of the medical practitioner: 64 per cent of the respondents were males and 36 per cent were females (refer to Table 15 for a summary of Section 1 responses).

The respondent medical practitioners were heavily weighted towards a high degree of experience, with 91 per cent listing more than 10 years of experience. Of the four experience groups in the survey, 9 per

cent had less than 10 years experience, 31 per cent had 10 to 19 years experience, 35 per cent had 20 to 29 years experience and 24 per cent had more than 30 years experience.

Location

The location of the medical practitioner respondents reflects the targeted nature of the survey. The following table shows the distribution of respondents grouped by ARIA Categories.

Table 14: Medical Practitioner ARIA Categories

	Percent of respondents
Category 1 - Highly Accessible	0%
Category 2 -Accessible (Group A)	3%
Category 3 - Accessible (Group B)	65%
Category 4 - Moderately Accessible	17%
Category 5 - Remote	4%
Category 6 - Very Remote	12%

From the data obtained, of the three population groups being serviced by the rural medical practitioners surveyed, the majority (75 per cent) were servicing towns of more than 10,001 people.

Question three of Section 1 asked the medical practitioner if he/she provided medicine supply services in any rural and remote areas, where there are no physical pharmacies. A surprisingly high number of respondents (22 per cent) supplied medicines where there are no physical pharmacies.

A number of the respondents (8 per cent) indicated that they were involved in the provision of S100 pharmaceutical services to Aboriginal Health Services (AHS), and only 9 per cent were planning to offer medicine supply services to rural and remote communities in the future.

The final question in Section 1 of the survey asked the medical practitioner if Broadband ADSL was available in the area where he/she practiced. The vast majority (91 per cent) of the respondents indicated that Broadband ADSL was available in the area where the medical practitioner practised.

Table 15: Summary of Responses - Doctor Survey Section 1

Variable	%	n
Gender		
Male	63.6%	68
Female	36.4%	39
Years of Practice		
LT 10 yrs	9.3%	10
10 to 19 yrs	30.8%	33
20 to 29 yrs	34.6%	37
MT 30 yrs	24.3%	26
Missing	0.9%	1
Population of town/city where practising		
LT 5000	15.0%	16
5001 to 10000	10.3%	11
MT 10001	74.8%	80
Doctor provides medicine supply services in any rural and remote areas, where there are no physical pharmacies.		
Yes	22.4%	24
No	72.0%	77
Unsure	3.7%	4
NA	1.9%	2
Doctor provides S100 medicine supply services to any Aboriginal and Islander Health Services, where there is no physical pharmacy.		
Yes	8.4%	9
No	82.2%	88
Unsure	7.5%	8
NA	1.9%	2
If doctor does not provide medicine supply services in any rural and remote areas, where there are no physical pharmacies, does doctor plan to offer services to these areas in the future:		
Yes	6.1%	10
No	19.2%	53
Unsure	37.4%	16
NA	27.3%	25
Missing	10.1%	3
Broadband ADSL available where doctor practices		
Yes	90.7%	97
No	1.9%	2
Unsure	7.5%	8

Section 2 of the survey form was dedicated to questions about the medical practitioner's opinions on telepharmacy. A series of ten questions were posed and the respondents asked to rate their response to the question using the rating scale "Strongly Agree", "Agree", "Neutral", "Disagree" and "Strongly Disagree".

The first question in this section asked if the medical practitioner thought that telepharmacy can improve the provision of health care by pharmacists to rural and remote communities, who may have poor access to health services. The majority of the respondents were supportive of this question: 33 per cent strongly agreed and 56 per cent agreed. Only 2 respondents disagreed and none strongly disagreed, refer to Table 16 for Section 2 responses.

The second question in this section asked if the medical practitioner thought it is feasible to use telepharmacy to provide professional health care services, like patient counselling, to remote communities. The majority of the respondents were supportive of this question: 23 per cent strongly agreed and 63 per cent agreed. Only three of the respondents (3 per cent) disagreed and none strongly disagreed.

The third question asked if the medical practitioner thought that medication reviews (e.g. HMRs) could be carried out by using telepharmacy. Of the respondents 12 per cent strongly agreed and 56 per cent agreed. However nineteen of the respondents (18 per cent) were neutral, ten of the respondents (9 per cent) disagreed and three strongly disagreed.

The fourth question asked if the medical practitioner thought that medication reviews, carried out by using telepharmacy, would require the help of a trained person or healthcare worker in the remote location to assist the patient during the review. The majority of the respondents were in favour of a trained remote assistant (84 per cent agreed or strongly agreed). Of the respondents 36 per cent strongly agreed and 49 per cent agreed. Nine of the respondents (8 per cent) were neutral, six of the respondents (6 per cent) disagreed and two strongly disagreed.

The fifth question asked if the medical practitioner thought there was potential for pharmacies using telepharmacy to act as a site to deliver pharmacy services (e.g. dispensing by trained assistants under video supervision) to remote areas without pharmacies. The majority of the respondents were in favour of using a trained remote assistant to deliver pharmacy services under video supervision (86 per cent agreed or strongly agreed). Of the respondents 23 per cent strongly agreed and 63 per cent agreed. However twelve of the respondents (11 per cent) were neutral, three of the respondents disagreed and none strongly disagreed.

The sixth question asked if the medical practitioner thought there was potential for a Call Centre, operated by pharmacists, using telepharmacy, to provide professional health care services like patient counselling, to rural and remote communities when the local pharmacy is closed. The majority of the respondents were in favour of using a Call Centre, operated by pharmacists, to provide professional health care services to rural and remote communities when the local pharmacy is closed (67 per cent agreed or strongly agreed). Of the respondents 16 per cent strongly agreed and 51 per cent agreed. However twenty four of the respondents (22 per cent) were neutral, ten of the respondents (9 per cent) disagreed and one strongly disagreed.

The seventh question asked if the medical practitioner thought there was potential for a Call Centre, operated by pharmacists, using telepharmacy, to dispense prescriptions for rural and remote communities when the local pharmacy is closed, by operating a remote automated dispensing machine situated in a secure area. Of the respondents only 9 per cent strongly agreed and 47 per cent agreed. However, twenty seven of the respondents (25 per cent) were neutral and thirteen of the respondents (12 per cent) disagreed and six strongly disagreed (6 per cent).

The final question asked if the medical practitioner thought there was potential for a Call Centre, operated by pharmacists, using telepharmacy, to deliver pharmacy services to remote areas, without pharmacies, by operating remote automated dispensing machines situated in a secure area such as the local medical centre. A small majority of the respondents were in favour of using such a Call Centre to provide dispensing services to rural and remote communities where there is no local pharmacy (53 per cent agreed or strongly agreed versus 20 per cent who disagreed or strongly disagreed). However twenty eight of the respondents (26 per cent) were neutral.

Table 16: Summary of Responses - Doctor Survey Section 2

Variable	%	n
Doctor thinks that telepharmacy can improve the provision of health care by doctors to rural and remote communities, who may have poor access to health services.		
Strongly Agree	12.1%	13
Agree	57.9%	62
Neutral	17.8%	19
Disagree	9.3%	10
Strongly Disagree	2.8%	3

Variable	%	n
Doctor thinks that it is feasible to use telepharmacy to provide professional health care services, like patient counselling, to remote communities.		
Strongly Agree	35.5%	38
Agree	48.6%	52
Neutral	8.4%	9
Disagree	5.6%	6
Strongly Disagree	1.9%	2
Doctor thinks that medication reviews (e.g. HMRs) could be carried out by using telepharmacy.		
Strongly Agree	23.4%	25
Agree	62.6%	67
Neutral	11.2%	12
Disagree	2.8%	3
Doctor thinks that medication reviews, carried out by using telepharmacy, would require the help of a trained person or healthcare worker in the remote location to assist the patient during the review.		
Strongly Agree	15.9%	17
Agree	51.4%	55
Neutral	22.4%	24
Disagree	9.3%	10
Strongly Disagree	0.9%	1
Doctor thinks there is potential for pharmacies using telepharmacy to act as a site to deliver pharmacy services (e.g. *dispensing by trained assistants under video supervision*) to remote areas without pharmacies.		
Strongly Agree	9.3%	10
Agree	46.7%	50
Neutral	25.2%	27
Disagree	12.1%	13
Strongly Disagree	5.6%	6
Missing	0.9%	1
Doctor thinks there is potential for a Call Centre, operated by pharmacists, using telepharmacy, to provide professional health care services like patient counselling, to rural and remote communities *when the local pharmacy is closed*.		
Strongly Agree	11.2%	12
Agree	42.1%	45
Neutral	26.2%	28
Disagree	15.0%	16
Strongly Disagree	4.7%	5
Missing	0.9%	1

Variable	%	n
Doctor thinks there is potential for a Call Centre, operated by pharmacists, using telepharmacy, to dispense prescriptions for rural and remote communities *when the local pharmacy is closed,* by operating a remote automated dispensing machine situated in a secure area.		
Strongly Agree	9.3%	10
Agree	46.7%	50
Neutral	25.2%	27
Disagree	12.1%	13
Strongly Disagree	5.6%	6
Missing	0.9%	1
Doctor thinks there is potential for pharmacies using telepharmacy to deliver pharmacy services to remote areas, *without pharmacies,* by operating remote automated dispensing machines situated in a secure area such as the local medical centre.		
Strongly Agree	11.2%	12
Agree	42.1%	45
Neutral	26.2%	28
Disagree	15.0%	16
Strongly Disagree	4.7%	5
Missing	0.9 %	1

5.2.3.3 Further Analysis

The data consisting of categorical variables were analysed with SPSS® 14.0 for Windows. Table 17 reveals information about the gender differences between respondent medical practitioners. There were no significant gender differences ($P<0.05$) in the responses to the questions.

Table 17: Responses to Medical Practitioner Survey by Gender –Chi-Square, Kruskal-Wallis test.

Question	Chi-Square	df	Asymp. Sig.
Years of Practice	0.332	1	0.564
Population of town/city where practising	0.038	1	0.845
ARIA where practising	0.013	1	0.909

Question	Chi-Square	df	Asymp. Sig.
Doctor provides pharmacy services in any rural and remote areas, where there are no physical pharmacies.	2.059	1	0.151
Doctor provides S100 services to any Aboriginal and Islander Health Services, where there is no physical pharmacy.	0.464	1	0.496
If doctor does not provide pharmacy services in any rural and remote areas, where there are no physical pharmacies, does doctor plan to offer services to these areas in the future	1.289	1	0.256
Broadband ADSL available where doctor practices	0.865	1	0.352
Doctor thinks that telepharmacy can improve the provision of health care by pharmacists to rural and remote communities, who may have poor access to health services.	0.407	1	0.524
Doctor thinks that it is feasible to use telepharmacy to provide professional health care services, like patient counselling, to remote communities.	0.002	1	0.969
Doctor thinks that medication reviews (e.g. HMRs) could be carried out by using telepharmacy.	0.344	1	0.557
Doctor thinks that medication reviews, carried out by using telepharmacy, would require the help of a trained person or healthcare worker in the remote location to assist the patient during the review.	0	1	0.986
Doctor thinks there is potential for pharmacies using telepharmacy to act as a site to deliver pharmacy services (e.g. *dispensing by trained assistants under video supervision*) to remote areas without pharmacies.	0.696	1	0.404
Doctor thinks there is potential for a Call Centre, operated by pharmacists, using telepharmacy, to provide professional health care services like patient counselling, to rural and remote communities *when the local pharmacy is closed*.	0.502	1	0.479
Doctor thinks there is potential for a Call Centre, operated by pharmacists, using telepharmacy, to dispense prescriptions for rural and remote communities *when the local pharmacy is closed*, by operating a remote automated dispensing machine situated in a secure area.	0.696	1	0.404
Doctor thinks there is potential for pharmacists using telepharmacy to deliver pharmacy services to remote areas, *without pharmacies,* by operating remote automated dispensing machines situated in a secure area such as the local medical centre.	0.502	1	0.479

The data were then further analysed by ARIA. The ARIA variable was collapsed into two categories; urban and rural (ARIA 1 and 2 for urban and ARIA 3-6 for rural). No significant differences ($P < 0.05$) were found in this analysis.

A further analyse by experience groups was then undertaken. The experience variable was collapsed into two categories; less than 10 years experience and more than 10 years experience. Only one question indicated a significant difference; where the doctor indicated that he/she provided pharmacy services in rural and remote areas, where there are no physical pharmacies (Chi-Sq. = 4.7, df = 1, *P* = 0.03).

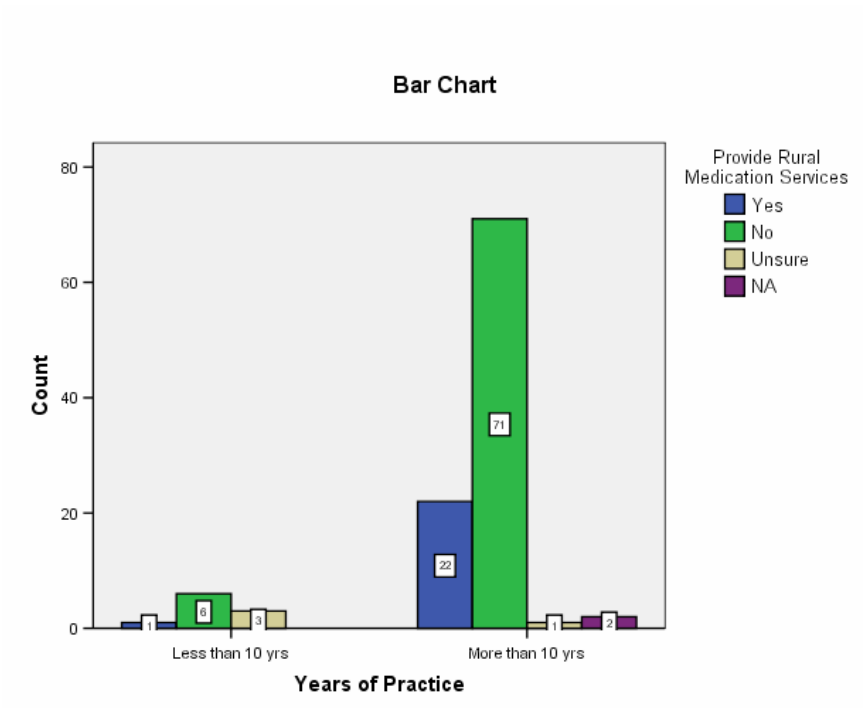

Figure 24: Doctor provides rural medication services where there is no pharmacy.

The above figure indicates that 23 per cent (22 respondents out of 96) of the older doctor group (more than 10 years experience) provided pharmacy services in rural and remote areas, where there are no physical pharmacies. Only ten doctors were in the less experienced group.

5.2.4 Survey of Nurses on Telepharmacy

5.2.4.1 Methods

The third survey, of nurses, was administered at the Royal College of Nursing 2006 conference held in Cairns, North Queensland. As with the previous two surveys the James Cook University Human Ethics Committee had given approval for the survey to be carried out as a low risk study (refer to Appendix A for ethics approval application).

A poster requesting conference participants to complete the survey forms was displayed at the James Cook University conference desk. As an incentive to encourage the completion of the questionnaire, each survey form was entered in a draw to win an iPod (valued at $300). The entries were drawn at the final day of the conference.

The survey form had two main sections (refer Appendix B3). Most of the questions were similar to those included in the pharmacist survey to enable comparison.

The first part of the survey was aimed at collecting information about the demographics of the nurse sample (e.g. gender, number of years of experience in nursing practice, location of practice (Post Code), population of the practice location and whether or not the nurse offered healthcare services to rural and remote areas without physical access to pharmacies and if the nurse planned to provide these services in the future. The first part of the survey also asked questions relating to the supply of S100 services to Aboriginal and Islander Health Services and if the nurse has access to broadband ADSL in their practice.

