# DEPARTMENT OF COMMUNITIES, CHILD SAFETY AND DISABILITY SERVICES

RESEARCH TO INFORM SERVICE DELIVERY MODELS THAT INCLUDE THE APPLICATION OF SMART ASSISTIVE TECHNOLOGY

## FINAL REPORT

14 NOVEMBER 2012

# C

# CONTENTS

# FIGURES

## TABLES

**Department of Communities, Child Safety and Disability Services**
**Research to inform Smart Assistive Technology service delivery models**

hoi

G

## GLOSSARY OF TERMS

| | |
|---|---|
| AAL | Ambient Assisted Living |
| AAQ | Alzheimer's Association Queensland |
| ADHC | Ageing, Disability and Home Care |
| ADOPT | Accelerating Diffusion of Proven Technologies |
| ANZTC | Australian and New Zealand Tele-health Committee |
| CAT | Comprehensive Assistive Technology Model |
| CCHT | Care Coordination Home Tele-health |
| COAG | Council of Australian Governments |
| COPD | Chronic Obstructive Pulmonary Disease |
| COPM | Canadian Occupational Performance Measure |
| DCCSDS | Department of Communities, Child Safety and Disability Services |
| DSCWA | Disability Services Commission, Western Australia |
| FHACSIA | Department of Families, Housing, Community Services and Indigenous Affairs |
| GPS | Global Positioning System |
| GYSC | Golden Years Senior Centre |
| HACC | Home and Community Care |
| HOI | Health Outcomes International |
| ICT | Information and Communication Technology |
| IPPA | Individually Prioritised Problem Assessment |
| MCN | Managed Clinical Networks |
| NBN | National Broadband Network |
| NDA | National Disability Agreement |

| NDS | National Disability Strategy |
| --- | --- |
| NGO | Non-Government Organisation |
| ONI | Ongoing Needs Identification Tool |
| OT | Occupational Therapist |
| QALY | Quality Adjusted Life Year |
| SAT | Smart Assistive Technology |

# E

# EXECUTIVE SUMMARY

In March 2012 the former Queensland Department of Communities (now the Department of Communities, Child Safety and Disability Services) engaged Health Outcomes International (HOI) to conduct research to provide evidence to inform models of disability and community care service delivery that integrate smart assistive technologies (smartAT) as an integrated component of service delivery for specialist disability and community care services for people with a disability.

## E.1  RESEARCH OBJECTIVES

The broad objective of this research project was to provide evidence that will inform decision making about the use of smartAT. In particular, the research considered the:

1.  Existing evidence base at a national and international level in relation to smartAT and how it is used at a service provider and client level;

2.  Extent to which smartAT is being considered and implemented across the disability and community care sector both within Queensland and across other Australian jurisdictions; and

3.  Experience of the five Home and Community Care (HACC))[1] funded organisations involved in the smartAT demonstration projects in terms of:

    –  The uptake and application of smartAT within their service delivery/operational environment;

    –  Policy and practice change that smartAT has required;

    –  Service provider views regarding the client experience of smartAT; and

    –  Service provider views regarding the staff experience of smartAT.

## E.2  PROJECT BACKGROUND

Nearly four million Australians experience long term impairment, and that number is growing. It is difficult for these people to fully participate in their communities because of barriers and discrimination. The barriers can be physical, such as access to buildings, transport and information, and also attitudinal, due to a lack of awareness of disability issues. The causes of this exclusion are varied,

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[1]  Prior to 1 July 2012 the Home and Community Care (HACC) Program provided basic maintenance and support services for frail aged people, younger people with a disability and their carers. The program was administered by the Queensland Government and jointly funded by both the Queensland and Commonwealth Governments. Following the signing in 2011 of the National Health Reform Agreement, from 1 July 2012 the HACC program has been fully funded and administered by the Commonwealth Government and provides services to eligible clients aged over 65 years (over 50 years for Aboriginal and Torres Strait Islander people) and their carers. From 1 July 2012 the Queensland Government has full funding and program responsibility for the new Community Care program, which provides basic maintenance and support services to younger people with a disability and their carers.

but the effects are disabling and the costs to individuals, families and the community is high (Commonwealth of Australia, 2008).

At both a federal and state levels, governments have articulated the need to improve access to mainstream and assistive technologies to support people with disabilities and have recognised the requirement for these technologies to be better integrated within the disability and home care service models. The Department implemented a process for exploring the opportunities which the application of smartAT might provide in terms of promoting independence, choice and capacity building in the service. In 2011 the Department funded five smartAT demonstration projects that involved developing and implementing service delivery models which meet this end. The principal objectives of the demonstration projects were as follows:

- Identify client cohorts likely to benefit from such technologies;

- Develop strategies to maintain the uptake of assistive technologies by clients, staff and organisations;

- Assess the impact of these technologies on clients and carers; and

- Determine how staff workload is affected by the implementation of assistive technologies.

The following organisations participated in the demonstration projects:

1. Blue Care;

2. Jymbilung House;

3. Centacare (Bundaberg);

4. Alzheimer's Association Queensland; and

5. Golden Years Seniors' Centre.

## E.3   SUMMARY OF RESEARCH FINDINGS

As discussed above, HOI conducted the research that focused on the three research objectives through the completion of three research components, incorporating a literature review, a jurisdictional review and the conduct of site visits at the five HACC demonstration sites.  It is of significance that despite the three-tiered approach, there was considerable consistency and alignment in the key findings and conclusions that were derived from the research.

The principle findings of the research are presented below.  These ten findings represent the key conclusions across the identified research domains contained in the research framework and were in turn mapped to the project objectives (refer E.1 above).  These conclusions provide a basis for considering future smartAT policy direction and service integration. There are lessons within for government, funding bodies, device suppliers and service providers.

To illustrate the extent to which the results of the research were supported across each research component, an assessment of the extent to which the research finding is supported, as indicated by a rating of High (highly correlated and supported by the findings within this component), Moderate (moderate level of correlation and support) and Low (lower level of correlation and support).

### E.3.1    PRINCIPAL FINDINGS

| Principal finding | HOI's assessment of level of support | | |
|---|---|---|---|
| | Evidence-base | Jurisdictions | Demo projects |
| 1.  The introduction of smart assistive technology is often carried out in a context of uncertainty in which several alternatives are possible, because reasonable evidence on the effectiveness, efficiency and costs of the technology is not available.  To truly facilitate the adoption of smartATs as an integrated component of service delivery in the disability sector, service providers identified greater support is needed in terms of:  ▪ Policy and legislation;  ▪ The identification of and management of risk; and  ▪ Certainty and flexible funding models to accommodate clients' needs. | High | Low | High |
| 2.  Ethical considerations are perhaps the most frequently mentioned concerns when discussing smart assistive technology.  The two dimensions most highlighted are privacy and trust.  However, the experience in Australia (and in the pilot sites) demonstrated that if these issues are dealt with in a transparent manner then ethical concerns and risks can be managed and mitigated. | Moderate | Moderate | High |
| 3.  It is clear from this review that technological advances are occurring very quickly, so that funders and service providers have to be adaptable to capture the benefits of the new, although not so fast to engage with the new that they embed systems that may become redundant soon after, and not so slow that they miss out on the advantages that the new technology brings.  These challenges were experienced at a number of sites, where a different approach may have been adopted had existing products been available at commencement of the pilot. | High | Moderate | High |
| 4.  To some extent, the role of government in respect of facilitating increased adoption of smartATs is still evolving. Existing government policies in Australia provide general direction towards including assistive technologies in disability services, but the policies currently lack the systematic planning which is necessary to integrate this service into the current service delivery model. The challenge here will be transforming these general statements into a policy which specifies a detailed and well structured plan to roll out a well-integrated assistive technology services which will meet the needs of the relevant cohorts. | High | High | High |

| Principal finding | HOI's assessment of level of support | | |
|---|---|---|---|
| | Evidence-base | Jurisdictions | Demo projects |
| 5. As assessment of the cost-effectiveness of smartAT is hampered by a lack of available data regarding clinical effectiveness, efficacy, and costs, which requires the adoption of assumptions that decrease robustness of the analyses. Although the pilot sites and other projects identified in the literature review have identified the capacity of smartAT interventions to be cost-effective, delivery of these sorts of results in the real world still needs to be tested. | High | Low | High |
| 6. There are no standardised change strategies for implementation, except that engagement with all stakeholders particularly at a local level is essential. Initial enthusiasm is important to create impetus to support the introduction of the intervention, but after implementation has taken place, there will be rejection and a diminishing of support if some stakeholders consider the impact of the interventions to be negative or disappointing. A high quality central management system will be required in order to establish large scale smartAT services. This in turn requires sound planning and organisational systems to ensure services are integrated and delivered seamlessly and deliver positive outcomes to clients. | High | Moderate | High |
| 7. There is a need for smartAT suppliers to consider a revised contracting model that better facilitates the adoption of smartAT and provides for a more appropriate model for sharing risk, cost and responsibility. Perhaps more broadly, in the context of device accessibility and service funding, the question of whether community service organisations should be device owners and suppliers in their own right, is one that should be debated at not only an organisational level, but should be also be considered by policy makers and funders. | High | Moderate | High |
| 8. The main benefits for rural and remote clients and their families have been reported as focused upon three key themes: lessening the burden (costs of travel, accommodation issues, lost wages, lost time), maximising supports (access to family, friends, familiar home environment, and care providers) and the need for smart assistive technology systems to be tailored to enhance client and family needs. However, in order to ensure service sustainability, all service provider staff need to be trained and capable of supporting the SAT devices, so that support can provided by local staff and in incorporated into other client visits (i.e. special device visits would no longer be required). Further, smartAT approaches in this setting are limited by the capabilities and reliability of communications infrastructure (internet, mobile phone) and service provider planning needs to appropriately consider this potential barrier. | Moderate | Low | High |

| Principal finding | HOI's assessment of level of support | | |
| --- | --- | --- | --- |
| | Evidence-base | Jurisdictions | Demo projects |
| 9. This review has revealed that identification of key criteria for evaluating success is required, but producing the correct technological responses for a person's needs, experiences and wishes is what is critical. | High | High | High |
| 10. In terms of the effectiveness of smart assistive technologies, it has been evidenced that their use can result in positive client outcomes for the elderly and for people with disabilities (outcomes include increased independence, confidence to live at home, delay of entry into residential facilities, less anxiety about one's safety and general improvement in quality of life). Overall, whilst at times technological malfunctions may occur, the benefits of the technologies or devices have been shown to far outweigh the negatives. | High | High | High |

### E.3.2   IMPLICATIONS FOR THE FUTURE

It is evident that each of these principal findings has implications for government, funding bodies, device suppliers and service providers alike. Key development actions as a consequence of these findings can be summarised as:

| Stakeholder | Action required |
| --- | --- |
| Government/funding bodies | Given that the evidence has determined that smartAT is in producing positive client outcomes for people with disabilities (and the elderly), Government can play an increased leadership and facilitating role in the integration of smartAT into service delivery models. The recommendations for action are: |
| | 1. *Queensland government*: Develop and introduce clear and specific policy intentions with respect to smartAT, supported by funding certainty and flexible funding models to accommodate clients' needs. |
| | 2. *Commonwealth government*: Develop and introduce clear and specific policy intentions with respect to smartAT supported through the introduction of Medicare items in relation to assessment and support of smartAT. |
| | 3. *Queensland government*: Develop funding approaches that recognise that technology advances are occurring very quickly and as such need to be adaptable to capture the benefits of the new.  Funding should not be device or technology specific, but rather needs-specific thereby allowing for the assessment process (see below) to identify the particular smartAT (if any) that is appropriate to meet the individual client needs. This model could incorporate self-directed approaches. |
| | 4. *Commonwealth & Queensland governments*: Support the development of appropriate and effective assessment tool that extend the functionality of the currently prescribed tool (ONI) to better accommodate smartAT responses. Matching of client needs is critical, and the demonstration projects piloted varied assessment tools varying degrees of success. |
| | 5. *Queensland & Commonwealth governments*: Develop an innovative, interactive and sustained health promotion campaign directed towards the |

| Stakeholder | Action required |
|---|---|
| | public and health professionals to improve knowledge of smartAT applications and benefits. Consumer and clinician awareness of smartAT applications and benefits is still very low. The capacity of Occupational Therapists, GPs and clinicians to recommend smartAT (following assessment) is limited by their knowledge of products availability and benefits. Similarly, increase consumer knowledge would improve smartAT acceptance rates. There is a broader public education message that could be effectively delivered by government to ensure that smartAT have broader acceptance. <br><br>6. *Queensland government:* Identify smartAT products that have broad application and benefit to a wide range of disabled people (e.g. sensor lights) and support a system-wide introduction of smartATs of this nature through appropriate funding to people with a disability. <br><br>7. *Commonwealth government*: Communications infrastructure (through the NBN) requires significant development in many locations to facilitate the introduction of smartAT. This requires significant investment and, though challenging, still presents a significant barrier to providing services in regional and remote locations. Equity of services will continue to be an issue whilst these barriers exist. |
| Device suppliers | Device suppliers can continue to assist in the integration of smartAT. The recommendations for action are: <br><br>1. Increased co-development (with service providers) of smartAT products. <br><br>2. Review existing contract model and develop more innovative contracting approaches that better facilitate the adoption of smartAT and provide for a more appropriate model for sharing risk (i.e. support, maintenance), cost and responsibility between client, service provider and supplier. A three-party relationship, with appropriate sharing of risk, may best facilitate increased acceptance and adoption of smartAT. |
| Service providers | The recommendations for action for service providers are: <br><br>1. Ethical considerations and concerns be addressed in a transparent way with families and carers earlier in the smartAT adoption cycle. <br><br>2. Recognising that there are no standardised change strategies for implementation and smartAT, this research report does provide some important insights. At the highest level, service providers must develop a high quality central management system in order to establish large scale smartAT services. This requires the support of management and the development of appropriate policies and procedures and a precursor to the integration of smartAT. <br><br>3. Given the importance of appropriate and effective assessment and matching of client needs, and continuing review of smartAT effectiveness, service provider process must establish a robust smartAT screening and assessment framework (that is integrated with the prescribed ONI tool), as well as providing for review and evaluation at a client level. |

# 1

# INTRODUCTION

In March 2012 the former Queensland Department of Communities (now the Department of Communities, Child Safety and Disability Services) engaged Health Outcomes International (HOI) to conduct research to provide evidence to inform models of disability and community care service delivery that integrate smart assistive technologies (smartAT) as an integrated component of service delivery for specialist disability and community care services for people with a disability.

## 1.1 THE CONTEXT

The specialist disability and community care sector is facing a number of key issues including an increase in the number of people who require specialist disability support services; significant future workforce shortages; maintaining quality service delivery in rural and remote communities; and ensuring access to services for Aboriginal and Torres Strait Islander people and other clients with specific cultural or special needs.

### PREVALENCE OF DISABILITY IN AUSTRALIA

Nearly four million Australians and 782,000 Queenslanders experience long term impairment, and that number is growing. It is difficult for these people to fully participate in their communities because of barriers and discrimination. The barriers can be physical, such as access to buildings, transport and information but also attitudinal due to a lack of awareness of disability issues. The causes of this exclusion are varied but the effects are disabling and the costs to individuals, families and the community is high (Commonwealth of Australia, 2008).

Australians with disability are a diverse group of people. They include people who were born with disability and those who acquire disability during their life through accident, ageing or illness. The ageing of the Australian population and its increased longevity are leading to increasing numbers of people with disability.  The National Disability Strategy discussion paper identified that:

- In 2003 there were an estimated 3.9 million people with disability in Australia. Of these, 2.6 million were under 65 years of age (15 per cent of that population). Among the 3.9 million people with disability, 1.2 million people sometimes or always needed help or supervision with self-care, mobility or communication. Of these, nearly 700,000 were aged less than 65 years (Commonwealth of Australia. 2008).

- The prevalence of disability among Indigenous Australians is higher than for other Australians at all ages, and rates of severe disability are at least twice as high. In 2002, 102,900 (37 per cent) of Indigenous Australians aged 15 years or older had disability or a long-term health condition. Of these, 21,800 or 8 per cent of the Indigenous population aged 15 years or older, had a severe or profound limitation (Commonwealth of Australia, 2008).

More recently, the tenth biennial welfare report of the Australian Institute of Health and Welfare (AIHW) (Australian Institute of Health and Welfare, 2011) identified the following key statistics:

- In 2009, 4 million Australians (18.5% of the population) had a disability, of whom 1.3 million (5.8% of the population) had severe or profound core activity limitation. For Queensland, 782,000 people (17.9% of the population had a disability, of whom 243,000 (5.6% of the population) had a severe or profound limitation;

- Almost half a million (492,500) were aged less than 25 years—a prevalence rate of 6.8%. There were more males with disability than females in this age group;

- Almost 2 million adults aged 25–64 years had disability—17% of the population in this age group - comprising roughly equal numbers of males and females;

- Just over 1.5 million were aged 65 years or over, equal to 53% of the older population; and

- Most people aged less than 65 years who needed help with core activities (mobility, self-care or communication) relied solely on informal sources of assistance, and around one in 10 received no assistance at all.

### Needs of People with a Disability

Of the core activities of daily living, people with severe or profound core activity limitations living in households were most likely to need assistance with mobility and self-care. In addition to this AIHW 2011 identified that one in five needed help with communication. Need for assistance with activities related to mobility generally increased with age, while children and young adults were more likely than older people to need help with communication. Need for assistance with self-care did not vary considerably with age (Table 1):

**Table 1.1: People with severe or profound core activity limitation living in households needing assistance with selected activities, by age group, 2009 (per cent)**

|  | 0–24 years | 25–44 years | 45–64 years | 65–84 years | 85 years and over | Total |
|---|---|---|---|---|---|---|
| **Core activities** | | | | | | |
| Self-care | 49.7 | 49.3 | 50.5 | 52.8 | 48.8 | **50.7** |
| Mobility | 62.8 | 82.9 | 79.6 | 83.2 | 90.8 | **79.0** |
| Communication | 63.6 | 16.0 | 6.4 | 8.8 | 12.2 | **20.1** |
| **Non-core activities** | | | | | | |
| Cognitive or emotional tasks | 68.7 | 53.6 | 37.8 | 22.7 | 21.2 | **39.6** |
| Health care[a] | 51.2 | 46.6 | 55.1 | 71.4 | 82.0 | **59.5** |
| Reading or writing tasks[b] | 52.2 | 33.4 | 17.1 | 22.2 | 37.1 | **22.1** |
| Transport[b] | 49.3 | 60.8 | 51.7 | 63.2 | 79.7 | **51.6** |
| Household chores[b] | 39.6 | 52.2 | 57.1 | 63.8 | 72.6 | **50.9** |
| Property maintenance[b] | 31.7 | 47.2 | 59.8 | 65.5 | 64.7 | **50.2** |
| Meal preparation[b] | 37.3 | 29.1 | 22.1 | 27.4 | 43.5 | **24.4** |

(a) Excludes children aged 0–4 years.
(b) Excludes children aged 0–14 years.
Source: AIHW analysis of ABS 2011 datacubes.

The support and care for people with a disability can be provided across a continuum of care that ranges from independent living at home, through to 24-hour care in a nursing facility. Between these two ends of the continuum a range of care and support levels are available:

**Figure 1.1: Care continuum: people with disability**
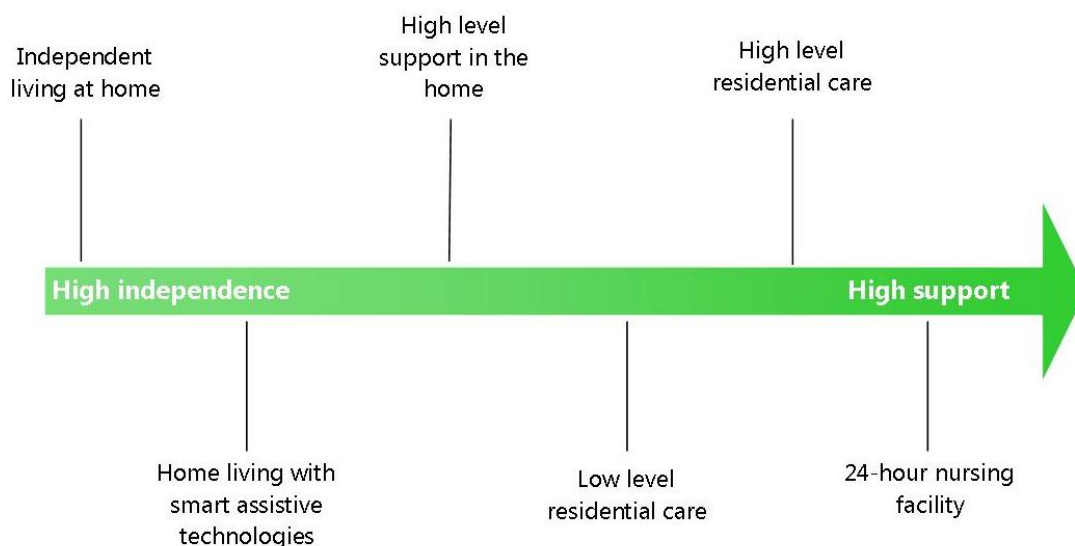


There are increasing opportunities to respond to these challenges through the use of technology, both mainstream technology and specialist technology developed specifically for the disability, community care or aged care market.

## 1.2 RESEARCH OBJECTIVES

The research was commissioned to provide an evidence base to inform models of disability and community care service delivery that integrate smartATs and considered the:

1. Existing evidence base at a national and international level in relation to smartAT and how it is used at a service provider and client level.

2. Extent to which smartAT is being considered and implemented across the disability and community care sector both within Queensland and across other Australian jurisdictions; and

3. Experience of the five Home and Community Care (HACC) organisations involved in the smartAT demonstration projects in terms of:

   - The uptake and application of smartAT within their service delivery/operational environment;

   - Policy and practice change that smartAT has required;

   - Service provider views regarding the client experience of smartAT; and

   - Service provider views regarding the staff experience of smartAT.

## 1.3  DEFINING SMARTAT

Assistive technologies form an important component of recent strategic and policy development in Australia, principally resulting from the available evidence indicating that access to assistive and mainstream technologies and universally designed technologies leads to greater levels of engagement between people with diverse abilities (Filed & Jette, 2007).

In a broad sense, assistive technology refers to any device designed, made or adapted to help a person perform a particular task. Products may be specifically produced or generally available for people with a disability (World Health Organisation, 2011). The intersection between technology and disability is a complex issue for a number of reasons; as technology can be a barrier or a means to independence and participation in the community.

### PROJECT DEFINITION OF SMARTAT

For the purposes of this research, SmartAT was defined as including the following technology applications to:

- Enhance safety, independence and quality of life for people with a disability;

- Increase efficiencies in direct client service delivery; and

- Achieve greater integration across service providers.

## 1.4  OVERVIEW OF RESEARCH METHODOLOGY

Table 1.1 below provides an overview of the research methodology that was designed to for the purposes of this project.

