The Impact of Telehealth and Telecare on Clients of the Transition Care Program (TCP)

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EXECUTIVE SUMMARY

This report outlines the findings of a randomised controlled trial of Telehealth and Telecare in the management of frail older people who are receiving post-acute care in their own homes under the Transition Care Program (TCP). Results of this study demonstrate numerous benefits to clients receiving post-acute care augmented by Telehealth and Telecare solutions. In particular, clients experienced improvements in personal wellbeing, particularly in perceptions of health, safety and future security.

Older people who participated in this study were willing and able to use Telehealth and Telecare products reliably. Clients demonstrated a positive attitude towards the use of technology and that age per se was not a barrier to the reliable use of technology for home monitoring of vital signs.

Carers of clients receiving Telehealth and Telecare viewed the use of these products favourably. Carers felt that the person they cared for was safer as a result of using Telehealth and Telecare and that their care overall was improved through better monitoring of their clinical condition.

Additional observed benefits to clients who used the technology included increased utilisation of general practice services and a significant reduction in the use of personal assistance services such as help with housework and gardening. No significant changes in use of personal assistance services were observed in participants in the Control Group.

A range of factors were identified that GPs reported should be addressed in order to improve the appropriate use of Telehealth solutions in post-acute care of frail older people. These include the provision of information to the GP that is timely and relevant to the patient’s care, in a format that is preferred by their GP. According to GPs, the model of care should be adapted so that monitoring data is first reviewed by trained nursing personnel to ensure patients are appropriately triaged and only receive GP intervention if clinically indicated.

The study did not have sufficient recruitment of participants to enable the impacts of Telehealth and Telecare on service utilisation to be definitively established. A number of areas of further research enquiry were identified, including establishing the differential...
effects of Telehealth and Telecare in improving outcomes for patients with different clinical conditions, particularly for patients with diabetes and cardiovascular disease who are receiving post-acute care. Further, the insight of frail older people who are receiving post-acute care into their vulnerability and the impact this has on compliance with ongoing monitoring of their clinical condition also needs to be investigated.

Key findings for practice

Key findings for practice that emerged from this study are summarised as follows:

- Older people did not experience difficulties in using Telehealth and Telecare products in home-based transitional care;

- The use of Telehealth and Telecare products in transitional care was associated with improvements in the user’s sense of personal wellbeing and with reduced use of personal assistance services. These improvements were observed regardless of the patient’s primary diagnosis;

- Short-term use of Telehealth and Telecare products was associated with improvements; and

- The preferred model of care to improve the efficacy of Telehealth and Telecare in transitional care is a nurse case management approach with involvement of general practitioners only when clinically warranted.
GLOSSARY

ASLaRC Aged Services Unit: Part of the Health and Wellbeing Research Cluster of Southern Cross University. A primary goal of ASLaRC is to improve the health and well-being of older people in the North Coast NSW region and beyond, through teaching, research, the promotion of evidence-based practice and community engagement.

Baptist Community Services: a leading not-for-profit Christian care organisation that has been serving the aged and people living with disadvantage for the past 65 years. As an organisation BCS has two operating divisions – BCS AgeCare and BCS LifeCare – which together care for thousands of people across NSW and the ACT on a daily basis, through more than 160 facilities and programs.

Department of Health and Ageing: The Department of Health and Ageing (DoHA) works towards better health and active ageing for all Australians through research, improved program management, strengthening evidence-based policy advising, regulation, and partnerships with other government agencies, consumers and stakeholders. DoHA provides support to older Australians, their carers and support services to ensure that older people receive a choice of high quality, affordable and accessible care that assists them in leading as healthy and independent lives as possible. DoHA also assists carers and support services to help look after frail older people living at home (DoHA 2010).

Tunstall Healthcare Asia Pacific: Established in the UK in 1957, Tunstall is the world’s leading provider of Telecare and Telehealth solutions. Operating in 30 countries and employing over 1000 people, Tunstall supports 2.5m people around the world. Tunstall established its Australian office in 1992 and opened a Brisbane-based national emergency response centre in May 2001. In 2002 Tunstall opened a response centre in Tauranga New Zealand and is now one of the largest response services in New Zealand.

Telecare: Care provided at a distance, using information and communication technology, generally to help people in their own homes.
Telehealth: A service where clients’ vital signs are monitored remotely, at pre-set time intervals, using technology in their home.

Telehealth Telecare Project: A research project initiated by a consortium of stakeholders, including DoHA, Baptist Community Services (BCS), Southern Cross University (SCU) and Tunstall Healthcare Asia Pacific. BCS, the lead agency, subcontracted the ASLaRC Aged Services Unit of SCU and Tunstall Healthcare Asia Pacific to provide project evaluation and project equipment respectively. The Telehealth Telecare Project was funded by DoHA.

Transition Care Program: Commencing in October 2005, the Transition Care Program (TCP) provides time-limited, therapy-focused and goal-orientated care to eligible older individuals discharged from hospital (DoHA, 2005). TCP is jointly funded by the Australian Government and all states and territories (Australian Government Productivity Commission [AGPC], 2009) and is part of the Government Investing in Australia’s Aged Care: More Places, Better Care package (DoHA, 2008). The program provides support to care recipients in a non-hospital environment; allows recipients an opportunity to return home rather than enter into residential care; optimises the functional capacity of individuals who enter residential care from TCP; and reduces inappropriate hospital length-of-stay for older people (AGPC, 2009). Services available to TCP recipients include nursing support, occupational therapy, physiotherapy and social work to maintain cognitive and physical functioning (DoHA, 2005).

BCS TCP Sites: Six geographical locations in NSW and the ACT provided Telehealth TCP services for this project. These included:

- Canberra;
- Central Coast (Mt Penang, Parklands and Kairong);
- Parkes;
- Castle Hill;
- Cowra; and
- Dubbo.
CHAPTER 1 – BACKGROUND

An extensive search was conducted of the peer-reviewed literature and ‘grey’ literature to identify publications that described the use of Telehealth and Telecare in the management of care of older people. Key words and search terms used in the search included: Telecare, Telehealth, ageing population, ageing population Australia, use of technology in health care, government ageing in place. Databases that were interrogated included Web of Science, MEDLINE, IEEE and PubMed. Government policy documents, reports and projects, journal articles, conference presentations and web pages were also accessed.

Ageing Population

Populations around the world are ageing. Australian projections (Department of Treasury 2007) predict that between the years 2007 and 2047, the percentage of older Australians aged between 65 and 84 years will almost double from 11.7 percent to 19.7 percent of the total Australian population; the proportion of the Australian population that is classified as ‘very old’ (aged 85 years and over) is predicted to almost quadruple from 1.7 percent in 2007 to 5.6 percent in 2047.

An ageing Australian population will affect individuals and their communities socially and economically because of increasing incidences of age-related chronic health conditions (Australian Institute of Health and Welfare [AIHW], 2006) and disability (AIHW, 2000). Chronic health conditions significantly impact on a person’s quality of life and consume a large proportion of health and social care resources.

The recommendations of the 2009 National Health and Hospital Reform Commission (NHHRC) report, to redesign the Australian health system to place it in a better position for responding to arising challenges, includes a recommendation to better connect and integrate health and aged care services. The report emphasises the need to redesign health services to ensure individuals are able to access the right care in the right setting. In addition, the need for greater choice for clients in the configuration and type of aged care services available to them was highlighted (NHHRC, 2009).
Aged Care Services

Aged care services assist over one million older Australians at present. More than half receive low-intensity support through the Home and Community Care program and over 160,000 Australians receive permanent residential care, the majority of which is high level care (AIHW 2009). Within limits, the types of services, their intensity and their duration, are provided according to each older person’s assessed needs. The aged care service continuum is represented in Figure 1.1

Figure 1.1  Current modes of care in the aged care system*

*Productivity Commission 2011

The aged care system is difficult to navigate and the quantity of services is limited, exacerbated by workforce shortages. The system will be further challenged in the future by an increase in the numbers and expectations of older people, a relative decline in informal carers and the need for a larger workforce (Productivity Commission 2011). The 2010 Intergenerational Report estimates that Australian Government spending on aged care will increase from 0.8 percent of Gross Domestic Product (GDP) in 2010 to 1.8 percent by 2050.
While further advances in the management of some diseases are expected, more people will require complex care for dementia, diabetes and other morbidities associated with longevity, as well as palliative care.

The Productivity Commission has proposed that these weaknesses be addressed by promoting independence, connectedness and choice for older Australians. Under the proposed reforms, older Australians would:

- contact a simplified ‘gateway’ for assessments of care needs, entitlements to approved services and care coordination at a regional level;
- receive a flexible range of care and support services that meet their individual needs; and
- choose, where feasible and appropriate, to receive care at home.

Thus, there is a policy imperative to improve older people’s ability to remain within their own homes as long as possible, with access to care and support services that enable them to do this safely.

**Post-acute Care**

The American Geriatric Society defines post-acute care as “a set of actions designed to ensure coordination and continuity of healthcare as patients transfer between different locations or different care levels within the same location” (Coleman and Boult, 2003). Locations can include hospitals, sub-acute / post-acute facilities, patients' homes and long-term care facilities. Quantitative studies show that during transitions, patients are at risk for:
- delay in follow-up;
- inappropriate or conflicting care recommendations;
- medication errors;
- and patient/caregiver distress (Boockvar, Fishman, Kyriacou et al., 2004; Coleman and Fox, 2004). Qualitative studies document that patients are not sufficiently involved in care planning and lack the tools to manage their care as they move between settings (Coleman, Smith, Frank et al., 2002; Weaver, Perloff, Waters, 1998). Collectively, these issues lead to higher re-admission rates (ranging from 15 to 25 percent) and health care utilization (Moore, Wisnivesky, Williams et al., 2003).

Post-acute care is therefore a critical interface between acute care and either community or residential care. People who receive post-acute care usually do so after a significant acute
medical episode which requires their admission to an acute hospital. The ability of the individual to exit hospital and continue to remain at home depends on their underlying clinical condition but also on their ability to be successfully supported in a community environment (Liggins, Pryor and Bernard, 2010; Parry, Coleman, Smith, et al, 2003).

The ageing of the population is resulting in an increasing number of frail elderly people being admitted to acute hospitals for medical and surgical treatment, but a trend towards shorter lengths of hospital stay for clinical conditions over time means that they more frequently require post-acute care for rehabilitation or restoration of function. Many of these frail older patients do not do well in hospital. Older people occupy an increasing proportion of hospital beds but may actually derive substantial benefit from care in the home, as acutely ill older people commonly experience adverse events when cared for in the acute care hospital (Caplan, Ward, Brennan, et al., 1999; Fretwell, 1990).

Clinical trials assessing the safety of home versus hospital treatment in older patients demonstrate higher hospital-associated adverse events, making home treatment more attractive for elderly patients (Caplan, 2008).

Post-acute care for older people is provided for a range of conditions including for general frailty. Diagnoses for which services are frequently provided include acute exacerbation of congestive cardiac failure, and the management of infectious diseases including exacerbation of chronic obstructive pulmonary disease, genitourinary infection, community acquired pneumonia and cellulitis (Caplan, 2006; Cunliffe, 2004; Harris, 2005; Leff, 2005; Lemelin, 2007; Mader, 2008).

The American Geriatric Society Health Care Systems Committee (AGSHCSC) offered five position statements, each describing an important goal for improving geriatric post-acute care. They recommended: (1) actively involving patients and caregivers in decisions and preparing them for care in the next setting; (2) insuring good bidirectional communication between sending and receiving clinicians; (3) developing policies that promote high quality post-acute care, including reimbursement rule changes; (4) providing education to all professionals involved in patient transfer; and (5) conducting research to improve post-acute care processes, focusing on patient/family involvement and training healthcare professionals (Coleman and Boult, 2003).
The Transition Care Program

The Transition Care Program is a joint initiative of all Australian governments. The TCP aims to provide time-limited, therapy-focused and goal-orientated care to eligible older individuals discharged from hospital (DoHA, 2005). The program is designed to: provide support in a non-hospital environment; allow recipients an opportunity to return home rather than enter into residential care; optimise the functional capacity of individuals who enter residential care from TCP; and reduce inappropriate hospital length-of-stay for older people (AGPC, 2009). Services available to TCP recipients to assist in regaining/maintaining cognitive and physical functioning include nursing support, occupational therapy, physiotherapy and social work (DoHA, 2005). Eligibility for residential-based or community-based places (DoHA, 2008) is assessed by an Aged Care Assessment Team (DoHA, 2005).