Section 2 of the survey form was concerned with nurse's opinions about using telepharmacy as part of pharmacy practice. The questions required responses of 'Yes', 'No', 'Unsure', and 'Non Applicable'. The issues canvassed included the nurse's opinions regarding the potential of telepharmacy to improve healthcare in rural and remote communities by providing professional pharmacy services such as patient counselling and medication reviews. Other questions included the nurse's opinions on delivering pharmacy services in rural and remote areas, by supervision of trained assistants by video link and the operation of remote automated dispensing machines.

Because the surveys were administered at a conference, and time was of the essence for conference attendees, no free format section was included in the form to enable the nurse to express his/her opinions about telepharmacy. Reference material including the North Dakota publication and JCU documentation including Ethics Committee Approval was available at the JCU conference desk.

5.2.4.2 Results

Out of the 360 attendees at the conference, 59 forms were completed. However, one of the surveys was returned incomplete. Therefore, a total of 58 (response rate of 16 per cent) survey forms were analysed.

Question 1, asked the gender of the nurse: 12 per cent of the respondents were males and 88 per cent were females (refer to Table 19 for a summary of Section 1 responses).

The respondent nurses were heavily weighted towards a high degree of experience, with 91 per cent reporting more than 10 years of experience.

From the data obtained, of the three population groups being serviced by the nurses surveyed, the majority (85 per cent) were servicing towns of more than 10,001 people.

Question four of Section 1 asked the nurse if he/she provided medicine supply services in any rural and remote areas, where there are no physical pharmacies. As per the medical practitioner survey, a surprisingly high number of respondents (26 per cent) supplied medicines where there are no physical pharmacies.

The location of the respondents reflects the attendees at the conference. The following table shows the distribution of respondents grouped by ARIA Categories.

Table 18: Nurse ARIA Categories

	Percent of respondents
Category 1 – Highly Accessible	66%
Category 2 – Accessible (Group A)	7%
Category 3 – Accessible (Group B)	24%
Category 4 – Moderately Accessible	4%
Category 5 – Remote	0%
Category 6 – Very Remote	0%

Only a small number of the respondents (9 per cent) indicated that they were involved in the provision of S100 pharmaceutical services to Aboriginal Health Services (AHS) and only one of the respondents was planning to offer medicine supply services to rural and remote communities in the future.

The final question in Section 1 of the survey asked the nurse if Broadband ADSL was available in the area where he/she practiced. The majority (81 per cent) of the respondents indicated that Broadband ADSL was available in the area where the nurse practised.

Table 19: Survey of Nurses Section 1

Variable	%	n
Gender		
Male	12.1%	7
Female	87.9%	51
Years of Practice		
LT 10 yrs	8.6%	5
10 to 19 yrs	10.3%	6
20 to 29 yrs	39.7%	23
MT 30 yrs	41.4%	24
Population of town/city where practising		
LT 5000	10.3%	6
5001 to 10000	5.2%	3
MT 10001	84.5%	49
Nurse provides medicine supply services in any rural and remote areas, where there are no physical pharmacies.		
Yes	25.9%	15
No	58.6%	34
NA	15.5%	9

Variable	%	n
Nurse provides S100 medicine supply services to any Aboriginal and Islander Health Services, where there is no physical pharmacy.		
Yes	8.6%	5
No	69.0%	40
Unsure	5.2%	3
NA	17.2%	10
If nurse does not provide medicine supply services in any rural and remote areas, where there are no physical pharmacies, does nurse plan to offer services to these areas in the future:		
Yes	1.7%	1
No	39.7%	23
Unsure	20.7%	12
NA	37.9%	22
Broadband ADSL available where nurse practices		
Yes	81.0%	47
No	6.9%	4
Unsure	10.3%	6
NA	1.7%	1

Section 2 of the survey form was dedicated to questions about the nurse's opinions on telepharmacy.

A series of ten questions were posed and the respondents asked to rate their response to the question using the rating scale "Strongly Agree", "Agree", "Neutral", "Disagree" and "Strongly Disagree".

The first question in this section asked if the nurse thought that telepharmacy can improve the provision of health care by pharmacists to rural and remote communities, who may have poor access to health services. The majority of the respondents were supportive of this question: 16 per cent strongly agreed and 72 per cent agreed, (refer Table 20 for a summary of responses).

The second question in this section asked if the nurse thought it feasible to use telepharmacy to provide professional health care services, like patient counselling, to remote communities. The majority of the respondents were supportive of this question: 28 per cent strongly agreed and 66 per cent agreed. Three respondents were neutral in their answer and one disagreed.

The third question asked if the nurse thought that medication reviews (e.g. HMRs) could be carried out by using telepharmacy. Of the respondents 24 per cent strongly agreed and 72 per cent agreed. One of the respondents was neutral and one disagreed.

The fourth question asked if the nurse thought that medication reviews, carried out by using telepharmacy, would require the help of a trained person or healthcare worker in the remote location to assist the patient during the review. All of the respondents were in favour of a trained remote assistant.

The fifth question asked if the nurse thought there was potential for pharmacies using telepharmacy to act as a site to deliver pharmacy services (e.g. dispensing by trained assistants under video supervision) to remote areas without pharmacies. The majority of the respondents were in favour of using a trained remote assistant to deliver pharmacy services under video supervision (81 per cent agreed or strongly agreed). Of the respondents 19 per cent strongly agreed and 62 per cent agreed. Five of the respondents were neutral and six of the respondents disagreed.

The sixth question asked if the nurse thought there was potential for a Call Centre, operated by pharmacists, using telepharmacy, to provide professional health care services like patient counselling, to rural and remote communities when the local pharmacy is closed. The majority (76 per cent) of the respondents were in favour of using a Call Centre, operated by pharmacists, to provide professional health care services to rural and remote communities when the local pharmacy is closed. Of the respondents 17 per cent strongly agreed and 59 per cent agreed.

The seventh question asked if the nurse thought there was potential for a Call Centre, operated by pharmacists, using telepharmacy, to dispense prescriptions for rural and remote communities *when the local pharmacy is closed*, by operating a remote automated dispensing machine situated in a secure area. Of the respondents only 19 per cent strongly agreed and 62 per cent agreed. However five of the respondents (9 per cent) were neutral and six of the respondents (10 per cent) disagreed and none strongly disagreed.

The final question asked if the nurse thought there was potential for a Call Centre, operated by pharmacists, using telepharmacy, to deliver pharmacy services to remote areas, *without pharmacies*, by operating remote automated dispensing machines situated in a secure area such as the local medical centre. A majority of the respondents were in favour of using such a Call Centre to provide dispensing services to rural and remote communities where there is no local pharmacy (76 per cent agreed or strongly agreed versus 10 per cent who disagreed or strongly disagreed). Eight of the respondents (14 per cent) were neutral.

Table 20: Nurse Survey Section 2

Variable	%	n
Nurse thinks that telepharmacy can improve the provision of health care by pharmacists to rural and remote communities, who may have poor access to health services.		
Strongly Agree	15.5%	9
Agree	72.4%	42
Neutral	12.1%	7
Nurse thinks that it is feasible to use telepharmacy to provide professional health care services, like patient counselling, to remote communities.		
Strongly Agree	27.6%	16
Agree	65.5%	38
Neutral	5.2%	3
Disagree	1.7%	1
Nurse thinks that medication reviews (e.g. HMRs) could be carried out by using telepharmacy.		
Strongly Agree	24.1%	14
Agree	72.4%	42
Neutral	1.7%	1
Disagree	1.7%	1
Nurse thinks that medication reviews, carried out by using telepharmacy, would require the help of a trained person or healthcare worker in the remote location to assist the patient during the review.		
Strongly Agree	25.9%	15
Agree	74.1%	43
Nurse thinks there is potential for pharmacies using telepharmacy to act as a site to deliver pharmacy services (e.g. *dispensing by trained assistants under video supervision*) to remote areas without pharmacies.		
Strongly Agree	19.0%	11
Agree	62.1%	36
Neutral	8.6%	5
Disagree	10.3%	6

Variable	%	n
Nurse thinks there is potential for a Call Centre, operated by pharmacists, using telepharmacy, to provide professional health care services like patient counselling, to rural and remote communities *when the local pharmacy is closed*.		
Strongly Agree	17.2%	10
Agree	58.6%	34
Neutral	13.8%	8
Disagree	10.3%	6
Nurse thinks there is potential for a Call Centre, operated by pharmacists, using telepharmacy, to dispense prescriptions for rural and remote communities *when the local pharmacy is closed,* by operating a remote automated dispensing machine situated in a secure area.		
Strongly Agree	19.0%	11
Agree	62.1%	36
Neutral	8.6%	5
Disagree	10.3%	6
Nurse thinks there is potential for pharmacists using telepharmacy to deliver pharmacy services to remote areas, *without pharmacies,* by operating remote automated dispensing machines situated in a secure area such as the local medical centre.		
Strongly Agree	17.2%	10
Agree	58.6%	34
Neutral	13.8%	8
Disagree	10.3%	6

5.2.4.3 Further Analysis

The data consisting of categorical variables were analysed with SPSS® 14.0 for Windows. The results from Section 1 of the survey of nurses indicated that there was no significant difference ($P<0.05$) in opinions, other than the population of the town or city where the nurse practised (shaded portion in Table 21). This difference is due to the bias introduced into the survey, since it was conducted at the Royal College of Nursing annual conference and there were a significant number of nurses from urban areas.

Table 21: Section 1 Responses to Nurse Survey by Gender - Chi-Square, Kruskal-Wallis test.

Question	Chi-Square	df	Asymp. Sig.
Years of Practice	0.250	1	0.617
Population of town/city where practising	4.433	1	0.035
ARIA where practising	2.022	1	0.155
Nurse provides pharmacy services in any rural and remote areas, where there are no physical pharmacies.	0.031	1	0.860
Nurse provides S100 services to any Aboriginal and Islander Health Services, where there is no physical pharmacy.	1.732	1	0.188
If nurse does not provide pharmacy services in any rural and remote areas, where there are no physical pharmacies, does nurse plan to offer services to these areas in the future	0.345	1	0.557
Broadband ADSL available where nurse practices	0.206	1	0.650

The survey results for Section 2 of the survey appear in the following table:

Table 22: Section 2 Responses to Nurse Survey by Gender – Chi-Square, Kruskal-Wallis test.

Question	Chi-Square	df	Asymp. Sig.
Nurse thinks that telepharmacy can improve the provision of health care by pharmacists to rural and remote communities, who may have poor access to health services.	0.862	1	0.353
Nurse thinks that it is feasible to use telepharmacy to provide professional health care services, like patient counselling, to remote communities.	1.148	1	0.284
Nurse thinks that medication reviews (e.g. HMRs) could be carried out by using telepharmacy.	0.184	1	0.668
Nurse thinks that medication reviews, carried out by using telepharmacy, would require the help of a trained person or healthcare worker in the remote location to assist the patient during the review.	0.030	1	0.863
Nurse thinks there is potential for pharmacies using telepharmacy to act as a site to deliver pharmacy services (e.g. *dispensing by trained assistants under video supervision*) to remote areas without pharmacies.	0.334	1	0.563
Nurse thinks there is potential for a Call Centre, operated by pharmacists, using telepharmacy, to provide professional health care services like patient counselling, to rural and remote communities *when the local pharmacy is closed*.	0.046	1	0.830

Question	Chi-Square	df	Asymp. Sig.
Nurse thinks there is potential for a Call Centre, operated by pharmacists, using telepharmacy, to dispense prescriptions for rural and remote communities *when the local pharmacy is closed*, by operating a remote automated dispensing machine situated in a secure area.	0.334	1	0.563
Nurse thinks there is potential for pharmacies using telepharmacy to deliver pharmacy services to remote areas, *without pharmacies,* by operating remote automated dispensing machines situated in a secure area such as the local medical centre.	0.046	1	0.830

The results from Section 2 of the survey of nurses indicated that there was no significant difference in opinions on telepharmacy between male and female nurses (Section 2 questions). The one identified gender difference was in the Section 1 responses; the population areas. Table 23 indicates that proportionally more male nurses practised in towns of less than 10,000 population than female nurses (albeit on a very low sample base).

Table 23: Population Nurse Survey Gender Cross-tabulation

			Gender		Total
			Male	Female	
Population	Less than 5000	Count	2	4	6
	5,001 to 10,000	Count	1	2	3
	More than 10,001	Count	4	45	49
Total		Count	7	51	58

The data were then further analysed by ARIA. The ARIA variable was collapsed into two categories; urban and rural (ARIA 1 and 2 for urban and ARIA 3-6 for rural). One significant difference ($P < 0.05$) was found in this analysis (Figure 25).

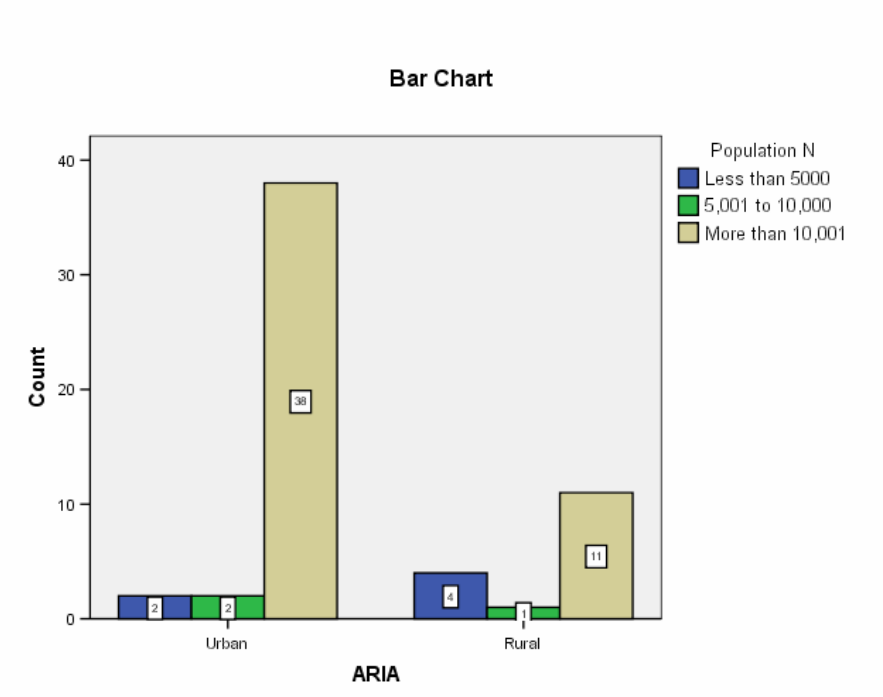

Figure 25: Nurse Group, population of the town/city where practising by ARIA group.

Further analyse by experience groups was then undertaken (Figure 26). The experience variable was collapsed into two categories; less than 10 years experience and more than 10 years experience. Only one question indicated a significant difference ($P < 0.05$); if the nurse group thought that there was potential for pharmacies using telepharmacy to act as a site to deliver pharmacy services (e.g. dispensing by trained assistants under video supervision) to remote areas without pharmacies. However, the small number of respondents (5) in the less than 10 year experience group indicates that this result is probably unreliable.