**Table 1.2: Overview of Research Methodology**

| Stage | Objectives |
|---|---|
| Stage 1 – Project Planning | The objective of this stage was to receive an initial briefing from the Department and to finalise the parameters for the project.  The discussion established the project management and communication processes with demonstration projects and other stakeholders and to arrange the transfer of relevant documentation to HOI.  This culminated in the development of a detailed project plan. |
| Stage 2 – Situation Analysis and Research Framework | The objectives of this stage were to undertake a situation analysis in respect of the demonstration projects and the development of a detailed research framework. The situation analysis also influenced the ultimate selection of data collection tools that were used to support the conduct of case studies. |
| Stage 3 – Literature and Jurisdictional Review | The objective of this stage was to conduct a literature review and investigate and provide a summary on approaches undertaken in other Australian jurisdictions in relation to the integration of smartAT in service delivery in the disability and community care sectors. |
| Stage 4 – Case Studies of Demonstration Projects | The objective of this phase was to collect the data required to address the research objectives, by conducting five case studies focusing the demonstration projects.  The case studies involved consultations with a range of stakeholders, to obtain feedback on the questions that are directly aligned to the agreed research framework. |

| Stage | Objectives |
|-------|-----------|
| Stage 5 – Data Analysis | The objective of this stage was to analyse the qualitative and quantitative data collected to address the questions specified in the research framework and to prepare a draft final report. |
| Stage 6 – Final Report | The objective of this stage was to finalise the research including the preparation of a Final Report. |

### DEVELOPMENT OF A RESEARCH FRAMEWORK

This project was based on the development of an evidence based research framework that represented a blue print for systematically addressing the research objective, and as such it identified the:

- Key research areas to be identified;
- Search criteria for the literature review (as well as a proposed definition of smartAT);
- Data to be collected support the analysis; and
- Type of analysis to which the data should be subjected.

A copy of the research framework adopted for this project in included in Appendix A.

### RESEARCH COMPONENTS

The research methodology also incorporated three key research components:

- A literature review;
- A jurisdictional review; and
- Case studies of the five Home and Community Care organisations involved in the smartAT demonstration projects

### 1.4.1.1 LITERATURE REVIEW

The purpose of the literature review was to compile an evidence base of smartATs that have been implemented and evaluated globally; the strategic directions that were being pursued; and the ramifications of implementation of the technologies that are available.

### 1.4.1.2 JURISDICTIONAL REVIEW

The objective of the jurisdictional review was to investigate and provide an assessment of the smartAT initiatives that have been implemented in other Australian jurisdictions to build and expand service delivery in relation to the disability and community care sector. HOI conducted telephone interviews with policy makers and NGO service providers in various jurisdictions (excluding Queensland). All stakeholders were provided with a copy of the key research questions and project scope (based on this document) in advance of the consultation to ensure they could make an effective contribution to the research.

### 1.4.1.3 DEMONSTRATION SITE CASE STUDIES

The objective of the case studies was to assess the experiences of the five HACC organisations involved in the smartAT demonstration projects to inform the responses to the research questions. The demonstration projects were due for completion in June 2012. Each project is conducting its own

internal evaluation at project completion, and as such each project has developed its own data collection approach. The internal evaluation reports for the demonstration projects were not available at the time of completing this research. The five demonstration projects are identified as follows:

- Alzheimer's Association Queensland
- Blue Care
- Centacare Bundaberg
- Jymbilung House
- GYSC

## 1.5 STRUCTURE OF THE REPORT

This document is the Final Report that draws on the information gathered throughout the research process. Its purpose is to present the analysis of the research findings against the objectives for the project outlined in section 1.2 above.

The remainder of the report is structured as follows:

| | |
|---|---|
| Chapter 2: | This chapter presents a discussion of the environmental landscape for emerging technologies in from a policy and service delivery context. |
| Chapter 3: | This chapter presents the findings of the Literature Review that focused on identifying establishing an evidence base to inform models of disability and community care delivery that integrate smart assistive technologies. |
| Chapter 4: | This chapter presents a discussion of the relevant policies and programs implemented across Australia. |
| Chapter 5: | This chapter presents a discussion of the assessment of key research outcomes from the five Queensland smartAT demonstration projects that have been conducted by the following HACC funded organisations. |
| Chapter 6: | The chapter presents provides a summary of the key research findings research that outline the evidence base to support future decision making regarding smartAT policy development, service planning and implementation. |

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# ENVIRONMENTAL LANDSCAPE FOR EMERGING TECHNOLOGIES

This chapter presents a discussion of the environmental landscape for emerging technologies in from a policy and service delivery context.

## 2.1 POLICY RESPONSES IN AUSTRALIA AND QUEENSLAND

While many people with disability are able to live independently and participate in society without assistance, or with the help of informal carers, others require organised services and supports to study, work, interact with the community, or carry out everyday activities. Disability-related policies are concerned with the funding and provision of organised services, as well as more generally ensuring people with disability have the opportunity to participate in the community, whether they require specialised services or not.

### AUSTRALIAN POLICY CONTEXT

In Australia there are a number of key policy initiatives and reports that specifically identify the need to undertake evidence based research to inform future policy direction with respect to enabling assistive technologies to provide added support to people with disabilities:

- Productivity Commission Inquiry Report on Disability Care and Support
- National Disability Insurance Scheme
- National Disability Strategy
- National Health Reform Agreement

### PRODUCTIVITY COMMISSION INQUIRY REPORT ON DISABILITY CARE AND SUPPORT

On 10 August 2011 Prime Minister Gillard released the Productivity Commission's (PC) final report, "Disability Care and Support"[2] that outlined a vision for a new model for providing care and support for people with a disability in Australia. In summary the PC Report found that the current disability support system was underfunded, unfair, fragmented, and inefficient[3]. It was reported that the current system gives people with a disability little choice, no certainty of access to appropriate supports and little scope to participate in the community. People with disabilities, their carers, service providers, workers in the industry and governments all want change.

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[2]     Productivity Commission (2010) "Disability Care and Support Inquiry Report"
        http://www.pc.gov.au/projects/inquiry/disability-support/report  (Accessed 8 June 2012)

[3]     Ibid

**Department of Communities, Child Safety and Disability Services**
**Research to inform Smart Assistive Technology service delivery models**

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The report recommended a new national funding system and locally coordinated support system to provide people with a disability an opportunity to live fulfilling and active lives and advocated major reform to address four key challenges:

- The current focus on the maintenance of service delivery systems rather than the satisfaction of the individual needs of those living with a disability;

- Unsustainable demand pressures, particularly as the current generation of family carers age;

- Multiple and complex state/territory systems including multiple assessment and delivery systems and inconsistent criteria for receiving support;

- Vertical fiscal imbalance – with jurisdictions not able to meet the future funding levels required, either to generate reform or to meet current demand levels.

The challenges outlined above, serve as a barrier to entry into the everyday life of the community for many people living with a disability, and into specific areas of participation, such as the workforce market.

It has been widely acknowledged by national and jurisdictional governments that there are many challenges that need to be addressed to ensure that jurisdictional systems are to be replaced with a single integrated funding and governance mechanism that is flexible and appropriately funded to meet client needs and to ensure the sustainability of the disability services sector.

**In terms of assistive technologies, this Productivity Commission's report highlights the need for innovation in service delivery through the development of new technologies and approaches to service delivery and has been highlighted as a research priority.**

### NATIONAL DISABILITY INSURANCE SCHEME

One of the recommendations of the PC Report was the introduction of NDIS which was subsequently agreed by the Council of Australian Governments (COAG) on 19 August 2011. The NDIS seeks to provide funding for long-term high quality care and support (but not income replacement) for people with significant disabilities. In other words, the goal of the NDIS is to properly fund the reasonable assessed needs of people with a disability.

The NDIS will also seek to address a range of deficiencies in the current disability services system and to minimise the impacts of disability by:

- Promoting opportunities for people with a disability;

- Creating awareness by the general community of the issues that affect people with a disability, and the advantages of inclusion; and

- Drawing on its data and research capabilities to engage with other agencies to improve public health and safety.

In summary, the implementation of the NDIS is focused on ultimately providing:

- A better system for people with disabilities in their jurisdictions (many governments agreed their own arrangements were heavily rationed and not working well);

- Relief of growing budgetary pressures. It would not be fiscally feasible for jurisdictions to fund the NDIS alone (given the need for a 90 per cent funding increase);

- A different role for jurisdictions - a contribution to the governance arrangements of the NDIS and a role in forming the legislation – however they would have no ongoing role in managing the disability system in their states; and

- The potential to continue as service providers - but on a competitively neutral basis with other providers.

## NATIONAL DISABILITY STRATEGY

The National Disability Strategy (NDS) 2010–2020 recognises that collaboration and coordination among governments, business and the community is needed to improve the lives of people with disability. The underpinning philosophy of strategy was clearly articulated in the primary objective of the National Disability Agreement (NDA) that commenced 1 January 2009.

The Strategy works in conjunction with the NDA and other Commonwealth–State/Territory agreements and partnerships and sets out six priorities that over 10 years will improve access and participation by people with a disability in the social and economic life of the community. The key policy areas are:

- Inclusive and accessible communities - the physical environment including public transport; parks, buildings and housing; digital information and communications technologies; civic life including social, sporting, recreational and cultural life.

- Rights protection, justice and legislation - statutory protections such as anti-discrimination measures, complaints mechanisms, advocacy, the electoral and justice systems.

- Economic security - jobs, business opportunities, financial independence, adequate income support for those not able to work, and housing.

- Personal and community support - inclusion and participation in the community, person-centred care and support provided by specialist disability services and mainstream services; informal care and support.

- Learning and skills - early childhood education and care, schools, further education, vocational education; transitions from education to employment; lifelong learning.

- Health and wellbeing - supporting health and wellbeing through appropriate prevention, diagnosis, treatment and early intervention.

The strategy recognises that the National Broadband Network (NBN) will provide the enabling technology platform to underpin all of the outcome areas. It will facilitate innovation in government service delivery and provide people with disability, dramatically improved access to a wide range of life-enhancing opportunities. The NBN will provide Australians with disability and their carers access to a range of benefits including e-health services, remote monitoring for assisted living, interactive learning opportunities, employment opportunities, increased connectedness within the community, and improved access to communication services.

**Of specific relevance to this research is Area for Action 4.4 that identifies assistive technology to provide "Support the development of assistive technologies and more access to aids and equipment for people with disability".**

## NATIONAL HEALTH REFORM AGREEMENT

The National Health Reform Agreement was signed 2 August 2011 by all jurisdictional governments and addressed wide-ranging changes affecting the delivery of health and health-related services in Australia. Of particular note, following the signing of the Agreement, from 1 July 2012 the HACC program has been fully funded and administered by the Commonwealth Government and provides services to eligible clients aged over 65 years (over 50 years for Aboriginal and Torres Strait Islander people) and their carers. From 1 July 2012 the Queensland Government assumed full funding and program responsibility for the new Community Care program, which provides basic maintenance and support services to younger people with a disability and their carers.

## QUEENSLAND POLICY CONTEXT

DCCSDS is, amongst other things, responsible for providing leadership in policy, services and programs that support people with a disability and their families and carers. At the time of writing this report, because of Machinery of government change, all policies are being reviewed in line with changes to program responsibilities.

## 2.2 ASSISTIVE TECHNOLOGY DEMONSTRATION PROJECTS

Recognising the requirement for assistive technologies to be better integrated within the disability and home care service model, the former Department of Communities implemented a process for exploring the opportunities which the application of smartAT might provide, in terms of promoting independence, choice and capacity building in the service. Hence the five smartAT demonstration projects were funded to develop and implement service delivery models which meet this end.

The principal objectives of the demonstration projects were as follows:

- Identify client cohorts likely to benefit from such technologies;

- Develop strategies to maintain the uptake of assistive technologies by clients, staff and organisations;

- Assess the impact of these technologies on clients and carers; and

- Determine how staff workload is affected by the implementation of assistive technologies.

The following organisations participated in the demonstration projects and are soon to provide written reports on the outcomes of their particular project:

- Blue Care;

- Jymbilung House;

- Centacare (Bundaberg);

- Alzheimer's Association Queensland; and

- Golden Years Seniors' Centre.

## 2.3 USE OF AIDS AND TECHNOLOGIES

Based on the results of the Survey of Disability, Ageing and Carers (SDAC) (Australian Bureau of Statistics, 2009) conducted by the Australian Bureau of Statistics from April to December 2009, there is a range of aids and technologies that are used to assist and support people who wish to remain in their own homes. In 2009, a total of 2 million people used aids and equipment needed because of disabling conditions. Use of aids and equipment was most common among older people with disability: 69% of those aged 65 years or over used aids and equipment, compared to 37% of people aged less than 65 years.

Approximately 77,500 children under 15 years used aids and equipment. Among people who lived in a private dwelling, the use of aids and equipment was more common for people who lived alone (55%) than people who lived with others (45%). Further, approximately one in six (16%) people with disability living alone and one in nine (11%) living with others had made home modifications because of their health conditions—such as modifications to a toilet, bath or laundry, or the installation of handrails. Medical aids (including nebulisers, dialysis machines, feeding pumps and oxygen cylinders) and

communication aids were most commonly used by people with disability aged less than 65 years. Older people with disability were most likely to use aids for communication, hearing and mobility (refer Table 2.1).

**Table 2.1: People with disability who used aids and equipment: type of activity in which aids were used, by age group, 2009**

| | 0–14 | 15–29 | 30–44 | 45–64 | Total <65 | 65+ | Total |
|---|---|---|---|---|---|---|---|
| | Per cent of all people with disability | | | | | | |
| Self-care | 6.9 | 5.1 | 5.2 | 8.0 | 6.9 | 26.0 | 14.2 |
| Mobility | 5.0 | 4.9 | 5.7 | 8.8 | 7.2 | 27.5 | 15.0 |
| Communication | 11.8 | 15.3 | 13.6 | 18.7 | 16.3 | 37.6 | 24.5 |
| Hearing | *2.2 | 1.8 | 2.4 | 7.2 | 4.8 | 28.3 | 13.9 |
| Meal preparation | *1.5 | 2.0 | 1.1 | 1.8 | 1.6 | 2.4 | 1.9 |
| Medical | 14.2 | 20.7 | 24.2 | 24.4 | 22.6 | 26.2 | 24.0 |
| **Any aids or equipment**[b] | **26.9** | **33.1** | **36.2** | **41.3** | **37.4** | **68.6** | **49.4** |
| | Number of people using aids or equipment ('000s) | | | | | | |
| **Any aids or equipment**[b] | **77.5** | **110.1** | **194.1** | **544.0** | **925.7** | **1064.9** | **1990.6** |

\* Estimate has a relative standard error of 25% to 50% and should be used with caution.

(a) Aids or equipment used are those needed because of disabling conditions.

(b) Each person may use more than one type of aid or equipment.

*Source:* Unpublished data table of the ABS 2009 Survey of Disability, Ageing and Carers.

### USE OF TECHNOLOGY

The published literature relating to the National Disability Strategy 2010-2020 indentifies that technologies have created new ways to participate in community life, both in and outside the home. Home computers, email, chat sites and a range of other internet sites offer potential for fresh modes of social interaction. The use of the internet as a platform for communication has transformed the way of life for people with and without disability. Moreover, information and communication technologies are now an essential part of daily life, affecting everyday social interaction, education, employment, etc.

Computer use and internet access are also important as these technologies are being increasingly used by Australians to interact with government. More than half of all Australians now interact with government using a variety of information and communications technologies.

# 3

# LITERATURE REVIEW FINDINGS

This chapter presents the findings of the Literature Review that focused on establishing an evidence base to inform models of disability and community care delivery that integrate smart assistive technologies.

## 3.1 LITERATURE REVIEW METHODOLOGY

This section outlines the objectives and methodology adopted in conducting the literature review.

### OBJECTIVES OF THE LITERATURE REVIEW

Within the context of the broader research framework, the literature review was conducted to provide an evidence base for the implementation of assistive technologies. Specifically, an extensive review of national and international literature was conducted in order to:

1. Inform the decision on an appropriate definition of assistive technology in relation to the disability and community care sector;

2. Identify international and national trends in policy and program responses that support the integration of assistive technology in service delivery in the disability and community care sectors;

3. Identify best practice strategies and service models that support the ongoing use of assistive technology with clients and service providers when considering human resources, service delivery costs, and service delivery efficiency and effectiveness;

4. Identify ethical issues associated with the introduction of assistive technology, and the extent to which policy makers are addressing those risks;

5. Identify and analyse any samples that can be found of disability and community care funded service providers' current policies and practices about client and organisational use of assistive technology, including the range of assistive technology used, the types of clients who use assistive technology and any perceived improvement in life domains as a result of its use;

6. Identify change strategies that have been shown to support the integration of assistive technology into service delivery models;

7. Identify if and how smart assistive technologies have been tested and implemented in rural and remote settings;

8. Identify examples of the implementation of smart assistive technologies within Indigenous populations;

9. Search for evidence that disabled people have in fact benefitted from the application of smart assistive technologies;

10. Identify the extent to which innovative approaches been adopted;

11. Identify any unintended outcomes from the implementation of smart assistive technologies; and

12. Identify barriers and key success factors for the introduction of smart assistive technologies, and how those barriers are being addressed.

## SCOPE AND PROCESS

The literature review process developed by The University of Auckland has delivered a literature scan, as opposed to a formal systematic literature review. Articles were not formally assessed to determine the quality of any research method.  The search reviewed what has been published from 2007 to the current day.  Literature before 2007 was not considered unless a particular article was considered relevant through being referenced by contemporary literature.  This was because of the rapid development of technology in recent years, and because there have been systematic literature reviews that have included earlier periods.

## DATABASES

The databases searched were MedLine (medicine, nursing, dentistry, health care systems, and preclinical sciences), CINAHL (nursing, allied health, biomedical and consumer), SCOPUS (Science), IEEE Explore (electrical engineering, electronics and computer science), PsychINfo (psychology and the behavioural sciences) and ABI/Inform (business and financial information).  Key words for the search have been chosen to ensure sufficient coverage.  Articles were narrowed down to the specific topic areas. Within each topic area, articles were then be scanned for relevance, and those remaining used as the basis for this report.

## SEARCH TERMS

The search terms were chosen as a result of an initial scan of the literature to identify the main keywords being used by journals publishing in this area. The search terms were: ambient assist*, ambient intelligence, assistive device, assistive technolog*, communication aids for the disabled, intelligen* and (device* or technolog* or control* or system*), optical sensor based system, pervasive cognitive assist*,self-help devices, sensor network, smart assist*, smart assistive technolog*, smart cane, smart home, smart house, smart technolog*, smart walker, smart wheelchair, teleassist* or tele-assist*, telehealth of tele-health, telemedicine or tele-medicine, telemonitor or tele-monitor, televigilance or tele-vigilance, wearable comput*.  The results of these searches were then combined and linked with other search terms such as health policy, social control policy, healthcare policy, organisational policy, cost effectiveness, efficiency, human resources, implementation strategies, Indigenous peoples, client/patient outcomes, etc. Articles were also sourced through identifying citations.

## SCOPE OF THE REVIEW

A formal research literature review was not undertaken for the following key reasons:

- The scope of the project and the varied subject areas that related were too broad to allow for a standard in-depth, structured literature review approach in the timeframe and with the resources available; and

- A number of extensive formal literature reviews on these subjects have been undertaken since 2007.

It also became clear early on in the literature search that the evidence base for this topic would not be strong. A recent review of telemedicine identified that systematic reviews tend to focus on identifying well-designed studies that report upon criteria that are commonly considered useful if one is to undertake a full assessment of new technology in a clinical context (Jackson & McCLean, 2012). A review of tele-rehabilitation in 2010 concluded that there is a lack of comprehensive studies providing

evidence for supporting decisions and policy-makers in adopting tele-rehabilitation technologies, with an overall lack of standardisation of terminology (Rogante, Grigioni, Cordella, & Giacomozzi, 2010). Few studies have been found that meet the stringent criteria because of financial constraints on the research. Evaluation is typically directed at meeting user-defined assessment criteria, rather than putting together metrics that are of general utility, instead focusing on isolated aspects of care as indicators of success. Therefore, while individual case studies provide useful indicators of success, broad reviews have found it difficult to draw general conclusions that encompass the many diverse services in operation. A recent review of the effectiveness of telemedicine noted that formative assessments were emerging as areas of interest, as economic analyses were particularly problematic in a process which was complex and required collaborative efforts in often unpredictable processes (Ekeland, Bowes, & Flottorp, 2010). The reality is that in the categories of the client, the provider and policy, there are still a multitude of significant questions that remain unanswered (Jarvis-Selinger & Bates, 2009).

A key point to note is that this lack of evidence relates to outcomes for the use of assistive technology, not assistive technology *per se*. The importance of assistive technology for people with disabilities and the research identifying positive outcomes is noted in the Equipping Inclusion Studies (Layton, Wilson, Colgan, Moodie, & Carter, 2010). This review only relates to assistive technology.

## 3.2  DEFINING ASSISTIVE TECHNOLOGY

There are a number of terms that are used to label the use of technology to assist people at a distance.

### DEFINITIONS

Relevant definitions to this review are presented below.

### TELECARE/MEDICINE

Telecare has been defined as the use of information and communication technology to facilitate health and social care delivery to individuals in their own homes (Rogers, Kirk, Gately, May, & Finch, 2011), the transmission of digital, audio and video data during live interactive healthcare encounters between participants in different locations (Dansky 2002 cited in (Postema, Peeters, & Friele, 2012), and the use of information, communication, and monitoring technologies which allow health and social care providers to remotely evaluate health status, give educational intervention, or deliver health and social care to clients in their homes (Solli, Bjork, Hvalvik, & Helleso, 2012).

Telemedicine has been acknowledged to have a wide definition – medicine practised at a distance, with a correspondingly wide range of telemedicine interactions having been trialled in the management of chronic conditions, either taking place in real time (e.g. video conferencing) or asynchronously  (e.g. store-and-forward transmission from a home meter) (Wootton, 2012). It has also been defined as a process in healthcare characterised by at least two of the following features: 1) Distance is bridged by using information and communication technology (ICT); and 2) There are at least two actors involved, with at least one of them being an approved care professional or someone acting on behalf of an approved care professional (Vollenbroek-Hutten et al., 2012).

### E-HEALTH

E-health has been defined as the application of information and communication technologies as tools to support healthcare (M. P. Gagnon et al., 2008).

### TELE-HEALTH

Tele-health has been defined as the delivery of health services at a distance, using ICT, as an interchangeable term with telemedicine, and as a subset of e-health which encompasses all used of ICT in health including electronic records and decision support systems (Wade, Karnon, Elshaug, & Hiller, 2010).

### REMOTE MONITORING

Remote monitoring has been defined as guarding the health condition of a subject by measuring and interpreting vital signals without interfering with the subject's activities of daily living but assuring assistance and reaction when required (Hermens & Vollenbroek-Hutten, 2008).