At 30 June 2008, 2,228 TCP places had been allocated. The program is offered for 12 weeks which may be extended by a further 6 weeks in some circumstances; in 2007-08 the average time on the program nationally was 50 days (AGPC, 2009).

A national evaluation of the TCP, undertaken by Flinders Consulting Pty Ltd, concluded that:

- the TCP was successfully identifying older, medically frail people with a need for further care after a stay in hospital;
- by 3 months, 37 percent of older people who received the program had returned to hospital at least once, rising to 47 percent by 6 months, with higher readmission for community-based recipients;
- those receiving TCP in a residential setting were more likely to go into long-term care (DoHA, 2008); and
- 6 months post-ACAT approval, TCP had reduced the risk of entering hospital or residential aged care for those who received the service compared to other frail people who did not.

Gray et. al. (2008), noting the high cost of TCP, recommended that the relative cost-effectiveness of transition care compared to other programs, such as inpatient sub-acute care, should be explored. The national evaluation also noted that further reductions in hospital readmission will be difficult without the increase of medical, nursing and pharmacy into the program and proposed that a broader range of models and interventions should be considered.
Changing Care Provision and Technology

Changes in technology allowing for its use in the provision of customised care, coupled with the need for alternative ways to support an ageing population, have given rise to the use of Telecare and Telehealth products in care delivery (Boden & Da Costa, 2004). There is no universal definition for either Telecare or Telehealth; Doughty et al (2008) suggest that definitions are likely to change as the services that are based on this technology continue to grow.

Home Telecare technologies currently fall into three generations of development. First-generation systems were designed for use among older and high risk users and aim to reduce anxiety, increase personal safety and reduce utilisation of primary healthcare services by users. First-generation systems include personal/pendant alarms (Celler et al, 1999). Second-generation systems are used in provision of social care services in the home (Kubitschke et al, 2008). They do not require direct user participation and are unobtrusive. These systems include sensor arrays worn by the patient that measure biological parameters including skin blood flow, temperature and respiration (Celler et al, 1999). Third-generation systems are generally known as lifestyle monitors. These systems deal with the quality of life of the user (Celler et al, 1999) and are pro-active, anticipating problems before they arise (Kubitschke et al, 2008). For example, third-generation systems may assist medication dispensing and alert a remote caregiver if the patient is about to miss a medication dose.

Baptist Community Service (BCS) defines Telecare as, “care provided at a distance, using information and communication technology, generally to help people in their own homes” (Curry, Tinoco & Wardle, 2002; cited by BCS, 2006). The term “Telehealth” is referred to as a service where clients’ vital signs are monitored remotely, at pre-set time intervals, using technology in their home. Readings are reviewed by a trained Telehealth consultant and if they fall outside the parameters set by the principal health care provider, a clinical process map is followed (BCS, 2009).

International Examples

Many international organisations have incorporated Telehealth and Telecare into their care services. Driven in part by funding from the respective government to assist ageing at home,
projects have ranged from small scale pilot programs through to large scale changes in service delivery.

**Government programs:**

- **2006**, UK £80 million Preventative Technology Grant Funding aims to benefit at least 160,000 older people through improvements to the pre-existing community alarm service infrastructure. This is also intended to complement the ‘Connecting for Health’ program which supports the development and implementation of telemedicine and Telecare applications through the establishment of a national broadband network and care records service (Joint Improvement Team, 2008).

- **2007**, Spain introduced The Law for the Promotion of Independent Living at Home with €17.9 billion funding covering the period 2007-2015, to promote independent living through the use of teleassistance and care provision (Gomez, 2006).

- A capital grant of £8.92 million announced in 2006 by the Minister for Health and Social Services for Wales aimed at equipping 10,000 homes in Wales with Telecare sensors and equipment (Welsh Social Services Improvement Agency, 2009).

- **2008**, the KOALA project - The Dutch Government, in conjunction with various business and home care organisations, provided approximately 600 participants with in-home videophones for remote “live” access to healthcare workers, and medical devices to monitor blood pressure or glucose level meters (Joint Improvement Team, 2008). A study commissioned by the FTTH Council Europe (Eekeren, 2009) identified that whilst there were Telehealth benefits to participants in this project, those benefits came at considerable extra cost. This was mainly due to most elderly participants having to receive equipment for the project resulting in Telehealth being an add-on cost to regular health costs.

**UK**

- **Sandwell Telecare Project**

Commenced in 2003 as a pilot program with 25 participants, this project aimed at introducing technological aids to assist vulnerable elderly people and individuals with a disability to live independently at home. However, the project identified that use of Telecare by itself cannot compensate for human resources in crisis situations or provide back-up to people in crisis situations (Waddington & Downs, 2005).
• Liverpool Telecare Pilot
A pilot service, established in 2004 (Lancaster University Management School, 2005), installed Telecare in the homes of 21 frail elderly Liverpool social service clients to assist in maintaining their safety, security and independence, using ambient sensors to continually monitor individual’s behavioural patterns within their homes. The pilot highlighted technological challenges that may arise with the use of Telecare including instances where door sensor events were missed (Barnes et al, 2006).

US
• Philips National Study on the Future of Technology and Telehealth in Home Care (Fazzi Associates, 2008).
Commencing in 2007, this 12-month study was designed to generate insights into the use of Telehealth and technology and surveyed 976 home care agencies across America. Of all organisations surveyed, 17.1 percent used some type of Telehealth system and these reported:
  - improved patient satisfaction - 71.3 percent
  - decrease in the number of on-site visits - 49.7 percent
  - increase in quality outcomes - 88.6 percent
  - reduction in costs - 42.8 percent
  - given all they knew they still would have started a Telehealth service - 89.1 percent

• Care co-ordinated enhanced telehome care program for elderly veterans with chronic heart failure (Schofield et al., 2005).
The Veterans’ Health Administration designed and implemented a nurse-directed, care co-ordinated, Telehealth management program for veterans with difficult-to-manage or new onset chronic systolic heart failure. An in-home Telehealth message device provided the patient with daily heart failure education. Clinical and demographic characteristics and outcome data were collected at enrolment and at nearly 6 months after enrolment. The ‘6-months after enrolment’ data on 73 patients demonstrated significant improvements in weight, blood pressure and shortness of breath ratings. Inpatient hospital days were reduced from 630 for the previous year to 122 whilst on the program; only 31 percent were related to heart failure.
Europe

- SOPRANO (Service-orientated Programmable Smart Environments for Older Europeans), European Commission’s 6th Framework Programme Intergrated project. SOPRANO is a €7 million funded consortium of public bodies, university research institutes and enterprises which commenced in 2007 and is anticipated to run for 40 months. It consists of organisations from several European countries including Greece, Ireland, Spain, Netherlands, UK, Germany and Slovenia (European Commission CORDIS, 2009). The main project goal is to extend the time individuals can live independently at home through the development of new systems of support using assistive technology linked to external service provision (SOPRANO, 2009). The project aims to implement a user-centred design process where both users and experts are involved in the initial conceptual design and later development of prototypes. This is based, in part, on the belief that the complexity in design of many devices that have been developed for older people actually excludes them from their use. The project also suggests that individuals are more likely to accept technology-based help if they have more say in what information is sent out, who receives that information and under what circumstances it is sent (Muller et al, 2008).

West Lothian Project

- Smart technology and care for older people: innovation in West Lothian, Scotland (Bowes & McColgan, 2006).

Commencing in 1999, the West Lothian project was a Telecare initiative undertaken by the West Lothian Council to support a rapidly increasing ageing community population by developing a new model of ageing-in-home away from residential care. This was achieved, in part, through a re-development of what services were delivered into the individual’s home including the use of technology for support and care. Phase one, costing £200,000, involved 75 packages of technology being installed into service user’s homes. In phase two the Council spent £700,000 upgrading their Community Care Alarm Service to a more advanced Home Safety Service which involved a core package of home security and safety including a 24-hour monitoring call centre. Individually tailored protocols were used by the operators to respond. Phase three commenced in 2003, at a cost of £1,228,916 and aimed at making the Home Safety Service available to all vulnerable individuals and people over the age of 60 living in West Lothian. By the end of the evaluation period the technology, provided by Tunstall Telecom Ltd, had been introduced into more than 2,000 homes in West Lothian.
The University of Sterling independent evaluation of the West Lothian Project interviewed service users, carers and staff in addition to undertaking a study in a comparator local authority and a value-for-money study. The study found:

**Service Users**

1) A large number of older people and carers living at home reported on the positive impact of the technology assisting them in staying in their own homes; 
2) Many individuals reported that they were reluctant to receive help and support. The research team felt that mainstreaming equipment to all households in phase three would reduce negative stigma that may be associated with the technology; 
3) The technology emerged as only one element of support with family relationships being important for both social support and specific care needs.

**Staff**

1) The new model resulted in staff focusing on providing support rather than care to individuals, thereby increasing the individual’s independence; 
2) The majority of staff were supportive of the new model; 
3) The technology was integral to the new ways of working.

**Cost effectiveness**

1) West Lothian was especially effective in dealing with delayed discharge. In April 2001, 48 patients were awaiting discharge from hospital to a local authority care facility; in April 2006 only 3 patients were on the waiting list - a reduction of 88 percent compared to 60 percent for the whole of Scotland over the same period. 
2) The new forms of care and support were central to this performance, offering high quality combined with control of costs.

- **NHS Lothian Telecare/health Pilot**

Stage one of this project, in 2008, involved a small scale pilot of 50 patients with COPD. It aims to provide early continuous monitoring of the social needs and health of individuals with selected long-term health conditions, carried out by adding Telehealth onto the existing Telecare infrastructure. It is anticipated this will reduce acute exacerbations of individual long term health conditions, resulting in a reduction of expensive interventions such as unplanned hospital admissions. Stage two will be a controlled randomised clinical trial of 350 patients. The University of Edinburgh is evaluating this project (Joint Improvement Team, 2008).
Australian Initiatives

- **Australian Coordinated Care Trials**
The Coordinated Care Trials were developed in 1995 in response to a Council of Australian Governments-endorsed proposal to meet health care needs in a more appropriate way whilst financially managing health care effectively (Silagy et al., 2000). The Commonwealth funded nine trials whose central concept was that a reduction in the need for hospitalisation was possible for people with chronic or complex needs if their care was better co-ordinated. While the overall results of the trials did not indicate improved health and well-being of participants, three of the trials showed a significant reduction in hospital admissions for the intervention group compared to the Control Group (Esterman & Ben-Tovim, 2002). Telecare was identified as having significant potential for contributing to the management of at-risk older people living at home alone and patients with acute exacerbation of chronic conditions (Celler et al, 1999).

- **Impact of installation of home alarms for clients and carers**
  A 1994 South Australian study (NARI cited in Lawson & Lowe, 2006), evaluated the impact of alarms on service usage for 64 clients with a disability and their carers. Prior to alarm installation almost 50 percent of the clients rated their coping ability below the midpoint on an 11-point scale. This reduced to 9 percent 20 weeks after installation. Five months after installation 74 percent of carers stated that they could not continue their lifestyle without the alarm, 79 percent felt less anxious and 7/24 carers required fewer respite hours.

- **Queensland Smart Home Initiative (QSHI)**
  QSHI is a consortium of government, researchers and leading companies who are supporting ageing Queenslanders by building greater capacity for research and development of assistive home care technologies (Soar & Croll, 2007).

- **Department of Veteran’s Affairs (DVA) Rehabilitation Appliances Program (RAP)**
  The RAP utilises a variety of aids and appliances to assist veterans, war widows, widowers and dependants to be as self-reliant and independent as possible in their own home (DVA, 2009). This includes use of personal response systems (wrist device or pendant) which allow a person to seek assistance quickly in an emergency (DVA, 2004).
• **Personal Alert Victoria (PAV)**

PAV, a Victorian Government-funded Telecare scheme aims to reduce premature or inappropriate admission of clients into residential care. Personal monitoring and emergency response services are offered free to all eligible isolated and frail older adults at risk of falls or medical emergencies (Lawson & Lowe, 2006). By June 2009 the program had expanded to support over 22,000 older Victorians (Neville, 2008).

• **Baptist Community Services (BCS) Care Call**

Established in 1999, BCS Care Call assists individuals in the community who are at risk due to frailty, illness or disability. The service aims to increase client’s independence and peace of mind through the provision of a 24-7 emergency monitoring support service with products that include a personal alarm monitoring system (BCS, 2009).