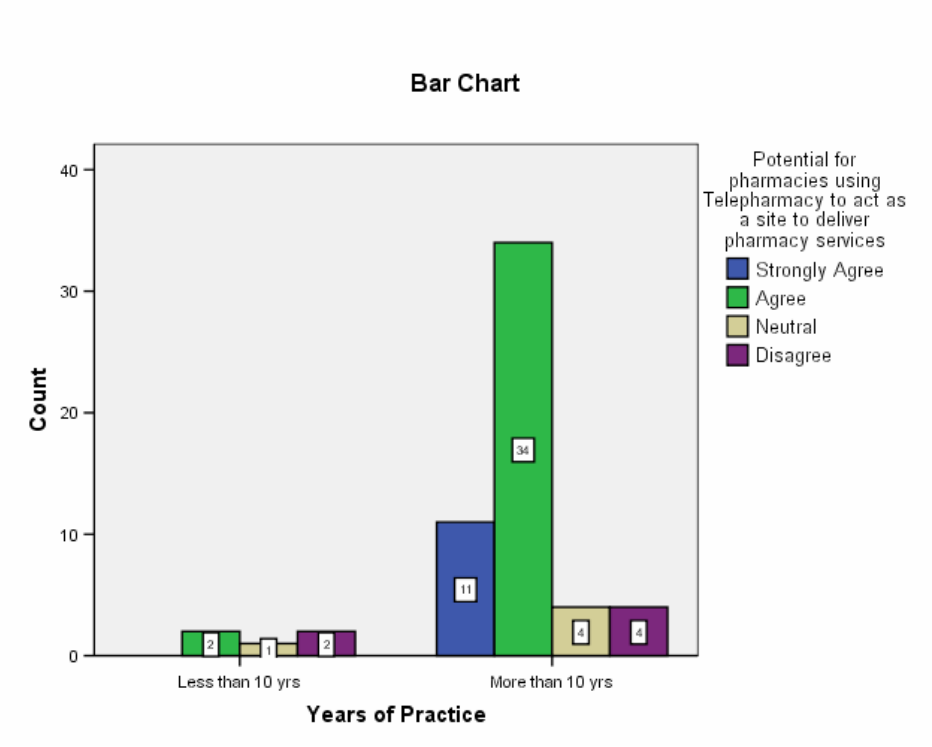

Figure 26: Experience variable -nurse group; potential for pharmacies using telepharmacy to act as a site to deliver pharmacy services (e.g. dispensing by trained assistants under video supervision.

Table 19 reveals that a large number (84 per cent) of the respondents who attended the Royal College of Nursing conference were from population areas of greater than 10,001 people. This information, when considered in conjunction with Table 18, which shows that 72 per cent of the respondents practised in ARIAs 1 and 2, indicates that the survey results should only be extrapolated to rural areas with care.

5.2.4.4 Conclusion

The survey of nurses suffers from the disadvantage that it was conducted at an annual conference. The participants, although highly experienced (91% having practised for more than 10 years), were mostly based in urban areas (72 per cent in ARIA < 3). This survey is therefore biased towards the opinions of urban nurses and the results, although interesting, need to be considered from that point of view.

5.2.5 Survey of Nurses/Healthcare workers on Telepharmacy

5.2.5.1 Methods

The fourth survey, of nurses and healthcare workers, was an Internet download. As with the previous three surveys the James Cook University Human Ethics Committee had given approval for the survey to be carried out as a low risk study (refer to Appendix A for ethics approval application).

An Internet website was set up with the domain name of www.telepharmacy.com.au, using the software program Dreamweaver MX (Macromedia Inc.).

A survey form was prepared in Acrobat 7 (Acrobat Professional, Adobe Inc.) format (see Appendix B4), to allow online submission of the completed form. For respondents who did not wish to download the Acrobat 7 to enable online completion of the form, two additional downloads were prepared: one in Word (Microsoft Corporation) and the other in Acrobat 5 format. These forms could be completed offline and either emailed, posted or telefaxed to the addresses and contact numbers provided on the website. The website also provided additional information on telepharmacy and links to telepharmacy websites of interest. Information on the survey was provided via a download document link. This document also provided details of the James Cook University complaints procedure.

The respondents were given one-month's time to complete and return the survey and an incentive to enter into the draw for an iPod (valued at $300) to encourage return of the survey forms prior to the due date was also included. Supplementary Human Ethics Approval was obtained authorising this incentive (refer to Appendix A). The use of an incentive is commonly used to encourage participation in web-based surveys. Bosnjak and Tuten state that the willingness to participate in a web-based survey has been shown to be highest for a prize draw group.[154]

The survey was advertised in the Nursing Careers and Allied Health booklet published in June 2006.

Unfortunately the response to the survey was very poor and only 28 completed forms were returned.

Question 1 asked the gender of the nurse/healthcare worker: 18 per cent of the respondents were males and 82 per cent were females (refer to Table 25 for a summary of Section 1 responses).

The respondent nurse/healthcare workers were weighted towards a high degree of experience, with 68 per cent listing more than 10 years of experience. Of the four experience groups in the survey, 32 per cent had less than 10 years experience, 7 per cent had 10 to 19 years experience, 36 per cent had 20 to 29 years experience and 25 per cent had more than 30 years experience.

From the data obtained, of the three population groups being serviced by the nurse/healthcare workers surveyed, the majority (61 per cent) were servicing towns of more than 10,001 people.

The following table shows the distribution of respondents grouped by ARIA Categories. These categories were derived from converting the postal code where the respondent practised to the appropriate ARIA code.

Table 24: Nurse Healthcare worker ARIA Categories

	Percent of respondents
Category 1 - Highly Accessible	18%
Category 2 -Accessible (Group A)	0%
Category 3 - Accessible (Group B)	68%
Category 4 - Moderately Accessible	0%
Category 5 - Remote	4%
Category 6 - Very Remote	11%

Question 5 of Section 1 asked the nurse/healthcare worker if he/she provided medicine supply services in any rural and remote areas, where there are no physical pharmacies. A low number of respondents (7 per cent) supplied medicines where there are no physical pharmacies and 11 per cent provided S100 medicine supply services to AHSs (Question 6) and only 3 per cent planned to provide such services in the future (Question 7).

The final question in Section 1 of the survey asked the nurse/healthcare worker if Broadband ADSL was available in the area where he/she practiced. The vast majority (93 per cent) of the respondents indicated that Broadband ADSL was available in the area where the nurse practised.

Table 25: Nurse Healthcare Worker Survey Section 1

Variable	%	n
Gender		
Male	17.9%	5
Female	82.1%	23
Years of Practice		
LT 10 yrs	32.1%	9
10 to 19 yrs	7.1%	2
20 to 29 yrs	35.7%	10
MT 30 yrs	25.0%	7
Population of town/city where practising		
LT 5000	14.3%	4
5001 to 10000	25.0%	7
MT 10001	60.7%	17
Nurse/HCW provides medicine supply services in any rural and remote areas, where there are no physical pharmacies.		
Yes	7.1%	2
No	85.7%	24
NA	7.1%	2
Nurse/HCW provides S100 medicine supply services to any Aboriginal and Islander Health Services, where there is no physical pharmacy.		
Yes	10.7%	3
No	82.1%	23
Unsure	3.6%	1
NA	3.6%	1
If Nurse/HCW does not provide medicine supply services in any rural and remote areas, where there are no physical pharmacies, does Nurse/HCW plan to offer services to these areas in the future:		
Yes	3.6%	1
No	57.1%	16
Unsure	10.7%	3
NA	28.6%	8
Broadband ADSL available where Nurse/HCW practices		
Yes	92.9%	26
No	7.1%	2

Section 2 of the survey form was dedicated to questions about the nurse's opinions on telepharmacy. A series of ten questions were posed and the respondents asked to rate their response to the question using the rating scale "Strongly Agree", "Agree", "Neutral", "Disagree" and "Strongly Disagree".

The first question in this section asked if the nurse/healthcare worker thought that telepharmacy can improve the provision of health care by pharmacists to rural and remote communities, who may have poor access to health services. The majority of the respondents were supportive of this question: 25 per cent strongly agreed and 43 per cent agreed. Nine respondents were neutral in their answer (32 per cent) and none disagreed or strongly disagreed, (refer Table 26 for a summary of responses).

The second question in this section asked if the nurse/healthcare worker thought it is feasible to use telepharmacy to provide professional health care services, like patient counselling, to remote communities. The majority of the respondents were supportive of this question: 39 per cent strongly agreed and 50 per cent agreed. Three respondents were neutral in their answer (11 per cent) and none disagreed or strongly disagreed.

The third question asked if the nurse/healthcare worker thought that medication reviews (e.g. HMRs) could be carried out by using telepharmacy. Of the respondents 21 per cent strongly agreed and 64 per cent agreed. Four of the respondents (14 per cent) were neutral, none disagreed or strongly disagreed.

The fourth question asked if the nurse/healthcare worker thought that medication reviews, carried out by using telepharmacy, would require the help of a trained person or healthcare worker in the remote location to assist the patient during the review. The majority of the respondents were in favour of a trained remote assistant (79 per cent agreed or strongly agreed). Of the respondents 32 per cent strongly agreed and 57 per cent agreed. Three of the respondents (11 per cent) were neutral, none of the respondents disagreed or strongly disagreed.

The fifth question asked if the nurse/healthcare worker thought there was potential for pharmacies using telepharmacy to act as a site to deliver pharmacy services (e.g. dispensing by trained assistants under video supervision) to remote areas without pharmacies. The majority of the respondents were in favour of using a trained remote assistant to deliver pharmacy services under video supervision (64 per cent agreed or strongly agreed). Of the respondents 7 per cent strongly agreed and 57 per cent agreed. Eight of the respondents were neutral, two of the respondents disagreed and none strongly disagreed.

The sixth question asked if the nurse/healthcare worker thought there was potential for a Call Centre, operated by pharmacists, using telepharmacy, to provide professional health care services like patient counselling, to rural and remote communities when the local pharmacy is closed. The majority of the respondents were in favour of using a Call Centre, operated by pharmacists, to provide professional health care services to rural and remote communities when the local pharmacy is closed (82 per cent agreed or strongly agreed). Of the respondents 14 per cent strongly agreed and 68 per cent agreed.

The seventh question asked if the nurse/healthcare worker thought there was potential for a Call Centre, operated by pharmacists, using telepharmacy, to dispense prescriptions for rural and remote communities when the local pharmacy is closed, by operating a remote automated dispensing machine situated in a secure area. Of the respondents only 7 per cent strongly agreed and 57 per cent agreed. However, eight of the respondents (29 per cent) were neutral and two of the respondents (7 per cent) disagreed and none strongly disagreed.

The final question asked if the nurse/healthcare worker thought there was potential for a Call Centre, operated by pharmacists, using telepharmacy, to deliver pharmacy services to remote areas, without pharmacies, by operating remote automated dispensing machines situated in a secure area such as the local medical centre. A majority of the respondents were in favour of using such a Call Centre to provide dispensing services to rural and remote communities where there is no local pharmacy (82 per cent) agreed or strongly agreed. Five of the respondents (18 per cent) were neutral.

Table 26: Nurse Healthcare Worker Survey Section 2

Variable	%	n
Nurse/HCW thinks that telepharmacy can improve the provision of health care by pharmacists to rural and remote communities, who may have poor access to health services.		
Strongly Agree	25.0	7
Agree	42.9	12
Neutral	32.1	9
Nurse/HCW thinks that it is feasible to use telepharmacy to provide professional health care services, like patient counselling, to remote communities.	39.3	11
Strongly Agree	50.0	14
Agree	10.7	3
Neutral		
Nurse/HCW thinks that medication reviews (e.g. HMRs) could be carried out by using telepharmacy.		
Strongly Agree	21.4	6
Agree	64.3	18
Neutral	14.3	4

Variable	%	n
Nurse/HCW thinks that medication reviews, carried out by using telepharmacy, would require the help of a trained person or healthcare worker in the remote location to assist the patient during the review.		
Strongly Agree	32.1	9
Agree	57.1	16
Neutral	10.7	3
Nurse/HCW thinks there is potential for pharmacies using telepharmacy to act as a site to deliver pharmacy services (e.g. *dispensing by trained assistants under video supervision*) to remote areas without pharmacies.		
Strongly Agree	2	7.1
Agree	16	57.1
Neutral	8	28.6
Disagree	2	7.1
Nurse/HCW thinks there is potential for a Call Centre, operated by pharmacists, using telepharmacy, to provide professional health care services like patient counselling, to rural and remote communities *when the local pharmacy is closed*.		
Strongly Agree	14.3	4
Agree	67.9	19
Neutral	17.9	5
Nurse/HCW thinks there is potential for a Call Centre, operated by pharmacists, using telepharmacy, to dispense prescriptions for rural and remote communities *when the local pharmacy is closed,* by operating a remote automated dispensing machine situated in a secure area.		
Strongly Agree	7.1	2
Agree	57.1	16
Neutral	28.6	8
Disagree	7.1	2
Nurse/HCW thinks there is potential for pharmacies using telepharmacy to deliver pharmacy services to remote areas, *without pharmacies,* by operating remote automated dispensing machines situated in a secure area such as the local medical centre.		
Strongly Agree	14.3	4
Agree	67.9	19
Neutral	17.9	5

5.2.5.2 Further Analysis

Because of the small number of respondents to this survey, further statistical analysis was unlikely to reveal any meaningful results; therefore no further analysis was undertaken.

5.3 Discussion of Survey Results

5.3.1 Combined survey results

The survey results for each of the above four surveys were combined into a single database and a variable "Profession" created to enable analysis of the healthcare groups. The data consisting of categorical variables were analysed with SPSS® 14.0 for Windows using appropriate non-parametric statistical functions, such as "Frequencies" and "Crosstabs", along with the Chi-square Kruskal-Wallis test. Table 27 reveals the summary results for Section 1 questions.

In Section 1 of the combined results, of the total of 292 respondents, the female group was slightly larger than the male group (54 per cent). The respondents were experienced professionals, 82 per cent had more than 10 years of experience. The majority (73 per cent of the respondents practised in towns of more than 10,001 population and also mostly practised in rural locations (71 per cent) classified as ARIA 3 and above. Of the total professionals surveyed 69 per cent did not provide medicine supply services where there were no physical pharmacies, 80 per cent did not provide S100 services, 44 per cent were not planning to provide such services in the future. The majority of the respondents (90%) practised in areas where Broadband ADSL was available.

Table 27: Total Combined Surveys (Pharmacists, Doctors, Nurses and HCWs) Section 1 – Descriptive Statistics and Chi-square

Variable	%	n 292	Chi-sq	df	*P*
Gender			51.829	3	<0.001
Male	45.9%	134			
Female	54.1%	158			
Years of Practice			16.225	3	<0.001
LT 10 yrs	18.5%	54			
10 to 19 yrs	20.9%	61			
20 to 29 yrs	32.9%	96			
MT 30 yrs	27.4%	80			

Variable	%	n 292	Chi-sq	df	*P*
Population of town/city where practising			6.565	3	0.087
LT 5000	14.0%	41			
5001 to 10000	13.4%	39			
MT 10001	72.6%	212			
ARIA where practising			96.894	3	<0.001
Highly Accessible	14.7%	43			
Accessible (Group A)	5.8%	17			
Accessible (Group B)	51.7%	151			
Moderately Accessible	14.0%	41			
Remote	5.1%	15			
Very Remote	8.6%	25			
Healthcare professional provides medicine supply services in any rural and remote areas, where there are no physical pharmacies.			12.383	3	0.006
Yes	25.3%	74			
No	68.5%	200			
Unsure	1.4%	4			
NA	4.5%	13			
Healthcare professional provides S100 medicine supply services to any Aboriginal and Islander Health Services, where there is no physical pharmacy.			9.116	3	0. 28
Yes	10.3%	30			
No	79.5%	232			
Unsure	4.8%	14			
NA	5.5%	16			
If Healthcare professional does not provide medicine supply services in any rural and remote areas, where there are no physical pharmacies, does healthcare professional plan to offer services to these areas in the future:			7.274	3	0.064
Yes	7.5%	22			
No	44.2%	129			
Unsure	19.9%	58			
NA	25.3%	74			

Variable	%	n 292	Chi-sq	df	*P*
Broadband ADSL available where healthcare professional practices			7.346	3	0.062
Yes	89.7%	262			
No	3.8%	11			
Unsure	5.8%	17			
NA	0.3%	1			

As detailed in Table 28, Section 2 of the combined survey results, 81 per cent thought (strongly agreed or agreed) that telepharmacy could improve the provision of health care by pharmacists to rural and remote communities, who may have poor access to health services. A further 87 per cent (strongly agreed or agreed) thought that it was feasible to use telepharmacy to provide professional health care services, like patient counselling, to remote communities. On the subject of medication reviews, 80 per cent of the respondents thought that medication reviews (e.g. HMRs) could be carried out by using telepharmacy and that this would require the help of a trained person or healthcare worker in the remote location to assist the patient during the review (82 per cent strongly agreed or agreed). The respondents (67 per cent) also strongly agreed or agreed that there was potential for pharmacies using telepharmacy to act as a site to deliver pharmacy services (e.g. dispensing by trained assistants under video supervision) to remote areas without pharmacies and that there was potential for a Call Centre, operated by pharmacists, using telepharmacy, to provide professional health care services like patient counselling, to rural and remote communities when the local pharmacy is closed. However, only 53 per cent (strongly agreed or agreed) of respondents felt there was potential for a Call Centre, operated by pharmacists, using telepharmacy, to dispense prescriptions for rural and remote communities when the local pharmacy is closed, by operating a remote automated dispensing machine situated in a secure area and 57 per cent thought that there was potential for pharmacies using telepharmacy to deliver pharmacy services to remote areas, without pharmacies, by operating remote automated dispensing machines situated in a secure area such as the local medical centre. See Section 5.4 Hypothesis Testing for further discussion.