### TELE-REHABILITATION

Tele-rehabilitation has been defined as the set of instruments and protocols aimed at providing rehabilitation at a distance (Rogante, et al., 2010).  Solli et al (2012) note that reading the literature in this area can be rather confusing as it uses several expressions that seem to describe the same thing. Martin et al reported a lack of international consensus on terminology, classification or taxonomy of devices, products and service models (Martin S, Kelly G, Kernohan WG, McCreight B, & C, 2008).

Steen (1993, cited in Solli et al 2012) developed a typology that requires a definition to be clear, not circular, not too broad, not too narrow, and not including more or less accompanying features than the concept includes. An example of a definition following this typology is that by Solli et al (2012) of telecare: "the use of information, communication, and monitoring technologies which allow healthcare providers to remotely evaluate health status, give educational intervention, to deliver health and social care to patients in their own homes" (Pg 11).  This definition encompasses the three dimensions or actions of nursing practice as conceived by Orem's theory of Nursing Agency: the social system, the interpersonal system, and the professional-technological system (Orem et al 2001 cited in  (Solli, et al., 2012).

### SMART ENVIRONMENTS

Smart environments have been defined as augmented environments capable of utilizing embedded computers, information appliances, micro/nano systems and multi-modal sensors, in which computational intelligence is ubiquitous to provide contextual, proactive and personalized services to people. Nowadays networks, microprocessors, memory chips, smart sensors and actuators are faster, cheaper and smaller. They have been identified as becoming pervasive in the physical environment, with current advances in such enabling technologies making it possible to build real smart environments and hence provide the opportunity for novel applications and services to be delivered for improving the quality of life and health of people at home and outside. A smart environment allows people to perform tasks efficiently by offering unprecedented levels of access to information and assistance. In the near future, the elderly and people with disabilities will avail of assistive technology to assist in carrying out daily activities, socializing, enjoying entertainment and leisure activities, all while maintaining good health and well-being. These smart environments are complemented by the role of health telematics (Abdulrazak, Giroux, Bouchard, Pigot, & Mokhtari, 2011).

### SMART HOME

A smart home has been defined as a network technology which derives its smartness from the effectiveness of the interaction between the resident and the network, rather than simply the power and versatility of the technology located in the home (Tony Kinder, 2000).  It has also been defined more simplistically as a house that comprises smart devices (Dewsbury & Linskell, 2011), although

smart devices in this definition are then explained as devices that can be programmed so that they determine their status in relation to other devices.  The devices are able to share any information that is available within the system and the sophistication of individual devices determines how many layers of functionality that can each engage in simultaneously. Another definition of smart homes is that they rely on pervasive computing and tangible user interfaces to turn the whole house into a cognitive orthosis (i.e. an orthopaedic appliance or apparatus used to support, align, prevent, or correct deformities or to improve function of movable parts of the body) (Giroux et al., 2009).

An Australian author recently used the definition that smart home technology is the integration of home-based technology and services for a better quality of living, with a smart home having five basic characteristics: automation, multi-functionality, adaptability, interactivity and efficiency (Lê, Nguyen, & Barnett, 2012). An addition to this definition in the context of dementia adds the dimension of facilitating the monitoring of residents to improve quality of life and promote physical independence while also reducing caregiver burden (Frisardi & Imbimbo, 2011).

### ASSISTIVE TECHNOLOGY

Assistive technology has been defined as: "Assistive Technology is any product or service designed to enable independence for disabled and older people." This broad definition means that a wide range of products and services are eligible for inclusion in the report, both high and low tech (A.-M. Hughes, Freeman, Meadmore, Burridge, & Rogers, 2011).  A definition that fits with a social model of disability defines the aim of assistive technology as to overcome the gap between what a disabled person wants to do and what the existing social infrastructure allows them to do, consisting of equipment, devices and systems that can be used to overcome the social infrastructure and other barriers experienced by disabled people (Marion A. Hersh & Michael A. Johnson, 2008).

A definition used recently in a paper on an Australian perspective is that it involves any item, piece of equipment, product or system that is used to increase, maintain or improve the functional capabilities of individuals and independence of people with cognitive, physical or communication difficulties (Soar, 2011).  Another definition from an Australian source is "any device, system or design, whether acquired commercially or off the shelf, modified or customised, that allows an individual to perform a task that they would otherwise be unable to do, or increase the ease and safety with which a task can be performed (Independent Living Centres Australia, n.d., cited in (Layton, et al., 2010).

### CONCLUSION

Given these definitions and the application of the term "smart" to "environments" and "homes" to mean "augmented" with "computational intelligence" (Abdulrazak, et al., 2011), the definition of assistive technology by the State of Queensland seems sensible. In the literature there is no clear definition of this term.  The State of Queensland definition is:

- Technology to enhance safety, independence and quality of life for people with a disability;
- Technology applications to increase efficiencies in direct client service delivery; and
- Technology applications to achieve greater integration across service providers.

This definition meets Steen's requirements for a definition very well, and incorporates all the elements of the many definitions given above. Therefore, in this literature review the term assistive technology has been used as that is the term used by the former Department of Communities, Disability and Community Care Services, unless the context of any research being reported on is clearly limited to a specific domain.

## 3.3 CURRENT AND 'IN-THE-PIPELINE' TECHNOLOGIES

Already existing technologies hold great promise for expanding the capabilities of the health and social care system, maximising the independence and participation of people through improved diagnostics, monitoring and assistance with the tasks of daily living. This section on current technologies and their possibilities concentrates on the findings of a review of wearable sensors and systems that are relevant to the field of rehabilitation, because this review creates a real sense that the world is just on the threshold of realising the full potential of electronic technology (Patel, Park, Bonato, Chan, & Rodgers, 2012).

What is clear in this review is that technological advances are occurring very quickly, so that funders and service providers have to be adaptable to capture the benefits of the new, not so fast to engage with the new that they embed systems that may be redundant very quickly, and not so slow that they miss out on the advantages the new technology brings. As Patel et al (2012, pg 2) state: "It is hard to overstate the magnitude of the problems that these technologies might help solve".

### WEARABLE SENSORS AND SYSTEMS

The development of wearable sensors and systems and smart homes has been enhanced by recent advances in sensor technology, microelectronics, telecommunication, and data analysis techniques. Particularly relevant to applications in the field of rehabilitation have been advances in technology to manufacture micro-electromechanical systems. Wearable systems rely on three building blocks: the sensing and data collection hardware to collect physiological and movement data; communication hardware and software to relay data to a remote centre; and, data analysis techniques to extract clinically relevant information from physiological and movement data (Patel, et al., 2012).

Since the early 2000's there has been tremendous progress in the development of low-power wireless communication, with the latest IEE 802.15.4a standard opening the door for low-power, low-cost but high data sensor network applications. With widespread broadband connectivity, sensor data can be aggregated using a personal computer and transmitted to a remote site over the internet. The development of the 4G mobile communication standard means that pervasive continuous health monitoring is also possible when a person is outside the home environment. Smart phones provide a virtually "ready to use" platform to log data as well as to transmit data to a remote site. They can also function as information processing units. Most now also include an integrated GPS tracking system making it possible to locate people in case of an emergency. Data analysis techniques such as signal processing, pattern recognition, data mining and other artificial intelligence-based methodologies have enabled remote monitoring applications that would have been otherwise impossible (Patel, et al., 2012).

### SENSING TECHNOLOGY

Sensors can be integrated into tight fitting garments, although further advances in signal processing techniques are needed to mitigate motion effects. Advances in the field of wearable biochemical sensors have sped up due to the development of micro and nano fabrication technologies. When monitoring older adults while deploying interventions to improve balance control and reduce falls, wearable sensors could be used to track motion and vital signs. Ambient sensors can unobtrusively monitor individuals in the home environment.

### AMBIENT SENSORS

Instrumented environments include sensors and motion detectors on doors that detect opening. This approach is totally unobtrusive and avoids the problem of misplacing or damaging wearable devices. Ambient assisted living (AAL) refers to intelligent systems of health assistance in the individual's living environment. AAL technologies are embedded (distributed throughout the environment or directly integrated into appliances or furniture), personalised (tailored to the users' needs), adaptive (responsive to the user and the user's environment) and anticipatory (anticipating user's desires as far as possible without conscious mediation). Home robots may soon be integrated into home monitoring systems.

Patel et al (2012) identify that this new technology will provide applications that are useful in the fields of: 1) health and wellness monitoring; 2) safety monitoring; 3) home monitoring; 4) assessment of treatment efficacy; and 5) early detection of disorders.

### WEB TECHNOLOGY

Web technology has also developed to a point where it can be very useful. A key factor in the success of managed support networks (known in health as Managed Clinical Networks or MCNs) is the implementation of equitable "joined-up" care. Managed networks have been defined as linked groups of professionals and organisations from primary, secondary and tertiary care, working in a coordinated manner, unconstrained by existing professional, social and health board boundaries to ensure equitable provision of high quality and effective services (Edwards, BN. (2002) Clinical networks, BMJ,321 (1152-3). In Scotland there are MCNs for stroke, cardiovascular disease, cancer services, and diabetes. It has been shown with diabetes care that web-based technology can support an MCN across a geographical region by providing a "shared care" dataset with automated exchange of clinical data. At the moment the MCNs have evolved from a "disease focus" rather than a patient focus, but the opportunity exists to provide seamless communication that is patient focused and integrated and seamless across diagnostic groups (Cunningham et al., 2011).

### REAL-TIME CLOSED CAPTIONING

Another example of emerging technology that supports assistive technology as being useful for people in their own homes is real-time closed captioning using the latest voice recognition technology. This offers great possibilities, especially for collaborations composed of a relatively finite membership. All Web conferences could be archived with captioning (Myhill, Cogburn, Samant, Addom, & Blanck, 2008).

With all this new technology emerging, a vision has arisen that a user-centred, home-based system will become the basis of disability and health support services in the future. This integrated system will consist of:

1. Specialist disability and health professionals giving tele-consultations and virtual visits from their institutional base;

2. Devices capable of integrated analysis providing support for making decisions and diagnoses, improving access to disability and health care services and optimizing resource utilisation for high-risk patients;

3. Hospital or institutional-based management only for acute illness or investigations which cannot be undertaken at home;

4. Clients, with the help of disability support and health professionals receiving care at home (postoperative, chemotherapy, asthma, chronic obstructive pulmonary disease, diabetes, etc.). In

daily life, some of the devises that are being explored for use in smart homes are: 1) Devices capable of home appliance control (heating, air-conditioning, bath water control, windows, doors, etc.); and, 2) Assistive devices (e.g. robotic-assistants, companion robots, autonomous wheelchairs, stair lifts, etc.) (Chan, Campo, Esteve, & Fourniols, 2009. A visual representation of this system is shown in Figure 3.1 below (Chan, Campo, Esteve, & Fourniols, 2009).

**Figure 3.1: Key Organisation in Smart Home**
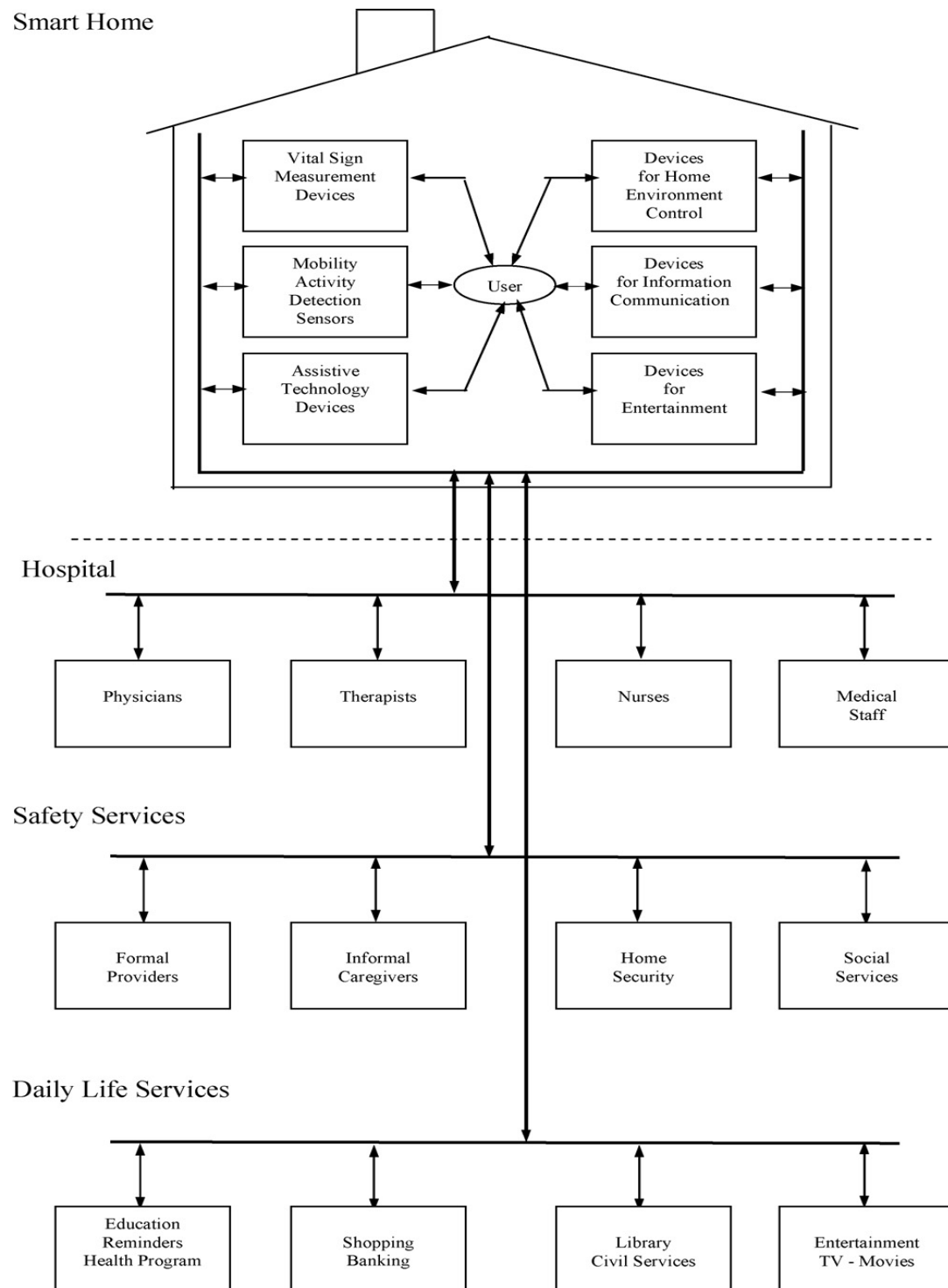
One way of understanding the scope of the technology is to examine a review of current and proposed technologies. In this review they considered device types and archetypal applications.

1. **Device types.** Device types were identified as: wearable devices; ambient unobtrusive services or devices; smart sensors; audio data collection; GPS (global positioning system) devices; RFID tags, which track objects as well as monitoring daily patterns such as eating and taking medication; smart cameras for fall detection, location and object tracking; phone/video input for communication; robotics as mobility aids, day-to-day support; and software that interprets the data from various devices, or as a reminder for critical tasks.

2. **Archetypal applications.** These are the generic application types and include event driven systems, e.g. fall detection, fire, security; continuous systems, e.g. walking aids, communication aids, cognitive training reminder software, environmental control, e.g. temperature or automatic vacuuming; and object location. Trend analysis can provide general monitoring, location monitoring, e.g. for people with dementia who might wander; health monitoring of vital signs, medication management, food intake, and hygiene (O'Brien & Ruairi, 2009).

Aged and Community Services Australia has identified the following features that could be considered useful smart home technology for older people, depending on the health and financial situation of the users: personal alarms via pendants and pull cords to a response centre; video door entry systems that allow the resident to see who is visiting and to then open the door remotely; bed and seat occupancy sensors that provide early warning if the resident does not return in a predetermined time; lighting that can be automatically activated when the resident rises from bed; medical monitoring, such as pulse, blood pressure and soiling that can be assessed on site with information forwarded appropriately; and increased use of robotics to assist around the house (Aged and Community Services Australia, 2007).

Queensland has already started on the development of smart homes with the Queensland Smart Home Initiative, which has completed its first phase involving a smart home demonstrator unit, and commencing a 'connected-community for care' project researching the impact of better sharing of information in the community. The second phase will involve a large-scale roll-out of assistive technologies into the homes of people needing support (Soar, 2011); http://www.qshi.org.au). This is just one of many initiatives taking place worldwide, all of which are still evaluating their effectiveness.

## 3.4  USER GROUPS

The user groups for assistive technology that are identified in the literature are mainly those with disabilities and older people who are getting frail or have chronic conditions. A major driver around the world for investment in this area is concern about the ageing populations in many countries, and with that ageing, a prediction that there will be an increase in people living with disabilities (Soar, 2011).

If the focus is put on the disability rather than the age of the client, then it becomes clearer that while health is one aspect of the concern of the client, the other major concern is functional disability. What is then also clear is that people with disabilities have great variability in their needs and levels of motor and/or cognitive handicap. If disability is then reframed as not only a physical deficiency, but as resulting mainly from the inadequacy of the environmental infrastructure to meet the user's needs (Fougeyrollas, 1995), then personalisation of the environmental response is necessary (Kadouche, Abdulrazak, Mokhtari, Giroux, & Pigot, 2009). This approach fits within the social model of disability that defines disability as the loss or reduction of opportunities to take part in normal life on an equal

level with others due to physical, environmental or social barriers (Marion A. Hersh & Michael A. Johnson, 2008).

### THE HOME AND COMMUNITY CARE PROGRAM (HACC)

This approach is consistent with the key components of the Active Service Model, a quality improvement initiative based on the premise that HACC services should, wherever possible, assist clients to improve their capacity and enable them to live independently at home for as long as possible. The HACC Program provides services such as domestic assistance, personal care as well as professional allied health care and nursing services, in order to support older Australians, younger people with a disability and their carers to be more independent at home and in the community and to reduce the potential or inappropriate need for admission to residential care (http://www.health.gov.au/internet/main/publishing.nsf/content/hacc-index.htm accessed 27 June 2012). As mentioned previously, HACC services are now fully funded by the Commonwealth Government.

The key components of the Active Service Model include:

1. An emphasis on capacity building or restorative care to maintain or promote a client's capacity to live as independently as possible. The overall aim is to improve functional independence, quality of life and social participation;

2. An emphasis on a holistic 'person-centred' approach to care, which promotes clients' wellness and active participation in decisions about care; and

3. Provision of more timely, flexible and targeted services that are capable of maximising the client's independence (Ryburn, Wells, & Foreman, 2008).

The theoretical base behind the HACC and Active Service Model is also a social and environmental model in which there is an appreciation that disability is not a fixed personal characteristic, but instead can be conceptualised as a gap between personal capability and environmental demand. If too much emphasis is placed on personal capability, for instance, there may be a tendency to ignore the potential for individuals to reduce demand through activity accommodations, environmental modifications, psychological coping and external supports. The active service model clearly aims to minimise the extent to which processes within the HACC system decrease a client's ability to function and increase their dependency, and instead attempts to redirect service provision to try to maximise the wellness/independence pathway. Assistive technology solutions may be sensible additions to the HACC and active service model approaches as the literature is clear that to be effective smart assistive technologies have to be personalised to the user (Baskar, Lindgren, Surie, Yan, & Yekeh, 2012; Dewsbury & Linskell, 2011; Kadouche, et al., 2009; Sommerville & Dewsbury, 2007; Systems, 2012).

However, personalisation for people with disabilities is very complex, and it has been argued should involve several disciplines (ergonomics, occupational therapy, design, engineering, medicine, etc.) (Kadouche, Mokhtari, Giroux, & Abdulrazak, 2008). Because of the great diversity in potential end-users, it has been suggested that there is a strong need for a simple, effective and unified modelling framework to support the on-going dialogue that is needed between the end-users and all the professional groups involved in the development and operation of the assistive technology systems. The Comprehensive Assistive Technology Model (CAT) reported here does not relate specifically to assistive technology, but provides a process for thinking through issues that feeds into some of the policy decision frameworks presented in the next section. There are other models, but this one is presented here because it places at the top of the model the four components necessary when considering assistive technology:

1. End-user;

2. Context in which they will be using the technology;

3. Activities for which they want to use it; and

4. Technology itself.

From this starting point, a tree like structure enables each aspect to be considered to the level of depth appropriate in each individual case (M. A. Hersh & M. A. Johnson, 2008). Examples are illustrated in Figure 3.2 below.

**Figure 3.2: Comprehensive Assistive Technology Model**
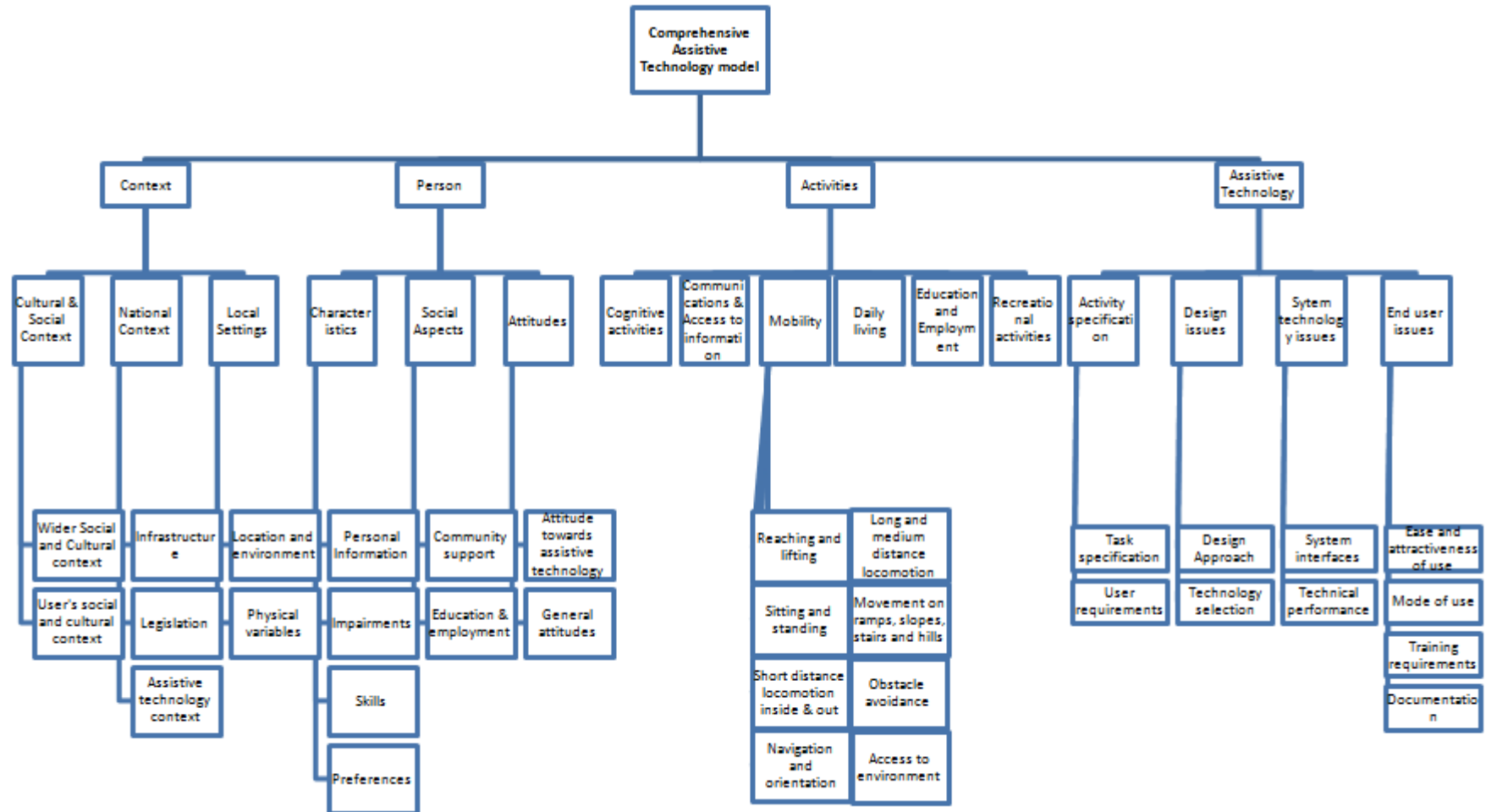
Recent literature from the artificial intelligence field suggests that the CAT approach can usefully be applied in the assistive technology area. There is some emphasis on user models that develop interfaces that recognise the goals and characteristics of the user and adapt accordingly. There is recognition that it is necessary to tailor support for the person at home based on a set of self-assessments and activity recognition and evaluation (Baskar, et al., 2012). For this reason, in this report the focus has been on generic approaches to smart assistive technologies, rather than focusing on different disability types.