**Home monitoring and treatment**

Equipment is used to assist in the delivery of home monitoring and treatment across a range of conditions. Intravenous infusion therapy of antibiotics, total parenteral nutrition, chemotherapy, analgesia, home ventilators, oxygen therapy, home-based imaging, and telemedicine monitoring of chronic disease can be deployed to treat illness. As such technology continues to improve it will permit the scope of post-acute care to expand and, in some cases, may reduce the need for on-site monitoring by medical personnel.

Recent advances in home intravenous infusion technologies allow infusion to be delivered in a highly controlled manner with programmable pumps, also known as “smart pumps,” with dose-checking capability, predefined dose limits, bolus delivery options, and the ability to recognize programming errors before medication delivery. Pumps have evolved from large stationary units to portable devices that can be carried on a belt clip (Wilson, 2004).

Advances in radiology enable provision of home-based diagnostic services. Simple home-based x-rays are available in many settings. Handheld ultrasound devices have been developed, which enable investigations such as echocardiograms and monitoring of deep vein thrombosis or pleural, peritoneal, or pericardial fluid (Galasko, 2003; Lapstolle, 2006).
Continuous monitoring of patients in certain diagnostic categories, outside hospital environments, has been the subject of a number of studies. Outcomes of studies where these methods have been evaluated are similar to those achieved in hospital (Berry, 2001; Ho, 2007; Malasanos, 2006; Wilson, 2000). Theoretically, the application of these technologies to the home monitoring and treatment of patients suffering from a wide range of diseases could be applied to the delivery of post-acute care services, and may improve the quality, safety and efficiency of services.

Specialist nurse-led telephone call services have been demonstrated to improve care and reduce health services costs associated with delivering care for heart failure. Hospital re-admissions have been reduced by 33 percent and costs associated with in-patient hospitalisation reduced by 42 percent with the use of these methods. Home-monitoring for heart failure includes the use of peripheral devices for measuring and automatically transmitting electrocardiograms (ECG), blood pressure, heart rate, medication use, bodyweight and symptoms. This type of home monitoring may be associated with reduced hospital re-admissions for patients; however other researchers have failed to demonstrate significant differences in patient outcomes when comparing home monitoring with regular face-to-face visits with health care providers (Benatar, 2003; Martinez, 2006).

Specialist nurse-led telephone-based care has also been trialled for provision of care for patients with acute exacerbations of chronic obstructive pulmonary disease (COPD). Patients demonstrate better knowledge of the disease, better self-management and higher satisfaction where this method is used to augment face-to-face service delivery. Costs of services have been reduced by up to 40 percent with the application of this method (Hernandez, 2003).

Home monitoring has been demonstrated to improve the mental and physical needs of the elderly and chronically ill, and assist them to remain out of hospitals and other institutions. This can improve their quality of life, as well as reduce the costs of prolonged stays in hospital care facilities (Neale, 2004). The installation of home monitoring systems that monitor physiological variables, such as the ECG and blood pressure, and video-links that allow health professionals and relatives to interact more frequently with the elderly, assist some patients to maintain their independence (Koch, 2006).

Internet-based video-phones have been trialled for their suitability for use in the homes of families in need of paediatric palliative care services. The technology is a feasible alternative
to face-to-face service provision but numerous technical problems were encountered during the trial, affecting the reliability of the method (Bensink, 2004).

A videophone system was used to link adult cancer patients, undergoing chemotherapy at home, with care providers in the healthcare facility. Using a pre-intervention/post-intervention design, improvements were observed in the Hospitalisation Anxiety and Depression Scale (HADS), SF36 Health Survey Questionnaire and Palliative Care Outpatient Scale (POS) scores, indicating an improvement in quality of life due to use of the videophone service (Clemensen, 2007).

Telephone, video and internet have been demonstrated to improve the delivery of home-based care for ulcers and chronic wounds (Clemensen, 2007; Dobke, 2008). Low-bandwidth telemedicine has been successfully used to enable rehabilitation services to be delivered directly to the home of patients in rural and remote areas after a knee replacement. Clinical physiotherapists delivered the services, which were demonstrated to be effective, safe and easy to use (Russell, 2004).

Telephone, video and internet have been successfully used to monitor patients acutely ill with infections, such as community-acquired pneumonia, skin and soft tissue infections, and urinary tract infections, with satisfactory outcomes, cost savings and more rapid convalescence of the unwell patient achieved (Eron, 2004; Eron, 2004(b); Chambers, 2002).

A systematic review of 40 studies internationally was conducted evaluating Telehealth technology where peripheral medical devices were used to deliver home care for adult patients with chronic illness. Patients and providers were accepting of the technology and it appears to have positive effects on chronic illness outcomes such as self-management, re-hospitalisations, and length of stay (Bowles, 2007).

There are still significant gaps in the evidence base about where telemedicine is used and where its use is supported by high-quality evidence (Hersch, 2007). A systematic review of 65 studies of home telemonitoring for 4 chronic diseases (pulmonary conditions, diabetes, hypertension, and cardiovascular diseases) suggests that while telemonitoring is a promising patient-management approach, further studies are needed to examine its clinical effects and cost effectiveness (Pare, 2007).
Glueckauf (2007) noted a lack of randomised controlled trials of Telecare and Telehealth programs for ageing groups and a systematic literature review carried out by Imperial College London in 2006 identified almost 9,000 papers in scientific journals on the outcomes of Telecare trials, but the majority were based on small scale or pilot projects. Only approximately 100 studies met their criteria for inclusion i.e. observational studies with more than 80 participants or randomised controlled trials of any size. Those studies provided an emerging evidence base for monitoring people’s vital signs by Telecare, pointing to both quality of life and clinical benefits for certain conditions including heart failure, diabetes and hypertension (Barlow et al., 2007).

A review of published studies by Meystre (2005) found that the most promising application of monitoring patients at a distance using information technology was for chronic illness in the home such as cardiopulmonary disease, heart failure and asthma. It also found a number of benefits of telemonitoring including a reduction of chronic disease complications due to better follow up, the provision of health care services without the need for hospital beds and a reduction in overall costs including less time required off work for carers and a reduction in patient travel time. Obstacles to the development of telemonitoring were also identified, including initial set-up cost.

**Reduced health-care costs**

Telemedicine and Telecare can contribute to a reduction in healthcare costs. However, economic evaluations to date have generally involved small numbers of patients with diverse types and doses of telemedicine / Telecare intervention for a select few chronic illnesses; most commonly heart failure. Further research is needed to clarify how interventions can be used to maximize benefits (Bergius, 2001; Bowles, 2007).

Large-scale trials have yet to be carried out for most tele-medical applications. As a result, there is little quantitative information about the savings resulting from using telemedicine instead of traditional methods of providing care (Bensink, 2001). So far most applications have focused on bridging large distances, and caring for patients in remote or inaccessible areas. Such applications are often quite expensive because of the prevailing telecommunications costs.
Issues identified in the literature

A number of issues have been identified in the published literature that should be considered when implementing Telehealth and Telecare solutions as a component of healthcare service delivery.

• Ethical Considerations

Professor Kluge, the former Director of Ethics and Legal Affairs of the Canadian Medical Association, identified that electronic healthcare presents a number of ethical and legal challenges including issues surrounding the consent to data collection, record ownership, the right to disposition, and protocols for exchange and use of the data. He argued that patients’ rights should play a central role in the structuring and implementation of eHealth (Kluge, 2006).

The importance of individual data protection as technology evolves was also highlighted in the literature. Directive 95/46/EC of the European Parliament outlines eight enforceable personal data principles for countries governed by the Act, including the need for data to be processed fairly, lawfully and for limited purposes, be accurate, relevant and not excessive, secure and not transferred to other countries without adequate protection (AGE, 2008). The UK Department of Health recommended that Telecare service users should be fully informed of the implications of the information created from a Telecare package, including being advised that they have access to that information and are aware of any conclusions that may be drawn (Swann, 2007).

• Impact of Service Users’ Attitudes towards Technology

The review identified several factors that can impact on an older adult’s use of technology. Magnusson et al., (2004) noted that a lack of confidence in the abilities required to use the equipment, coupled with the cognitive effects of ageing on learning, can result in a failure to adopt information and communication technology. A study by Cardiff University of information collected from 352 adults aged over 60 years, and follow-up interview data from 35 of those individuals, found that the main reason for non-use of Information and Communication Technology was that non-users had no interest in it and were not motivated to do so. The study concluded that when a system is relevant to an older adult and training is made available, the individual will take part in using the technology (Selwyn et al., 2003).
Factors that affect a patient’s perception of home Telecare have also been explored. University of New South Wales researchers (Rahimpour, et.al. 2008) conducted ten focus group interviews with patients suffering from chronic obstructive pulmonary disease, congestive heart failure, or both, and found that anxiety and self-efficacy are important constructs in patients’ acceptance of home Telecare, with implications for training programs.

- Social Considerations

Gatward (2004) suggested that as many as 80 percent of people requiring care want this to take place in their own homes. For house- or bed-bound individuals, visits from family, friends and in some instances, healthcare providers may be their only form of social interaction. As Telecare can be designed to reduce the required number of visits to people receiving the service, there is a risk that social isolation could be exacerbated for those individuals. Swann (2007) recommended that service design should address social isolation.

- Benefits of Telehealth in Rural and Regional Australia

Australia’s population is spread across metropolitan cities, rural and regional areas and isolated outback locations. In 2006, 32 percent of Australians lived in regional and remote locations and the highest proportion of people aged 50-79 years were located in regional areas (Australian Bureau of Statistics, 2008). An ageing regional population has a greater need for the provision of specialised health services, home help and public transport (Australian Bureau of Statistics, 2002). Restrictions and limitations in accessing essential health services is experienced by people living in rural areas which often results in large distances needing to be travelled to metropolitan specialist healthcare centres (Smith et. al., 2005). Telehealth has the potential to assist in the delivery of health care and services to rural areas (Bahaadini et. al., 2009) and if required, provide an alternative method for the delivery of health services in those locations (Smith et. al., 2005).

- Australian Medicare Support for Telehealth

The Australian Government’s role in the provision of incentives for health IT was noted by then Minister for Health and Ageing, Tony Abbott, in 2007. He stated that healthcare providers needed to be supported in moving towards greater use of IT which he believed would be achieved through the Government’s commitment to introduce more Medicare items for Telehealth services. Allied Health Professions Australia, the national peak body for allied
health professionals, recommended in a submission to the Primary Health Care Strategy Paper (2009) that Telehealth be placed on the medical benefits scheme to ensure rural and remote consumers obtain equity of access to the right health professional at the right time, a view reiterated by Royal Australian and New Zealand College of Ophthalmologists (2009) in their submission to the National Health and Hospitals Reform Commission.

- UK Identification of Participation Barriers

The Whole System Demonstrator (WSD), a large-scale randomised controlled trial being undertaken in England exploring the use of Telecare and Telehealth, invited more than 20,000 patients/service users to participate. The project report identified several key reasons why people did not participate in the trial, including that some individuals:

- did not meet the eligibility criteria;
- did not have the time to be involved;
- experienced a negative reaction to the technology once they saw it and declined to use it;
- did not want to operate the equipment;
- went into a care home;
- were confused and did not understand the trial.

However, the study found a very low drop-out rate once the Telecare and Telehealth equipment was installed (Ellis, 2009).

**Business Involvement**

A number of business organisations have taken an active interest in the development of technology to support ageing in place with estimates that this market will grow to $20 billion by 2020 (Weintraub, 2009). Since 2006, Philips has acquired a number of health-care companies, at a cost of $6 billion, including Lifeline, a maker of personal emergency-alert systems (Capell, 2009). General Electric has developed a partnership with Living Independently Group for the production of QuietCare, a wireless home monitoring system (Schmitt, 2009) and Tunstall provides Telecare and Telehealth in 30 countries, supporting 2.5 million people around the world (Tunstall Australasia, 2009). In 2003, 400 technology companies and health care organisations, under the auspices of the American Association of Homes and Services for the Aging, formed the Center for Aging Services Technologies. This coalition aims to accelerate the development, evaluation and adoption of technologies that can assist in ageing (CAST, 2009).
Summary

The social and economic impact of an ageing population, both internationally and within Australia, has resulted in the exploration of alternative methods of care provision. Advances in technology have allowed technological devices to be part of this process through the development of “Telecare” - support and care from a distance, and “Telehealth” - monitoring individual’s health from a distance. This type of assistance is gaining support with governments internationally and within Australia funding small and large-scale trials to test its use, business investing in its continued development and individuals choosing to use it as part of their care.