Table 28: Total Combined Surveys (Pharmacists, Doctors, Nurses and HCWs) Section 2 - Descriptive Statistics and Chi-square

Variable	%	n 292	Chi-sq	df	P
Healthcare professional thinks that telepharmacy can improve the provision of health care by pharmacists to rural and remote communities, who may have poor access to health services.			24.096	3	<0.001
Strongly Agree	20.9%	61			
Agree	60.3%	176			
Neutral	12.7%	37			
Disagree	5.1%	15			
Strongly Disagree	1.0%	3			
Healthcare professional thinks that it is feasible to use telepharmacy to provide professional health care services, like patient counselling, to remote communities.			1.259	3	0.739
Strongly Agree	31.8%	93			
Agree	55.5%	162			
Neutral	7.2%	21			
Disagree	4.5%	13			
Strongly Disagree	1.0%	3			
Healthcare professional thinks that medication reviews (e.g. HMRs) could be carried out by using telepharmacy.			22.698	3	<0.001
Strongly Agree	20.9%	61			
Agree	58.6%	171			
Neutral	13.0%	38			
Disagree	6.8%	20			
Strongly Disagree	0.7%	2			

Variable	%	n 292	Chi-sq	df	P
Healthcare professional thinks that medication reviews, carried out by using telepharmacy, would require the help of a trained person or healthcare worker in the remote location to assist the patient during the review.			28.458	3	<0.001
Strongly Agree	28.4%	83			
Agree	53.8%	157			
Neutral	13.4%	39			
Disagree	4.1%	12			
Strongly Disagree	0.3%	1			
Healthcare professional thinks there is potential for pharmacies using telepharmacy to act as a site to deliver pharmacy services (e.g. *dispensing by trained assistants under video supervision*) to remote areas without pharmacies.			10.102	3	0.018
Strongly Agree	13.7%	40			
Agree	53.4%	156			
Neutral	15.4%	45			
Disagree	14.0%	41			
Strongly Disagree	3.1%	9			
Healthcare professional thinks I think there is potential for a Call Centre, operated by pharmacists, using telepharmacy, to provide professional health care services like patient counselling, to rural and remote communities *when the local pharmacy is closed*.			12.235	3	0.007.2
Strongly Agree	14.4%	42			
Agree	52.7%	154			
Neutral	18.2%	53			
Disagree	11.0%	32			
Strongly Disagree	3.1%	9			

Variable	%	n 292	Chi-sq	df	P
Healthcare professional thinks there is potential for a Call Centre, operated by pharmacists, using telepharmacy, to dispense prescriptions for rural and remote communities *when the local pharmacy is closed*, by operating a remote automated dispensing machine situated in a secure area.			41.026	3	<0.001
Strongly Agree	10.3%	30			
Agree	42.8%	125			
Neutral	22.9%	67			
Disagree	18.2%	53			
Strongly Disagree	5.5%	16			
Healthcare professional thinks there is potential for pharmacies using telepharmacy to deliver pharmacy services to remote areas, *without pharmacies*, by operating remote automated dispensing machines situated in a secure area such as the local medical centre.			28.958	3	<0.001
Strongly Agree	10.6%	31			
Agree	46.2%	135			
Neutral	22.3%	65			
Disagree	15.4%	45			
Strongly Disagree	5.1%	15			

5.3.2 Survey results – pharmacist and medical practitioner groups combined.

The survey results for the nurses and nurse/HCW, surveys three and four, each had some issues. This is because the ARIA grouping for the nurse group was biased towards urban practice and may not reflect a rural opinion and there were a relatively small number of respondents in the nurse/HCW group (N=28).

Accordingly the survey results for the pharmacist and medical practitioner groups were combined into a single database and a variable "Profession" created to enable analysis of the two groups. The data consisting of categorical variables were analysed with SPSS® 14.0 for Windows using appropriate non-parametric statistical functions, such as "Frequencies" and the Chi-square Kruskal-Wallis test.

In Section 1 of the pharmacist and medical practitioner combined results, of the total of 206 respondents, the female group was slightly smaller than the male group (41 per cent). The respondents were experienced professionals, 81 per cent had more than 10 years of experience. The majority (71 per cent of the respondents practised in towns of more than 10,001 population and also mostly practised in rural locations (94 per cent) classified as ARIA 3 and above. Of the total professionals surveyed 69 per cent did not provide medicine supply services where there were no physical pharmacies, 82 per cent did not provide S100 services, 90 per cent were not planning to provide such services in the future. The majority of the respondents (92 per cent) practised in areas where Broadband ADSL was available.

Table 29 reveals the summary results for Section 1 questions. The shaded portions of the table indicate significant results ($P<0.05$).

Table 29: Combined Pharmacist and Medical Practitioner Surveys Section 1 – Descriptive Statistics and Chi-square

Variable	Pharmacists		Doctors		Total n=206	Chi-sq	*P*
	%	n	%	n			
Gender						0.868	0.351
Male	54.5%	54	63.6%	68	122		
Female	45.5%	45	36.4%	39	84		
Years of Practice						5.874	0.015
LT 10 yrs	30.3%	30	9.3%	10	40		
10 to 19 yrs	20.2%	20	30.8%	33	53		
20 to 29 yrs	26.3%	26	34.6%	37	63		
MT 30 yrs	23.2%	23	24.1%	26	49		
Missing			0.9%	1	1		
Population of town/city where practising						1.24	0.265
LT 5000	15.2%	15	15.0%	16	31		
5001 to 10000	18.2%	18	10.3%	11	29		
MT 10001	66.7%	66	74.8%	80	146		
ARIA where practising						0	0.991
Highly Accessible	0%	0	0%	0	0		
Accessible (Group A)	10.1%	10	2.8%	3	13		
Accessible (Group B)	49.5%	49	64.5%	69	118		
Moderately Accessible	21.2%	21	16.8%	18	39		
Remote	10.1%	10	3.7%	4	14		
Very Remote	9.1%	9	12.1%	13	22		
Healthcare professional provides medicine supply services in any rural and remote areas, where there are no physical pharmacies.						4.105	0.043
Yes	33.3%	33	22.4%	24	57		
No	65.7%	65	72.0%	77	142		
Unsure			3.7%	4	4		
NA			1.9%	2	2		
Missing	1.0%	1			1		
df=1							

Variable	Pharmacists		Doctors		Total	Chi-sq	*P*
	%	n	%	n	n 206		
Healthcare professional provides S100 medicine supply services to any Aboriginal and Islander Health Services, where there is no physical pharmacy.						1.973	0.16
Yes	13.1%	13	8.4%	9	22		
No	81.8%	81	82.2%	88	169		
Unsure	2.0%	2	7.5%	8	10		
NA	3.0%	3	1.9%	2	5		
If Healthcare professional does not provide medicine supply services in any rural and remote areas, where there are no physical pharmacies, does healthcare professional plan to offer services to these areas in the future:						0.248	0.618
Yes	10.1%	10	6.1%	10	20		
No	37.4%	37	19.2%	53	90		
Unsure	27.3%	27	37.4%	16	43		
NA	19.2%	19	27.3%	25	44		
Missing	6.1%	6	10.1%	3	9		
Broadband ADSL available where healthcare professional practices						1.565	0.211
Yes	92.9%	92	90.7%	97	189		
No	3.0%	3	1.9%	2	5		
Unsure	3.0%	3	7.5%	8	11		
NA							
Missing	1.0%	1			1		
df=1							

The first significant result ($P<0.05$), indicated by the shaded portions in Table 29 show the differences in years of practice between the two professional groups. Inspection of Table 9 reveals that 30% of the pharmacist group had less than 10 years of experience, whilst only 9 per cent of the medical practitioner group had less than 10 years experience (Table 15).

The second significant result was on the question whether the pharmacist or medical practitioner provided medicine supply services to rural and remote areas without physical pharmacies. Figure 27 graphically shows the differences. As would be expected, the pharmacist group provided a greater proportion of these services than the medical practitioner group.

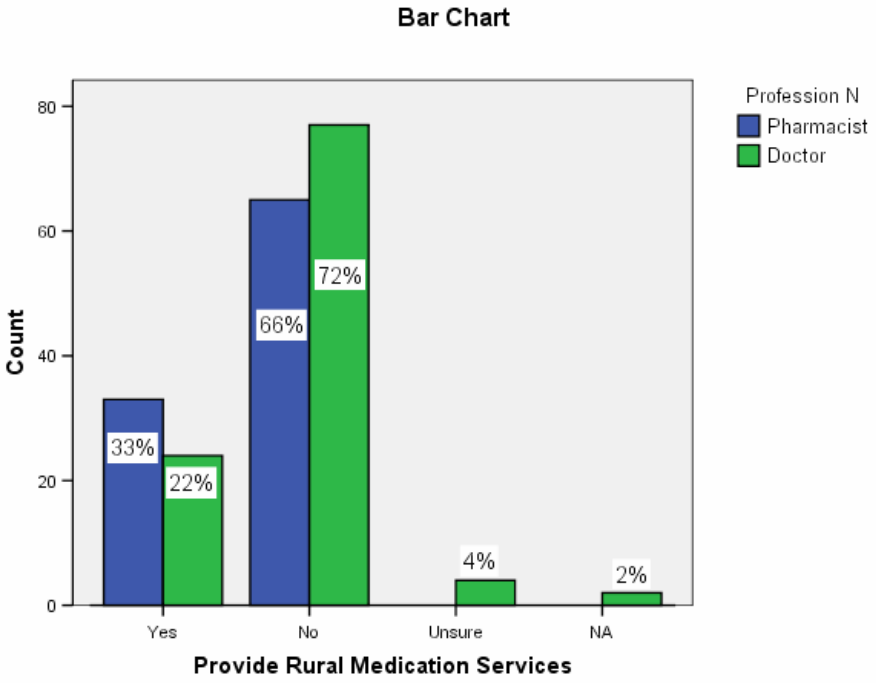

Figure 27: Provides medicine supply services in any rural and remote areas, where there are no physical pharmacies.

As detailed in Table 30, Section 2 of the combined survey results, 81 per cent thought that telepharmacy could improve the provision of health care by pharmacists to rural and remote communities, who may have poor access to health services. A further 85 per cent thought that it was feasible to use telepharmacy to provide professional health care services, like patient counselling, to remote communities. On the subject of medication reviews, 74 per cent of the respondents thought that medication reviews (e.g. HMRs) could be carried out by using telepharmacy and that this would require the help of a trained person or healthcare worker in the remote location to assist the patient during the review (76 per cent agreed). The respondents (64 per cent) also agreed that there was potential for pharmacies using telepharmacy to act as a site to deliver pharmacy services (e.g. dispensing by trained assistants under video supervision) to remote areas without pharmacies and that

there was potential for a Call Centre, operated by pharmacists, using telepharmacy, to provide professional health care services like patient counselling, to rural and remote communities when the local pharmacy is closed (63 per cent). However, only 44 per cent of respondents felt there was potential for a Call Centre, operated by pharmacists, using telepharmacy, to dispense prescriptions for rural and remote communities when the local pharmacy is closed, by operating a remote automated dispensing machine situated in a secure area and 48 per cent thought that there was potential for pharmacies using telepharmacy to deliver pharmacy services to remote areas, without pharmacies, by operating remote automated dispensing machines situated in a secure area such as the local medical centre. The shaded portions of the table indicate significant results ($P<0.05$). The Figures (28-32) that follow Table 30 graphically show the differences between the pharmacist and medical practitioner groups for the significant results indicated in the Table.

See also Section 5.4 Hypothesis Testing for further discussion.

Table 30: Combined Pharmacist and Medical Practitioner Surveys Section 2 – Descriptive Statistics and Chi-square

Variable	Pharmacists		Doctors		Total n=206	Chi-sq	*P*
	%	n	%	n			
1. Healthcare professional thinks that telepharmacy can improve the provision of health care by pharmacists to rural and remote communities, who may have poor access to health services.						14.38	0
Strongly Agree	32.3%	32	12.1%	13	45		
Agree	60.6%	60	57.9%	62	122		
Neutral	2.0%	2	17.8%	19	22		
Disagree	5.1%	5	9.3%	10	15		
Strongly Disagree			2.8%	3	3		

Variable	Pharmacists		Doctors		Total n=206	Chi-sq	*P*
2. Healthcare professional thinks that it is feasible to use telepharmacy to provide professional health care services, like patient counselling, to remote communities.						0.691	0.406
Strongly Agree	28.3%	28	35.5%	38	41		
Agree	58.6%	58	48.6%	52	120		
Neutral	6.1%	6	8.4%	9	25		
Disagree	6.1%	6	5.6%	6	16		
Strongly Disagree	1.0%	1	1.9%	2	4		
3. Healthcare professional thinks that medication reviews (e.g. HMRs) could be carried out by using telepharmacy.						17.96	0
Strongly Agree	16.2%	16	23.4%	25	41		
Agree	44.4%	44	62.6%	67	111		
Neutral	21.2%	21	11.2%	12	33		
Disagree	16.2%	16	2.8%	3	19		
Strongly Disagree	2.0%	2			2		
4. Healthcare professional thinks that medication reviews, carried out by using telepharmacy, would require the help of a trained person or healthcare worker in the remote location to assist the patient during the review.						8.977	0.003
	42.4%	42	15.9%	17	59		
Strongly Agree	43.4%	43	51.4%	55	98		
Agree	12.1%	12	22.4%	24	36		
Neutral	2.0%	2	9.3%	10	12		
Disagree			0.9%	1	1		
Strongly Disagree							

Variable	Pharmacists		Doctors		Total n=206	Chi-sq	*P*
5. Healthcare professional thinks there is potential for pharmacies using telepharmacy to act as a site to deliver pharmacy services (e.g. *dispensing by trained assistants under video supervision*) to remote areas without pharmacies.						8.864	0.003
Strongly Agree	17.2%	17	9.3%	10	27		
Agree	54.5%	54	46.7%	50	104		
Neutral	5.1%	5	25.2%	27	32		
Disagree	20.2%	20	12.1%	13	33		
Strongly Disagree	3.0%	3	5.6%	6	9		
Missing			0.9%	1	1		
6. Healthcare professional thinks I think there is potential for a Call Centre, operated by pharmacists, using telepharmacy, to provide professional health care services like patient counselling, to rural and remote communities *when the local pharmacy is closed*.						16.30	0
Strongly Agree	16.2%	16	11.2%	12	28		
Agree	56.6%	56	42.1%	45	101		
Neutral	12.1%	12	26.2%	28	40		
Disagree	10.1%	10	15.0%	16	26		
Strongly Disagree	4.0%	4	4.7%	5	4		
Missing	1.0%	1	0.9%	1	2		

Variable	Pharmacists		Doctors		Total n=206	Chi-sq	*P*
7. Healthcare professional thinks there is potential for a Call Centre, operated by pharmacists, using telepharmacy, to dispense prescriptions for rural and remote communities *when the local pharmacy is closed*, by operating a remote automated dispensing machine situated in a secure area.						16.30	0
Strongly Agree	7.1%	7	9.3%	10	17		
Agree	23.2%	23	46.7%	50	73		
Neutral	27.3%	27	25.2%	27	54		
Disagree	32.3%	32	12.1%	13	45		
Strongly Disagree	10.1%	10	5.6%	6	16		
Missing			0.9%	1	1		
8. Healthcare professional thinks there is potential for pharmacies using telepharmacy to deliver pharmacy services to remote areas, *without pharmacies*, by operating remote automated dispensing machines situated in a secure area such as the local medical centre.						2.834	0.092
Strongly Agree	5.1%	5	11.2%	12	17		
Agree	37.4%	37	42.1%	45	82		
Neutral	24.2%	24	26.3%	28	52		
Disagree	23.2%	23	15.0%	16	39		
Strongly Disagree	10.1%	10	4.7%	5	15		
Missing			0.9%	1	1		
df=1							

5.3.2.1 Significant results ($P<0.05$), pharmacist, medical practitioner groups.

The following charts illustrate the significant differences in opinion between the pharmacist and medical practitioner groups (shaded areas in Table 30).