This perspective is reinforced by a report on the United Kingdom experience in developing smart home technology for safety and functional independence (Dewsbury & Linskell, 2011). While focused on the provision of assistive technology for people with neurological conditions, the authors state that from their research experience, getting the correct technological responses for a person's needs, experiences and wishes is what is critical. In their view, while the particular condition is important, what is most important is the outward expression of how that condition is experienced and the resulting needs and wishes. Two people with the same condition, e.g. brain injury, will experience their condition in completely different ways. The key point that Dewsbury & Linksell raise is that the method of informing an assessment process allows the person to be more than their medical or physical condition. They developed a Neurological Dependability Assessment Matrix (Figure 3.3) as a technological assessment tool, a tool which could be adapted to any person needing technological assistance.

**Figure 3.1: The Neurological Dependability Assessment Matrix (NDAM)**

**Person with Neurological condition requiring technology**

**FITNESS FOR PURPOSE** - What does the person want from the system? Does/will system meet and fit with the broad needs, experiences and wishes of the person and/or their carers.

**TRUSTWORTHINESS** - Can the person trust the system to do what is expected without adverse reactions? Does the technology meet the expectations of the carers?

**ACCEPTABILITY** - Does the person find the technology an acceptable addition to their lifestyle? Does the technology fit with the person's lifestyle and experiences? Will the person use the technology? Will the carers' use/help use the technology?

**ADAPTABILITY** - Is the system flexible enough to cope with the person's changing needs and experiences?

**Shape and size**

**Reliability** – How reliable is the system for the person? Will the system do what is needed when it is needed to?

**Capacity** – Can system accommodate the person's lack of acceptance of their condition and/or its consequences?

**Variability** – the ability to adapt to external conditions and respond accordingly.

**Portability** - Can the person carry the system? Does the system need to be carries? Is there a trade-off/compromise if the (full) system cannot be carried?

**Safety** – How safe the system is for the person – does it mitigate risk or potentially cause more? Will the person's life be improved by the system?

**Usability** – How practical is the system solution to the person? Can the person operate what needs operating?

**Comfort** - How comfortable is the technology for the person to wear for long periods? Will this exacerbate any conditions? Will help be required to put on and take off? Will it interfere with any activities?

**Maintainability and serviceability** – How easy is the system to be serviced or maintained? Does the person need to be involved in this process? Are they able to get involved if they want to? Are carers required for the maintenance?

**Learnability** – Is the person able to learn how to use the system? Is the system too complex? Are control panels clear and easy to use?

**Dexterity** – Can the person interact with device appropriately and press the correct buttons easily? Size of buttons, spacing, 'feel' (tactility!)

**Compatibility** – Does the system solution work well with existing technologies? (Interoperability)

**Survivability** – Will the system still work when the power is not available? Will the system survive when primary communication channels fail?

**Cost** – Can the person afford to run and maintain the system?

**Timeliness** – Does the system work in appropriate time frames? Is there a (adjustable) margin of error?

**Aesthetics** – Does the system look good and blend in with the person's surroundings? Does the system cause concern for the person?

**Responsive** – Does the advice produce the correct response? Is the system response appropriate for the person's medical condition? Can the person hear/see/feel the device or its output re: perpetual/sensory changes?

**Utility** – How useful is the system solution to the person? Will the person use the system?

**(Dewsbury & Linskell, 2011)**

The approach that it is the experience of the end-user that is most important in designing a smart adaptive technology support system becomes crucial when considering smart homes. Once the aspects of assistive technology that are required have been determined, then another useful aspect to consider is the "fitness-for-purpose". In considering dependability for domestic systems, Sommerville and Dewsbury (2007) developed a model which considers the functionality of the system, the technical quality of service, the suitability of the system for a particular user in their own home, and the ability of the system to change in response to changing user needs. Their framework is presented in Figure 3.4 below.

**Figure 3.2: The Dependability Model Domestic Systems (DMDS)**
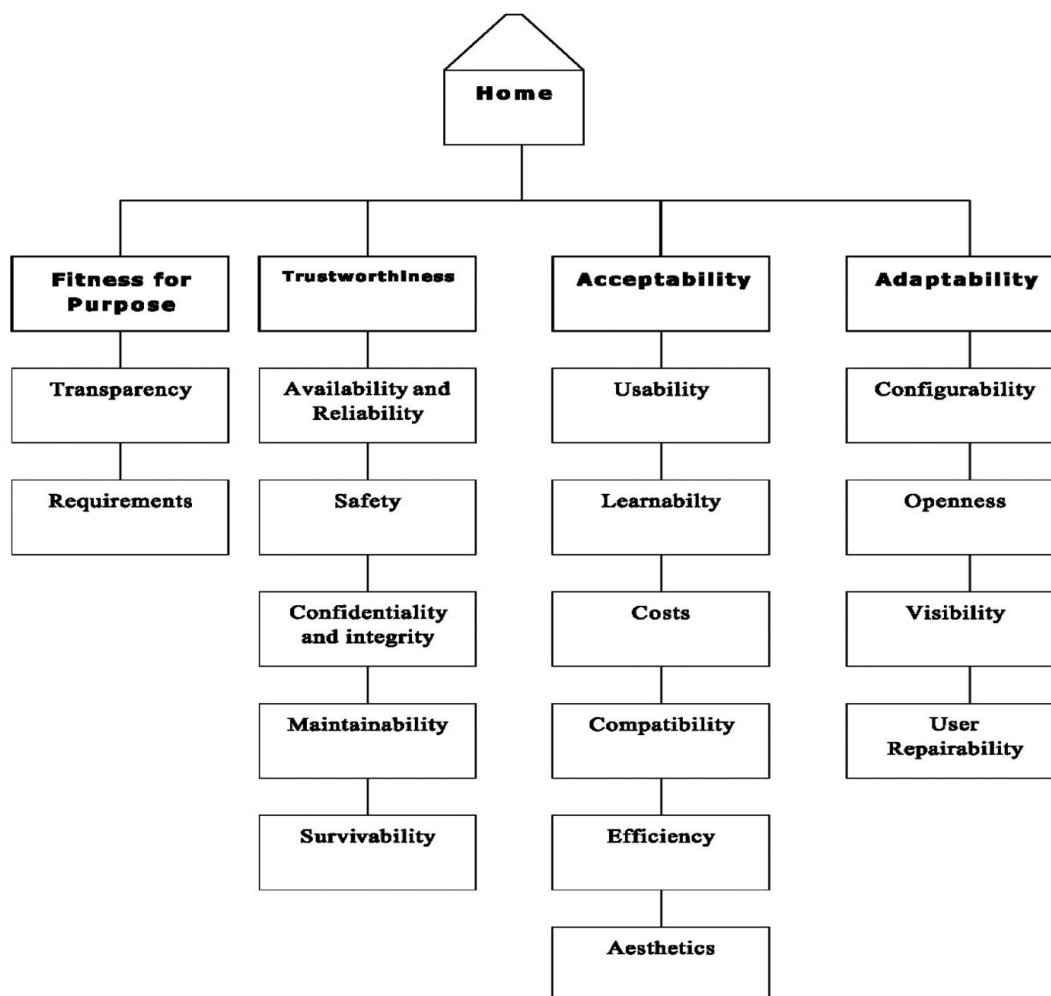


Source: (Sommerville and Dewsbury, 2007)

## 3.5 POLICY

Advanced technology has been described as developing as rapidly as the rate of the population ageing with e-Health technology receiving considerable recognition from governments, business and researchers, meaning that policies must continue and grow at a similar rate to ensure the safety, quality and decision-making for these products (Coughlin, 1992).

Policy makers and funders have been urged to note that one of the most important factors driving adoption of assistive technology is the impact of societal issues. These financial, economic, cultural, and environmental issues are driving change. Assistive technologies have become a silver lining, and

a viable option (Doarn & Merrell, 2007) because it can be viewed as an agent for actions that support people with long-term conditions and prevent further illness deterioration. It can also be viewed as a means of making services more responsive, equitable, cost and clinically-effective, more highly co-ordinated and able to play a central part in mediating between service users, health, welfare professionals, and service providers (Rogers, et al., 2011). Assistive technology may be one way of assisting governments to meet their obligations to overcome barriers to the equal citizenship of people with a disability, as required by the National Disability Strategy (Layton, et al., 2010).

However, social and health care is a complex ecosystem of stakeholders, so a lack of consolidated procedures for supporting decision-making is a major weakness in institutionalising assistive technology applications on a large scale. Institutionalisation is the last phase within the reference pathway that assistive technology applications follow to enter into clinical routine (Figure 3.5). Decisions about the institutionalisation of assistive technology applications are usually taken by health care regulators, governments, and authorities in countries with national social and health care service, such as the United Kingdom and Australia.

**Figure 3.3: Assistive Technology Pathways**
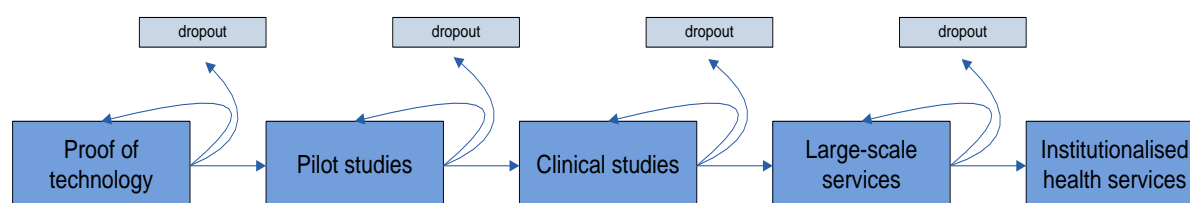


Source: (Zanaboni & Lettieri, 2011).

In these countries institutional personnel (i.e. health care regulators, governments, and authorities) are required by relevant stakeholders (e.g., social and health care providers, client groups, researchers, insurance companies, and technology suppliers) to legitimise their decision-making about institutionalisation of new social and health care technologies, such as smart assistive technologies. A major issue for stakeholders is that they are able to discuss and decide which decision-making criteria should be used in the selection of promising assistive technology applications. The decision-making should be rational, requiring a multi-criteria framework. Key dimensions need to include technical feasibility, legal and ethical issues, clinical effectiveness, economics, equity of access, acceptance by providers and patients, and organisational impacts. The decision should be fair, accountable and transparent. Lastly, the process should be efficient, using a two-stage decision-making process requiring applicants to submit a limited outline proposal, followed by a full briefing of the selected assessed proposals. Additionally, contextual sustainability, which means paying respect to ethical and legal requirements, is necessary for the long-term use of assistive technology applications (Zanaboni & Lettieri, 2011).

### THE DECISION-MAKING CONTEXT

Decisions regarding the implementation of assistive technology applications in the social and health care systems occur at three decisional levels: political, organisational and clinical. Specific determinants influence the degree of knowledge utilisation required for the process to be effective at each level. Furthermore, decisions made at each level are interdependent, since a decision made at one level can impact on the other levels. For instance, a decision to invest in a particular technology made at the health policy level could influence resource allocation at the organisational level and the involvement of health care professionals at the clinical level. A multidimensional analysis is necessary

in order to draw an overall picture of the factors influencing knowledge application to support the implementation of assistive technology.

The phases of knowledge application are:

- Identify problems and relevant knowledge;

- Adapt knowledge;

- Assess barriers to knowledge use and factors facilitating it;

- Implement interventions;

- Monitor knowledge use;

- Evaluate outcomes; and

- Sustain knowledge use (M.P. Gagnon et al., 2008).

The application of knowledge to support decision-making on e-Health has been conceptualised as being a 'black box' of interactions between the knowledge available and the decisions made at each decisional level at the various phases of assistive technology implementation. Seven main policy strategies have been suggested for this implementation: Policy goal-setting; recognition and resolution of policy barriers/challenges in assistive technology; collaboration, partnerships and sharing; identification of high-impact areas for assistive technology; evaluation and research; and lastly, investment (Jennett et al., 2004).

The reality is that the introduction of assistive technology is often carried out in a context of uncertainty in which several alternatives are possible, because reasonable evidence on the effectiveness, efficiency and costs of the technology is not available. Optimal integration of assistive technology has been framed as the use of approaches which consider the best scientific knowledge available as well as the specific context and values of the different stakeholder groups involved (M. P. Gagnon, et al., 2008). Understanding the processes impacting on knowledge application in assistive technology decisions is central to a planned integration of these technologies into the social and health care systems. A planned strategy of assistive technology implementation supported by empirical and theoretical knowledge, while taking into account the context of decision-making (evidence-based, theory-driven, and contextualised) is essential (M.P. Gagnon, et al., 2008). This planned strategy helps with the management of the tensions that develop with all policy decisions, no matter how evidence based they are. These tensions revolve around differences in opinions and judgements amongst individual clients, their families, and the various professionals in the social and health workforce supporting them, resulting in on-going negotiations about who makes what decisions when. By using evidence based practice as a framework within which decisions are made, the decisions can become explicit, consistent and transparent within a policy framework that aims to improve the wellbeing of the beneficiaries of services (Price & Kricka, 2007).

Policies designed to support the introduction and use of assistive technology for long term conditions have been based on the gains that are assumed to flow from empowering patients to be self-reliant, responsible and activated. This is a characteristic of health policy in the UK, USA and Australia. However, Rogers et al (2011) have shown, in policy terms, telecare has failed to engender a new role for patients in which they are assisted to manage their own health status through more self-activation and autonomy. The hypothesis is that this stems from a failure to consider the way in which tasks need to change or be re-distributed in a system in which professionals dominate decision-making, along with the creation of a client dependency on the technology along with a perceived enhanced right to use other existing services as well.

Whilst policy makers may not be primarily interested in the lived experiences or practices of patients when they are intent on fashioning more responsive services, promoting better self-management or

managing demand, a consumer focus is central to re-thinking or adjusting policies to achieve intended policy goals (Rogers, et al., 2011): keep the consumer at the centre of innovation, keep it simple, link products and services to a broader ecosystem of care, and encourage wellbeing and health in addition to treating illness. Current innovations in information technology make this a good time to consider investing in consumeristic approaches (Cohen, Grote, Pietraszek, & Laflamme, 2010).

Apart from this necessary consumer focus, the success of assistive technology depends on the inextricable relationship with e-Commerce, health, information, and communication technology, collaboration and policy coordination across government departments. Strategies for the achievement of a successful assistive technology industry include:

1. Improvement of assistive technology related laws and institutions. Legal and policy planning in assistive technology are regarded as necessary conditions for standardisation professionals to help address the issue of law enforcement.

2. Establishment of an assistive technology industry infrastructure.

3. Support for research and technology development, standardisation and human resources development.

4. Building information infrastructure for state, national and international cooperation on assistive technology.

5. Inter-ministry cooperation for the development of the assistive technology industry (M. Lee, Min, Shin, Lee, & KimJin, 2009).

In reviewing the introduction of telehealth programs across the United States of America, Schmeida et al (2007) identified that innovation and the spread of policy ideas depended on the program having good links with professional networks of government legislators and social and health care specialists within state agencies (Schmeida, McNeal, & Mossberger, 2007). The World Health Assembly resolution of 2005 called on member states to draw up long-term strategic plans for developing and implementing e-Health. It is very important that government and institutional leaderships understand the range of policy issues to be addressed at all levels and stages of an assistive technology in order to facilitate planning and implementation (Shariq Khoja, Hammad Durrani, Parvez Nayani, & Ammad Fahim, 2012; Tracy, Rheuban, Waters, DeVany, & Whitten, 2008).

### OPPORTUNITIES FOR IMPROVEMENT

To enable government and institutional leaderships to support smart assistive technologies, there need to be improvements in evaluation and in methods of validating and certificating assistive technology systems. These processes all take time for both systems developers and administrators plus there are cost limitations. Collaboration is essential.

### KEY RECOMMENDATIONS

Key recommendations to enable an increase in evaluations and the development of accepted validation processes are:

1. The provision of funding for multi-stakeholder meetings with focused deliverables.

2. Research programs should assess, develop and support innovative approaches into developing assistive technology-related tools and technologies with appropriate funding.

3. There is a need for research and development focusing on issues surrounding data security, client and provider privacy and trust, and management of assistive technology systems.

4. Consideration of funding for ''implementation'' research to assess and improve delivery, use, and adoption of technologies. There are needs for economical, organisational management,

communication and information dissemination systems, change management, and sociological and behavioural studies for effective adoption of assistive technology tools and technologies among end users.

5. The creation of a central information resource managed by a neutral entity to compile an inventory of assistive technology software and resources, with regular updates and ongoing outreach to both the end-user communities and the research community (Michael J. Ackerman, Rosemarie Filart, Lawrence P. Burgess, Insup Lee, & Ronald K. Poropatich, 2010a).

It has also been suggested that assistive technology projects present features that determine the type of evaluation needed to inform decision making. Desirable conditions for successful assistive technology evaluations include:

- Evaluating throughout the whole life cycle of projects;

- Establishing an agreed framework for needs assessment and priority setting;

- Reaching common evaluation principles according to a consensual approach;

- Adopting rigorous methods from the biomedical ICTA management asocial economic and political sciences;

- Involving stakeholders in the design and definition of evaluation questions; and

- Addressing complex human factors, engineering and interaction with stakeholders (governments, healthcare systems, professional groups, providers, patients communities and populations) (Gagnon & Scott, 2005).

Another important aspect is assessment over time. Each of the stages in the life of an assistive technology program requires economic assessment, but the assessment requirements change as the application matures, including changes in the focus of evaluation and the sources of information, as shown in Table 3.1 (Hailey & Jennett, 2004).

**Table 3.1: Different stages of economic evaluation for an assistive technology application.**

| Stage of evaluation | Issues to be considered by decision-making bodies | Focus of evaluation | Source of information |
|---|---|---|---|
| Pilot studies | • Whether the application is feasible. Whether to adopt as routine service | Single link or local network application | • Local administrative data on specialty.<br>• Surveys.<br>• Preliminary cost studies. |
| Initial routine use | • Influence of local practice patterns. Level of resources for Telemedicine and non-Telemedicine services. Access to services.<br>• Workforce requirements.<br>• Effects on health outcomes.<br>• Multi-application use of the Telemedicine network.<br>• Impact of technological change. | Local network application, consider wider diffusion in health system | • Routine administrative data collection/processing.<br>• Surveys.<br>• Develop approaches to measure preferences. Intermediated indications of health outcomes.<br>• Monitoring/ assessment of price and efficacy of new technical developments |

| Stage of evaluation | Issues to be considered by decision-making bodies | Focus of evaluation | Source of information |
|---|---|---|---|
| Longer term use | • Economic efficiency and equity of health program.<br><br>• Effect on population health.<br><br>• Effect of new technology and additional Telemedicine applications. Effect on level organisation of non-Telemedicine services. | Whole jurisdiction/health system | • Routine administrative data. System-wide patient tracking. Longer term outcomes.<br><br>• HRQOL studies. |

Source: (Hailey & Jennett, 2004)

The Australian and New Zealand Telehealth Committee (ANZTC) (E. Hughes, King, & Kitt, 2002) has suggested an evaluation framework which is a set of tools for this purpose. In Table 3.2 the ANZTC template is shown. This could act as a skeleton around which an evaluation can be built.

**Table 3.2: The ANZTC evaluation framework – areas of evaluation**

| Stages | Description | Data collection | Analysis | Results and Summary |
|---|---|---|---|---|
| Current situation | | | | |
| Proposed change | | | | |
| All consequences | | | | |
| Important consequences | | | | |
| Areas of uncertainty | | | | |
| Summary | | | | |

Source: (E. Hughes, et al., 2002)

Caution must be noted in using such a tool as the ANZTC that the results in the evaluations may fail to match the complexities of assistive technology. Thus, there is a need for: multi-perspective, multi-method evaluations with evaluators from different backgrounds working together to produce an integrated evaluation, coupled with an awareness of the importance of qualitative methods. In order to understand all complexities, investigators must deal with the differences between private opinions, public statements and actual behaviour (E. Hughes, et al., 2002).

Health, social services and housing policy makers should consider establishing an assistive technology forum in which technology, services, and housing providers' foster coordination between themselves. The quality of life can be greatly enhanced by smart homes and smart assistive technologies which have the potential to foster independent living and enhanced quality of life. However, for smart-homes to be enhanced to the fullest degree providers of technology should be aware of developments in smart-homes, and equally as important, builders of smart-homes should be aware of the possibilities for assistive technology. The rationale for this is the savings from more efficient delivery of care, and increased opportunities for independent living. This coordination between relevant government, non-statutory and private organisations assists in the enhanced quality of life required. This would also reduce the danger of duplication and inefficient allocation of resources, and facilitate the development of a coherent framework for the implementation of assistive technology.

Another substantial opportunity is the market and export potentials of smart assistive technologies. The pursuit by many governments of more cost-efficient care delivery and better quality of life for health consumers and the growing demands for better services and treatment is paramount. This

economic potential in turn could also provide an incentive for governments to promote the wider adoption of these technologies and services. The Australian Department of Industry and Science is actively supporting the development and adoption of assistive technology applications, with the aim of developing export markets. Government assistance for the promotion of domestically developed smart assistive technologies could generate significant benefits for the domestic economies, both in Australia and elsewhere (Tang & Venables, 2000).