Research investigating its effectiveness has shown promising results with a number of studies indicating that Telehealth and Telecare can reduce the cost of care provision (Meystre, 2005; Schofield et al. 2005; Bowes & McColgan, 2006), increase the confidence and independence of clients and carers (Waddington & Downs, 2005; Barnes et al. 2006; Celler et al. 1999), and reduce demands on formal services (Fazzi Associates, 2008; Schofield, 2005).

Research has also indicated a number of factors to be considered when implementing use of Telecare and Telehealth, including:

- it cannot compensate for human resources in a crisis (Waddington & Downs, 2005);
- errors can occur in its use (Barnes et al., 2006);
- patients’ rights should play a central role when there are ethical considerations in the structuring and implementation of eHealth (Kluge, 2006);
- service users’ attitudes towards technology can impact on their willingness to use it (Magnusson et al. 2004; Selwyn et al. 2003); and
- social isolation from use of Telecare and Telehealth should be addressed (Swann, 2007).
Aim
The aim of this project was to test the use of Telehealth and Telecare products with frail older clients from BCS community based Transition Care Program (TCP) who had a chronic disease and were being discharged from hospital.

Objectives
The main objectives of the project were to improve evidence to support policy-makers’ resource allocation decisions about any future use of Telehealth and Telecare in post-acute care; to improve knowledge of the impact of Telehealth and Telecare products on morbidity and mortality in recipients of post-acute care; to improve knowledge about acceptance and barriers to use of Telehealth and Telecare by frail older people and carers; and to describe service configuration that optimises outcomes for recipients of Telehealth and Telecare.
CHAPTER 2 – PROJECT METHODS

Steering Committee

As required by the Funding Agreement, a Steering Committee of relevant stakeholders was established to provide support and advice to the Research Team (see Acknowledgements). Given the geographic spread of the Steering Committee members, meetings were held centrally at BCS Head Office in Sydney with a teleconference option for members who were unable to attend in person.

Ethics Approval

Due to the complex and sensitive nature of this study a full National Ethics Application Form (NEAF) submission was made to Southern Cross University Human Research Ethics Committee (HREC). An Ethics Submission was also made to the BCS Human Research Ethics Committee. Ethics Approval was granted by both organisations.

There were a number of complex ethical issues arising from the project that were raised by the HREC and addressed by the Research Team. These included;

1) the risks associated with placing medical equipment in the homes of frail older adults, who have just come home from hospital;

2) the risks associated with the equipment itself (the equipment is linked into the phone line so issues around reliability were addressed);

3) the usability of the equipment for frail older adults who did not have a carer to assist them in its use.
Study Design

This project was a randomised controlled trial involving five groups:

- Group 1: Control Group,
- Group 2: Group with Telehealth (personal monitoring of blood pressure, heart rate, oxygen saturations and body weight) for the duration of receiving Transition Care (up to 12 weeks),
- Group 3: Group with Telehealth for the duration of receiving Transition Care (as above) plus an additional 12 weeks of Telehealth monitoring,
- Group 4: Group with Telehealth and Telecare (a personal medical alarm) for the duration of receiving Transition Care (up to 12 weeks),
- Group 5: Group with Telehealth and Telecare for the duration of receiving Transition Care (as above) plus an additional 12 weeks of Telehealth and Telecare monitoring.

Target Group

The target group were frail older clients from the BCS community-based Transition Care Program (TCP), who had a chronic disease, and had just been discharged from hospital in one of the following six BCS service sites:

1) Canberra;
2) Central Coast
3) Central West;
4) Mid-state (NSW);
5) North-West Sydney;
6) Parkes.

Carers of participating clients were also invited to take part in the study.

Written informed consent was obtained from eligible clients and carers.

Each client was randomised into one of the 5 groups. If the carer of a consenting client wished to take part in the study, they were allocated into the same group as the client they cared for.
**Inclusion/Exclusion Criteria**

The following was the exclusion criteria of the study:

1. The client (or the carer of a client who lacks capacity) had insufficient English proficiency to complete the survey and/or to follow the instructions for use of the equipment.

2. The client lacked capacity* to complete surveys and/or operate the equipment, and had no-one to do it for them. (Note: not having a carer was not an exclusion criterion, provided the client had capacity*).
   
   *Note: In some cases BCS staff were prepared to assist the client to complete the survey, if the client had eyesight or literacy problems but could understand each question. However, the client still needed to be able to use the Telehealth equipment, which involved reading and answering questions, and staff were not be able to visit each day to assist with that.

3. The client had a carer and the carer did not wish the client to participate.

4. The client had a live-in carer and the client did not want the carer involved.

5. There was no phone line connected to the house or there was no power source in a suitable location in the house, or nowhere to install the equipment which would not be a hazard to the client or potentially result in damage to the equipment.

6. The client was using other Telehealth and/or Telecare Products* before going into hospital and intended to continue using those products. (*Note: using a BCS Care Call alert pendant was not an exclusion criterion; however those participants were randomly allocated into either Control, Group 4 or Group 5, see Randomisation)

7. The client’s live-in carer or partner was already participating in the project

8. The client’s live-in carer or partner was already using Telehealth equipment
Method of Randomisation

BCS offers the same Care Call pendant to all relevant clients of TCP as was used by Groups 4 and 5 of the study. Some clients who wanted to participate in the study were either in possession of a BCS Care Call pendant prior to commencing the study, or were assessed by BCS as needing one as part of their TCP package. Due to safety considerations, it was decided that either having a Care Call pendant from BCS prior to commencing the study, or being assessed by BCS as needing a Care Call pendant as part of the TCP package, did not exclude participation in this project. To accommodate this, the following method was implemented:

A stratified random sample utilising a random numbers table was used. Participants who were assessed as either needing a BCS Care Call pendant or who already had a BCS Care Call pendant were allocated to the first number on the list out of 1, 4 or 5 and that number was marked off the list. If they were assessed as not needing a Care Call pendant they were allocated to the first number on the list out of 2 or 3 and that number was marked off the list.

In some instances the person’s GP either did not wish to be involved in the study or did not respond to the request in time. In both instances that participant was allocated into the Control Group and the next number 1 on the list was marked off.

To ensure both sufficient coverage, and allocation of participants into groups from each of the six BCS service sites, the number of clients required from each area in each group was calculated. A package, containing the required number of group-related questionnaires was sent to the BCS service site with an understanding that once the number was reached for each respective group, no more participants would be randomised into that group. The low participation rate did not result in this number being met in any of the six locations.

Questionnaire Development

The Research Team developed three separate sets of questionnaires (baseline, midpoint and final) for this study. A different version of each set of questionnaires was created for each of the 5 groups. This was due to there being questions that related specifically to each group depending on what equipment/technology was used and how long that group received TCP
and the equipment/technology. Variations also existed within each of the different versions of the questionnaire for each group, to accommodate clients with and without capacity and carers of clients with and without capacity. In total 32 different questionnaires were required.

**Process of Enrolment and Commencement**

1. The client was assessed in hospital for suitability for TCP by an Aged Care Assessment Team (ACAT).

2. If they were assessed as suitable for TCP the Hospital Discharge Planner contacted the appropriate BCS coordinator.

3. The BCS coordinator visited and assessed the client in hospital, set up a care plan for the client and completed the TCP contract.

4. The BCS coordinator then assessed the client’s suitability for the Telehealth project. This would occur prior to being discharged from hospital or, for the Central Coast office, during the client’s first day at home. Clients who were assessed as being eligible were provided with information about the project.

5. The BCS coordinator then contacted the TCP staff who followed up with the client and provided any additional information about the Telehealth project that was required.

6. If the client decided that they would like to participate in the project, a BCS TCP staff member visited the client and obtained written consent.

7. The TCP staff contacted the GP of the client and asked if the GP would assist in the project. The group that the client was randomised into was, in part, dependent upon the involvement of the client’s GP in the project (see Randomisation).

8. The TCP staff then contacted the client and organised a visit to install the equipment and train the client/carer in its use. This was done as close to the hospital discharge date as possible. The baseline questionnaire was completed prior to the installation of the equipment (or if in Control, after consent was obtained).
9. Dependent upon the group that the client was randomised into, the client either had no equipment or a pre-existing pendant alarm (Group 1), a Telehealth monitor (Groups 2 and 3), or both a pendant alarm and a monitor (Groups 4 and 5) installed.

10. Once the client was discharged from TCP they completed a mid-point survey. Clients in Groups 2 and 4 had their equipment removed at this point. Clients in Groups 3 and 5 continued with the equipment.

11. Twelve weeks post the end of their TCP, a final survey was mailed out to all participants, completed by the client (and their carer if they were also participating in the study, or by the carer only for clients who lacked capacity) and returned to BCS.

12. Clients in Groups 3 and 5 had their equipment removed at this point.

13. If a client withdrew at any point, the equipment was removed and an exit survey completed.

**Data management and analysis**

Data for the project was collected from the following sources:

- Questionnaires completed by clients and carers
  - Personal Wellbeing Index (PWI) validated quality of life survey instrument
  - Use of Health Care Services
  - Use of Technology
  - Attitude to Technology
- Readings from the Telehealth Equipment
- Alert information from BCS Care Call
- Client exit information from BCS
- Personal Profile information obtained from the participants, their ACAT form and BCS
Questionnaires

When completed by clients and/or carers, the questionnaires were placed into an envelope by the respective participant. The envelope was sealed and forwarded to BCS. The unopened envelopes were then forwarded on to the ASLaRC Research Team. This protected the participants’ confidentiality as there were no names on the questionnaires, only Code Numbers which has been added by BCS Staff, and BCS Staff did not see the completed questionnaires.

Telehealth Data

The data from the Telehealth equipment was provided to BCS by Tunstall. The readings were then transcribed into an Excel Data File by BCS and forwarded onto the ASLaRC/SCU Research Team as linked-to-ID-Code data.

Care Call

The data from the BCS Care Call equipment was provided to the ASLaRC/SCU Research Team by BCS, again as linked-to-ID-Code data.

The data was manually coded and transcribed into Microsoft Office Access forms with each entry being checked twice for accuracy. It was then transferred into SPSS Version 17. The results of the analysis are reported in Section 4.

GP Survey

A survey of all general practitioners whose patients participated in the study was conducted. The survey was developed through conducting telephone interviews with a convenience sample of 6 GPs in the sample in order to first identify relevant areas for research enquiry. The survey was field tested with a convenience sample of participants before being distributed to GPs by BCS by facsimile. Non-respondents were followed up by telephone by a member of the ASLaRC/SCU research team who is also a GP.

Completed surveys were data entered into a password-protected Microsoft Excel spreadsheet by ASLaRC personnel. Data were transferred into SPSS Version 17 for analysis. The results of the analysis are reported in Section 4.
CHAPTER 3 - RESULTS

Number of participants

There were 255 people eligible for post-acute care who were approached to participate in the study. Of these, 112 did not meet the inclusion criteria for participation and were excluded. Of the 143 people who did meet inclusion criteria, 76 declined to participate, 4 were re-admitted to hospital and 2 withdrew prior to being randomised into groups, leaving 61 participants who were enrolled and randomised to groups (Figure 3.1). There were 29 carers who were eligible to participate; all gave consent and were enrolled in the study.

Each client was randomised into one of five groups. Carers were randomised to the same group as the client they cared for. There were 16 clients and 5 carers randomised into the Control Group; 6 clients and 4 carers randomised into Group 2; 9 clients and 4 carers were randomised into Group 3; 16 clients and 7 carers randomised into Group 4; and 14 clients and 9 carers randomised into Group 5 (Table 3.1).

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of participants enrolled</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Clients</td>
<td>Carers</td>
</tr>
<tr>
<td>Group 1</td>
<td>16</td>
<td>5</td>
</tr>
<tr>
<td>Group 2</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Group 3</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>Group 4</td>
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<td>7</td>
</tr>
<tr>
<td>Group 5</td>
<td>14</td>
<td>9</td>
</tr>
<tr>
<td>Total</td>
<td>61</td>
<td>29</td>
</tr>
</tbody>
</table>

Of these enrolled/randomised participants, 42 clients and 19 carers completed the study. There were 11 clients and 4 carers in the Control Group who completed the study; 4 clients and 1 carer completed in Group 2; 4 clients and 1 carer completed in Group 3; 11 clients and 5 carers completed in Group 4; and 12 clients and 8 carers completed in Group 5 (Table 3.2).
Table 3.2: Number of participants who complete the study

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of participants who withdrew</th>
<th>Clients</th>
<th>Carers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td></td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td>Group 2</td>
<td></td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Group 3</td>
<td></td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Group 4</td>
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<td>11</td>
<td>5</td>
</tr>
<tr>
<td>Group 5</td>
<td></td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>42</strong></td>
<td><strong>19</strong></td>
</tr>
</tbody>
</table>

The following diagram represents the number of participants at each stage of the study (Figure 3.1):

All participants were accounted for in the analysis. Data were analysed on an intention-to-treat basis.
Demographic characteristics of clients at study commencement

The mean age of participants was 81 years (range 63 to 99 years). There were 23 male participants (38%) and 38 female participants (62%). Overall, 48 percent of participants were married, 43 percent were widowed and 7 percent were divorced (Table 3.3). The remainder of participants were either single or did not provide their marital status.