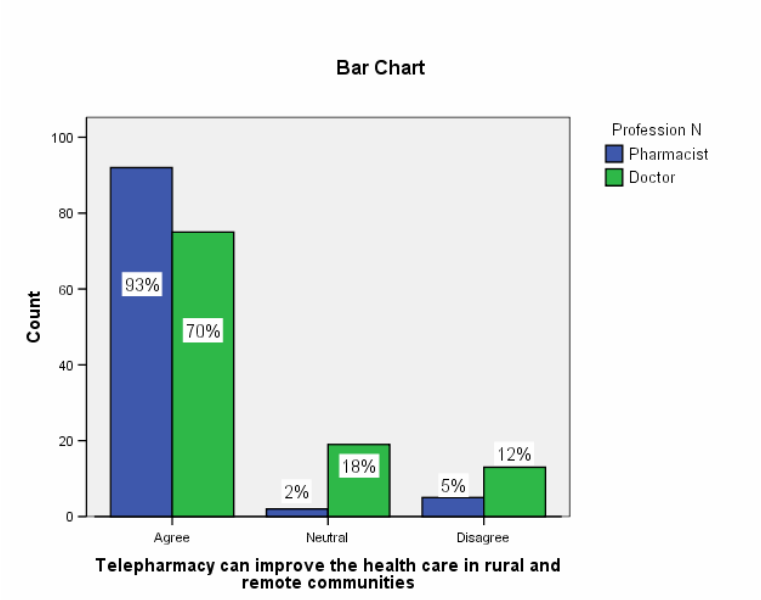

Figure 28: Pharmacist vs. Doctor-Telepharmacy can improve the provision of health care by pharmacists to rural and remote communities, who may have poor access to health services.

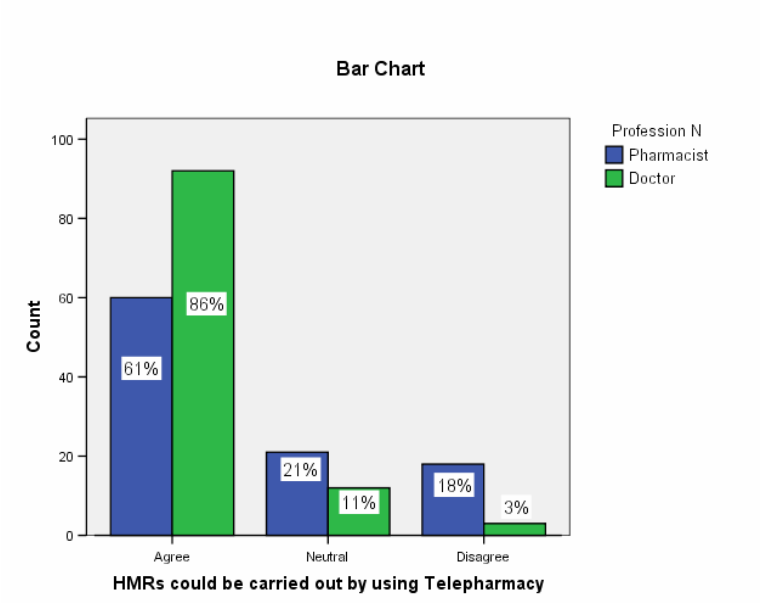

Figure 29: Pharmacist vs. Doctor-Medication reviews (e.g. HMRs) could be carried out by using telepharmacy.

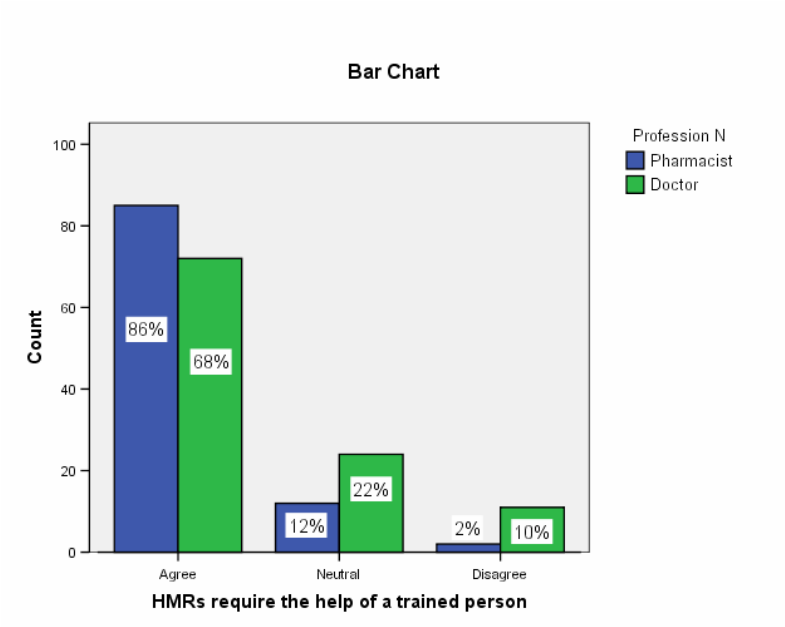

Figure 30: Pharmacist vs. Doctor-Medication reviews, carried out by using telepharmacy, would require the help of a trained person or healthcare worker in the remote location to assist the patient during the review.

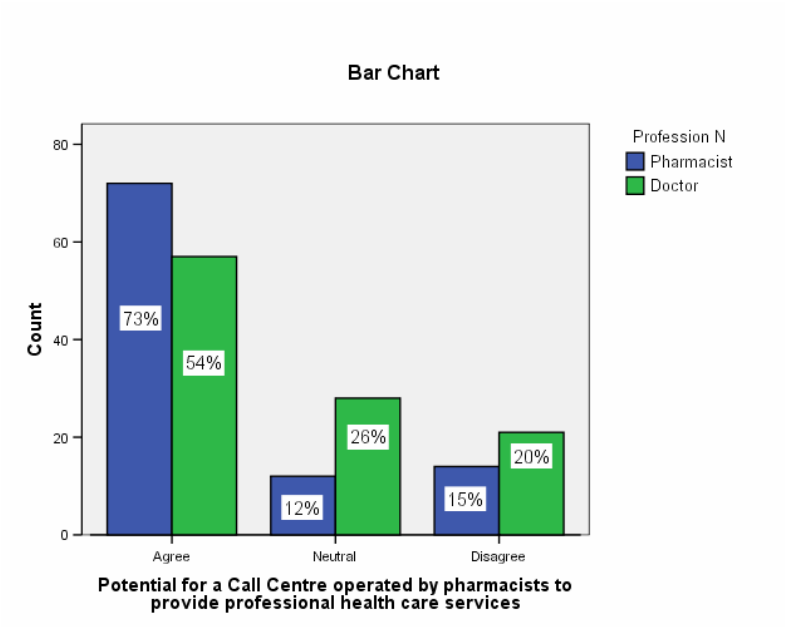

Figure 31: Pharmacist vs. Doctor-There is potential for a Call Centre, operated by pharmacists, using telepharmacy, to provide professional health care services like patient counselling, to rural and remote communities when the local pharmacy is closed.

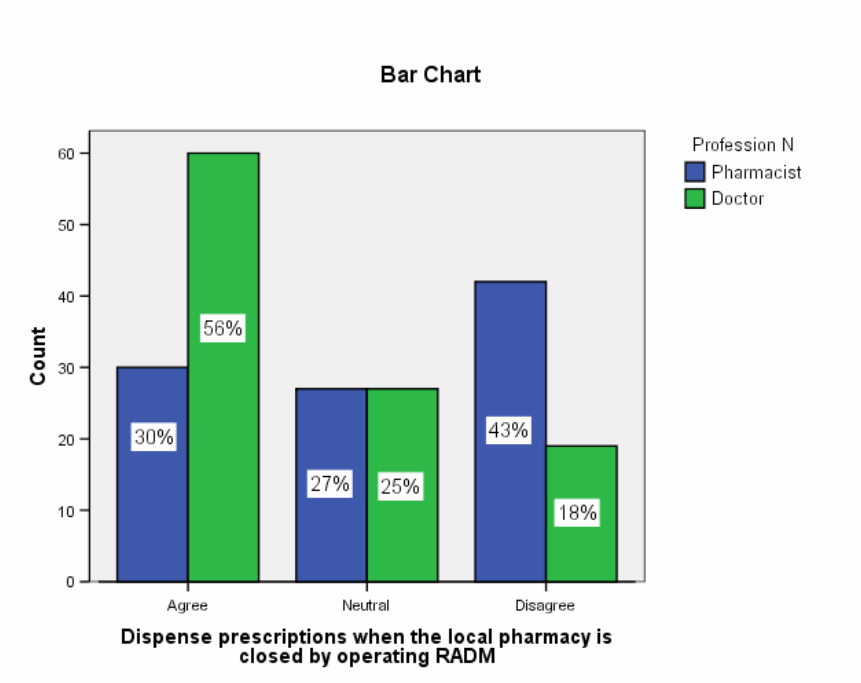

Figure 32: Pharmacist vs. Doctor-There is potential for a Call Centre, operated by pharmacists, using telepharmacy, to dispense prescriptions for rural and remote communities when the local pharmacy is closed, by operating a remote automated dispensing machine.

5.3.3 Free format comments

The free format sections in the surveys sent to pharmacists and medical practitioners yielded some interesting (and valid) additional comments. As indicated by the survey responses, there were more cautious comments from the pharmacist group. Issues raised by both groups included the potential logistics and technical problems, security of the product, maintenance of stock within expiry dates, payment methods, legal issues and language and cultural issues. Three of the medical practitioner respondents raised the issue of RFDS medicine chests; two comments were particularly enlightening:

> "Australian remote communities already have a 'telepharmacy' service. The RFDS and remote communities have been operating a basic dispensing service for many years".

> "As DMO (Flying Dr) out of Darwin in early 70's, each station/community had a medicine chest with drugs labelled in different compartments and numbered. There were 2 radio

schedules/day. Consultations took place and drugs were ordered by numbers with advice on how & when to take the medicines. It worked!!".

Some selected positive comments from the medical practitioner group are as follows:

"We currently use telemedicine video link up to assess patients in areas up to 300kms distance from here for anaesthetic assessment for upcoming operations. I think there is a good potential for telepharmacy to be successful".

"Interesting and promising concept. Be great if could work!".

"I love the idea that remote communities will enjoy the same professional care as those in urban areas".

Some negative comments from the medical practitioner group include:

"Although a good idea, the logistics would be quite difficult. Acceptance by our predominantly Indigenous population would be very difficult. English is usually their second language. There is a great degree of suspicion regarding tele-conference & tele-medicine to begin with".

"I don't like the idea of removing humans from all this as patients need to be able to consult with pharmacists. How does the prescriber fit into all this?"

"Most of the patients who require regular prescriptions are elderly patients who have problems of sight and hearing. Automated machines could be a problem".

The pharmacist responses were, on the whole, less positive and more considered, as indicated by the following remarks:

"An excellent initiative. As a confirmation of drug being taken, MIMS and Webstercare issue graphics images, especially as many foil packed items are now hidden from view, this could be incorporated."

"I think telemedicine/telepharmacy has great opportunities for the delivery of health services to people living in remote communities, especially in areas where people speak English as a

first language. There's some important issues that need to be taken into account, however, within the group of people we service, namely language and cultural differences. I would be happy to be involved in further discussion and the involvement of community members in the feasibility of and acceptability of this mode of service delivery".

"Doing HMR's by videolink seems like a good idea. Bit dubious about the practicalities of checking scripts by videolink especially if one or both of the locations is particularly busy. Very much against machines remotely dispensing medicines, who's liable if there is an error?"

"Telepharmacy sounds like the opportunity that businesses like Coles-Myer would be looking for".

"If automated dispensing machines get introduced there is a worrying potential for them to leave "remote" areas and be used in general areas. This could be very damaging to pharmacy".

The full transcribed list of comments appears in Appendix B5.

5.4 Hypothesis Testing

Hypothesis 1 (Chapter 1) states that:

1. Healthcare professionals, specifically pharmacists, medical practitioners, nurses and healthcare workers, support the introduction of telepharmacy applications to communities who may have poor access to pharmacy services in rural and remote Australia.

   This hypothesis can be further elaborated as follows:

   a. Healthcare professionals support the proposition that telepharmacy can provide professional pharmacy services such as patient counselling to remote communities.
   b. Healthcare professionals support the proposition that it is feasible for pharmacists to conduct medication reviews using telepharmacy techniques.
   c. Healthcare professionals support the proposition that it is feasible to provide medication dispensing services, by remotely located trained assistants, under telepharmacy supervision by pharmacists.
   d. Healthcare professionals support the proposition that it is feasible to provide medication dispensing services, under telepharmacy supervision by pharmacists, by using remotely located dispensing machines.

Survey questions 1 – 8 were used to test this hypothesis. The numbering of the questions follows the Doctor, Nurse and Nurse/Healthcare workers survey forms (Section 2).

The variables “Strongly Agree” and “Agree” were combined (collapsed) into one variable “Agree”. The variables “Strongly Disagree” and “Disagree” were also combined, and in order to provide a robust test of opinion, the variable “Neutral” was combined into the variable “Disagree” (refer Table 31).