It is as important to ascertain policy maturity in e-Health as in any other health related area. In order to do this four categories (1 strongest to 4 weakest) of policy maturity have been developed for jurisdictions, such as governments, health authorities, and private organisations. These are:

1. Regulations and laws governing e-Health activity. This represents well established development of policy, formally embedded into the administration of the jurisdiction.

2. Statements, directives and guidelines defining and delimiting e-Health activity. Although slightly weaker, this level still shows clear evidence of formal written material that governs e-Health activity.

3. Evidence of proactive consideration of e-Health activity. Although weaker still, this is an important advance and might be where a jurisdiction establishes mechanisms or funding programs to move e-Health initiatives forward.

4. Broad suggestions of intended direction encompassing e-Health activity. This is the weakest, yet probably the most common policy statement for any jurisdiction (Scott, 2004).

Although not commonly requested, research into e-Health policy is essential to assist in ensuring the policy's maturity. This can be undertaken from several vantage points. To encourage greater research in this area some possible sequential approaches including issues, questions and examples are briefly described in Table 3.3.

**Table 3.3: Possible sequential approaches to encourage research in the area of e-Health policy (Scott, 2004)**

| Approach | Issue | Question | Example |
|---|---|---|---|
| Historical | How did policy develop? | What was the role of research in policy making? | Examining policy development within a jurisdiction that occurred in relation to an established Telehealth activity such as radiology or Telepsychiatry |
| Developmental | What policy should exist? | What policy options exist for a given jurisdiction and e-Health tool? | Analysing the evidence and proffering specific policy options and recommendations around home Telehealth/Telecare |
| Comparative | What policy exists? | Is e-Health policy in one jurisdiction applicable to or better than that in another? | Comparing the e-Health policy with another country |
| Impact | What outcome resulted? | Did implementation of a specific e-Health related policy have the desired effect and did the expected outcomes materialise? | Investigating whether the introduction of broadband communication in rural and remote areas resulted in greater connectivity for the people |

| Approach | Issue | Question | Example |
|---|---|---|---|
| Transferability | What policy can be used elsewhere? | Can transfer of e-Health policy be successfully accomplished? | Examining how e-Health policy has been transferred between member states of the European Union |
| Policy Failure | What policy does not work? | When or why has implemented e-Health policy failed? | Analysing protective state physician licensure policies and their enhancement of inter-jurisdictional patient access to e-Health services. |

## 3.6 SERVICE AND COST EFFICIENCY AND EFFECTIVENESS

Cost-effectiveness is a critical matter for the adoption of any new technique or technology into health care. The conventional approach to answering questions about cost-effectiveness is to summarise the results of randomised controlled trials and produce a pooled estimate of effect by conducting a meta-analysis. Generally the effect of interest is the Quality-Adjusted Life Year (QALY). If such an estimate for the cost of a QALY passes an agreed threshold, then widespread implementation of the intervention is likely. However, for assistive technology interventions there have been very few studies of cost-effectiveness, so calculating a pooled estimate is impossible.

Meta-analysis examining a quantitative outcome such as mortality, emergency department visits or length of stay in hospital is also difficult because published trials have used a wide range of outcome measures, so that a pooled estimate of any one outcome reduces the size of the dataset considerably. For example, Wooten et al (2012) reviewed 141 randomised controlled trials on the value of telemedicine on the management of five common chronic diseases (asthma, COPD, diabetes, heart failure, and hypertension). Their findings were that most studies reported positive effects with almost none reporting negative effects. Their hypothesis is that this showed publication bias. Another finding was that there were no significant differences between diseases in the effectiveness of telemedicine. An issue was that most of the studies have been relatively short-term (median duration 6 months) and the researchers thought it unlikely that any intervention can have much effect unless applied for a long period. There were very few studies of cost-effectiveness (Wootton, 2012).

However, as storage and computation becomes more and more cloud based, health monitoring systems can become low-cost, platform independent, rapidly deployable and universally accessible. Users will be enabled to buy off-the-shelf devices and access customised monitoring applications via cloud-based services. Monitoring applications deployed via the cloud can be easily updated without requiring that the patient installs any software on their personal monitoring device, thus making system maintenance quick and cost effective. Movement sensors are also becoming increasingly inexpensive, small and requiring very little power. Innovative solutions for recognising emergencies in the home are developing through a combination of monitoring the vital parameters of the person living at home as well as supervising the conditions of domestic appliances. Sensors embedded in electrical devices and doors and windows are able to be integrated into an easy-to-use house-control system, so that there can be early detection of trends in patients' health status through remote monitoring (Patel, et al., 2012).

In 2002 Burgestahler (Burgstahler, 2002) commented that people with disabilities can, and in a majority of situations do, face a second level of digital divide by being unable to use commonly existing technological tools even if they have access to them. Universal design refers to the creation of products and environments as well as practices, programs and services that are accessible to and usable by all persons, including individuals with disabilities, without adaptation or specialised design. Universally designed technologies provide for input and interaction in multiple alternative and equally

effective ways. Designers and manufacturers of electronic and information technology have not applied universal design principles, which are distinct from practices of adaptable and accessible design. According to Myhill (2007) technologies that are adapted to meet the needs of specific populations, or even individuals, are less desirable than other designs because they can be expensive, time-consuming, and idiosyncratic. Technologies designed to be accessible provide content that can be accessed using assistive technologies, such as screen readers, and are more generally available to a wide audience. However, universally designed technologies are designed to be always accessible and can be used universally without the use of assistive technologies.

In future the application of UD principles to cyber-infrastructure technology design may obviate expensive and complex assistive technology (Myhill, et al., 2008). The economic evaluation of remote device management is hampered by a number of obstacles:

1. Paucity of available data regarding clinical effectiveness, efficacy, and costs, requiring assumptions that decrease robustness of the analyses.

2. The multitude of parameters that affect cost in this field, and the in homogeneity of these parameters (e.g. variations in distances travelled, different reimbursement policies, etc.). This is particularly true in Europe.

3. Possible differences in performance between systems that may affect the drivers of economic models.

4. Medical devices and communication technology are in constant evolution, making it difficult to make mid- or long-term projections of cost.

Economic analysis of remote follow-up involves essentially costs and measures of preferences of patients and physicians, whereas remote monitoring involves analysis of cost-effectiveness (i.e. using outcome measures such as hospitalization, heart failure events, etc.). Evaluation of remote monitoring is particularly complex, due to few available data on impact of this strategy on outcomes, such as reduction in heart failure events, stroke, or inappropriate shocks. Costs related to remote monitoring are also difficult to anticipate, as on the one hand, disease management may lead to reduced hospitalization costs (for instance, due to earlier therapeutic intervention, or willingness of physicians to discharge patients earlier due to the patient being remotely monitored), but may increase use of resources in response to alert messages.

Until recently, there have been no randomized controlled trials demonstrating effectiveness and efficacy of remote management to provide robust data for performing economic analysis. In most healthcare systems worldwide, despite a strong growing interest in health economics, reimbursement decisions do not require formal health economic evaluations. Reimbursement for remote patient follow-up was granted in the USA in 2006 and in Germany in 2008, without any requirement for proof of cost savings. Therefore, there was no need thereafter to conduct cost analysis in these countries. In Europe, reimbursement for remote follow-up is restricted to a few countries, limiting the numbers of patients and thus the possibility of conducting large international registries.

Implications of remote device management according to the different parties involved are shown in Table 3.4 below.

**Department of Communities, Child safety and Disability Services**
**Research to inform Smart Assistive Technology service delivery models**

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**Table 3.4: The impact of remote monitoring and follow-up as seen from different perspectives**

| | Accessibility | Quality | Efficiency | Costs | Financial incentive |
|---|---|---|---|---|---|
| **Patients** | Increased, especially if remote | Better care received Quality of life | Less travel | No extra cost | Less costs (travel, meals, accompanying person, etc.) |
| | | Reduced mortality and morbidity [a] | Less time spent | | |
| | | Better care given | Quicker follow-up | | |
| | | Increased satisfaction | | | |
| **Medical personnel** | Increased access to patient data | Increased flexibility | Fewer missed visits | No extra cost | Possibility to increase total number of follow-ups |
| | | Less administrative work | | | |
| **Hospital** | Networking of patient data | Reputation | More efficient use of hospital resources | Transmitter purchase [b] | Shorter hospital stay (for same DRG) |
| | | Increased satisfaction of personnel | | Data analysis | |
| | | | | Patient education | |
| | | | | Transmitter | |
| | | | | Telecom | |
| **Device manufacturer** | Data centralization | Product quality control | Increased (avoids participation in in-office follow-up) | Database servicing | Marketing value |
| | | | | Helpline | |
| | | | | Scientific studies | |
| **Insurance company** | Data on healthcare use | Better patient care | Management of healthcare system | Transmitter [b] | Cost control |
| | | | | | Fewer cost-intensive clinical events [a] |
| **State** | Increased access of patient care | Better public service | Management of healthcare system | Transmitter [b] | Cost control |
| | | | | | Fewer cost-intensive clinical events [a] |

[a] Proof pending from randomized controlled trials.

[b] Depends on reimbursement.

(Burri, Heidbuchel, Jung, & Brugada, 2011)

## 3.7   ETHICAL ISSUES

There is nothing about assistive technology that should be in conflict with ethical standards set by social and health service organisations.  Care of clients should not be compromised regardless of the assistive technology programs.  This responsibility encompasses a broad range of issues including, but not limited to, confidentiality, image, quality, data integrity, clinical accuracy, and reliability.  All assistive technology programs are expected to incorporate ethics statements into administrative policies and be aware of medical and professional codes when using assistive technology.  Foremost in these codes is informed consent, privacy, a process for resolving issues, and an absence of conflict of interest (Merrell & Doarn, 2009).

At no previous time in history have new ideas or inventions been promoted so quickly or distributed so widely.  Thus, the impact of any disruptive technology (ethical or moral) is felt immediately on a global level.  Unfortunately, our political, social, and behavioural systems can be too slow to respond, with moral and ethical implications either ignored or made subservient to a more pressing (commercial?) need (Satava, 2003).

Ethical considerations are perhaps the most frequently mentioned concerns when discussing assistive technology.  The two dimensions most highlighted are privacy and trust.  There is a major concern that technologies are being developed to perform functions, for example, 24/7 home monitoring, because the technology can do it, rather than it being necessary or desirable.  Ethics should be used as a veto point to decide between what we can do and what we should do.  The use of ethics to determine how best to use smart technologies in social and health care can assist when the issue of privacy is identified as a major concern.  Questions that have been considered are: How much personal information is collected, who manages and has access to these data?  Where does an individual's right start and stop?  And if data are available to improve patients' health and healthcare overall; should it be used, and to what extent if it risks individual rights? (Coughlin, 1992).

### EXISTING ETHICAL CONSIDERATIONS

There are four primary areas presenting ethical and moral issues to the widespread delivery of social health services through electronic means:

1.  The establishment of a support professional / client relationship, particularly online, and the need for agreement on what constitutes informed consent in an online relationship.

2.  Social and health malpractice, with licensure and disciplinary concerns surrounding assistive technology (for instance with Telemedicine) and practice in cyberspace.

3.  Standardisation of practice and client privacy in assistive technology (including support professional/client email messages).

4.  Reimbursement for assistive technology exchanges (Silverman, 2003).

The advantages of the new technology are therefore combined with ethical tensions.  The use of the internet for Telehealth has raised problems stemming from conflicts between various aspects of technology usage and such ethical principles as abridgement of privacy, inaccurate and obsolete data, and security breaches.  The quality and accuracy of online information is of deep concern.  Among the issues that have been noted as important are the following:

1.  How provider or patient-centric is the technology?

2.  Does the shift to remote services promote rationality and efficiency at the expense of values traditionally at the heart of care-giving?

3.  How does the design affect home life and family dynamics?

4. To what extent should technology usage involve attempts to manipulate users into different behaviours?

5. How might the replacement of human contact by new technologies be ameliorated?

6. To what extent is the deployment of technology an end in itself, aimed not towards the improvement of health or well-being, but to create market needs?

7. How do we identify the boundaries between genuine solutions and futility in light of technologies that may shift them?

8. How can those who design technology become more cognisant of and sensitive to humans and all their complexities?

### How to Address the Ethical Considerations

Evaluation needs to include not only technological and economic assessments, but also the long-term effects on personal well-being, the structure of social and health care provision, professional roles and substitution of care (ethical and social aspects of the new technologies). Consequently, evaluation approaches need to be refined to take account of both new technologies and changes in social and health care delivery and to add to the evaluation research repertoire methods for studying computer-mediated communication and social and health care at a distance (Kaplan & Litewka, 2008).

Ethical standards in North America for the rehabilitation of patients, including through the use of assistive technology, have been developed by the Rehabilitation Engineering & Assistive Technology Society of North America (2012). This Code of Ethics is comprised of eight standards:

1. Hold paramount the welfare of persons served professionally.

2. Practice only in their area(s) of competence and maintain high standards.

3. Maintain the confidentiality of privileged information.

4. Engage in no conduct that constitutes a conflict of interest or that adversely reflects on the association and, more broadly, on professional practice.

5. Seek deserved and reasonable remuneration for services.

6. Inform and educate the public on rehabilitation/assistive technology and its applications.

7. Issue public statements in an objective and truthful manner.

8. Comply with the laws and policies that guide professional practice.

A second code directly relevant to the provision of rehabilitation services has also been developed. This is the Canadian Commission on Rehabilitation Counsellor Certification (2002). This code binds together all the factors of ethical issues and the underlying aspects of a service which assist this. While this code is based on a particular role, rehabilitation counsellor, the code could be seen as applicable to any professional working to assist a client to habilitate or rehabilitate in their own community. The code requires rehabilitation counsellors to:

1. Advocate for people with disabilities by addressing physical and attitudinal barriers to full participation in society.

2. Empower consumers by providing them with the information they need to make informed choices about the use the services.

3. Adhere to the principals of confidentiality and privacy.

4. Have professional responsibility.

5. Maintain professional relationships.

6. Provide an excellent evaluation, assessment and interpretation.

7. Make use of teaching, supervision and training.

8. Perform research and publish.

9. Provide technology and distance counselling.

10. Have correct business practices.

11. Resolve ethical issues.

A model of ethical decision-making can be implemented to raise the awareness regarding all stakeholders involved in service provision. Service providers must be responsive to consumers' needs in order to provide ethically responsible and effective services. Good up-front assessment, with the full participation of the consumer, will provide the most useful information with which to plan the services. Being consumer responsive minimises the potential of technology abandonment because of the attention paid to the complimentary match between person and the device. A four-level model of ethical decision-making was developed by Tarvydas et al (1991), and proposed a hierarchical model of ethical practice that could be applied to rehabilitation and its related applications. Critical techno-ethical considerations related to each level are discussed, and summarised in Table 4.4. Techno-ethical in this context implies ethical significance related to the development and use of rehabilitation services. The levels are as follows:

1. **Level One: Client-Professional Relationship Level**. Ethical consideration must be given to clinical assessment of matching consumers with appropriate rehabilitation services. Employing assistive technology that is inappropriate and counter-productive is a violation of the ethical principle of non-malfeasance. In addition, the principles of beneficence (i.e., benefit to the client), justice (fairness to the client's need for technology), and autonomy as related to the notion of client independence clearly apply.

2. **Level Two: Clinical Multidisciplinary Level.** This is operationalised by the relationships between practitioners. Some practitioners may be more adept at employing rehabilitation services to assisting people with disabilities than others. Again, the principals of non-malfeasance apply (i.e., not doing harm by promoting appropriate and informed services to the client's needs) and autonomy (i.e., the promotion of least restrictive functioning for the client). Consideration should be given to resource allocation for continuing education, given the cost of implementing technology. Such determination may blur the lines somewhat between agency specialisations and disciplines, and therefore initially might entail some professional cross-disciplinary political concerns.

3. **Level Three: Institutional/Agency Level.** This is operationalised by the institution/member relationship. Institutions and agencies are responsible for ensuring adequate provision of assistive technology services in an efficient and effective manner. Efficient refers to the use of cost-effective mechanisms that are effective and reliable. To this extent, the ethical principle of justice is met, in that individuals with disabilities will have their rehabilitation service needs met. A final consideration at this level is that technology is rapidly changing, and with it the incumbent necessity to stay informed of these changes. Remedial training and continuing education may be managed ultimately at the organisational level. If agencies are responsible for the training of their professional staff, it follows that they must provide up-to-date and functional information and opportunities for suitable continuing education.

**Table 3.5: Techno-ethical considerations within the four level model**

| Ethical levels | |
|---|---|
| **Level 1: Clinical/AT services:** | Educating consumers of rehabilitation services available |
| Operational context: | Clinical assessment matching consumer to device |
| Client-practitioner: | Beneficence, non-malfeasance, autonomy, fidelity |
| **Level 2: Clinical/interdisciplinary** | Information dissemination |
| Operational context | Resources allocation, pre-service and in-service training |
| Practitioner-practitioner | Justice, fidelity |
| **Level 3: Institutional/agency** | Adequate AT service provision |
| Operational context | Efficient and effective service provision |
| Institution-member | Justice, fidelity |
| **Level 4: Social resources** | Adequacy of resources |
| Public policy | Periodic review and assessment |
| Operational context | Legal issues |
| Legislative-constituent | Reciprocal advocacy, justice |

(Peterson & Murray, 2006; Tarvydas & Cottone, 1991)

4. **Level Four: Societal Resources/Public Policy Level.** This is operationalised by the legislative constituent relationship. When considering the adequacy of resources, a question relating to the principle of justice is: What is adequate? A best-practices approach to rehabilitation service interventions includes consideration of client, agency, and societal resources to access technologies available. Periodic review and assessment involves more formalised procedures for review and assessment of resources versus unmet needs. Quality of life issues may fall into this category, particularly those on the societal level versus an individual level. Additionally, evaluation of money expended compared to outcomes achieved on a periodic, regular, and fair basis, may help to assure that: (a) evaluation is inevitable because it is continuing, and (b) efficient and effective use of resources are realised, which satisfies ethical considerations of justice. Looking at this level in the four-level model employs primarily the ethical principles of justice (i.e., so that greater service needs for persons with disabilities will be achieved) and autonomy (i.e., such that increased resources will be available to facilitate client independence).

Reciprocal advocacy means that legislative leadership must be aware of constituent needs, and constituents must work to stimulate the proportional financial support that is required to meet those needs. Thus, each advocates for the other in a spirit of reciprocal support. It is important to remember that ethical service provision is not the ultimate outcome of all our collaborations, but a vehicle to help achieve more noble goals, including client skill and competency development, and maximum independence. Success in these areas results in increased quality of personal and professional spheres of life for people with disabilities using rehabilitation services (Peterson & Murray, 2006).

Medical deontology provides a set of principles, rules and conducts that any physician or health professional, should observe, or be inspired by during the exercise of his/her profession can be applied by analogy to all support professions. The purpose of a deontology code is to provide guidelines applicable to all professionals, at a country level or even at an international level. In practice, a *table of access rights* can be constructed. The table should not be two by two but with multiple entries. It has to include the *identity* of the requester (a clinician, a nurse, an administrator, a researcher, a physician in an ancillary service, the patient him/herself), to be *authenticated* (for

example by a personal card, allowing a digital signature) and associated to *rights to know* authorisation (France, 1998).

The Royal Academy of Engineering has stated that in their view the important social and ethical questions that need to be raised when considering smart homes for those who are older, experiencing ill health, or disabled are:

1. Is the cost of the autonomy afforded by smart homes social isolating?

2. How can an appropriate balance between independence and companionship be struck?

3. Will vulnerable people understand the nature of the technologies being used in smart homes, and will they be able to consent to their use?

4. Who should control the data generated by systems that monitor people's movements and track their physical and mental well-being? (The Royal Academy of Engineering, 2009).

These questions make it clear that technology and ethics may not always co-exist harmoniously, and that it is necessary to address these issues to ensure the technology supports human values and also reflects socio-cultural considerations. These socio-cultural considerations can present a challenge to the western view of the social model of disability. A challenge has been presented to the perspective that people are or should be independent and self-determinant, instead proposing the view that people are social and reciprocal which then provide a different lens on ethical considerations (Zwijsen, Niemeijer, & Hertogh, 2011).  Lê et al (2012) suggest that in a multi-cultural country like Australia, in which older people come from many different backgrounds, smart homes may be seen as anti-social. For instance, Vietnamese older migrants appreciate collaboration and collectivism, and the idea of independent living does not fit well.

## 3.8 IMPLEMENTATION

"There is no "store-bought" recipe to guide the innovation of complex networked technologies. This is particularly so when the technology is to be used by an array of professionals, by formal and informal carers and by vulnerable people reliant on locally provided services". (Tony Kinder, 2000)(pg 72). Although that was said in 2000, this comment stills appears to be correct. More than 75% of telemedicine initiatives fail during the operational phase. The implementation of telemedicine initiatives in regular health-care practice is difficult  (Broens et al., 2007).

### DETERMINANTS OF IMPLEMENTATION SUCCESS

The phases of assistive technology implementation are: emergence, adoption, adaptation, acceptance, routinisation, and diffusion (M. P. Gagnon, et al., 2008). The determinants of success have been determined to be:

### TECHNOLOGY

- Support is a major issue for technological acceptance of assistive technology systems.  Support is needed during both the deployment and operational phases. Support needs to be at the technical level on how to install and sustain the system and also on how to deal with errors and problems. If this support is not in place, problems lead to de-motivation and a high probability of abandoning the system.

- Training is needed at all levels: for managers and others who need to interpret the data; clinicians who need to read vital signs; social and health professionals who have to administer the practical components of the system.

- Easy usability is vital. Clients need to be comfortable wearing devices that should not hinder their daily life. Staff should be able to operate the devices and have flexible access.

- The quality of the equipment can be a major barrier. Non-connecting or malfunctioning devices, power loss and cable breakages all lead to distrust by users and low levels of dissatisfaction.

### ACCEPTANCE

- The attitude of those involved is crucial.  For them to be positive the equipment must be easy to use (Wade, Cartwright & Shaw 2012). For this reason involvement by the client and professionals in analysis and design is crucial to encourage feelings of ownership, enjoyment, self-efficacy and pride early in the development process. For acceptance, information that is gained through the use of the technology must be meaningful (correct, relevant and up-to-date) and ideally personalised as necessary for the clients and the professionals.  The level of education, age and previous computer experience of each person involved should be considered.

- Evidence based practice is necessary for all stakeholders to be convinced.

- Diffusion and dissemination is difficult if equipment is highly specialised to particular population groups.  Implementation will be easier when the technology is generic to a number of client populations and all interested parties are familiar with the intervention.

- There are usually two phases of introduction.  The first is enthusiasm; the second is consideration. Initial enthusiasm creates impetus to support the introduction of the intervention, but after implementation has taken place, there will be rejection and a diminishing of support if some stakeholders consider the impact of the interventions to be negative or disappointing.

### FINANCING

- A financing structure for the intervention needs to be developed that will sustain the intervention beyond the research or 'pilot' stage.