Forty-three percent of participants lived alone, 33 percent lived with their spouse only and 23 percent lived with other family members, with or without their spouse. Fifty-four percent of participants reported that they have a primary (non-professional) carer. The majority of participants received a pension (73% of respondents who answered) (Table 3.3).

Most clients (72%) lived in a house; 15 percent lived in a flat or unit and 13 percent lived in another accommodation type (Table 3.3).

There were 12 clients (17%) from the Central Coast of NSW, 11 (15%) from the ACT, 21 (29%) from Hornsby / Kuringai, 6 (8%) from Dubbo and 3 (4%) from Cowra. Another 18 clients (25%) did not report which region they were from.

There was no significant difference between study groups according to age, gender, marital status, living arrangements, accommodation type or whether the participant was in receipt of a pension (all $p > 0.05$)
Table 3.3: Demographic data for participants

<table>
<thead>
<tr>
<th>Client characteristic</th>
<th>Result* (Maximum N = 61)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Mean=81 years (Range=63 to 99 years)</td>
</tr>
<tr>
<td></td>
<td>N (%)*</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>- Male</td>
<td>23 (38)</td>
</tr>
<tr>
<td>- Female</td>
<td>38 (62)</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
</tr>
<tr>
<td>- Married</td>
<td>29 (48)</td>
</tr>
<tr>
<td>- Divorced</td>
<td>4 (7)</td>
</tr>
<tr>
<td>- Widowed</td>
<td>26 (43)</td>
</tr>
<tr>
<td>- Single</td>
<td>1 (2)</td>
</tr>
<tr>
<td>- Other</td>
<td>1 (2)</td>
</tr>
<tr>
<td>Living arrangements</td>
<td></td>
</tr>
<tr>
<td>- Live alone</td>
<td>26 (43)</td>
</tr>
<tr>
<td>- Live with spouse</td>
<td>20 (33)</td>
</tr>
<tr>
<td>- Live with family (and spouse)</td>
<td>7 (12)</td>
</tr>
<tr>
<td>- Live with family (no spouse)</td>
<td>7 (12)</td>
</tr>
<tr>
<td>- Live with others</td>
<td>1 (2)</td>
</tr>
<tr>
<td>Accommodation type</td>
<td></td>
</tr>
<tr>
<td>- House</td>
<td>44 (72)</td>
</tr>
<tr>
<td>- Flat or unit</td>
<td>9 (15)</td>
</tr>
<tr>
<td>- Other</td>
<td>8 (13)</td>
</tr>
<tr>
<td>Client in receipt of a pension</td>
<td></td>
</tr>
<tr>
<td>- Yes</td>
<td>32 (53)</td>
</tr>
<tr>
<td>- No</td>
<td>12 (20)</td>
</tr>
<tr>
<td>- Client did not answer question</td>
<td>17 (28)</td>
</tr>
</tbody>
</table>

*n=mean; SD=standard deviation; N=number of participants; demographic data missing for one participant
**Relationship between client and carer at study commencement**

There were 33 clients (54%) who had a primary (non-professional) carer. Thirty-eight percent of clients had a primary carer who lived with them. There were no significant differences between groups in whether or not the client had a primary (non-professional) carer (p=0.4).

The relationship between carer and client for clients who had a primary (non-professional) carer is outlined in Table 3.4.

**Table 3.4: Carer relationship**

<table>
<thead>
<tr>
<th>Carer relationship</th>
<th>N (%)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Husband</td>
<td>12 (36)</td>
</tr>
<tr>
<td>Wife</td>
<td>5 (15)</td>
</tr>
<tr>
<td>Daughter</td>
<td>12 (36)</td>
</tr>
<tr>
<td>Son</td>
<td>4 (13)</td>
</tr>
</tbody>
</table>

* N=number of participants

**Diagnoses affecting clients at study commencement**

The primary diagnosis that affected clients was as follows: (Table 3.5):

**Table 3.5: Primary diagnoses of clients**

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>N (% of cases)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orthopaedic</td>
<td>24 (39)</td>
</tr>
<tr>
<td>Mobility impairment or falls</td>
<td>10 (16)</td>
</tr>
<tr>
<td>Cardiovascular</td>
<td>6 (10)</td>
</tr>
<tr>
<td>Neurological</td>
<td>6 (10)</td>
</tr>
<tr>
<td>Respiratory</td>
<td>3 (5)</td>
</tr>
<tr>
<td>Renal</td>
<td>2 (3)</td>
</tr>
<tr>
<td>Malignancy</td>
<td>3 (5)</td>
</tr>
<tr>
<td>Infective</td>
<td>2 (3)</td>
</tr>
<tr>
<td>Other</td>
<td>5 (8)</td>
</tr>
</tbody>
</table>

* N=number of participants
Clients had a mean of 6 additional medical diagnoses (range of 1 to 10) affecting their health. There were 3 (5%) of clients with speech problems, 15 (25%) had problems hearing and 4 (7%) had problems using their hands. There were no significant differences between groups in the type of primary diagnosis affecting clients (p=0.73) or in the number of secondary diagnoses affecting clients (p=0.59). Nor were there significant differences in the primary diagnoses affecting clients or the number of secondary diagnoses affecting clients according to age, gender or marital status of participants or whether participants had a carer (all p>0.05).

Clients with cardiovascular disease, neurological illness, renal disease or infective illness were least likely to have seen a surgeon in the previous 12 months (p=0.02 for all). There were no other significant differences in utilisation of specialists according to primary diagnosis affecting clients.

Clients with neurological, respiratory, renal and mobility impairment as their primary diagnosis were most likely to require a community nurse for assistance (all p=0.02). There were no other significant relationships between primary diagnoses of clients and community health providers.

A total of 97 percent of participants had problems with Activities of Daily Living (ADLs) and/or problems with Instrumental Activities of Daily Living (IADLs).

The Barthel index, a tool for assessing functional independence, was completed by study participants. Scores may be interpreted as follows (Shah, 1998):

<table>
<thead>
<tr>
<th>Barthel index score</th>
<th>Dependency level</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-24</td>
<td>Total</td>
</tr>
<tr>
<td>25-49</td>
<td>Severe</td>
</tr>
<tr>
<td>50-74</td>
<td>Moderate</td>
</tr>
<tr>
<td>75-90</td>
<td>Mild</td>
</tr>
<tr>
<td>91-100</td>
<td>Minimal</td>
</tr>
</tbody>
</table>
The mean score on the Barthel index of clients as a whole was 74.6 (range 25 to 100). Participants with a carer had a significantly lower Barthel Index (mean=67.7) than participants who did not have a carer (mean=82.6) (p<0.01). Participants in the Control Group had a higher mean Barthel index (mean=79.4) than participants receiving Telehealth / Telecare (mean=72.8). However, this difference was not statistically significant (p=0.17).

There were no differences in ADL or IADL scores, or in Barthel index, according to age, gender or marital status of participants (al p>0.05).

Capacity to make decisions at study commencement

There were 57 clients (93%) who had capacity to make their own personal and health-care decisions. Of clients who did not have capacity, the person who made decisions was:

- Daughter – N=1;
- Other relative – N=2;
- Did not answer – N=1.

In all cases, clients reported that the person who makes their decisions has legal decision-making authority as Person Responsible.

Use of health care services in the 12 months prior to study commencement

In the 12 months prior to study commencement, clients visited the following medical specialists (Table 3.6):
There were no significant differences between participants in the Control Group and those receiving Telehealth / Telecare in utilisation of medical practitioners (all p>0.05). Male participants were more likely to access cardiology services (p<0.01) and diabetes specialists (p=0.01). Older participants were more likely to access a geriatrician (p<0.01). There were no other significant differences in use of healthcare services by clients according to the age, gender or marital status of participants, or according to whether or not the participant had a carer (all p>0.05).

**Emergency Department attendance:** There were 43 clients (71%) who reported attending an Emergency Department in the 12 months prior to study commencement. Frequency of attendance was:

- Twice a week (N=2);
- Once a week (N=2);
- Once a fortnight (N=1);
- Once a month (N=2); and
- Less often (N=36).

### Table 3.6: Use of health care services by clients*

<table>
<thead>
<tr>
<th>Type of specialist</th>
<th>N (%) accessing type of specialist</th>
<th>Once a week</th>
<th>Once a fortnight</th>
<th>Once a month</th>
<th>Less often</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N (%)</td>
<td>N (%)</td>
<td>N (%)</td>
<td>N (%)</td>
<td>N (%)</td>
</tr>
<tr>
<td>General practitioner</td>
<td>60 (98)</td>
<td>3 (5)</td>
<td>3 (5)</td>
<td>27 (44)</td>
<td>27 (44)</td>
</tr>
<tr>
<td>Cardiologist</td>
<td>29 (48)</td>
<td>3 (5)</td>
<td>1 (2)</td>
<td>0 (0)</td>
<td>25 (41)</td>
</tr>
<tr>
<td>Diabetes Specialist</td>
<td>4 (7)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>4 (7)</td>
</tr>
<tr>
<td>Geriatrician</td>
<td>6 (10)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>6 (10)</td>
</tr>
<tr>
<td>Oncologist</td>
<td>4 (7)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>1 (2)</td>
<td>3 (5)</td>
</tr>
<tr>
<td>Palliative Care Specialist</td>
<td>1 (2)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>1 (2)</td>
</tr>
<tr>
<td>Surgeon</td>
<td>23 (38)</td>
<td>1 (2)</td>
<td>2 (3)</td>
<td>3 (5)</td>
<td>17 (28)</td>
</tr>
<tr>
<td>Renal Physician</td>
<td>6 (10)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>6 (10)</td>
</tr>
</tbody>
</table>

* N=number of participants; (Note: Not all participants answered every question)
**Admission to local hospital:** Fifty clients (85%) reported being admitted to a local hospital in the 12 months prior to study commencement (excluding the hospital admission that led to the patient being referred for post-acute care). Frequency of admission was:

- Once in 12 months (N=21);
- Twice in 12 months (N=15);
- Three to five times in 12 months (N=12);
- Six to ten times in 12 months (N=2);

**Admission to other hospital:** Twenty-nine clients (48%) reported being admitted to a hospital other than a local hospital in the 12 months prior to study commencement. Frequency of admission was:

- Once in 12 months (N=21);
- Twice in 12 months (N=6);
- Three to five times in 12 months (N=2);

The proportion of clients who were admitted to a hospital other than a local hospital varied according to the geographical region the client was from. In total:

- 4 (67%) of clients from Dubbo;
- 12 (57%) of clients from Hornsby / Kuringai;
- 6 (50%) of clients from the Central Coast;
- 3 (27%) of clients from the ACT; and
- 0 (0%) of clients from Cowra

were admitted to a hospital other than a local hospital.

There were no significant differences between participants in the Control Group and those receiving Telehealth / Telecare in utilisation of Emergency Department or hospital inpatient services (all p>0.05). There were no significant differences in use of Emergency Department or inpatient services by clients according to the age, gender or marital status of participants, or according to whether or not the participant had a carer (all p>0.05).

**Use of Community Services:** Community health services were utilised by the majority of participants. Frequency of receipt of services from the following providers in the 12 months prior to study commencement was (Table 3.7):
Table 3.7: Use of community health services by clients*

<table>
<thead>
<tr>
<th>Type of service</th>
<th>N (%) accessing type of service</th>
<th>Every day N (%)</th>
<th>2 – 4 times a week N (%)</th>
<th>Once a week N (%)</th>
<th>Once a fortnight N (%)</th>
<th>Less often N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community nurse</td>
<td>24 (40)</td>
<td>5 (8)</td>
<td>8 (13)</td>
<td>1 (2)</td>
<td>4 (7)</td>
<td>6 (10)</td>
</tr>
<tr>
<td>Physiotherapist</td>
<td>23 (39)</td>
<td>1 (2)</td>
<td>1 (2)</td>
<td>6 (10)</td>
<td>6 (10)</td>
<td>9 (15)</td>
</tr>
<tr>
<td>Occupational therapist</td>
<td>18 (31)</td>
<td>0 (0)</td>
<td>1 (2)</td>
<td>5 (9)</td>
<td>1 (2)</td>
<td>11 (18)</td>
</tr>
<tr>
<td>Podiatrist</td>
<td>20 (33)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>1 (2)</td>
<td>19 (31)</td>
</tr>
<tr>
<td>Naturopath</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Massage therapist</td>
<td>4 (7)</td>
<td>1 (2)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>3 (5)</td>
</tr>
<tr>
<td>Dentist</td>
<td>29 (48)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>1 (2)</td>
<td>28 (46)</td>
</tr>
</tbody>
</table>

* N=number of participants

There were no significant differences between participants in the Control Group and those receiving Telehealth / Telecare in utilisation of community health services (all p>0.05).