Table 31: Section 2 Questions Collapsed variables – Total Combined Surveys (Pharmacists, Doctors, Nurses and HCWs)

Variable	%	n 292
Healthcare professional thinks that telepharmacy can improve the provision of health care by pharmacists to rural and remote communities, who may have poor access to health services.		
Agree	81.2%	237
Disagree	18.8%	55
Healthcare professional thinks that it is feasible to use telepharmacy to provide professional health care services, like patient counselling, to remote communities.		
Agree	87.3%	255
Disagree	12.7%	37
Healthcare professional thinks that medication reviews (e.g. HMRs) could be carried out by using telepharmacy.		
Agree	79.5%	232
Disagree	20.5%	60
Healthcare professional thinks that medication reviews, carried out by using telepharmacy, would require the help of a trained person or healthcare worker in the remote location to assist the patient during the review.		
Agree	82.2%	240
Disagree	17.8%	52
Healthcare professional thinks there is potential for pharmacies using telepharmacy to act as a site to deliver pharmacy services (e.g. *dispensing by trained assistants under video supervision*) to remote areas without pharmacies.		
Agree	67.1%	196
Disagree	32.5%	95
Healthcare professional thinks there is potential for a Call Centre, operated by pharmacists, using telepharmacy, to provide professional health care services like patient counselling, to rural and remote communities *when the local pharmacy is closed.*		
Agree	67.1%	196
Disagree	32.2%	94
Healthcare professional thinks there is potential for a Call Centre, operated by pharmacists, using telepharmacy, to dispense prescriptions for rural and remote communities *when the local pharmacy is closed*, by operating a remote automated dispensing machine situated in a secure area.		
Agree	53.1%	155
Disagree	46.6%	136
Healthcare professional thinks there is potential for pharmacies using telepharmacy to deliver pharmacy services to remote areas, *without pharmacies*, by operating remote automated dispensing machines situated in a secure area such as the local medical centre.		
Agree	56.8%	166
Disagree	42.8%	125

The following model (Figure 33) shows the hypothesis testing for the total combined surveys.

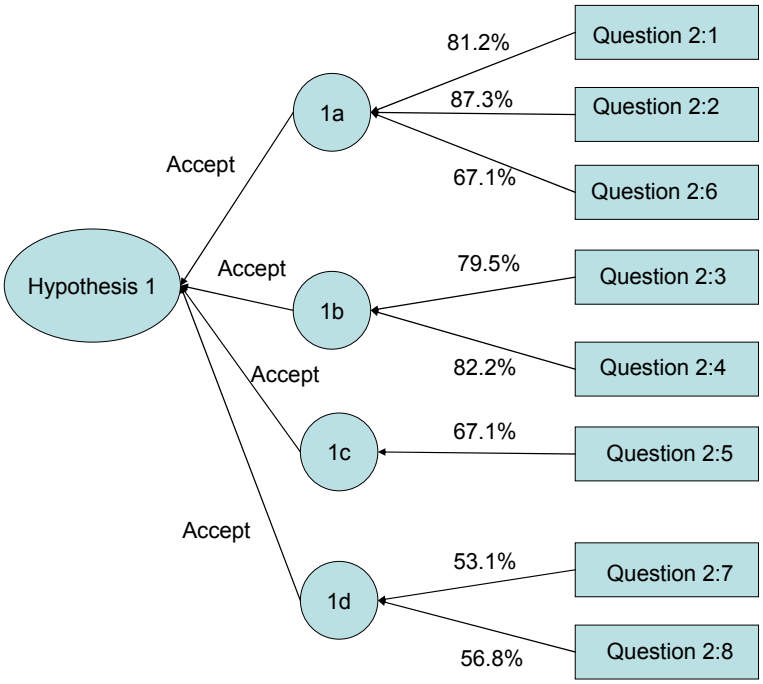

Figure 33: Hypothesis 1: Flow Chart

Key to questions below:

Hypothesis 1: Healthcare professionals, specifically pharmacists, medical practitioners, nurses and healthcare workers, support the introduction of telepharmacy applications to communities who may have poor access to pharmacy services in rural and remote Australia.	
1a. Telepharmacy can provide professional pharmacy services such as patient counselling to remote communities	2:1 Telepharmacy can improve the provision of health care by pharmacists to rural and remote communities, who may have poor access to health services.
	2:2 It is feasible to use telepharmacy to provide professional health care services, like patient counselling, to remote communities.
	2:6 There is potential for a Call Centre, operated by pharmacists, using telepharmacy, to provide professional health care services like patient counselling, to rural and remote communities when the local pharmacy is closed.
1b. It is feasible for pharmacists to conduct medication reviews using telepharmacy techniques.	2:3 Medication reviews (e.g. HMRs) could be carried out by using telepharmacy.
	2:4 Medication reviews, carried out by using telepharmacy, would require the help of a trained person or healthcare worker in the remote location to assist the patient during the review.
1c. It is feasible to provide medication dispensing services, by remotely located trained assistants, under telepharmacy supervision by pharmacists.	2:5 There is potential for pharmacies using telepharmacy to act as a site to deliver pharmacy services (e.g. dispensing by trained assistants under video supervision) to remote areas without pharmacies.
1d. It is feasible to provide medication dispensing services, under telepharmacy supervision by pharmacists, by using remotely located dispensing machines.	2:7 There is potential for a Call Centre, operated by pharmacists, using telepharmacy, to dispense prescriptions for rural and remote communities when the local pharmacy is closed, by operating a remote automated dispensing machine situated in a secure area.
	2:8 There is potential for pharmacies using telepharmacy to deliver pharmacy services to remote areas, without pharmacies, by operating remote automated dispensing machines situated in a secure area such as the local medical centre.

Hypothesis 1 a.

In testing hypothesis 1a, that healthcare professionals support the proposition that telepharmacy can provide professional pharmacy services such as patient counselling to remote communities, the results for Section 2, Questions 1, 2 and 6 are examined.

The null hypothesis, that there is no significant support for telepharmacy applications amongst the key health professional groups is false if the "Agree" variable is greater than the "Disagree" variable
Figures 34, 35 and 36 indicate that there is broad agreement across the four professional groups that telepharmacy can improve the provision of health care by pharmacists to rural and remote communities, who may have poor access to health services and that it is feasible to use telepharmacy to provide professional health care services, like patient counselling, to remote communities.

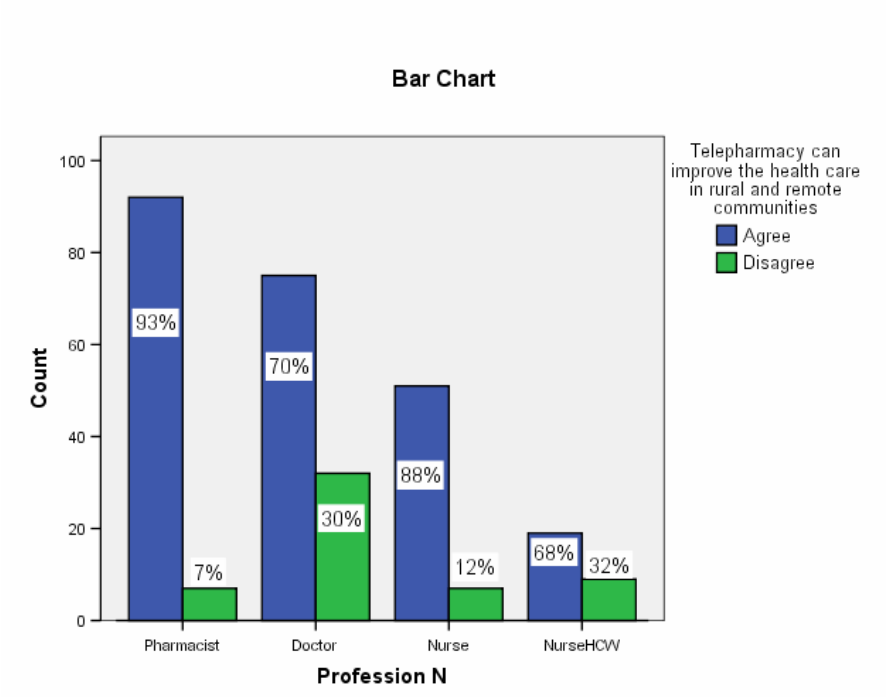

Figure 34: Hypothesis 1a-General Question Section 2:1

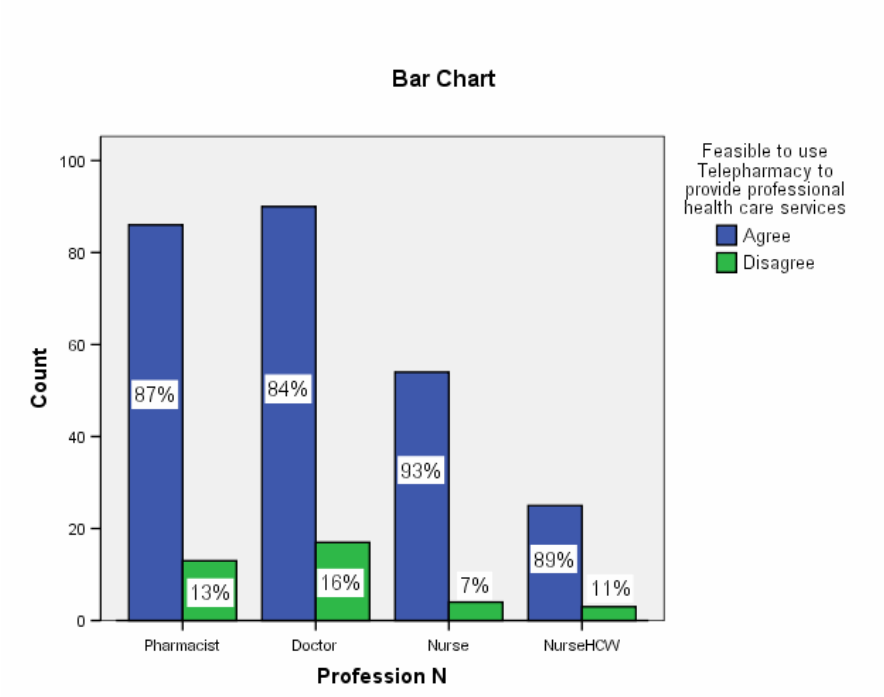

Figure 35: Hypothesis 1a-General Question Section 2:2

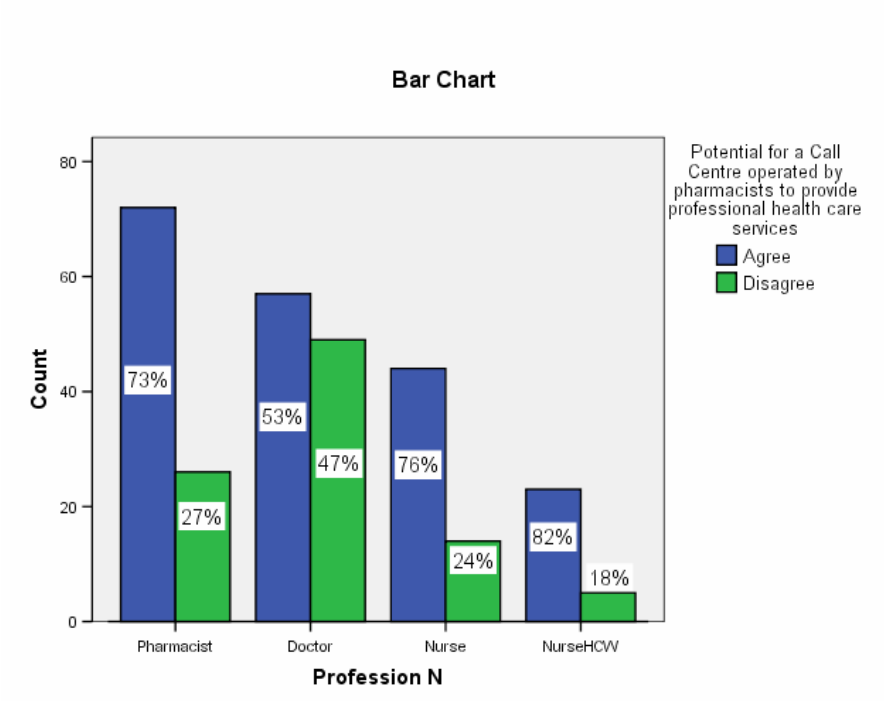

Figure 36: Hypothesis 1a-General Question Section 2:6

Figure 36 shows the responses for Section 2, Question 6, and indicates that there is support amongst the four professional groups surveyed that there is potential for a Call Centre, operated by pharmacists,

using telepharmacy, to provide professional health care services like patient counselling, to rural and remote communities when the local pharmacy is closed.

The null hypothesis is rejected. This therefore leads to the conclusion that there is broad support amongst the key professional groups surveyed for the provision of professional pharmacy services to rural and remote communities utilising telepharmacy techniques.

Hypothesis 1 b.

Hypothesis 1 b states that healthcare professionals support the proposition that it is feasible for pharmacists to conduct medication reviews using telepharmacy techniques. This section of the hypothesis (1b) is again tested by the null hypothesis. This can be stated that there is no significant support for conducting medication reviews by telepharmacy amongst the key health professional groups if the "Agree" variable is greater than the "Disagree" variable.

The two questions in the survey that address this application are questions Section 2, Questions 3 and 4 and Figures 37 and 38 again reveal that there is broad agreement across the four professional groups that medication reviews (e.g. HMRs) could be carried out by using telepharmacy and that medication reviews, carried out by using telepharmacy, would require the help of a trained person or healthcare worker in the remote location to assist the patient during the review.