### ORGANISATION

- Working protocols are frequently lacking for assistive technology. The structure of service and health organisations may be impacted on as well as collaborations with other organisations. The novel work practices needed for an effective model of support using assistive technology do not always fit with existing traditional working protocols in health care. Intramural and extramural work practices may need to change, and new work policies developed.

### POLICY AND LEGISLATION

- As described in the section above on Policy, work must be done on policy, legislation, standardisation, and security  (Broens, et al., 2007)

### CO-PRODUCTION

One core principle of successful implementation of assistive technology support for people with disabilities would seem to be summed up by the term 'co-production', the design and/or delivery of services by some combination of state and non-state agents, involving active participation by communities using innovative forms of state support to deliver services.  Co-production empowers local spatial communities, raises social capital, and strengthens local infrastructure  (Tony  Kinder, 2010).  A case study example of what is reported as being successful implementation of an assistive technology program is the delivery of a Care Coordination/Home Telehealth (CCHT) program in rural or remote locations to military veterans in the United States of America by the Veterans Hospitals Association (VHA). In 2010, 40% of 43,000 veterans were receiving care through the CCHT program.

The number of over 80 year olds had tripled since 2000. From a cost-economic point of view, there have been direct benefits in reduction of need for long-term institutional care and reduction of hospital admissions. There have been reductions in haemoglobin A1c, with high levels of patient satisfaction and no diminishing of health status. The technology has been described as actually supporting relationships between the patient and the care coordinator, acting as a facilitator in the relationship. About 10% of patients would prefer traditional face-to-face care, which the program director has interpreted as meaning 90% are happy. Mean satisfaction scores are 85%. Patients' self-management was very important to implementing the program. VHA developed an algorithm to match patients to the appropriate technology. Technologies include messaging, monitoring and videoconferencing into the home and acquiring images from the home. Relatively simple push-button technologies that are tried and trusted have been used, and they are implemented systematically. Some technology is over engineered. It needs to be kept relatively simple and straightforward, paying heed to issues such as size of text, use of buttons, etc. The technology must support the patient and the clinicians in an uncomplicated way.

Therefore, adoption has not been based on a command and control approach. It has been implementation driven at a local clinical level because of the immediate benefits: reduced utilisation, client satisfaction and helping people live independently in their own homes. They have deliberately not created a new clinical silo. There has been a clear vision of how the technology is going to be used, which is not focused implementing a new technology, but identifying an issue and thinking technology could be a useful as part of the solution. This means the assistive technology program needs to be integrated into the organisation(s) providing services, not a small orphaned siloed program.

It has been found that resistance is usually from clinicians in the form of initial reticence. The emphasis on program outcomes and patient satisfaction as well as robust training has helped overcome this resistance. A number of staff who started the program have moved into more senior levels of management and become champions. Over more than 6 years a master preceptor cadre has developed, key individuals who help solve programmatic issues at the local level and serve as ambassadors for the program. This has profoundly helped organisational level information about the program grow, with buy-in and understanding.

The approach has been one with an ideal that care should be standardised so each client would get the same care wherever in the VHA system. The basic model is one in which a care coordinator, typically an Registered Nurse or social worker, supports a group of 100 – 150 clients, not providing direct hands-on care, but monitoring, supporting education and self-management, determining if someone is deteriorating and if so guiding them and intervening to help prevent avoidable hospital admissions. It has been found vital to have an electronic patient record as it enables just-in-time decisions. Using home telehealth provides a longitudinal record that is better adapted to managing chronic disease than a hospital's record.

### TRAINING

The other key aspect is that training is vital. VHA have found it takes three weeks for a new clinician to be comfortable with the approach. All the training is done virtually (Lindeman, 2010). A recent review of key factors influencing the successful implementation of telecare programs identified what they terms 10 influencers in Table 3.5.

**Table 3.6: Influencers of successful implementation of telecare**

| Reference | Description |
|---|---|
| **In the technological context:** | |
| Influencer 1: | Stability and reliability of the technology was crucial in service delivery and adoption of the technology. |
| Influencer 2: | The experience of the technology partner is seen as important.  Experienced suppliers are expected to be better able to deliver reliable support and technology, leading to higher acceptance during the implementation stages for nurses and clients. |
| Influencer 3: | There needs to be a high level of content-goal alignment, that is, the content provided through the technology infrastructure must match the goals of the organisations involved and the services that are to be provided ("It took us some time to realise that it is of little use thinking in terms of illnesses or treatment characteristics in defining appropriate content. Instead we evaluated different sets of needs independent of client characteristics and matched appropriate services that could be supplied using the video communication application. Then we evaluated and discussed the needs with each client ...." (Project manager). |
| **In the external context** | |
| Influencer 4: | There needs to be stability of infrastructural and operational financing.  This is difficult because there may be considerable costs during the design and implementation period, not all of which are covered by the funder. |
| Influencer 5: | The level and structure of service collaboration was perceived as a major factor in speeding up implementation.  Since the development can be somewhat haphazard, collaboration with others in content groups appears to be beneficial, from the perspective of learning from others and sharing experiences. |
| **In the user context: There must be an innovation –value fit.** | |
| Influencer 6: | There must be alignment between the virtual and the physical care aspects of the service. Care professionals greatly appreciate personal contact with clients. This presented a source of resistance towards video communication. It is important to position services not as a replacement of physical care, but as an enhancement of quality of care, e.g. instead of one actual visit, three virtual visits can take place. On equate given as an example was the following: "because of the technology we are now able to have more contact moments with distant clients that is highly appreciated and contributes to reduction of feelings of loneliness" (Nurse). |
| Influencer 7: | There needs to be continuous assessment of the direct and indirect effects of virtual service delivery on all user groups.  The innovation must fit with the client's changing daily activities and needs and those of the primary caregivers, with this fit achieved through closely continuous involvement of the various stakeholders.  Reasons for resistance from stakeholders arise mainly from a lack of conviction that the technology can actually improve the quality of care or indeed provide care services at all.  Virtual service delivery must be of added value to all clients, employees and primary caregivers involved, and clearly formulating and communicating these benefits enhances the success of implementation. |
| **In the context of the organisational climate** | |

| Reference | Description |
|---|---|
| Influencer 8: | A comprehensive framework for support needs to be available, with sufficient top management support and a basic set of procedures. Top management needs to be closely involved and affiliated with the project, showing that they strongly believe in its benefits. If operational protocols are not clear or not adhered to this has been shown to lead to misunderstandings and impromptu decision making. This can lead to differences in service provision across teams, complicating coordination. |
| **The implementation strategy** | |
| Influencer 9: | A high level of involvement is needed along with goal alignment. A mismatch between goals and strategy leads to poor performance. There needs to be proper involvement of both clients and personnel. |
| Influencer 10: | Orchestrating champion-led rollout is useful. The best way to overcome resistance is to continuously promote the services through enthusiastic ambassadors. During the design phase the partners are the clients and the technology supplier. During implementation, the key stakeholder is the one in close physical contact with the client (primary caregivers); this championing role seems to be crucial in convincing users to actually utilise the technology and in removing reservations. The local care teams attitude is a decisive success factor during the final stages of implementation(Postema, et al., 2012). |

### ACCELERATING DIFFUSION OF PROVEN TECHNOLOGIES (ADOPT) MODEL

When considering the issue of technology diffusion to older people, some unique considerations are necessary for this population as they can be expected to have a lower level of familiarity with new technology than younger populations (Wang, Redington, Steinmetz, & Lindeman, 2010) . The avenue for technology adoption may well be social and health service providers rather than workplaces or educational facilities. The technology may also be used in many cases by caregivers or other collaborators. Wang et all therefore developed what they called the ADOPT Model: Accelerating Diffusion of Proven Technologies for older adults. In their view there are seven diffusion strategies that need to be considered. These are:

1. **Is the design of the technology relevant and user-friendly?** In their view, older adults tend to use technology to reach a goal or realise a benefit, rather than for the sake of using technology. This means the perceived usefulness and ease of use are very important.

2. **What is the value of the technology?** Reimbursement for technology is a critical part of driving wider technology diffusion. In their view, at the moment closed or integrated support systems and accountable care organisations, such as the Veterans Hospitals Association and Kaiser Permanente in the United States of America, have business models that promote the use of remote client monitoring systems because they have the largest financial incentives to use new technologies to promote healthier behaviours, disease management methods, and care co-ordination.

3. **Is there a sustainable business model?** Developing a strong business model as early as possible is necessary for successful and sustainable technology diffusion. This includes finding proper mechanisms for supporting business partners (though payments, grants, partnerships, reimbursement, or other sources), as well as making the technology affordable to clients. Financial concerns are among the largest barriers to assistive technology adoption, as many clients and providers have significant financial constraints.

4. **Is the technology promoted to users and service providers?** While it is important to have user-friendly technology that is value–for-money, it is also necessary to market the technology effectively.

5. **Have partnerships been formed to allow for scale in the diffusion process?** Trying to diffuse technologies through solo technology providers and individuals can be extremely challenging both monetarily and in terms of time.

6. **Have technology champions been identified?**

7. **Is there a process to coach users?**

Attention must also be given to the relationship between the users and healthcare providers, as well as the communication skills healthcare providers need to have when they provide remote caring (Solli, et al., 2012). Participatory and persuasive assistive technologies are two concepts that have been presented as requirement for effective implementation into the current health and social service delivery framework.

Certain groups may be resistant to change, which can reduce the efficacy of assistive technology systems. Older people may be the moist resistant group. Therefore participatory and persuasive technology is required to reduce and/or combat this resistance and promote healthy lifestyles. Social networking systems can be used to add a persuasive influence to alter behaviour and promote effective interventions. The effectiveness of assistive technology can be limited by its dependence on sensory and medical devices to collect vital signs and provide data collection and monitoring of these unless there is also a focus on affecting or altering behaviours which can maintain well-being related changes longer term for people and offer more effective and meaningful interactions between the client, support professionals and the client's support network. Social networking with web 2.0 technologies and methods is one way to deal with this issue. There are several online forums and groups that connect clients who have similar diseases and chronic conditions and encourage the exchange of information or inform the user about their conditions etc. e.g. Patientslikeme, SenseFace. These web portals enable patients to manage their own records and share them with the support professionals. The hypothesis is that this enables clients to be actively involved in their own care and also includes their wider social networks. The idea of using a social networking system in the assistive technology area is that this approach can include the person's family, friends and neighbours, which supports a participatory approach to wellbeing. Such an approach may be more likely to be more current for those people already frequent users of technology (younger populations, those with physical disabilities and assistive technology supports that have been a part of their life in order to carry out activities of daily living). The Web 2 technology enables the person to produce and assemble content in a new way that works for them. Their extended care networks can check into the monitoring system, which has been configured to meet the person's care needs, and see how the person is going and support their on-going wellbeing and delivery of their care (D. Lee, Helal, Anton, De Deugd, & Smith, 2012).

Older primary care patients have in fact been shown to be amendable to using the internet as a means to support or improve their health care, although as in every aspect of this topic further research is needed in the area of how these resources can be most useful for the older adult to support their health and wellbeing regime (Crabb, Rafie, & Weingardt, 2012).

From the systems perspective, integrating assistive technology systems into health and social service delivery represents a high-impact topic. Increasing system complexity, the interaction of multiple systems, and interaction with the physical world are major challenges. Key considerations when addressing increasing system complexity include function, integration, networking, interoperability, security, technology management, assurance, certification, reliance on software, and usability. The assistive technology system requires integration of techniques, including interoperability of medical devices, electronic data collection, personal health records, and other technologies. Trust management is crucial to adoption and sustainability of systems. Secure, dependable, real-time communication networks with quality of service guarantees, and interference-resistant wireless networks are needed to increase adoption of assistive technology systems (Michael J. Ackerman,

Rosemarie Filart, Lawrence P. Burgess, Insup Lee, & Ronald K. Poropatich, 2010b). Costs from the payer's perspective are shown in Table 3.7 below.

**Table 3.7: Costs from the payer's perspective**

|  |  Direct social and health care costs | Indirect costs |
| --- | --- | --- |
| **In-office** | Social and health professional consultation | • Administrative work<br>• scheduling<br>• data entry to electronic record<br>• report preparation and mailing<br>• billing |
|  | Sickness allowance | • Transportation |
|  |  | • Accommodation, meals |
| **Remote follow-up** | Home transmitter | • Administrative work<br>• data entry to electronic record |
|  | Social and health professional consultation | • report preparation and mailing<br>• billing |
|  |  | • Client education |
|  |  | • Phone transmissions |

Source: (Burri, et al., 2011)

For the device manufacturer, the cost of the home transmitter hardware is only a fraction of that of the service provided. Maintenance of the server database, telecommunication costs, and staffing of the technical support helpline (especially as this has to be provided in multiple local languages in Europe), all come at a significant cost. It is unlikely that an increase in numbers of patients on remote monitoring will reduce prices, as service costs will also increase proportionately. However, as remote device management is anticipated to become the standard of care in the near future, device companies have a marketing interest in proposing efficient telemonitoring systems (Burri, et al., 2011).

Cost savings of $4.3 billion a year have been modelled if telehealth were implemented to facilitate consultations between healthcare providers in the USA, with this figure not even including the provision of care directly to the client (Cusack et al., 2008). However, delivering these results in the real world is still being tested. Given the wide range of types of telehealth services provided, with different technologies, definitions, and measurement factors, one research team decided to concentrate on reviewing the delivery of health services via synchronous real time, as opposed to asynchronous delayed store-and-forward, video communication (Wade, et al., 2010). They found such communication was cost-effective for home care and access to on-call hospital specialists, showed mixed results for rural service delivery, and was not cost-effective for local delivery of services between hospitals and primary care. In rural areas the key factor was that the health services paid more for telehealth, but there were demonstrated costs savings from reductions in client travel. Where there were savings for both the service provider and the client, the service providers were paying for care workers to travel.

## 3.9  USE IN RURAL SETTINGS

A qualitative research project has shown that video telehealth used from local clinics can be seen to be an effective mechanism for delivering nursing and other health services to rural and remote communities with a positive impact on the quality of health care  (Shore et al., 2012).  The main

benefits for clients and their families were reported as focused on three key themes: lessening the burden (costs of travel, accommodation issues, lost wages, lost time) maximising supports (access to family, friends, familiar home environment, and care providers) and the need for assistive technology systems to be tailored to enhance client and family needs. This study has been supported by a pragmatic evaluation of remote monitoring technology in a real-world setting (Hicks, Fleming, & Desaulnier, 2009).  Using qualitative and quantitative approaches, but with no control group, they found that both clients and providers were very satisfied with the service provided. They all felt that it was easy to communicate and that the technology was easy and convenient to use.  Clients felt that the technology had a positive impact on the provider-client relationship and improved the quality of care. There was a suggestion that hospitalizations were reduced along with personnel expenses.

A recent review of telecommunications (Ipsen, Rigles, Arnold, & Seekins, 2012) describes telecommunication as a cost-saving alternative to face-to-face vocational rehabilitation (VR) service delivery, but with little known about current use. Using an online survey approach, this study found that counsellors with a higher rural caseload mix engaged in significantly less email telecommunication during the VR process.  A key issue was that rural clients as compared with urban clients were characterized as having less personal access to a computer with Internet, so that strategies to address this barrier are needed to expand telecommunication use during the VR process.

One system organised and financed on geographical boundaries has been examined to assess the ability of telehealth services to minimize barriers that rural and remote areas created.  Despite high hopes that telehealth would improve access to these areas, gate-keeping inherent in certain telehealth systems imposed barriers to unfettered use.  It was found that policy approaches were needed to promote a closer match between the expectations for telehealth and the realities reflected by many existing models (Kraetschmer, Deber, Dick, & Jennett, 2009).

When considering the cost effectiveness of assistive technology programs or evaluating outcomes for rural or other areas, it is important to clarify what type of technology is utilised as well.  That is, many researchers and practitioners have the expectation that assistive technology has to be "tech heavy," but this is not necessarily always the case.  The time has come for the federal government, individual states, communications companies and health and social care providers and facilities to coordinate their efforts to take full advantage of the opportunities offered by assistive technology, and make health care more accessible to rural residents, particularly older rural residents (Goins, Kategile, & Dudley, 2008).

The factors covered in the next section, Indigenous use, also in many aspects relate to rural and remote areas.

## 3.10   INDIGENOUS USE

"The speed with which residents have adopted 3G phones runs counter to the argument that Indigenous people need careful initiation into new technology and time to construct it in personal terms...This study indicates that if indigenous people want a technology and can afford it, they will adopt it" (Dyson & Brady, 2009), pg 172.

"The mobile phone is another example of Indigenous Australians adopting and adapting western technologies, and it is time that those charged working to a better future cease to be convinced they are not capable of doing so in order to harness their full potential for meeting individual aspirations" (Taylor, 2012), pg 289.

The evidence is clear that indigenous populations in all parts of the world have shown rapid uptake rates for mobile ICTs, including mobile phones and laptops. Four main themes have emerged from the literature about the impacts and benefits of this new technology in these culturally specific contexts:

1.  Access and Cost: Even where infrastructure and services have been forthcoming, low incomes may be an inhibitor to uptake;

2.  Local consultation and collaboration: a lack of engagement with local leaders and the community is a commonly cited reason for the failure of local ICT initiatives;

3.  Issues of gender: In some communities females have not been afforded equal access to ICT;

4.  Impacts on culture: New ICTs have been criticised for enhancing individualism and altering societal norms, undermining hierarchies and deteriorating traditional means of communication.

Basically there has been scepticism about the benefits of ICT rollouts to remote Indigenous populations.

However, many benefits for Indigenous peoples from ICTs have also been identified. These have been summarised as developmental – more efficient delivery of services and programs to target populations, cultural and individual outcomes. From a sociological perspective, ICT has been reported as well regarded for enabling individuals to achieve their goals within a non-hierarchical and flexible environment and without the limitations of prejudice (Taylor, 2012).

A review of the provision of providing mental healthcare to American Indians and Alaskan Northerners in rural locations on tribal or Alaska native lands, identified the challenges of these potentially harsh environments as including access to care, healthcare provider recruitment and retention, access to culturally appropriate care, underfunded healthcare resources, and often geographically isolated and dispersed communities. Focusing on American Indians with mental health issues following military service, the Department of Veterans Affairs established a series of videoconferencing-based clinics to reach this vulnerable population. The clinical feasibility of the services has now been clearly established, with high degrees of patient and provider acceptance and satisfaction. The diagnostic reliability of video-conferencing has been supported by a randomised controlled trial. The review reported that some of the most important lessons to emerge is recognition of the impact that video-conferencing has on patient-provider relationships and the clinical process, including the importance of modifications for cultural considerations. The larger relationship with the local tribal community is of equal importance to the individual patient-provider relationship. Without respect, trust, and community alliance, patients are not comfortable engaging in treatment. The lessons learned from the American Indian Veteran Tele-mental Health Clinics have been both administrative and clinical. Administratively, it is reported that multi-organisation collaborations are essential, but also possible and desirable; that the right configuration of organisational partners is critical with clear roles, responsibilities and processes of communication; that the overall administration structure needs to be consistent but with enough flexibility to meet the needs of individual patient sites; and that having a local facilitator between tribal-based organisations and official government systems is important. Clinically, it is important that there is formal and informal care cooperation within and between the systems of care for the patient; that an electronic medical and care record serves as an important communication tool for care coordination; that attention must be paid to the cultural impact on clinical processes and cultural adaptation of the patient site; and that the primary treatment/care providers build long-term service approach rapport, engagement and trust (Shore et al., 2012).

## 3.11   OUTCOMES FOR CLIENTS

Users who can benefit from smart assistive technologies are:

1.  People living alone who are unable to seek help in emergencies (unconsciousness, falls, strokes, myocardial infarction, etc.).

2.  Older or disabled people who suffer from cognitive (Alzheimer disease, dementia, etc.) and/or physical (visual, hearing, mobility, speech, etc.) impairment.

3. People who need help in daily life to perform personal care activities (eating, toileting, getting dressed, bathing, etc.) and instrumental activities (cooking healthy meals, dealing with medication, and doing laundry).

4. Informal (family, friends, neighbour people) or formal (care provider) caregivers for older people or the disabled.

5. People living in rural and remote communities or in urban communities with inadequate health and social service provision.

6. People who suffer from chronic disease, and who need continuous monitoring (diabetes, cancer, cardiovascular disease, asthma, COPD, etc.).

7. People involved in telehealth care undertaking health care at a distance or telemedicine, with health and social service professionals practising 'virtual visits' (Chan, et al., 2009).

A recent study (Shea & Chamoff, 2012) showed that frequent communication between a remote health professional and a patient via telephone may lead that health professional to believe patients are integrating blood pressure, weight, and other information into daily self-care behaviours, but this appears to be a halo effect clouding the health professionals perception of what is actually happening. Patients have reported that this integration into their daily lives is not in fact happening. Best practice therefore should include explicit goals and intentions for remote monitoring of care with individualised instructions about how to use the information for self-care. One of the interesting findings in this study was that 70% of health professionals thought that when remote monitoring they, the patient and any home helper had the same goals, while only 25% of patients had the same view. There were also wide differences between patients in how useful they thought the information from the remote monitoring was. Shea and Chamoff speculate that some patients may consider that the remote monitoring enables them to rely on that remote health professional rather than self-manage. They suspect this is even more so if the patient sees the information as generic and not applicable to their own lives.

In a telemonitoring program for people with asthma, led by nurses, patient satisfaction was high and after one year less than 20% of participants had chosen to discontinue their participation (Willems et al., 2007). In another pilot telerehabilitation study with 10 clients who had who had an arm motor impairment following a stroke, the degree of satisfaction for those who received a virtual reality therapy program at home was compared to those who received the same virtual reality therapy in a hospital. The rehabilitation equipment was installed in the client's home using 4 lines of connection. The rehab data was transmitted via one line and videoconferencing accessed the other 3. The study showed that both groups were satisfied with the delivery of rehabilitation in terms of quality of treatment, user-friendliness of the equipment and the patient-therapist relationship. The level of satisfaction for the therapist explaining the treatment was higher in the tele therapy home group. Both groups had good improvement in arm motor performance with no significant difference between them. This was attributed more to the arm rehabilitation approach rather than where or how the rehab was delivered (Piron et al., 2008).

A systematic review of clinical outcomes, clinical process, healthcare utilization and costs associated with telerehabilitation, found 28 studies with 82% of them reporting positive clinical outcomes following telerehabilitation intervention. The types of telerehabilitation reported in the studies included: rehabilitation of the community-dwelling older or disabled population; follow up of patients with spinal cord injury; neurological rehabilitation; cardiac rehabilitation; and speech or language rehabilitation. The studies found overall positive support for telerehabilitation programs in terms of perceived benefits, convenience and usefulness. Where there were complaints from either the patient or therapist they related to the quality of video transmission, scheduling issues and difficulties in using the technology with more active clients and shy children. There was no clear or definitive evidence found regarding the effect of telerehabilitation on healthcare utilization. This study found that there

were generally unsatisfactory findings relating to client satisfaction, by which they meant how this concept is defined and measured. The findings in the studies they reviewed were generally limited to the technology and with the service received/given and did not specify aspects of the service delivery or the clients or therapist/practitioners experience in the program. They recommended that there need to be studies of user ability trials with specific assistive technology equipment for specific conditions or client groups over long periods of time. They considered that sustainability factors of assistive technology do not seem to have been studied (Kairy, Lehoux, Vincent, & Visintin, 2009).