There were no significant differences in use of community health services by clients according to the age, gender, pension status or marital status of participants, or according to whether or not the participant had a carer (all p>0.05).

Use of personal assistance in the 12 months prior to study commencement

There were 55 clients (76%) who used one or more personal assistance services (Table 3.8). The most commonly used service was assistance with housework. The least used service was personal assistance such as having a shower or going to church. Family members were the most common provider of assistance with shopping, paying bills, going to the doctor and going to church. Paid helpers were the most common provider of assistance with housework and gardening. Friends were the most common provider of assistance with personal care such as having a shower. Other sources of assistance most commonly provided help with going out socially (Table 3.8).
Table 3.8: Use of personal assistance in the 12 months prior to study commencement

<table>
<thead>
<tr>
<th>Type of service</th>
<th>Total % accessing type of service</th>
<th>Family member</th>
<th>Paid helper</th>
<th>Friend</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N (%)</td>
<td>N (%)</td>
<td>N (%)</td>
<td>N (%)</td>
<td>N (%)</td>
</tr>
<tr>
<td>Shopping</td>
<td>35 (57)</td>
<td>26 (43)</td>
<td>11 (18)</td>
<td>7 (12)</td>
<td>1 (2)</td>
</tr>
<tr>
<td>Housework</td>
<td>46 (75)</td>
<td>14 (23)</td>
<td>33 (54)</td>
<td>3 (5)</td>
<td>2 (3)</td>
</tr>
<tr>
<td>Gardening</td>
<td>32 (53)</td>
<td>13 (21)</td>
<td>17 (28)</td>
<td>3 (5)</td>
<td>2 (3)</td>
</tr>
<tr>
<td>Personal care such as having a shower</td>
<td>19 (31)</td>
<td>4 (7)</td>
<td>15 (25)</td>
<td>19 (31)</td>
<td>2 (3)</td>
</tr>
<tr>
<td>Paying bills</td>
<td>22 (36)</td>
<td>19 (31)</td>
<td>3 (5)</td>
<td>1 (2)</td>
<td>1 (2)</td>
</tr>
<tr>
<td>Going out socially</td>
<td>29 (48)</td>
<td>21 (34)</td>
<td>3 (5)</td>
<td>11 (18)</td>
<td>29 (48)</td>
</tr>
<tr>
<td>Going to the doctor</td>
<td>32 (53)</td>
<td>24 (39)</td>
<td>4 (7)</td>
<td>4 (7)</td>
<td>2 (3)</td>
</tr>
<tr>
<td>Going to church</td>
<td>14 (23)</td>
<td>10 (16)</td>
<td>1 (2)</td>
<td>3 (5)</td>
<td>1 (2)</td>
</tr>
</tbody>
</table>

(Note: More than 1 response per service was possible, so N & % do not add across rows)

There were no significant differences between participants in the Control Group and those receiving Telehealth / Telecare in utilisation of personal assistance services (all p>0.05). Participants who were widowed were more likely to receive assistance with personal care (p=0.049) and paying bills (p=0.041); and participants who were married were less likely to receive assistance going out socially (p=0.047). There were no other significant differences in use of personal assistance services by clients according to the age, gender or marital status of participants, or according to whether or not the participant had a carer or was on a pension (all p>0.05). The primary diagnosis of clients was not associated with use of personal assistance services (all p>0.05).

Use of technology at study commencement

There were 55 clients (90%) who reported using the telephone for making their own telephone calls; 40 (66%) clients made calls every day, 13 (21%) made calls at least once a week, 1 (2%) made calls at least once a month and 1 (2%) made calls rarely. Thirty clients (49%) reported owning and using a mobile telephone for making their own telephone calls.
Twenty-one clients (34%) reported owning a personal computer and 19 (31%) reported that they ever used a computer for looking at the internet or sending emails; 12 clients (20%) reported using the computer every day, one client (2%) used the computer at least once a week and 6 clients (10%) used the computer rarely for looking at the internet or sending emails.

There were no significant differences between participants in the Control Group and those receiving Telehealth / Telecare in use of technology at study commencement (all p>0.05). Participants with a carer were less likely to own and use a mobile telephone (p=0.03) and to own a personal computer (p=0.04) than those without a carer. There were no other significant differences in use of technology by clients according to the age, gender or marital status of participants, or according to whether or not the participant had a carer (all p>0.05).

**Attitudes to technology at study commencement**

The beliefs of clients regarding the use of Telehealth monitoring and its impact on their health were appraised. The majority of clients at baseline who were randomised to Telehealth +/- Telecare were confident in their ability to use the Telehealth Monitor and that the equipment would be of benefit to them (Table 3.9).

Participants in the Control Group did not complete an Attitude to Technology survey.
Table 3.9: Attitudes to technology

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neither agree or disagree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>N (%)</td>
<td>N (%)</td>
<td>N (%)</td>
<td>N (%)</td>
<td>N (%)</td>
<td>N (%)</td>
</tr>
<tr>
<td>Using the Telehealth Monitor will improve my access to regular testing of my health condition</td>
<td>12 (29)</td>
<td>26 (63)</td>
<td>2 (5)</td>
<td>0 (0)</td>
<td>1 (2)</td>
</tr>
<tr>
<td>Using the Telehealth Monitor will make it easier to do regular testing</td>
<td>13 (32)</td>
<td>23 (56)</td>
<td>4 (10)</td>
<td>0 (0)</td>
<td>1 (2)</td>
</tr>
<tr>
<td>Using the Telehealth Monitor with save me time in having regular testing</td>
<td>13 (32)</td>
<td>22 (53)</td>
<td>2 (5)</td>
<td>3 (7)</td>
<td>1 (2)</td>
</tr>
<tr>
<td>I will find the Telehealth Monitor useful in my regular testing</td>
<td>13 (32)</td>
<td>19 (46)</td>
<td>8 (20)</td>
<td>1 (2)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Learning to operate the Telehealth Monitor will be easy for me</td>
<td>12 (29)</td>
<td>10 (24)</td>
<td>12 (29)</td>
<td>6 (15)</td>
<td>1 (2)</td>
</tr>
<tr>
<td>My interaction with the Telehealth Monitor will be clear and understandable</td>
<td>11 (27)</td>
<td>18 (44)</td>
<td>9 (22)</td>
<td>3 (7)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>It will be easy for me to become skilful at using the Telehealth Monitor</td>
<td>12 (29)</td>
<td>18 (44)</td>
<td>8 (20)</td>
<td>2 (5)</td>
<td>1 (2)</td>
</tr>
<tr>
<td>I will find the Telehealth Monitor easy to use</td>
<td>11 (28)</td>
<td>16 (40)</td>
<td>9 (23)</td>
<td>3 (7)</td>
<td>1 (2)</td>
</tr>
<tr>
<td>I am completely comfortable with the idea of using the Telehealth Monitor in my own home</td>
<td>12 (29)</td>
<td>19 (47)</td>
<td>5 (12)</td>
<td>5 (12)</td>
<td>0 (0)</td>
</tr>
</tbody>
</table>

There were no significant differences in attitudes to technology by clients according to the age, gender or marital status of participants, or according to whether or not the participant had a carer (all p>0.05).
### Personal Wellbeing Index at study commencement

The Personal Wellbeing Index (PWI) is a validated survey instrument that is used to measure quality of life across cultural groups. The PWI scale contains eight items of satisfaction, each one corresponding to a quality of life domain: standard of living; health; achieving in life; relationships; safety; community connectedness; future security; and spirituality/religion. These eight domains are theoretically embedded, as representing the first level deconstruction of the overarching question “How satisfied are you with your life as a whole?”.

The normative range for Western means is 70 to 80 points; the normative range for Australia is 73.4 to 76.4 points.

Clients recorded the following values for PWI domains at baseline (Table 3.10).

<table>
<thead>
<tr>
<th>Domain</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard of living</td>
<td>76.1</td>
<td>21.6</td>
</tr>
<tr>
<td>Health</td>
<td>50.2</td>
<td>23.7</td>
</tr>
<tr>
<td>Achieving in life</td>
<td>65.6</td>
<td>26.3</td>
</tr>
<tr>
<td>Relationships</td>
<td>86.0</td>
<td>15.2</td>
</tr>
<tr>
<td>Safety</td>
<td>72.4</td>
<td>23.3</td>
</tr>
<tr>
<td>Community connectedness</td>
<td>73.7</td>
<td>25.3</td>
</tr>
<tr>
<td>Future security</td>
<td>70.1</td>
<td>20.4</td>
</tr>
<tr>
<td>Spirituality / religion</td>
<td>76.5</td>
<td>22.6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>71.5</td>
<td>14.1</td>
</tr>
</tbody>
</table>

The client group scored lower than the Australian normative range for the PWI as a whole and for the domains of health, achieving in life, safety and future security. Clients scored higher than the Australian normative range for relationships and spirituality / religion.

There was no significant difference between controls and participants receiving Telehealth / Telecare in PWI scores at baseline (all \( p>0.05 \)). Female participants scored significantly lower in the domain of ‘Achieving in life’ (mean=61.1) compared with male participants (mean=77.4) (\( p<0.01 \)) and in ‘Future security’ (female mean=69.0; male=74.4; \( p=0.04 \)).
There were no other significant differences in PWI scores according to the age, gender, marital status or pension status of participants, or according to whether or not the participant had a carer (all p>0.05).

Participants who reported difficulties with speech scored significantly lower on ‘Feeling part of the community’ and Spirituality or religion’ than other participants (p=0.02 and p<0.01 respectively). Participants who reported difficulty with the use of their hands scored significantly lower on ‘Health’ and ‘Personal relationships’ than other participants (p<0.01 and p<0.05 respectively). There were no other differences in PWI scores according to speech, hearing, use of hands, ADLs or IADLs (all p>0.05).

**Change in use of healthcare services by clients over the duration of the study**

Between baseline and the end of the study, statistically significant increases were observed in utilisation of GP services (p<0.01) and statistically significant decreases were observed in utilisation of medical specialists (p=0.03). No other statistically significant differences were observed (Figure 3.2). This may be accounted for by the lower number of participants accessing other specialists. However, a trend was observed in increasing utilisation of geriatricians and oncologists and decreasing utilisation of surgeons.

Utilisation of healthcare services between the beginning and end of the study did not vary according to the primary diagnosis affecting the client (all p>0.05).

Change in use of healthcare services was not influenced by whether the client received a shorter or longer duration of Telehealth / Telecare (all p>0.05).
Figure 3.2: Use of healthcare services by participants receiving Telehealth / Telecare, baseline to endpoint of study

Hospital admissions and Emergency Department attendances did not change significantly between baseline and study endpoint.

**Change in use of community health personal support services by clients over the duration of the study**

Between baseline and the end of the study, there were no statistically significant changes in utilisation of community health services (Figure 3.3). However, a trend towards increased utilisation of physiotherapists, and occupational therapists was observed.
Change in use of community health services was not influenced by whether the client received a shorter or longer duration of Telehealth / Telecare (all p>0.05).

**Change in use of personal assistance services by clients over the duration of the study**

Between baseline and the end of the study, a statistically significant reduction was observed among patients receiving Telehealth / Telecare in assistance with housework (p=0.02) and gardening (p<0.01) (Figure 3.4). Differences in the level of statistical significance are accounted for by the variation in numbers of participants accessing each of these personal assistance services and by the degree of change in utilisation of each personal assistance service. There were no statistically significant changes in the use of personal assistance services by participants in the Control Group (all p>0.05).
Figure 3.4: Use of personal assistance services by participants receiving Telehealth / Telecare, baseline to study endpoint

Change in use of personal assistance services was not influenced by whether the client received a shorter or longer duration of Telehealth / Telecare (all p>0.05).