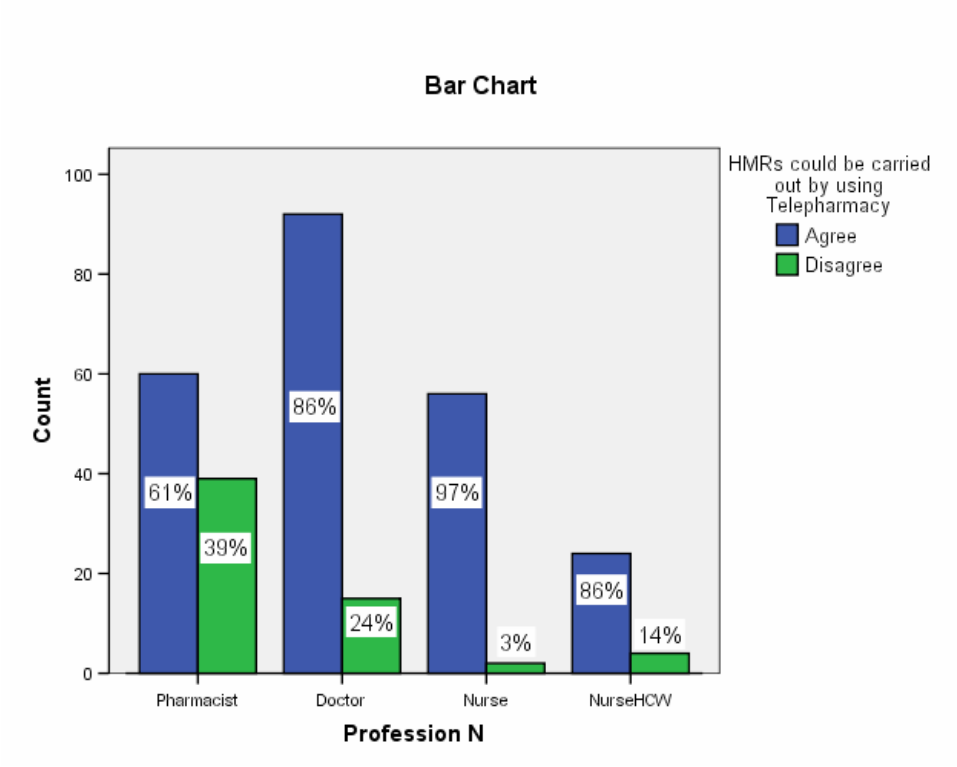

Figure 37: Hypothesis 1b-General Question Section 2:3

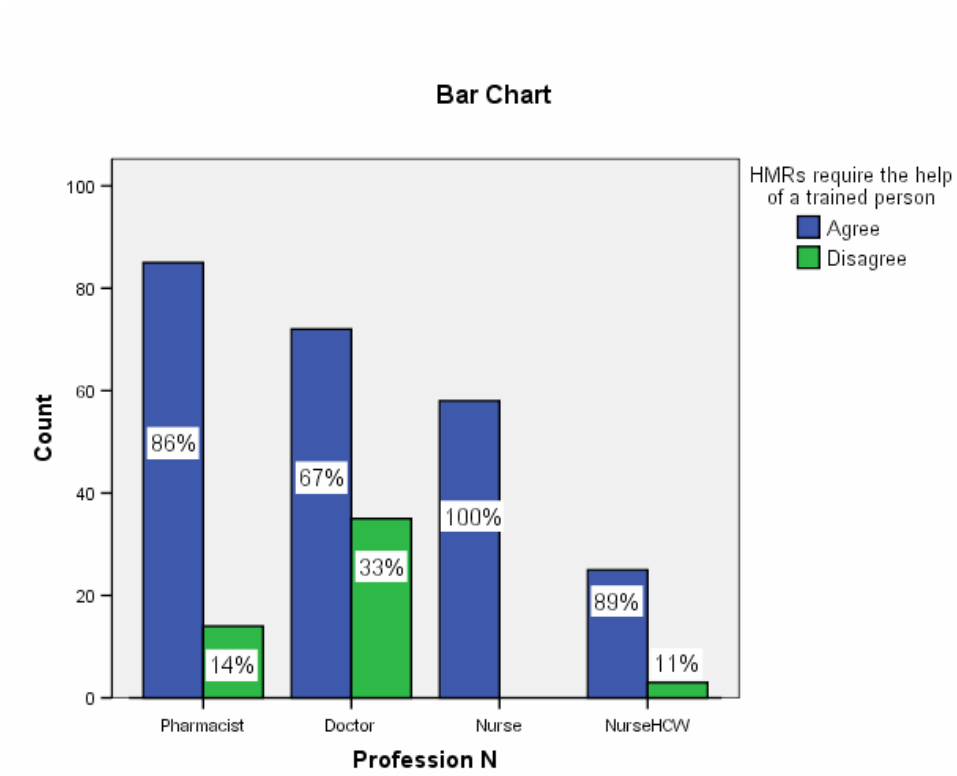

Figure 38: Hypothesis 1b-General Question Section 2:4

Since both these results indicate the "Agree" variable is greater than the "Disagree" variable, the null hypothesis is rejected, with the acknowledgement that a helper will be required to assist the patient during the medication review interview by telepharmacy. It is therefore concluded that there is support amongst the key professional groups surveyed for conducting medication reviews via telepharmacy.

Hypothesis 1 c.

Hypothesis 1 c states that healthcare professionals support the proposition that it is feasible to provide medication dispensing services, by remotely located trained assistants, under telepharmacy supervision by pharmacists.

Question 5 of the survey addressed this issue:

- There is potential for pharmacies using telepharmacy to act as a site to deliver pharmacy services (e.g. dispensing by trained assistants under video supervision) to remote areas without pharmacies.

Figure 39 shows the responses for Section 2, Question 5, and indicates that there is support amongst all professional groups surveyed that there is potential for pharmacies using telepharmacy to act as a site to deliver pharmacy services (e.g. dispensing by trained assistants under video supervision) to remote areas without pharmacies (variable Agree > Disagree).

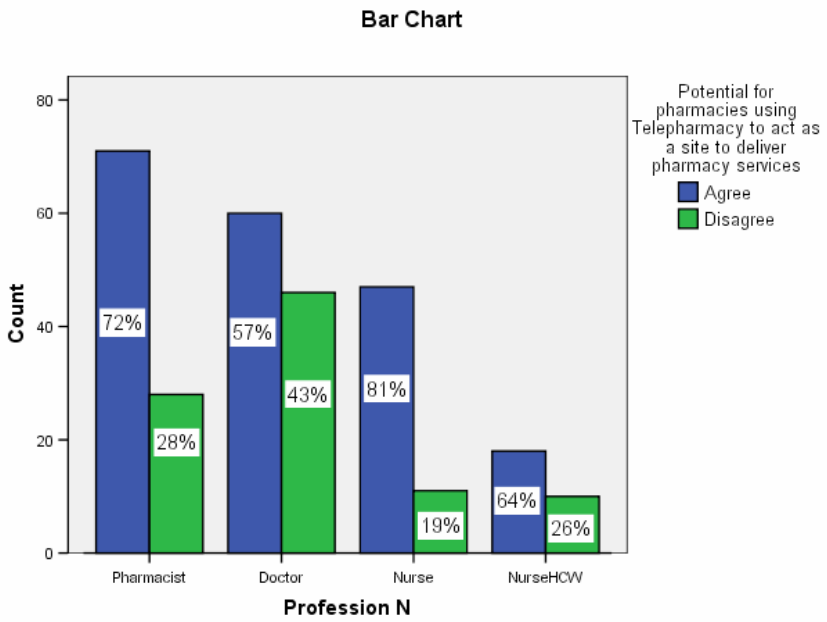

Figure 39: Hypothesis 1c-General Question Section 2:5

Hypothesis 1 d.

Hypothesis 1 d states that healthcare professionals support the proposition that it is feasible to provide medication dispensing services, under telepharmacy supervision by pharmacists, by using remotely located dispensing machines. The questions that address remote dispensing are Section 2, Questions 7 and 8. These questions stated:

- There is potential for a Call Centre, operated by pharmacists, using telepharmacy, to dispense prescriptions for rural and remote communities when the local pharmacy is closed, by operating a remote automated dispensing machine situated in a secure area.
- There is potential for pharmacies using telepharmacy to deliver pharmacy services to remote areas, without pharmacies, by operating remote automated dispensing machines situated in a secure area such as the local medical centre.

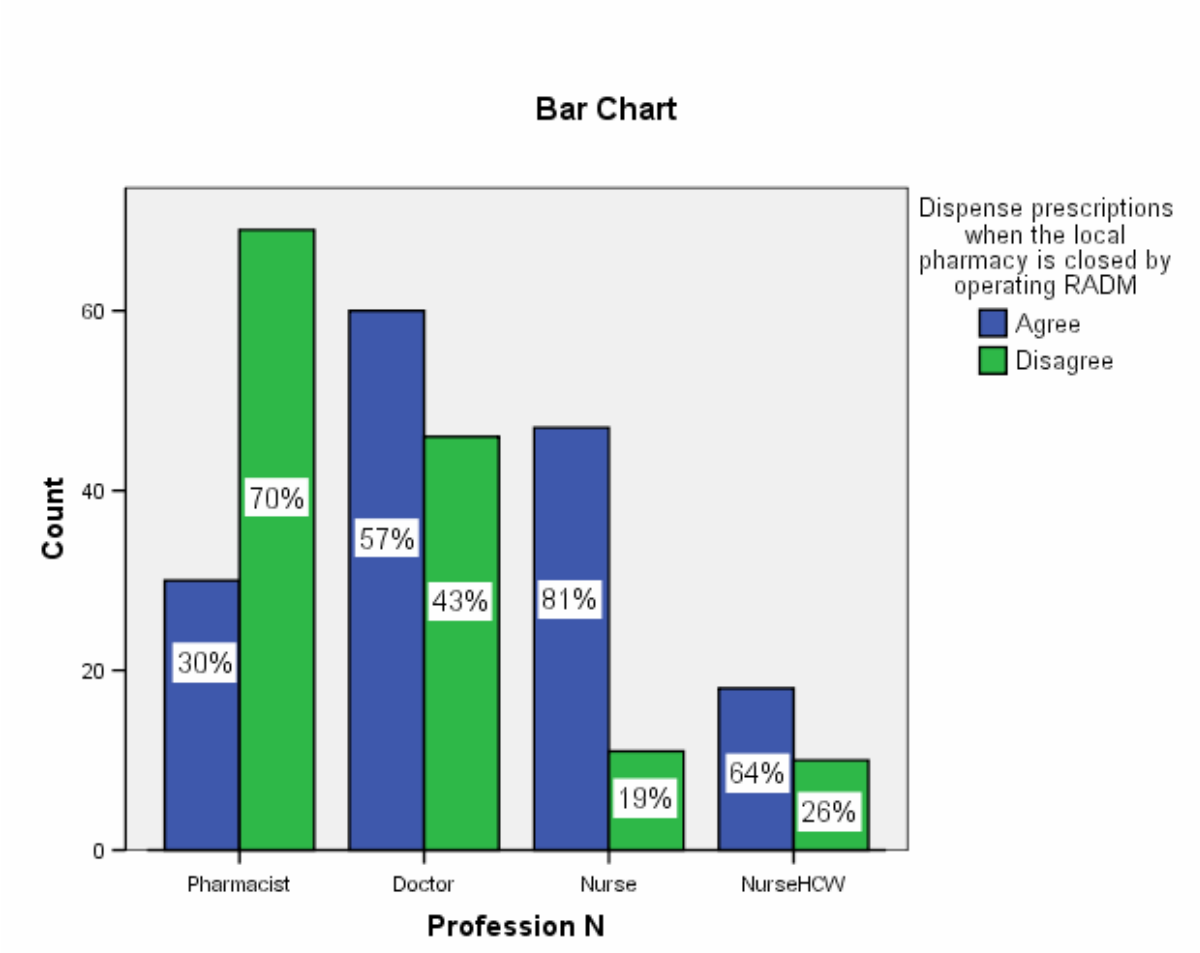

Figure 40: Hypothesis 1d-General Question Section 2:7

Figure 40 shows the responses for Section 2, Question 7, and indicates that there is partial support amongst the four professional groups surveyed that there is potential for a Call Centre, operated by pharmacists, using telepharmacy, to dispense prescriptions for rural and remote communities when the local pharmacy is closed, by operating a remote automated dispensing machine situated in a secure area.

The professional group that is in disagreement is the pharmacist group, indicating that there is sensitivity in the pharmacist group for automated dispensing machines to be used to supply medications when the local pharmacy is closed.

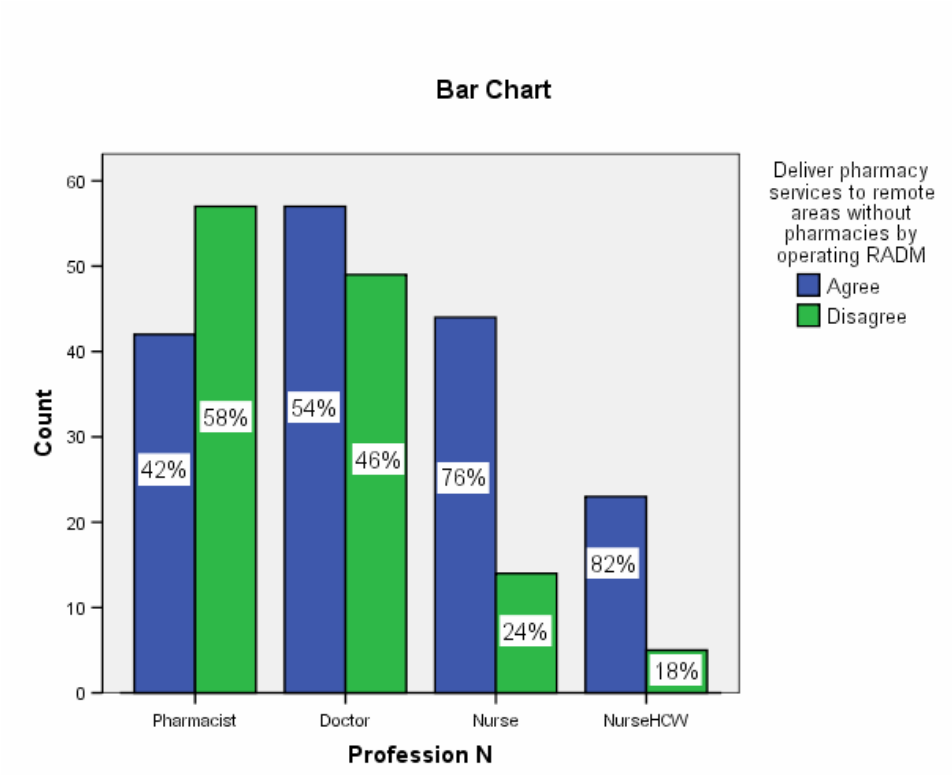

Figure 41: Hypothesis 1d-General Question Section 2:8

Figure 41 shows the responses for Section 2, Question 8, and also indicates that there is partial support amongst the four professional groups surveyed that there is potential for pharmacies using telepharmacy to deliver pharmacy services to remote areas, without pharmacies, by operating remote automated dispensing machines situated in a secure area such as the local medical centre.

Again, the professional group that is in disagreement is the pharmacist group, indicating that there is sensitivity in the pharmacist group for automated dispensing machines to be used to supply medications in communities without a local pharmacy.

The reason for this disagreement will need further investigation. It could be postulated that the reason for the difference in opinion is that the pharmacist group does not wish to see the use of a dispensing machine, after hours, when there is a local pharmacy in the community in order to protect the viability of the pharmacy.

Further analysis of the pharmacist survey data was undertaken. The survey responses for the above two questions were statistically analysed against the gender, experience of the pharmacist, population area where practising, and ARIA classification where pharmacist practised. This analysis revealed no significant differences ($P<0.05$) in the responses, except for one group (Table 32). Further analysis identified (Chi-sq.=10.478, df=3, $P=0.015$) that the less experienced group of pharmacists (<10 years) were more comfortable with the concept of operation of remote dispensing machines in areas where there was no physical pharmacy than the older pharmacist groups (see Figure 42).

Table 32: Section2 Pharmacist Group Questions, 7&8 analysed by grouping variables

Grouping Variable	**Question**	**Pearson Chi-Square**	**df**	***P* - Value**
Gender	7	1.200	1	0.273
	8	0.220	1	0.639
Years of practice	7	5.952	3	0.114
	8	13.656	3	0.003
Population where practising	7	0.971	2	0.615
	8	1.269	2	0.530
ARIA where practising	7	5.071	4	0.280
	8	3.818	4	0.431

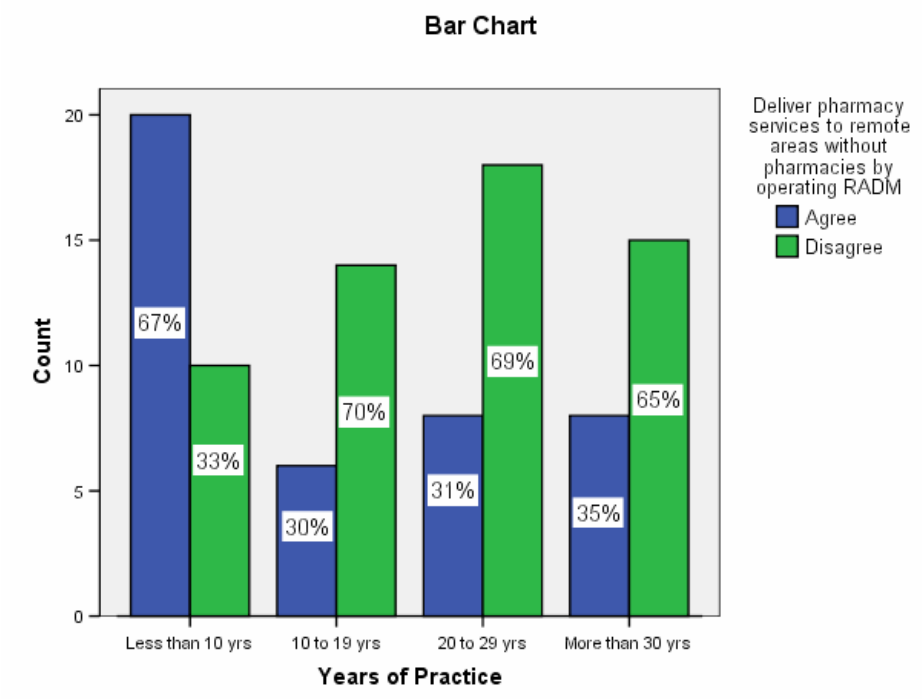

Figure 42 Section 2: Question 8, by Years of Experience

However, the reason for the older pharmacist groups not supporting an automatic dispensing machine in a community where there is no pharmacy is intriguing, since, as discussed in Chapter 2, this is an area where pharmacists have essentially handed over the supply of medications to other healthcare professionals such as nurses. The reason may be as simple as the fear of not being able to provide personal supervision of the dispensing process, distrust amongst the older pharmacy groups of information technology or it may be a combination of other factors requiring closer examination in future studies.