## 3.12 BARRIERS AND SUCCESS FACTORS

The following is a summary of many of the factors already presented in previous sections.

Overall, end-user adoption of assistive technology is challenged by the need for the integration of new technologies in clinical practice workflow and daily activities. Adoption requires cultural and behavioural changes for use and reliance on smart assistive technologies. The lack of standard metrics for quality of service assessment impedes the evaluation and obscures the progress of technology adoption and utility. From the client's perspective, the usability and ease-of-access to technologies are obstructed by the lack of technology integration, interoperability, and standardization. For example, though assistive technology vendors and vendor resources could provide low-cost solutions as data are transmitted through their ubiquitous networks, some telecommunications providers might also limit expansion of applications and affordability for such things as cell phone text and data transmission for economic reasons.

From the service providers' perspective, there is limited time available to respond to the multitude of electronic data from patients and to enter data into data systems. A pervasive barrier for these end users to secure new tools and technologies is the limited financing available for implementation, maintenance, and sustainability. From the data perspective, limited access and limited data flow impede progress. Data flow into service provider centres is strictly regulated, making the main data repository's difficult to access and utilize for their true value with ongoing data mining and automated decision support. Failure to address data integration will limit the proliferation of client-centric assistive technology tools. The lack of data standards coupled with issues of security, privacy, and trust remain barriers to data collection, compilation, and transmission between health and social service providers, thus frustrating efforts to coordinate care.

These barriers also hinder access to data for research purposes. Moreover, limited funding resources remain a barrier for data analysis, integration, and automated decision support. From a systems perspective, proliferation of stand-alone systems, non-integrated data, and disparate databases provides an infrastructure poised for collapse and end-user discontent. Lack of interoperability limits data sharing, utilization, and the comparison of data, algorithms, and approaches. Electronic record systems do not currently facilitate data integration and automated analysis. There are no clinical standards for automated decision support, such as agreement in alarm and trend setting of devices. System developers and administrators are well aware of the time and cost limitations for improved validation and certification within computerized assistive technology systems (Ackerman, et al., 2010b).

## 3.13 ISSUES FOR FURTHER CONSIDERATION

The fact that the evidence base for assistive technology is still not strong makes it clear that ongoing research is needed. For a government or funder or service provider that is seeking to implement assistive technology as a means of providing a better support service to their populations, this means that research and evaluation should be built in to all their endeavours, so that over time they will be able to assess the impact of their service models within a service improvement framework.

Perhaps one of the core issues that need to be addressed is identification of key criteria for evaluating success. Decision makers require useful indicators to determine whether innovative assistive technology programs have been successful or not in comparison with other programs. This means that when considering new programs and then when evaluating implemented programs, the major considerations must be evaluation of outcomes for clients, especially effectiveness and safety, client satisfaction, and cost effectiveness (Jackson & McCLean, 2012). To progress an ongoing program of implementation of assistive technology, one of the first steps recommended from this review would be the development of an evaluation matrix that contains all the elements that are necessary for evaluating success. Adopting this strategy at the beginning of the process will provide the Queensland (and other) Governments with the information they need for decision making in the future.

## 3.14  BEST PRACTICE

The state of the evidence presented in this literature review makes it clear that there is no state of best practice that has been definitively identified for assistive technology. However, there are clear processes that can be followed to ensure that decisions are made on a rational logical basis, that implementation processes are well designed, and that performance management and evaluation is based on agreed critical success factors. Kamal (2006) reviewed a number of IT innovation processes and developed a model eight stages of innovation adoption process. Theses stages are:

- Motivation towards innovation;

- Specific conception about innovation;

- A formal proposal to the rest of the organisation about innovation adoption;

- Actual adoption decision stage;

- Implementation of innovation in the organisation;

- Confirmation of innovation idea;

- User acceptance of the technology, i.e. actual use of the innovative technology within the

- Organisation; and

- Integrating innovative technology with other information system applications.

Motivation signifies the state when an organisation becomes aware of a specific innovation and attempts to acquire knowledge about this innovation, and further leads to motivating the organisation in ascertaining an attitude towards its adoption.

**Figure 3.6: A novel taxonomy of IT innovation adoption processes (Kamal, 2006)**
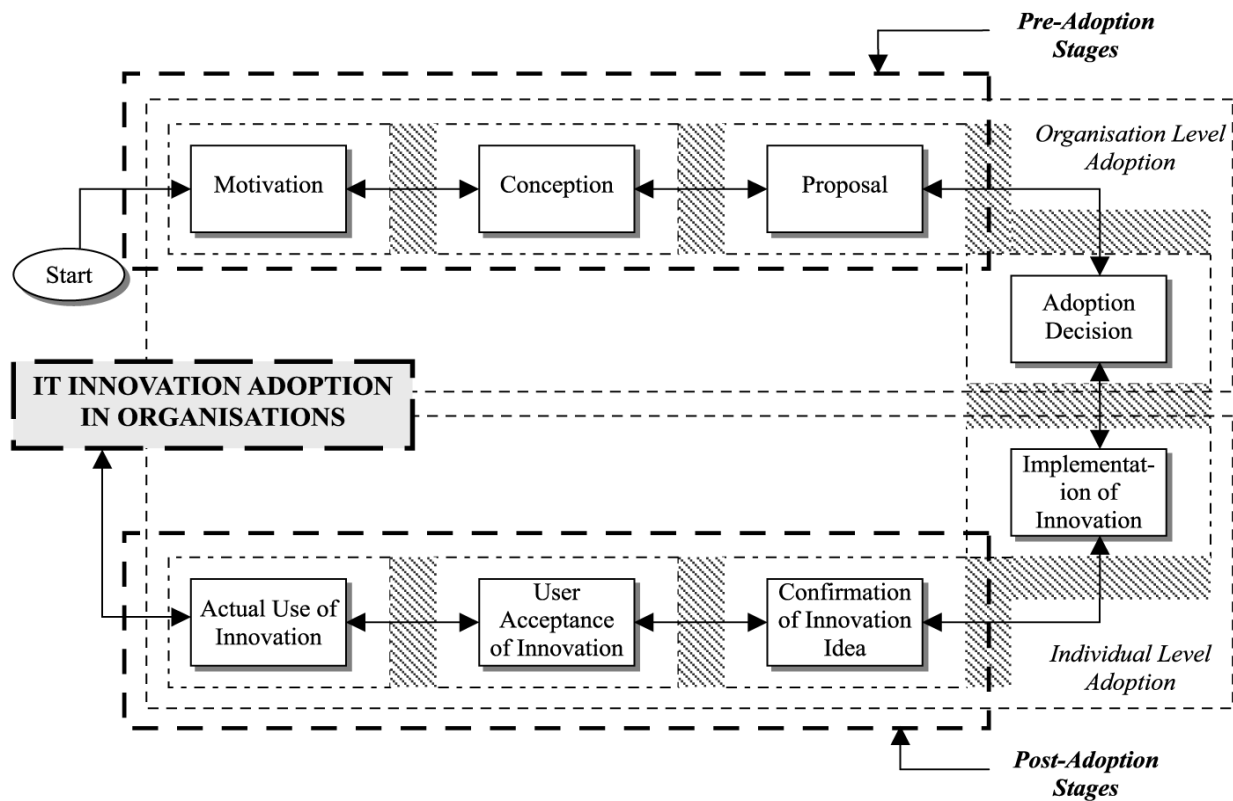


Kamal also developed an IT innovation model for the government sector based on research findings regarding organisational innovation adoption in private and government organisations. The author identified a set of factors that have been found to be an influence at two levels of the organisation – i.e. the adoption of innovation at the organisational level and the acceptance and impact of IT innovation on the individual adopter level within the organisation.

**Figure 3.4: IT innovation (Kamal, 2006)**
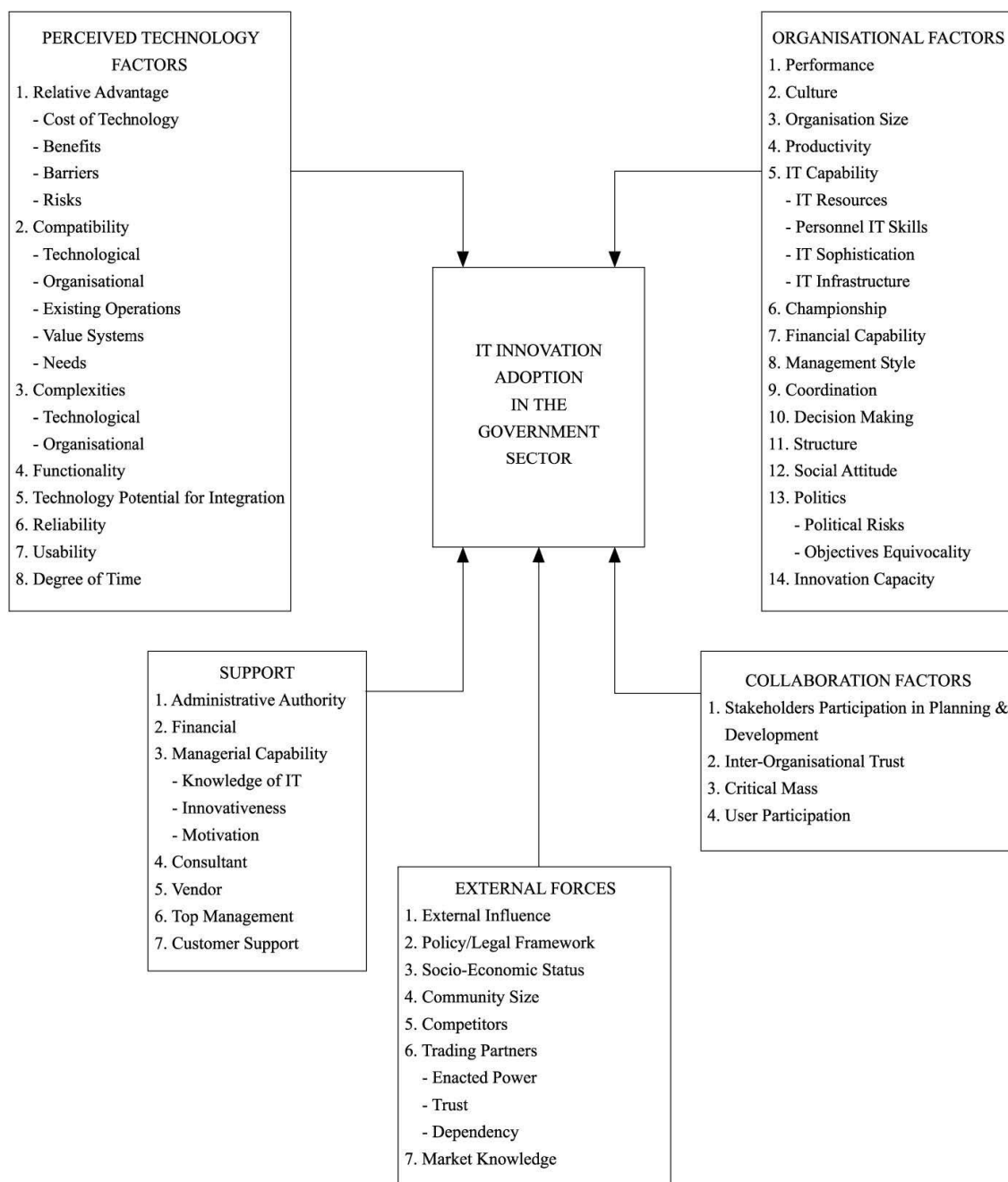


Achieving successful change in an organised vision driven manner is well recognised as difficult (Kee & Newcomer, 2008), especially in the health and disability support services sector, which consists of networks operating across organisational structures. People work across boundaries that exist among professional groupings as well as between the community, primary and secondary health and disability services sectors (Glouberman & Mintzberg, 2001a, 2001b; Marshak & Grant, 2008; Powell, 1990). Engaging will all key sectors will therefore be important for success. One approach may be to operate from Kamal's eight-step innovation adoption processes model, and within each step considering both the factors Kamal's IT innovation adoption in the government sector factors plus the

factors in the Dependability Model Domestic Systems (DMDS) model (Sommerville & Dewsbury, 2007).

One factor to note is that there has been a clearly identified benefit in having a critical mass of organisations adopting the same technology as one aspect of inter-organisational relationships and technology adoption (Chwelos et al., 2001, cited in Kamal (2006). This may be related to another research finding that mutual inter-organisational trust is a precondition to sharing information (Dawes, 1996; Landsbergen and Wolken, 2001, cited in Kamal (2006). Best practice in developing a regional approach to assistive technology innovation that might lead to standardised practice would therefore seems to start with Kamal's motivation and conception stages, followed by agreed implementation processes and then agreed performance management and evaluation measures. Decision-makers, including funders, providers and service users, require useful indicators to determine success or failure of novel assistive technology applications. Identifying the evaluation criteria considered most important by assistive technology developers in specific contexts will enable better early stage assessment of novel applications and help identify the most useful key performance metrics (Jackson & McCLean, 2012).

## 3.15 SUMMARY LITERATURE REVIEW FINDINGS

The purpose of this literature review was to assist with the development of an evidence base for the implementation of assistive technology. In this literature review it has been noted that the reality is that there are still a number of important questions that remain unanswered, whether that be at a client, service provider, or policy level (Jarvis-Selinger & Bates, 2009). Despite this, guidance can still be taken for the research completed to date and policy makers, funders and service providers have to find a path that suits their particular context, understanding that there is no "right" answer at this particular moment in the development of smart assistive technologies. However, with the speed of development in new technologies, it is clear that they will be part of the future of service delivery to assist people with support needs.

The key conclusions from the literature review can be summarised as:

1.  The assistive technology definition used by the State of Queensland

    –   technology to enhance safety, independence and quality of life for people with a disability;

    –   technology applications to increase efficiencies in direct client service delivery; and

    –   technology applications to achieve greater integration across service providers.

    Meets requirements for a definition in the area of electronic technology that is used to support people's health and wellbeing well, and incorporates all the elements of the many definitions used in the literature.

2.  The introduction of assistive technology is often carried out in a context of uncertainty in which several alternatives are possible, because reasonable evidence on the effectiveness, efficiency and costs of the technology is not available. A major issue for stakeholders is that they are able to discuss and decide which decision-making criteria should be used in the selection of promising assistive technology applications. The decision-making should be rational, requiring a multi-criteria framework. Key dimensions need to include technical feasibility, legal and ethical issues, clinical effectiveness, economics, equity of access, acceptance by providers and patients, and organisational impacts. The decision should be fair, accountable and transparent. Lastly the process should be efficient, using a two-stage decision-making process requiring applicants to submit a limited outline proposal, followed by a full briefing of the selected assessed proposals. Additionally, contextual sustainability, which means paying respect to ethical and legal

requirements, is necessary for the long-term use of assistive technology applications (Zanaboni & Lettieri, 2011).

With all that in mind, work must be done on policy, legislation, standardisation, and security to address all of these matters. (Broens, et al., 2007).

3. The economic evaluation of assistive technology is hampered by a number of obstacles:

   – Paucity of available data regarding clinical effectiveness, efficacy, and costs, requiring assumptions that decrease robustness of the analyses.

   – The multitude of parameters that affect cost in this field, and the in homogeneity of these parameters (e.g. variations in distances travelled, different reimbursement policies, etc.). This is particularly true in Europe.

   – Possible differences in performance between systems that may affect the drivers of economic models.

   – Medical and disability support devices and communication technology are in constant evolution, making it difficult to make mid- or long-term projections of cost (Myhill, et al., 2008).

Cost savings of $4.3 billion a year have been modelled for the use of telehealth if it were to be implemented to facilitate consultations between healthcare providers in the USA, with this figure not even including the provision of care directly to the client (Cusack, et al., 2008). Delivering these sort of results in the real world is still being tested, although reports from the Veterans Health Administration suggest that savings are possible.

4. Ethical considerations are perhaps the most frequently mentioned concerns when discussing assistive technology. The two dimensions most highlighted are privacy and trust. There is a major concern that technologies are being developed to perform functions, for example, 24/7 home monitoring, because the technology can do it, rather than it being necessary or desirable. Ethics should be used as a veto point to decide between what we can do and what we should do. The use of ethics to determine how best to use smart technologies in social and health care can assist when the issue of privacy is identified as a major concern. Questions that have been considered are: How much personal information is collected, who manages and has access to these data? Where does an individual's right start and stop? If data are available to improve patients' health and healthcare overall, should it be used, and to what extent if it risks individual rights? (Coughlin, 1992). There are four primary areas presenting ethical and moral issues to the widespread delivery of social health services through electronic means:

   – The establishment of a support professional / client relationship, particularly online, and the need for agreement on what constitutes informed consent in an online relationship.

   – Social and health malpractice, with licensure and disciplinary concerns surrounding assistive technology (for instance with Telemedicine) and practice in cyberspace.

   – Standardisation of practice and client privacy in assistive technology (including support professional/client email messages).

   – Reimbursement for assistive technology exchanges (Silverman, 2003)

5. It is clear from this review that technological advances are happening very quickly, so that funders and service providers have to be adaptable to capture the benefits of the new, not so fast to engage with the new that they embed systems that may be redundant very quickly, and not so slow that they miss out on the advantages the new technology brings. As Patel et al (2012, pg 2) state: "It is hard to overstate the magnitude of the problems that these technologies might help solve".

6. The user groups for assistive technology that are identified in the literature are identified mainly as older people who are getting frail or have chronic conditions, and other people with disabilities.

7. There are no standardised change strategies for implementation, except that engagement with all stakeholders particularly at a local level is essential. Initial enthusiasm is important to create impetus to support the introduction of the intervention, but after implementation has taken place, there will be rejection and a diminishing of support if some stakeholders consider the impact of the interventions to be negative or disappointing.

8. The main benefits for rural and remote clients and their families have been reported as focused on three key themes: lessening the burden (costs of travel, accommodation issues, lost wages, lost time), maximising supports (access to family, friends, familiar home environment, and care providers) and the need for assistive technology systems to be tailored to enhance client and family needs (Shore et al., 2012).

9. There is clear evidence that Indigenous populations in all parts of the world have shown rapid uptake rates for new technology when it meets certain conditions. Four main themes have emerged from the literature:

   – Access and Cost: Even where infrastructure and services have been forthcoming, low incomes may be an inhibitor to uptake;

   – Local consultation and collaboration: a lack of engagement with local leaders and the community is a commonly cited reason for the failure of local electronic technology initiatives;

   – Issues of gender: In some communities females have not been afforded equal access; and

   – Impacts on culture: New electronic technologies have been criticised for enhancing individualism and altering societal norms, undermining hierarchies and deteriorating traditional means of communication.

10. The research illustrates a number of potential benefits for users of SAT. Users who can benefit from smart assistive technologies have been reported to be:

    – People living alone who are unable to seek help in emergencies (unconsciousness, falls, strokes, myocardial infarction, etc.);

    – Older or disabled people who suffer from cognitive (Alzheimer disease, dementia, etc.) and/or physical (visual, hearing, mobility, speech, etc.) impairment;

    – People who need help in daily life to perform personal care activities (eating, toileting, getting dressed, bathing, etc.) and instrumental activities (cooking healthy meals, dealing with medication, and doing laundry;

    – Informal (family, friends, neighbour people) or formal (care provider) caregivers for older people or the disabled;

    – People living in rural and remote communities or in urban communities with inadequate health and social service provision;

    – People who suffer from chronic disease, and who need continuous monitoring (diabetes, cancer, cardiovascular disease, asthma, COPD, etc.); and

    – People involved in telehealth care undertaking health care at a distance or telemedicine, with health and social service professionals practising 'virtual visits'  (Chan, et al., 2009).

11. The ADOPT Model (Accelerating Diffusion of Proven Technologies) suggests there are seven diffusion strategies that need to be considered to assist adoption. These are:

    −   Is the design of the technology relevant and user-friendly

    −   What is the value of the technology?

    −   Is there a sustainable business model?

    −   Is the technology promoted to users and service providers?

    −   Have partnerships been formed to allow for scale in the diffusion process?

    −   Have technology champions been identified?

    −   Is there a process to coach users? (Wang, et al., 2010)

Attention must also be given to the relationship between the users and healthcare providers, as well as the communication skills healthcare providers need to have when they provide remote caring (Solli, et al., 2012)

One core principle of successful implementation of assistive technology support for people with disabilities would seem to be summed up by the term 'co-production', the design and/or delivery of services by some combination of state and non-state agents, involving active participation by communities using innovative forms of state support to deliver services.

12. Overall, end-user adoption of assistive technology is challenged by the need for the integration of new technologies in clinical practice workflow and daily activities. Adoption requires cultural and behavioural changes for use and reliance on smart assistive technologies. The lack of standard metrics for quality of service assessment impedes the evaluation and obscures the progress of technology adoption and utility. From the client's perspective, the usability and ease-of-access to technologies are obstructed by the lack of technology integration, interoperability, and standardization.

13. A pervasive barrier preventing end users from securing new tools and technologies is the limited financing available for implementation, maintenance, and sustainability. From the data perspective, limited access and limited data flow impede progress. Data flow into service provider centres is strictly regulated, making the main data repository's difficult to access and utilize for their true value with ongoing data mining and automated decision support. Failure to address data integration will limit the proliferation of client-centric assistive technology tools (Ackerman, et al., 2010b).

14. This review has identified that identification of key criteria for evaluating success is needed, but getting the correct technological responses for a person's needs, experiences and wishes is what is critical.

# JURISDICTIONAL REVIEW

The objective of this Chapter is to provide a discussion of the relevant policies and programs implemented in each jurisdiction and an outline of the findings drawn from the telephone consultations. HOI consulted with both government departments and non-government organisations. Each jurisdiction was provided with a Consultation Framework prior to the discussion.

## 4.1    SCOPE OF THE REVIEW

HOI conducted the jurisdictional review to inform the research into service delivery models that include the application of smartAT. As part of this review HOI consulted with representatives of nominated jurisdictions and service providers about the current programs and policies which involve smartAT, within their particular jurisdictions. The objective of the review was to investigate and provide a summary of the initiatives that have been implemented in other Australian jurisdictions to build and expand service delivery applications of assistive technology in relation to the disability and community care sector. The jurisdictions consulted with include:

- Government experiences

    – Department of Families, Housing, Community Services and Indigenous Affairs (FaHCSIA) - Commonwealth;
    – Department of Ageing, Disability and Home Care – New South Wales;
    – Department of Human Services – Victoria;
    – Disability Services Commission – Western Australia;

- NGO experiences

    – Feros Care; and
    – Alzheimer's Australia (Safe2Walk).