Change in attitude to use of technology by clients over the duration of the study

There was a statistically significant increase between baseline and study endpoint in clients level of agreement that the Telehealth Monitor was easy to learn to operate (p=0.02). The following trends were observed, but did not reach statistical significance: between baseline and the end of the study, clients agreed less strongly that the Telehealth Monitor would improve access to regular testing, make regular testing easier, save time or be useful. Clients agreed more strongly that interaction with the Telehealth Monitor was clear and understandable, that it was easy to become skilful at using the Telehealth Monitor, that the Telehealth Monitor was easy to use and that clients were comfortable with the use of the Telehealth Monitor in their own home (Figure 3.5). The impacts of the quality and nature of the instruction provided by the Telehealth provider were not appraised.
Figure 3.5: Beliefs regarding use of technology by participants receiving Telehealth / Telecare, baseline to endpoint

(5 = strongly agree; 1 = strongly disagree)

Change in Personal Wellbeing Index of clients over the duration of the study

Clients recorded the following values for PWI domains at the study midpoint (Table 3.11).

Table 3.11: Personal Wellbeing Index values, participants receiving Telehealth / Telecare, study midpoint

<table>
<thead>
<tr>
<th>Domain</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard of living</td>
<td>80.0</td>
<td>18.4</td>
</tr>
<tr>
<td>Health</td>
<td>58.5</td>
<td>22.3</td>
</tr>
<tr>
<td>Achieving in life</td>
<td>66.7</td>
<td>21.7</td>
</tr>
<tr>
<td>Relationships</td>
<td>81.7</td>
<td>20.0</td>
</tr>
<tr>
<td>Safety</td>
<td>79.8</td>
<td>17.9</td>
</tr>
<tr>
<td>Community connectedness</td>
<td>75.7</td>
<td>21.6</td>
</tr>
<tr>
<td>Future security</td>
<td>74.2</td>
<td>23.5</td>
</tr>
<tr>
<td>Spirituality / religion</td>
<td>80.0</td>
<td>20.3</td>
</tr>
<tr>
<td>Total</td>
<td>74.7</td>
<td>15.8</td>
</tr>
</tbody>
</table>
The client group scores for safety and the PWI as a whole moved from below to within the normative mean.

Clients recorded the following values for PWI domains at the study endpoint (Table 3.12).

**Table 3.12: Personal Wellbeing Index values, participants receiving Telehealth / Telecare, study endpoint**

<table>
<thead>
<tr>
<th>Domain</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard of living</td>
<td>81.0</td>
<td>17.9</td>
</tr>
<tr>
<td>Health</td>
<td>61.7</td>
<td>22.7</td>
</tr>
<tr>
<td>Achieving in life</td>
<td>70.0</td>
<td>21.4</td>
</tr>
<tr>
<td>Relationships</td>
<td>84.0</td>
<td>17.5</td>
</tr>
<tr>
<td>Safety</td>
<td>82.8</td>
<td>17.2</td>
</tr>
<tr>
<td>Community connectedness</td>
<td>74.2</td>
<td>24.9</td>
</tr>
<tr>
<td>Future security</td>
<td>82.8</td>
<td>19.1</td>
</tr>
<tr>
<td>Spirituality / religion</td>
<td>74.9</td>
<td>23.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>75.8</td>
<td>14.2</td>
</tr>
</tbody>
</table>

The client group scores for health, achieving in life, relationships, safety, future security and the PWI as a whole improved between midpoint and the endpoint of the study (Figure 3.6).
There was a statistically significant increase in the domains of health, safety and future security between baseline and the end of the study (p<0.05). There was no significant change in the PWI overall (p=0.64) (Table 3.13). Change in Personal Wellbeing Index scores between study commencement and the completion of the study was not influenced by whether the client received a shorter or longer duration of Telehealth / Telecare (all p>0.05).

Table 3.13: Statistical significance of change in PWI domains, baseline to endpoint

<table>
<thead>
<tr>
<th>Domain</th>
<th>Significance (2-tailed) baseline to endpoint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard of living</td>
<td>0.33</td>
</tr>
<tr>
<td>Health</td>
<td>0.03</td>
</tr>
<tr>
<td>Achieving in life</td>
<td>0.17</td>
</tr>
<tr>
<td>Relationships</td>
<td>0.31</td>
</tr>
<tr>
<td>Safety</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Community connectedness</td>
<td>0.75</td>
</tr>
<tr>
<td>Future security</td>
<td>&lt;0.00</td>
</tr>
<tr>
<td>Spirituality / religion</td>
<td>0.88</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>0.64</strong></td>
</tr>
</tbody>
</table>

*Paired samples t-test*
In comparison, clients in the Control Group experienced declines in PWI indices of standard of living, health, achieving in life, relationships, community connectedness, spirituality and religion and total personal wellbeing over the course of the study (Figure 3.7).

**Figure 3.7: Change in PWI domains between baseline and study endpoint, Controls**

Feelings and intentions after return of Telehealth / Telecare products

After returning the monitor, participants across groups did not report adverse feelings. The following were reported (Table 3.14):

**Table 3.14: Feelings after returning the monitor (number of participants compared with number in group)**

<table>
<thead>
<tr>
<th></th>
<th>Group 2</th>
<th>Group 3</th>
<th>Group 4</th>
<th>Group 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsafe</td>
<td>0 / 4</td>
<td>0 / 4</td>
<td>0 / 11</td>
<td>1 / 12</td>
</tr>
<tr>
<td>Nervous</td>
<td>0 / 4</td>
<td>0 / 4</td>
<td>0 / 11</td>
<td>1 / 12</td>
</tr>
<tr>
<td>Afraid</td>
<td>0 / 4</td>
<td>0 / 4</td>
<td>1 / 11</td>
<td>1 / 12</td>
</tr>
<tr>
<td>Stressed</td>
<td>0 / 4</td>
<td>0 / 4</td>
<td>1 / 11</td>
<td>1 / 12</td>
</tr>
<tr>
<td>Vulnerable</td>
<td>0 / 4</td>
<td>0 / 4</td>
<td>2 / 11</td>
<td>1 / 12</td>
</tr>
<tr>
<td>Relieved</td>
<td>0 / 4</td>
<td>1 / 4</td>
<td>2 / 11</td>
<td>2 / 12</td>
</tr>
</tbody>
</table>
Although almost all participants stated that they would recommend the use of the Telehealth and Telecare products to others, few organised products after they returned the study products or reported that they intended to organise products in the future (Table 3.15).

### Table 3.15: Intention to continue to use Telehealth and Telecare products

<table>
<thead>
<tr>
<th></th>
<th>Group 2</th>
<th>Group 3</th>
<th>Group 4</th>
<th>Group 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organised another monitor</td>
<td>0 / 4</td>
<td>0 / 4</td>
<td>0 / 11</td>
<td>0 / 12</td>
</tr>
<tr>
<td>Planned to organise another monitor</td>
<td>1 / 4</td>
<td>0 / 4</td>
<td>0 / 11</td>
<td>0 / 12</td>
</tr>
<tr>
<td>Would recommend the monitor to others</td>
<td>3 / 4</td>
<td>3 / 4</td>
<td>10 / 11</td>
<td>10 / 12</td>
</tr>
<tr>
<td>Organised another pendant</td>
<td>N / A</td>
<td>N / A</td>
<td>9 / 11</td>
<td>4 / 12</td>
</tr>
<tr>
<td>Planned to organise another pendant</td>
<td>N / A</td>
<td>N / A</td>
<td>1 / 11</td>
<td>3 / 12</td>
</tr>
<tr>
<td>Would recommend the pendant to others</td>
<td>N / A</td>
<td>N / A</td>
<td>11 / 11</td>
<td>12 / 12</td>
</tr>
</tbody>
</table>

### Carers of Clients

All carers who responded to questions regarding use of technology reported using the telephone for making their own telephone calls. Overall, 83 percent of carers reported owning and using a mobile telephone for making their own telephone calls.

Fifty percent of carers reported owning a personal computer and 57 percent used the internet.

The majority of carers reported a positive attitude to technology at baseline, with 85 percent or greater reporting that they were confident in their ability to use the Telehealth Monitor and for the equipment to be of benefit to the person they cared for.

Personal Wellbeing Index scores were collected for participating carers. As outlined above, the normative range for Western means is 70 to 80 points; the normative range for Australia is 73.4 to 76.4 points.

Carers recorded the following values for PWI domains at baseline (Table 3.16). Carers scored above the normative range for Australia overall and for all indices except health (below the normative range) and achieving in life (within the normative range).
Table 3.16: Personal Wellbeing Index Scores for Carers

<table>
<thead>
<tr>
<th>Domain</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard of living</td>
<td>83.9</td>
<td>16.8</td>
</tr>
<tr>
<td>Health</td>
<td>65.4</td>
<td>26.0</td>
</tr>
<tr>
<td>Achieving in life</td>
<td>74.2</td>
<td>21.6</td>
</tr>
<tr>
<td>Relationships</td>
<td>82.7</td>
<td>14.6</td>
</tr>
<tr>
<td>Safety</td>
<td>82.7</td>
<td>20.1</td>
</tr>
<tr>
<td>Community connectedness</td>
<td>81.2</td>
<td>15.1</td>
</tr>
<tr>
<td>Future security</td>
<td>80.0</td>
<td>17.2</td>
</tr>
<tr>
<td>Spirituality / religion</td>
<td>84.2</td>
<td>18.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>80.0</strong></td>
<td><strong>11.5</strong></td>
</tr>
</tbody>
</table>

Comments from carers regarding the use of Telehealth / Telecare were generally positive. Carers reported the following benefits:

- “I felt less stressed when he was discharged from hospital knowing that he was wearing the monitor whilst moving around in and outside the house;
- “More security;
- “We did not use the alarm in an emergency situation but it is a wonderful help just knowing it is here if needed. Thank you for your service;
- “Peace of mind when I had the occasion to be absent;
- “Useful tool, should be permanent.

Similar comments were provided by carers of clients who received Telehealth monitoring without Telecare.

The following drawbacks were reported by carers of participants receiving Telehealth / Telecare:

- “Sometimes it didn't work properly (in reference to Telehealth monitoring);
- “I don't feel its really necessary;
- “It will depend on his state of health, if it continues to improve it may not be necessary;
- “Added security in the beginning but realised it was not necessary as time went on;
• “I think this system is very good but the criteria for the inclusion has to be very clearly defined and accurate to make sure that errors do not occur (in reference to Telehealth monitoring);
• “Needs close supervision and is very limited in the type of clients/carers it could be used on (in reference to Telehealth monitoring);
• “Accuracy is an issue (in reference to Telehealth monitoring);
• “The equipment needs to be reviewed as far as accuracy (in reference to Telehealth monitoring).

Feedback from General Practitioners

A survey of general practitioners whose patients participated in the study was conducted. Responses were received from 25 of the 38 GPs (response rate 66%).

A total of 15 (61%) GPs were aged between 41 and 50 years and 10 (40%) were aged between 51 and 60 years. There were 19 male (76%) and 6 (24%) female respondents. GPs who responded worked between 6 and 11 sessions per week in practice.

GPs indicated that, while consulting, they mainly received urgent patient information via fixed telephone or fax machine. After-hours they mainly received urgent information via mobile telephone (Table 3.17).

Table 3.17: Communication methods with GPs while consulting and after-hours

<table>
<thead>
<tr>
<th>Communication method</th>
<th>*N (%) of respondents while consulting</th>
<th>* N (%) of respondents after-hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Email</td>
<td>11 (44)</td>
<td>4 (16)</td>
</tr>
<tr>
<td>Mobile telephone</td>
<td>10 (40)</td>
<td>21 (84)</td>
</tr>
<tr>
<td>Fixed telephone</td>
<td>23 (92)</td>
<td>2 (8)</td>
</tr>
<tr>
<td>Fax machine</td>
<td>23 (92)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Internet-ready PDA device</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
</tbody>
</table>

*more than 1 response was possible.
GPs were asked about their preferred methods for receiving urgent patient information. The majority wanted access to information via fixed telephone while consulting and to information via mobile telephone after-hours (Table 3.18). However, at the commencement of the study most had requested receiving the results by facsimile.