In accepting the hypothesis that there is support for remote dispensing, either by video supervision or by the use of automatic dispensing machines, it can be stated that there is no significant support for the use of remote dispensing machines by the pharmacist group since the "Agree" variable is less than the "Disagree" variable. The three other professional groups did support the hypothesis and therefore the hypothesis is accepted with the acknowledgement that the pharmacist group is only in partial agreement with the hypothesis.

5.4.1 Further testing

In order to check that the inclusion of the nurse and nurse/HCW surveys into the combined results of all four surveys did not skew the results of the hypothesis testing, the model (Figure 33) was recalculated using only the pharmacist and medical practitioner combined results.

Table 33: Section 2 Questions Collapsed variables – Combined Pharmacist/Medical Practitioner Surveys

Variable	%	n 206
1. Healthcare professional thinks that telepharmacy can improve the provision of health care by pharmacists to rural and remote communities, who may have poor access to health services.		
Agree	81.1%	176
Disagree	18.9%	52
2. Healthcare professional thinks that it is feasible to use telepharmacy to provide professional health care services, like patient counselling, to remote communities.		
Agree	85.4%	176
Disagree	14.6%	30
3. Healthcare professional thinks that medication reviews (e.g. HMRs) could be carried out by using telepharmacy.		
Agree	73.8%	152
Disagree	26.2%	54
4. Healthcare professional thinks that medication reviews, carried out by using telepharmacy, would require the help of a trained person or healthcare worker in the remote location to assist the patient during the review.		
Agree	76.2%	157
Disagree	23.8%	49
5. Healthcare professional thinks there is potential for pharmacies using telepharmacy to act as a site to deliver pharmacy services (e.g. *dispensing by trained assistants under video supervision*) to remote areas without pharmacies.		
Agree	63.9%	131
Disagree	36.1%	74
6. Healthcare professional thinks there is potential for a Call Centre, operated by pharmacists, using telepharmacy, to provide professional health care services like patient counselling, to rural and remote communities *when the local pharmacy is closed*.		
Agree	63.2%	129
Disagree	36.8%	75
7. Healthcare professional thinks there is potential for a Call Centre, operated by pharmacists, using telepharmacy, to dispense prescriptions for rural and remote communities *when the local pharmacy is closed*, by operating a remote automated dispensing machine situated in a secure area.		
Agree	43.9%	90
Disagree	56.1%	115
8. Healthcare professional thinks there is potential for pharmacies using telepharmacy to deliver pharmacy services to remote areas, *without pharmacies*, by operating remote automated dispensing machines situated in a secure area such as the local medical centre.		
Agree	48.3%	99
Disagree	51.7%	106

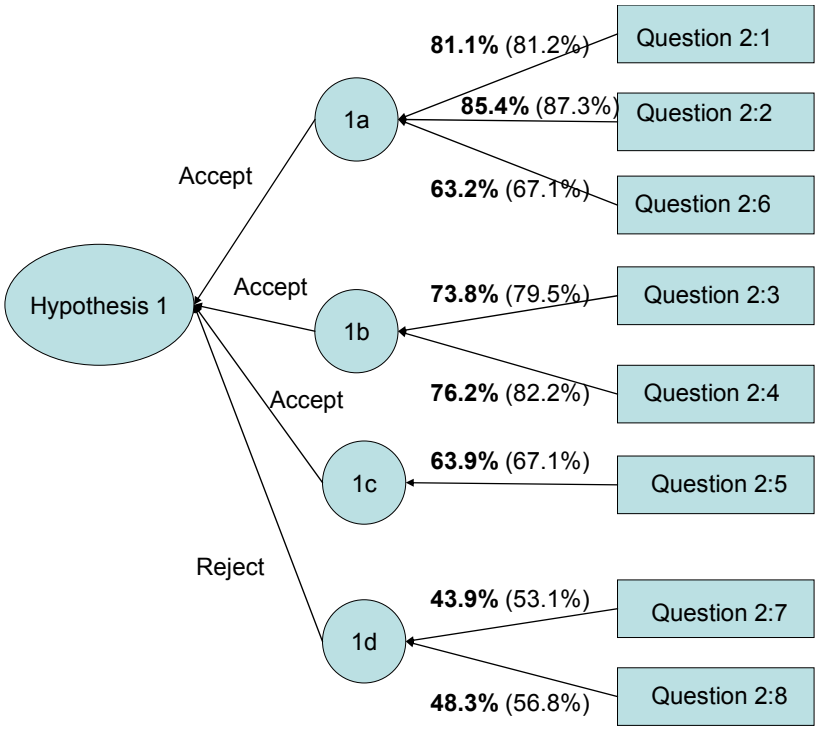

Figure 43: Hypothesis 1: Flow Chart pharmacist, medical practitioner group combined

(Total combined survey results in brackets). Key to model questions below:

Hypothesis 1: Healthcare professionals, specifically pharmacists, medical practitioners, nurses and healthcare workers, support the introduction of telepharmacy applications to communities who may have poor access to pharmacy services in rural and remote Australia.	
1a. Telepharmacy can provide professional pharmacy services such as patient counselling to remote communities	2:1 Telepharmacy can improve the provision of health care by pharmacists to rural and remote communities, who may have poor access to health services.
	2:2 It is feasible to use telepharmacy to provide professional health care services, like patient counselling, to remote communities.
	2:6 There is potential for a Call Centre, operated by pharmacists, using telepharmacy, to provide professional health care services like patient counselling, to rural and remote communities when the local pharmacy is closed.
1b. It is feasible for pharmacists to conduct medication reviews using telepharmacy techniques.	2:3 Medication reviews (e.g. HMRs) could be carried out by using telepharmacy.
	2:4 Medication reviews, carried out by using telepharmacy, would require the help of a trained person or healthcare worker in the remote location to assist the patient during the review.
1c. It is feasible to provide medication dispensing services, by remotely located trained assistants, under telepharmacy supervision by pharmacists.	2:5 There is potential for pharmacies using telepharmacy to act as a site to deliver pharmacy services (e.g. dispensing by trained assistants under video supervision) to remote areas without pharmacies.
1d. It is feasible to provide medication dispensing services, under telepharmacy supervision by pharmacists, by using remotely located dispensing machines.	2:7 There is potential for a Call Centre, operated by pharmacists, using telepharmacy, to dispense prescriptions for rural and remote communities when the local pharmacy is closed, by operating a remote automated dispensing machine situated in a secure area.
	2:8 There is potential for pharmacies using telepharmacy to deliver pharmacy services to remote areas, without pharmacies, by operating remote automated dispensing machines situated in a secure area such as the local medical centre.

5.4.2 Discussion

The results of the modified model (pharmacist/medical practitioner groups) indicate that Hypotheses 1a, b and c are accepted, whist Hypothesis 1d is rejected. On closer examination of the answers to questions 7 and 8, the results show that the pharmacist group are again in disagreement and therefore the conclusions of the combined group analysis are still valid as shown in the bar charts below.

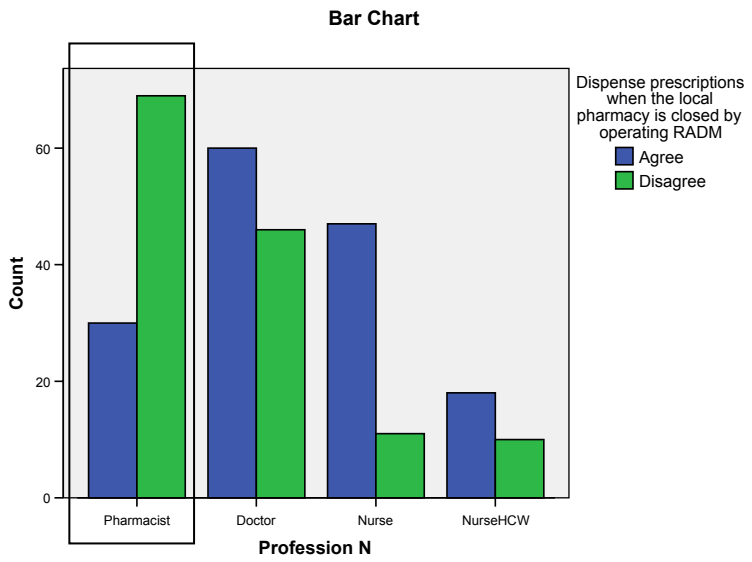

Figure 44: Hypothesis 1d-Combined Groups - General Question Section 2:7

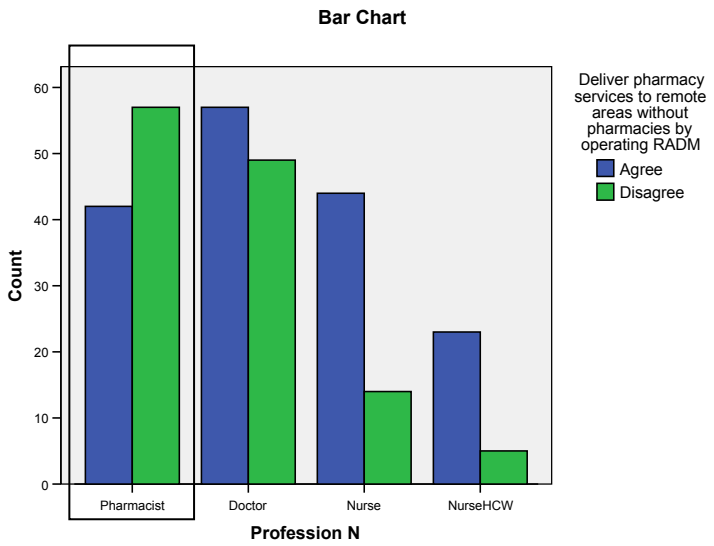

Figure 45: Hypothesis 1d-Combined Groups - General Question Section 2:8

5.5 Chapter Summary

Four surveys of health practitioners were undertaken to ascertain the opinions of these professionals on the concepts of telepharmacy. Two of the surveys, of pharmacists and medical practitioners, involved the use of postal questionnaires. The third survey, of nurses, was administered at the Royal College of Nursing 2006 conference held in Cairns, North Queensland and the fourth survey, of nurses and healthcare workers, was an Internet download.

The surveys had their limitations. The pharmacist medical practitioner surveys had response rates of 37 per cent and 17 per cent respectively and it could be postulated for both surveys that a proportion of the respondents responded because they were attracted to the concepts of information technology and its application and therefore could be biased in this regard.

The survey of nurses conducted at the Royal College of Nursing conference could also be criticised since most of the nurses completed the survey on the spot, although there was no requirement to do so since the forms could be taken away and completed during the conference (16 per cent of the conference attendees completed the survey). However, these results must also be viewed with caution due to the small sample size and the limitations of the ARIA classifications for this group, since the analysis of the post code indicated that only 15 per cent of the respondents practised in remote or very remote areas.

The Internet survey of nurses and healthcare workers had a poor uptake of only 28 respondents. This was probably due to the fact that only one advertisement was placed in the Nursing Careers and Allied Health booklet and a longer advertising and response period may have increased the response rate. Another complicating factor was that the online survey form was prepared using the Acrobat 7 Professional program (Adobe Inc). This required the respondent to download a copy of Acrobat Reader 7 to complete the survey and this was a large download (>22 MB) requiring a Broadband connection. Additional methods were provided such as Word (Microsoft Corp) and Acrobat (pdf) documents for download from the website, together with a telefax number and email address. The majority (25) of the forms were received this way.

Nevertheless, the results of the surveys indicated that there was broad support amongst the health professionals surveyed for the concepts of telepharmacy and that further studies should be undertaken to demonstrate telepharmacy applications such as Medication Reviews.

Two of the questions did, however, reveal a difference in opinions of pharmacists versus the other three professional groups on the use of automatic dispensing machines, after hours, where there was a local pharmacy and in communities where there was no pharmacy.

These surveys, in conjunction with the Lee survey,[123] provide interesting insights into the opinions of the various healthcare professionals into the possible uses of telepharmacy. It is important to understand the receptiveness of healthcare professionals to the introduction of telepharmacy applications. The results also indicate that further studies are required to identify the reasons for the lack of support by pharmacists for the use of remote dispensing machines, even though the model presented indicated that the machines were to be controlled remotely by pharmacists.

In the Lee survey, a total sample of 516 pharmacies in rural and remote areas across Australia with PhARIA (Accessibility and Remoteness Index of Australia) number ranging from 3 to 6 were chosen to be included. The pharmacies were randomly selected from the Pharmacy Guild of Australia's database of rural pharmacies. The pharmacies selected for this survey were quite evenly distributed throughout all the states and territories in Australia to minimise any possibility of obtaining biased results from the survey. 165 forms were analysed (response rate of 32 per cent) and the results are shown in the table below.

General Views on Telepharmacy (Lee, National Survey of Pharmacists)

Variable	Yes %	No %	Unsure %
1. Can telepharmacy improve healthcare provision to outlying area without pharmacies?	72.7	3.1	24.2
2. Can pharmacies using telepharmacy act as a hub site to deliver services to remote areas?	66.5	11.4	22.2
3. Is telepharmacy feasible to provide healthcare services, like patient counselling to communities?	71.3	6.0	22.8
4. Interested in using telepharmacy to deliver healthcare to remote areas without pharmacies (with endorsement from the Pharmacy Board)?	51.5	20.2	28.2
5. Can HMRs be done via telepharmacy capabilities?	38.5	29.8	31.7

Variable	Yes %	No %	Unsure %
6. Interested to offer HMRs using telepharmacy to outlying communities?	31.3	36.2	32.5
7. Any concerns about telepharmacy?	50.0	21.3	28.8
8. Is telepharmacy better than Internet and mail order pharmacies?	85.4	1.8	12.8

Of particular interest are the responses to the questions 1-3 in the Lee survey on the use of telepharmacy to provide healthcare services to remote communities. The responses to these questions indicate a positive level of support for the use of telepharmacy to provide healthcare services. When compared to the responses to the first two questions in the survey of pharmacists described in section 5.2.2 (Table 10), 93 per cent of pharmacist respondents thought that telepharmacy could improve the provision of healthcare by pharmacists to rural and remote communities who may have poor access to health services and 87 per cent thought that it was feasible to provide professional healthcare services such as patient counselling to remote communities via telepharmacy.

The results regarding the conduct of medication reviews (question 5) via telepharmacy were less clear. In the Lee survey 39 per cent of pharmacists surveyed agreed on the use of telepharmacy to conduct medication reviews, compared to 61 per cent who agreed to this proposition in the survey of pharmacists in northern Australia (question 3, Table 10).

Question 6 of the Lee survey asked if the pharmacist was interested in offering HMRs to outlying communities. Of the respondents, 31 per cent agreed compared to 42 per cent who agreed in the survey of pharmacists in northern Australia (question 10, Table 10).

Question 4 of the Lee survey asked if the pharmacist was interested in using telepharmacy to deliver healthcare to remote areas without pharmacies. Of the respondents 52 per cent indicated that they were interested compared to 51 per cent in the survey of pharmacists in northern Australia (question 9, Table 10).

These results were sufficiently encouraging to indicate that further studies were required to demonstrate the application of telepharmacy by developing pilot telepharmacy equipment. This is described in the following chapter.