Table 3.18: Preferred communication methods with GPs while consulting and after-hours

<table>
<thead>
<tr>
<th>Communication method</th>
<th>*Percentage of respondents while consulting</th>
<th>*Percentage of respondents after-hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Email</td>
<td>11 (44)</td>
<td>4 (16)</td>
</tr>
<tr>
<td>Mobile telephone</td>
<td>2 (8)</td>
<td>21 (84)</td>
</tr>
<tr>
<td>Fixed telephone</td>
<td>23 (92)</td>
<td>2 (8)</td>
</tr>
<tr>
<td>Fax machine</td>
<td>18 (72)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Internet-ready PDA device</td>
<td>0 (0)</td>
<td>2 (8)</td>
</tr>
</tbody>
</table>

*more than 1 response was possible

When asked which peripheral monitoring they had selected for their patients, 91 percent had selected blood pressure, 74 percent had selected heart rate, 9 percent had selected oxygen saturation levels and none had selected body weight.

When asked how useful these were, 79 percent had selected blood pressure was useful, 53 percent selected heart rate was useful and 18 percent selected oxygen saturations were useful.

GPs were asked to provide feedback regarding the alerts received for their patients. More GPs rated the alerts useful than not useful. More GPs did not rate the alerts as timely, relevant to the care of the patient, detailed enough for needs, succinct enough for needs or delivered using a modality that was appropriate (Table 3.19).
Table 3.19: Feedback regarding the alerts received regarding patients

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>Unsure</th>
<th>No</th>
<th>No response</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N (%)</td>
<td>N (%)</td>
<td>N (%)</td>
<td>N (%)</td>
</tr>
<tr>
<td>Useful</td>
<td>10 (40)</td>
<td>2 (8)</td>
<td>9 (36)</td>
<td>4 (16)</td>
</tr>
<tr>
<td>Timely</td>
<td>2 (8)</td>
<td>0 (0)</td>
<td>19 (76)</td>
<td>4 (16)</td>
</tr>
<tr>
<td>Relevant to the care of the patient</td>
<td>6 (24)</td>
<td>6 (24)</td>
<td>9 (36)</td>
<td>4 (16)</td>
</tr>
<tr>
<td>Detailed enough for needs</td>
<td>2 (8)</td>
<td>2 (8)</td>
<td>17 (68)</td>
<td>4 (16)</td>
</tr>
<tr>
<td>Succinct enough for needs</td>
<td>6 (24)</td>
<td>4 (16)</td>
<td>11 (44)</td>
<td>4 (16)</td>
</tr>
<tr>
<td>Delivered using a modality that was</td>
<td>6 (24)</td>
<td>2 (8)</td>
<td>11 (44)</td>
<td>6 (24)</td>
</tr>
<tr>
<td>appropriate to needs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

GPs were asked to provide qualitative feedback regarding Telehealth. Benefits that were reported included:

- Providing the patient with confidence;
- Making the GP aware of variation in BP; and
- Making the patient feel safe.

GPs reported that Telehealth detracted from the care of their patients in the following ways:

- It took too much time to read data that didn’t change management;
- Made patient and carer anxious;
- Parameters were monitored that weren’t useful or were measured too frequently.

GPs reported that Telehealth could have average BP over 24 hours as an alternative to periodic BP measurement.

Clinical conditions that GPs thought would be more appropriately managed using Telehealth included the following:

- Congestive cardiac failure;
- Cardiovascular disease;
- Diabetes;
- Emphysema; and
- Unstable blood pressure.
Ways that Telehealth could be improved include:

- Making reports more succinct;
- Only sending information when relevant;
- Providing reports via the internet;
- Better patient selection; and
- Appraisal of information by a nurse prior to forwarding to the medical practitioner.
CHAPTER 4 – DISCUSSION

The impact of Telehealth and Telecare on clients receiving community-based post-acute care is substantial. Results of this study demonstrate numerous benefits to clients, particularly relating to their personal wellbeing, with improvements in health, safety and future security observed in participants. This is consistent with findings from smaller, non-randomised studies that suggest Telehealth and Telecare are associated with quality of life benefits for recipients (Barlow et al., 2007).

Participants in this study demonstrated a positive attitude towards the use of technology for health monitoring. This did not decrease as participants’ experience of the technology increased. Further, participants did not experience difficulties in learning to reliably use the equipment provided in this study. This is at odds with the premise of the Soprano study, which assumed that the complexity in design of many devices that have been developed for older people actually excludes them from their use (Muller et al, 2008). Few randomised controlled trials of Telecare and Telehealth programs involving older participants have been performed (Glueckauf, 2007). This study therefore makes a valuable contribution to the literature through demonstrating that age per se is not a barrier to the reliable use of technology for home monitoring of vital signs.

Our findings did not show greater quality of life and clinical benefits for certain conditions compared with other conditions. This is at odds with previous research, where quality of life and clinical improvements have been greater in patients with heart failure, diabetes and hypertension compared with other conditions (Barlow et al. 2007). This may be explained by insufficient numbers of patients with these diagnoses in this study to enable valid comparisons. Alternatively, as the presence of comorbid medical conditions among participants was high, with the majority having established cardiovascular disease, including hypertension, in addition to their primary diagnosis, these comorbid conditions may have been benefited by the use of Telehealth and Telecare.

Although results of this study did not demonstrate greater clinical benefits for certain conditions, GPs whose patients participated in the study indicated that the diagnoses where Telehealth was most likely to be of benefit included congestive cardiac failure,
cardiovascular disease, diabetes, emphysema and unstable blood pressure. This reflects the need to tailor the monitoring that is performed to the clinical circumstances of the patients, in order to ensure monitoring is appropriate.

The majority of participants in this study entered post-acute care due to the presence of orthopaedic, mobility and falls-related issues. It is not immediately apparent why Telehealth and Telecare would benefit these patients to the same degree. However, even in these patients, improvements in personal well-being were observed and there were no differences identified in the use of health and community services compared with clients with other diagnoses.

A review of published studies by Meystre (2005) found that benefits of telemonitoring include a reduction of chronic disease complications due to better follow-up. In our study, an increase in GP consultations between study baseline and the end of the study was observed. This may indicate better follow-up of patients by their GPs. Further research involving larger numbers of patients is required to verify this finding.

A significant reduction in the use of personal assistance services between study commencement and completion was observed in study participants. Reductions in assistance received for shopping, housework, gardening, going out socially and going to the doctor were observed. These improvements may reflect improvements in health, through increased GP utilisation, and reflected by improvements in the PWI ‘health’ domain. However, use of other health and community services as a whole did not change substantially between study commencement and completion. Therefore, an alternative explanation may be the improvements in client perception of safety and future security leading to greater levels of functional independence.

Researchers have previously identified that errors can occur in the use of Telehealth (Barnes et al., 2006). Carers reported that sometimes equipment did not work and that accuracy of readings was an issue. Improvements in technology over time may assist this issue to be resolved. Further research and development are required to continue to refine available technologies to ensure they are reliable and accurate.
Service user’s attitudes towards technology have previously been identified as significant factors that influence the provider’s willingness to use Telehealth (Magnusson et al. 2004; Selwyn et al. 2003). A range of factors were identified that GPs in this study reported should be addressed in order to improve the acceptability of Telehealth solutions to their uptake of the technology. These include the provision of information that is timely and relevant to the patient’s care. Although GPs only received readings that went outside the monitoring parameters they had personally set for their patients, it appears that participating GPs did not view this information as always relevant to the care of their patient. Further exploration of GP’s views regarding what information is relevant and how timely this information should be is therefore required.

The format by which this information is received is likely to also influence GP engagement with the use of Telehealth. GPs prefer to receive urgent patient information by telephone. In this study the information was received by facsimile. Changing to telephone (or internet-based) formats may improve the acceptability of Telehealth to GPs. Similarly, GPs expressed a preference for information to first be reviewed by trained nursing personnel to ensure patients are appropriately triaged and only receive GP intervention if clinically indicated.

The majority of clients who received a pendant alarm in this study obtained another pendant alarm on study conclusion. In contrast, clients who received Telehealth monitoring did not obtain further monitors. The reasons for this are unknown. Ease of access, client familiarity with pendant alarms, ease of use of pendant alarms and the presence of multiple commercial providers able to supply pendant alarms at an affordable cost may each contribute to high ongoing use of these devices by clients who participated in this study. In contrast, Telehealth monitors may be less well established within the marketplace, require more intensive interaction between the client and the technology than pendant alarms and are more expensive. These factors may have limited the ongoing use of the monitors by participants.

Although clients did not intend to obtain a Telehealth monitor after the study concluded, the majority indicated that they would recommend the monitor to others. Clients valued the Telehealth monitor and felt that it was useful. However, they did not think that they personally needed the monitor by the end of the study. In fact, this client group has significant, multiple chronic illnesses and a past history of frequent recent hospitalisations.
They are therefore vulnerable to acute exacerbations of their illnesses and to deterioration in their function. It may be that clients in post-acute care do not have insight into their vulnerable state of health and their high risk of deterioration in the near future. This may be a barrier to compliance with Telehealth monitoring and should be the subject of further research.

**This study had several strengths.** The study design was a randomised controlled trial, which enables valid comparison of patients receiving Telehealth and Telecare interventions with appropriate controls. The majority of clients and carers who were enrolled in the study were accounted for at study completion. The setting for the study was an existing post-acute care program, which improves the validity of the findings.

**Study limitations.** The equipment used by clients in the study was limited in the parameters that were monitored. This influenced the applicability of the findings to patients in whom other forms of Telehealth monitoring may have been more appropriate. Further, given that the equipment was not capable of detecting, among other things, a pulse rate below 40 beats per minute, the suitability of the equipment for monitoring frail older adults who are at increased risk of bradyarrhythmias is questionable.

An additional limitation of the study was the lack of tailoring of Telehealth monitoring to the specific clinical condition affecting the patient. This was intentional, in order to reduce bias in the study design, but had the unintended consequence of performing monitoring of vital signs in patient groups in whom the monitored parameter was not clinically useful. In future, the model of care within which Telehealth monitoring is used should monitor only vital signs that are relevant to the patient’s needs.

The short timeframe over which participants receiving Telehealth / Telecare were followed is another limitation of this study. Ideally, hospital re-admission rates over at least the next 12 month period should be recorded in order to appraise the impacts of Telehealth / Telecare on this outcome.
Conclusions

In summary, this study provides much needed empirical data demonstrating the strengths and limitations of Telehealth and Telecare in post-acute care. Results show clear improvements in client perceptions of safety and security, and greater utilisation of general practice personnel in post-hospital management. The study did not have sufficient recruitment of participants to enable the impacts of Telehealth and Telecare on service utilisation to be definitively established. However, results did show a significant decrease in the use of personal support services, including assistance with shopping, housework and gardening. A number of areas of further research enquiry were identified, including establishing the differential effects of Telehealth and Telecare in improving outcomes for patients with different clinical conditions, particularly for patients with diabetes and cardiovascular disease who are receiving post-acute care. Further, the insight into their vulnerability of frail older people who are receiving post-acute care and the impact this has on compliance with ongoing monitoring of their clinical condition needs to be investigated.
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## ATTACHMENT 1

### TABLE OF RESPONSIBILITIES OF PARTNER ORGANISATIONS

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Responsibilities</th>
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| BCS          | - Responsible for the legal relationship with DoHA;  
              - Establish the aims and outcomes, deliverables, project schedule and resourcing arrangements with the partners;  
              - Provide access to clients;  
              - Conduct or arrange for installation and de-installation of products;  
              - Provide client data to SCU  
              - Provide direct care and management staff hours to support the ongoing research;  
              - Maintain responsibility for project governance through coordinating the Research Project Steering Committee and the other members of the consortium;  
              - Ensure the research is completed on time and on budget to the satisfaction of DoHA.  
              - Obtain approval by an Ethics Committee constituted in accordance with the *National Statement on Ethical Conduct Involving Humans (2007)* published by the National Health and Medical Research Council;  
              - Submit a final report and abstract to DoHA;  
              - Provide representation on the Research Project Steering Committee. |
| ASLaRC (SCU) | - Prepare a literature review;  
              - If necessary fine-tune the research methodology based on the literature review;  
              - Design the survey;  
              - Collect data from clients/carers;  
              - Analyse the data from BCS and above;  
              - Provide a draft/preliminary report to the Research Project Steering Committee;  
              - Complete up to two revisions for a final report as required by the Research Project Steering Committee;  
              - Provide representation on the Research Project Steering Committee. |
| Tunstall     | - Supply the relevant equipment;  
              - Provide technology support for the equipment provided;  
              - Ensure compliance with regulatory requirements;  
              - Train BCS staff in the installation, removal, storage and infection control of the Telehealth equipment services;  
              - Provide representation on the Research Project Steering Committee. |
| Research Committee Steering Committee | - Provide oversight for the research and any fine tuning of the methodology;  
                                         - Assume responsibility for the finalisation of the report for submission to DoHA |