## 4.2    GOVERNMENT EXPERIENCES

### DEPARTMENT OF FAMILIES, HOUSING, COMMUNITY SERVICES AND INDIGENOUS AFFAIRS

This section outlines the key learning's derived from the consultations with FaHCSIA and provides a summary of the relevant assistive technologies policies that have been implemented. FaHCSIA is the National Government department which has jurisdiction over families and children, housing support, communities and vulnerable people, women, Indigenous people and most relevantly, seniors and disability and carers.

### SMARTAT INITIATIVES

Based on our consultations, FaHCSIA advised that the agency had not developed a smartAT policy and was not presently funding initiatives specifically in relation to building and/or expanding the service delivery applications of assistive technology in relation to the disability and community care sector. FaHCSIA emphasised that its role is to ensure consistency and equity of access to aids and equipment

across Australia, and does not have responsibility for the development of, or provision of, services at a jurisdictional level.

FaHCSIA did, however, report that the agency had established a Working Group, with full jurisdictional representation, that has considered issues relevant to the second half of action item 4.4: "more access to aids and equipment for people with disability". In addition, research was commissioned with a focus of access to aids and equipment (rather than the integration of smartAT into service delivery approaches). As such, the research and the activities of the Working Group have only marginal relevance to the objectives of this research project. However, we understand that Draft Aids and Equipment Reform Research Report (draft dated 28 May 2012) does discuss smart assistive technologies, but that as this report has not been finalised or approved for release.

### POLICY OVERVIEW

Whilst FaHCSIA does not have an overarching policy focused on assistive technologies; the agency cited two federal policies that provide some direction towards this end, albeit in a general manner. The first is the National Disability Strategy 2010-2020 (Commonwealth of Australia, 2011) which proposes to support the development of assistive technologies and provide further access to this type of service for people with a disability. The second is the Productivity Commission's Inquiry Report, Caring for Older Australians (Productivity Commission, 2011), that also identifies assistive technology services as a future challenge which should be attended to by the Federal Government. However, as with the former policy, it does not provide a specific strategy for implementation, other than referring generally to assisting service users in terms of funding to establish advocacy services.

### DEPARTMENT OF FAMILY AND COMMUNITY SERVICES (AGEING, DISABILITY AND HOME CARE), NSW

This section provides a discussion of the issues raised by representatives of Ageing, Disability and Home Care (ADHC) in NSW. It also provides an outline of the relevant policies released by the Department, whose principal responsibility is to improve the integration of services for vulnerable people in NSW.

### SMARTAT INITIATIVES

It was reported that the ADHC had implemented one smartAT specific project; and there were two other initiatives that had some relevance for this research project:

1. NSW I-Technology Project

2. Access Point Demonstration (utilising HS-Net)

3. E-referral from GPs

#### *NSW I-Technology Project*

It was reported that NSW recently trialled the use of I-technologies (specifically the iPad and iPod Touch) that were utilised predominantly by clients for communication purposes. The clients were then able to purchase the devices if they met their needs. Whilst the evaluation findings of this project have not yet been released, the Department outlined some positive outcomes that have been evidenced through use of these devices (particularly those seen by speech pathologists) as summarised below.

- Assistive technologies have improved in design in recent times. Before these devices were introduced, communication devices were large, awkward to use, heavy and also quite expensive. These devices also made the client "stand out" or be more identifiable in the community as

someone with a disability. The I-technologies have a mainstreamed use, so that clients with a disability feel less identifiable.

- The devices have also improved unwanted behaviours in clients with specific disabilities, particularly those with Autism Spectrum Disorder who may at times elicit violent or anti social behaviour.

- The devices can be used to assist these particular clients with moderating their behaviour (for instance, photos can be shown to clients illustrating a daily task so that they have prior warning of what is expected of them).

- In a general sense the devices assist in skill development and different "apps" apply to different skills.

- With respect to staff, the devices do not necessarily save them any time in delivering services to such clients but it means that staff can simply carry around an I-Pad, for instance, as opposed to a set of communication cards, visual aids and the like. In this way the devices make the provision of services more manageable (for the client and the clinician).

### *Access Point Demonstration (Utilising HS-Net)*

The Access Point demonstration centres around the Human Service Network (HS-Net), which is an intake and eligibility screening model, where clients are assessed as eligible for services over the telephone (by the Access Point who then upload this onto HS-Net). The objectives of the project were to decrease the occurrence of multiple assessments and simplify access to the community care system within NSW. A broad assessment is carried out through use of the Ongoing Needs Identification (ONI) Tool, which asks questions pertaining to a range of areas in a client's life.  A referral will then be made by fax, phone or e-referral to the appropriate HACC service (including information obtained through the assessment and details of the ONI results) and all out-bound activity is completed by HS-Net. ADHC considered the utilisation of HS-Net as a smartAT in itself and noted the outcomes of the Access Point evaluation undertaken by KPMG in 2009. The key evaluation findings of the NSW Access Point project were (NSW Government, 2010):

- Client needs were identified effectively;

- Referrals were undertaken in a timely fashion;

- The HS-Net and other relevant or supporting infrastructure were a strength to this project;

- Sector support contributed to implementation of the project through engagement;

- Restriction of client choice occurred in cases where they can only be referred to one service provider; and

- Within the community care system, effective working relationships have been developed.

Overall, the project was found to facilitate a significant amount of referrals given the lack of promotion of the service. It also provides an e-referral system which is encrypted so that information can be transmitted safely and confidentially (on this point, the information is not stored on the system it is merely a means of transfer to service providers). ADHC now intends to facilitate the recommended client and carer feedback mechanism that included service provider feedback only.

### *E-referrals From GPs*

This project is aimed at facilitating e-referrals from GPs to the Access Point. The Department identified GPs as a significant referrer to community care services and engaged Divisions of General Practice (now Medicare Locals) in this undertaking. The initial part of the project was focussed on cultivating

awareness within the community of the e-referral service subsequently an e-referral system has been implemented between GPs, through HS-Net and into the community care Access Point, using secure medical messaging software. This project has not been evaluated as yet, however, it is anticipated that given referrals occur automatically as opposed to this being the client's responsibility to make the initial communication with the referrer (who may make contact with referred service provider), this is expected to improve access clinical services for clients.

### *Summary of Key Findings*

The common themes from these projects were:

1. **There was a need to consider ethical issues through the use of assistive technologies.** With respect to the E-referral project client consent at the point of assessment was obtained to ensure confidentiality and the Department has since developed a policy regarding ethical considerations.

2. **Client confidentiality.** With respect to the use of I-technologies, confidentiality of photos and video footage were identified and staff ensure that files are deleted if a device changes hands.

3. **Barriers to implementing assistive technologies.** The key barriers to implementation included:

   – Funding constraints;

   – The restricted use of assistive technologies by Departmental staff, due to the policies which exist around the use of iPads/tablets and smartphones in particular (despite the fact that these are used extensively by service providers in the provision of community care and disability services). Utilising these devices as a business tool (as in the private sector) may be a potential opportunity for ADHC. Staff are not permitted to use iTunes on their work computers which impedes delivery of the iPod Touch service (although policy changes are expected to address this issue). The use of iTunes and App stores also create issues around paying for its use, although some guidelines have been developed by regional offices to address this.

   – Some clients do not have internet access due to the cost or because they live in rural areas.

   – It is difficult to keep abreast of new technologies (particularly software applications) as they frequently enter the market (this has been managed through access to the disability specific websites that review and recommend applications).

   – The devices are inherently frail and are subject to damage by being dropped or even thrown by a client

   – There has been a recent shift in attitudes towards the use of particular assistive technologies (such as iPads), particularly for children. It is important to remember that they may not necessarily be the best technology for people disabilities and rigorous allied health assessment is required to determine assess suitability.

   – School students who have been provided with I-technologies are often not permitted to use them during school hours as it is considered unfair to peers, despite the fact that it is being used to assist students with disabilities.

#### POLICY OVERVIEW

The NSW Government's response (NSW Government, 2011) to the Productivity Commission's Inquiry into a National Disability Long Term Care and Support Scheme –articulates responses that relate to the Commission's recommendations on smart assistive technologies.

The first recommendation relates to the higher electricity costs that are incurred by people with a disability through the use of technologies which require power (or at least power to recharge if

battery-operated). The NSW Government responded that they supported the need for consideration of this issue and that funding has been provided for a Medical Energy Rebate for People who are unable to regulate their body temperature ($161 per year). The Life Support Rebate had been provided for people who required life supporting technologies which use power (the rebate depends on the type of technology but ranges from $.05 per day for heat pumps to $1.66 per day for ventilators). It should be noted that whilst this financial support is useful for people requiring medical technologies, it does not seem to cover other types of assistive technology that promote safety or quality of life only.

NSW has suggested that the design of a model of care comprising assistive technologies should incorporate the following goals:

- Access to information with respect to assistive technologies to ensure that decisions made by those with a disability or their carers are well informed;

- Instigate centralised procurement strategies in order to provide for cost savings; and

- Provide access to technology specialists to ensure correct choice of technology in complex cases (in turn this will remove the risk of added costs through providing unsuitable assistive technologies).

### DEPARTMENT OF HUMAN SERVICES – VICTORIA

This section outlines the key learning's from consultations with representatives of Disability Services Department of Human Services. This Department has jurisdiction over community services (including disability services), housing, women and youth in Victoria.

### SMARTAT INITIATIVES

Whilst Victoria has not formulated an overarching strategy or policy that specifically focuses on assistive technologies, various disability programs have been implemented, some of which encompass assistive technology. Some of these programs are operated by Yooralla that provides services to clients with disabilities. The most relevant programs that have involved assistive technologies include (Yooralla, 2012):

1. **ComTec:** An information and advice centre on devices facilitating computer access, communication and environmental control.

2. **Electronic Communication Devices Scheme:** A part of the Aids and Equipment Program, it generates devices and software to assist speech and communication including voice amplifiers; speech generating software (and 'apps'); speech generating devices and electronic communication devices to provide voice; devices which are unlocked so that they can provide a voice as well as other features such as computer functions and computers and mobile devices.

3. **Independent Living Centre:** Displays aids (and equipment) that may assist people with disabilities and provides information on the use and access.

4. **Assistive Technology Learning:** Provides training and education with respect to assistive technologies to health professionals, carers and other stakeholders or service providers, through workshops and courses.

5. **Personal Alert Victoria:** A daily monitoring device worn around the neck or wrist. The button sends a message to the device when pressed (connected to the user's telephone) that automatically dials the PAV team, who in turn, respond to the call appropriately (e.g. by phoning emergency services or a client's carer).

Although formal evaluations of these services have not been conducted, during the pilot of the unlocked devices (used in the Electronic Communication Devices Scheme), a number of issues were identified as requiring attention relating to the use of assistive technologies:

- Using technology is not always straightforward for some users;

- Technology is prone to breaking down or requiring maintenance;

- Expense of certain technologies can be a barrier to adoption; and

- Training clients to use certain technologies can delay the application of devices (i.e. effects are not necessarily immediate, depending on how the client adjusts to using the technology).

Despite these issues, recent client outcome surveys and quality of life reports have suggested that the application of smartATs in Victoria have contributed to, and improved the quality of life experienced by people with disabilities. Furthermore, in Victoria, the guidelines implemented to fund the categories of equipment are fairly broad and flexible, this makes it relatively straightforward to incorporate assistive technologies into a program or care plan when they become available. The self directed funding mechanism also allows clients to nominate assistive technologies to be incorporated into part of their support package, where they see fit.

Barriers to the provision of assistive technologies were also identified. The most significant barrier related to the availability of funding for the purchasing of the technology, as many devices can be expensive and were costly to maintain in working condition and replace when newer models supersede that which has been released prior.  It was suggested that some form of cost benefit analysis would be useful in assessing cost effectiveness and return on investment of assistive technologies, to provide a better understanding of the benefits of the technologies. In addition, more information was required for clients with disabilities and service providers about the use of technology in their care plan is required in order to allow for informed decision making to be achieved.

## POLICY OVERVIEW

The Summary Consultation Report, 'Victorian Aids and Equipment Program Redevelopment' (Department of Human Services Victoria, 2009) presents a number of proposed strategies to be considered by the Government in the future. Of particular note:

- It was recognised that the range of equipment that is currently available under the Victorian Aids and Equipment Program has not been reviewed for some time. It was advocated that regular reviews of the equipment provided should be undertaken and that smartATs should be included in the review process.

- Consumers should be invited to provide input into the review of smartAT devices to ensure the consumer perspective is understood. Whilst the logistics of providing such input or feedback have not been specifically outlined, in a general sense, it was suggested that periodic forums should be organised in order to facilitate the provision of consumer recommendations.

- It was identified that with the advancement in technology and the rising costs of complex equipment, the gap payment between the subsidy levels and the actual cost of equipment is a concern for the prescribing therapists and the families.

## DISABILITY SERVICES COMMISSION – WESTERN AUSTRALIA

This section outlines the key learning's from consultations with representatives of Disability Services Commission in Western Australia. The Commission is a State Government Agency which provides a range of disability services for clients and their carers as well as providing funding for other non-Government agencies to provide disability services.

## SMARTAT INITIATIVES

Whilst the Western Australian Disability Services Commission has not formulated an overarching strategy or policy that specifically focuses on assistive technologies, the Commission has recently commenced engaging in a streams of activities directly associated with developing the knowledge base with respect to smartAT:

- The Commission convened a meeting of key service providers on the 12 November 2012 to commence a discussion with the sector in relation to smartAT and its application;

- Two pilot projects are in the formative stages of development with a view to piloting and evaluating assessment, policy and procedure development and outcomes in relation to models of care utilising smartAT. The pilots will run over the next 12 to 24 months with evaluation findings reported thereafter.

## POLICY OVERVIEW

The Disability Services Commission released (in 2009) the Count Me In: Disability Future Directions policy to provide direction for the provision of disability services in Western Australia in the coming 10 to 15 years. The policy outlines a number of priority areas, one of which relates to enabling information and assistive technologies, and formulates a variety of pathways towards achieving this goal. These pathways include the following:

- Ensure easy access and affordability of new technologies as well as technical support;

- Facilitate access to library, internet and other facilities, including assistive technologies provided in particular places, such as schools, libraries, workplaces and home;

- Assist people with a disability to become involved in web-based groups to establish connection with others;

- Provide training for people using assistive technologies to ensure effectiveness of the service and ensure appropriate allocation of technologies to clients to suit their needs;

- Support improvement and innovation in assistive technologies; and

- Investigate the use of medical and rehabilitative technologies.

Whilst these pathways provide general direction towards achieving the overarching goal of facilitating the use of assistive technologies, it does not provide a detailed strategy for how these pathways will be, or could be rolled out in the future. However, this area has been recognised as a priority by Feros Care given the fact that the devices could increase independence and quality of life for those with a disability.

## 4.3    NGO EXPERIENCES

### FEROS CARE

Feros Care is a not for profit aged and community care service situated in New South Wales and Queensland, providing residential care, respite care and community care for the elderly.  The organisation was selected for inclusion in the jurisdictional review as a result of the telehealth and telecare services it provides to patients in their homes. Specifically it commenced a pilot in 2010 to trial two technologies, called "*Telehealthcare – Supporting People to Live Safely and Independently at home: An Australian Pilot Program*".

### PILOT OVERVIEW

In 2010, Feros Care conducted a nine month pilot program of two assistive technologies (Feros Care, 2012). The first comprised a range of multi-sensor telecare technologies that were installed into 30 client homes, including movement sensors, fall detectors, door sensors, medication reminders, environmental sensors and emergency pendants. The second involved the installation of telehealth home monitoring technologies for 15 clients with chronic health conditions including; blood pressure, pulse and oxygen monitors, weight scales and gluco-meters. The general findings of this study were overall positive indicating that:

- The technologies improved the likelihood of clients being able to remain in their own homes for longer;

- Quality of life was improved in 80% of clients;

- Concern about one's condition was decreased in 69% of clients;

- 44% of clients were able to visit their GP less;

- Clients and carers became less fearful of an undetected fall or accident at home;

- The technology can be delivered within reasonable cost; and

- The technology and services should be subject to further review.

As a result of the success of the pilot Feros Care subsequently increased its telecare and telehealth installations.

### SUMMARY OF KEY FINDINGS

A range of smart assistive technologies were provided at Feros Care, under two schemes. The first was Telehealth technologies that included remote vital signs monitoring and video linking with a client's general practitioner and other health professionals. The second involved Telecare technologies, that included a range of assistive technologies, sensors and triggers that assist in 24/7 monitoring and response to people who may be living with dementia, a high falls risk, anxiety about their safety or who are living alone.

To date, Feros Care has completed installation of nearly 700 smart home technologies (predominantly telecare) into people's homes. The products and technologies identified by consumers and carers/family as being particularly useful have been presented in Table 4.1 below:

**Table 4.1: Popular telecare and telehealth choices at Feros Care**

| Category | Product |
|---|---|
| Telecare | • Base Alarm, Pendant and Medication Reminder: a device which allows carers to remotely dial into the base alarm and record a reminder for the client to take medications or attend/book medical appointments.<br><br>• Inactivity Sensor: a response service is activated if there has been no movement sensed in the house after a certain period of time (this device is useful for clients who are living alone and who do not receive daily visitors who may detect inactivity dur to falls or illness).<br><br>• Carers Kit: a combination of a sensor mat, pager and pillow shaker for clients who wander and whose carers can be alerted.<br><br>• Fall Detector: detects any fall for those who lack the ability to use the pendant |

| Category | Product |
|---|---|
|  | to raise the alarm. <br> • Bed Occupancy Package: an automatic light illuminates when the client rises from bed during the night. It allows the client to move to the bathroom when needed and turns off upon their return. If the client has not returned to bed within half an hour an alert is raised. |
| TeleHealth | • Blood Pressure Monitor and Pulse Oximeter: provided as a kit for clients living with cardio and respiratory problems. <br> • Glucose monitor: useful for people with diabetes |

There were a range of positive, negative and unintended outcomes that were highlighted by these initiatives as summarised below.

1. **Increased client awareness of their health condition.** Clients developed a better understanding and more awareness about their health condition, and reports from elderly female clients suggested that this cohort developed more confidence with respect to discussing their condition with medical practitioners. By way of example, the discussion of blood pressure results obtained from the home Blood Pressure Monitor, would not have previously occurred.

2. **Reduced hospital emergency presentations.** There was the potential to reduce the number of hospital emergency presentations

3. **Increased reassurance for clients and families.** Another positive outcome was the client and family peace of mind knowing that a client's vital signs were being monitored on a daily basis, and that falls were much more likely to be detected was found to be anxiety-reducing and reassuring.

Based on the positive impact on client outcomes, it suggested that there were clear benefits for mainstreaming assistive technologies into disability and aged care service. Despite the many benefits that were cited, there were some barriers and gaps highlighted:

- More support is required from client GPs and specialists with respect to incorporating assistive technologies into care plans, as many clinicians remained sceptical and dismissive of the benefits of the devices.

- Current budget allocations for community care services were constrained and were unable to support the mainstreaming of assistive technologies in the disability and aged care services.

- Training of staff (particularly new staff) is required with respect to the particular technologies and to increase the awareness of benefits of specific devices.

- There appears to be a general lack of understanding or awareness in the community about assistive technologies, what they comprise and what they aim to achieve.

To some extent, Feros Care reported that the existing Government policies and practices are impacting upon the provision of assistive technology services. It was suggested that Government funded programs should provide within their service specifications, an option for assistive technologies to be included as a service option, or even as an alternative to more traditional treatment options.

Stemming from the idea that the service should be amalgamated into the current service options (i.e. it should be well integrated into service models) so that assistive technologies are considered an as integral service and not merely an appended service. Medicare practices also tend to impact upon the provision of services, and it is evident that there are gaps which exist in this system. Specifically,

Medicare payments to GPs could also be provided for consultations not carried out in person. Similarly, the Telehealth video conference consultation Medicare item rebate needs to cover consultation between GP and clients in their home, as it is currently only available between GP and specialist and GP and clients in a Residential Aged Care Facilities (noting that this is so despite the fact that 90% of elderly people live in their own homes, and not in Aged Care Facilities).

### *Summary of Key Evaluation Findings*

The key learning's from an organisational perspective are that the provision of assistive technology services requires a significant commitment from staff to learn how to use the technology and incorporate it into their service delivery practice.

It is mandatory for staff at Feros Care to consider incorporating assistive technologies into a client's care plan and staff have committed positively towards this endeavour. It also requires a degree of technical support to set up the service in clients' homes and also, efficient response to any set-up difficulties or technological malfunctions in order to avoid client angst and confusion. Feros Care has implemented "post-installation" support (at least 1 week post installation) to ensure the technology is functioning as planned, which ultimately improves client acceptance of the products. The provision of financial support and sound structural planning is also required to amalgamate this service into the current model.

In addition, the evaluation report highlighted a number of relevant findings in relation to key learning's as summarised below.

- The implementation of assistive technology requires business planning, financial resources investment, extensive technical training, inventory management systems and a new set of documentation and assessment processes which have not traditionally be used within the sector. A high level of financial commitment and support is required from executive management in order for implementations to be successful;

- The support and management of technologies needs to be incorporated into everyday care. As such, Care Managers and visiting staff should be able to assess the ongoing impact and benefit of each component of the technology in Clients' homes. Visiting staff members must be comfortable with the technology, and understand how to help the service provider to maximise the benefit of each component for the Client, and minimise the need for special "operational" trips (e.g. battery replacement, volume adjustments, positional changes and other minor operational issues).

- The relationship with the technology supplier is critical to the success of the service provider's Telehealthcare services. It is necessary to ensure the supplier has a fully committed and resourced "Telehealthcare Program" which encompasses all technical aspects of equipment approval, quality assurance, reliability, maintenance, warranty and replacement. The Supplier must also have a suitably experienced level of technical support and a systematic problem resolution methodology. Service Level Agreements should be in place to allow the service provider to install equipment confidently (with supplier support), and to monitor Client services trusting that the equipment (and software) work reliably.

- Client assessment and selection - The technology is not a "one size fits all" approach. Sound assessment processes and close post-installation monitoring and support are critical in obtaining successful outcomes.

#### ALZHEIMER'S AUSTRALIA (SAFE2WALK)

This section provides a discussion of the key issues identified during the course of consultations with Alzheimer's Australia WA that provides advocacy and support services for those living with dementia.

Alzheimer's Australia WA was selected for inclusion in the jurisdictional review as a result of the Safe2Walk device and its evaluation thereof.

### SAFE2WALK PILOT

The Evaluation of the Use of GPS to Promote Safe Walking Among People with Dementia (Safe2Walk) Pilot Study Report (Centre for Research on Ageing, 2009) focused on assessing the effectiveness of a GPS location device was for people suffering from dementia and who have a tendency to wander or walk as a result of this condition. The technology incorporated a GPS tracking device and website accessible by families or carers to locate where a client was, accurate to 10 metres. The device used was the size and shape of a mobile phone, and also featured a large but which could be pressed to connect to three programmed numbers. The button can also be activated in an emergency and the geographical details are sent to the carers' mobile.

The key findings of this study are summarised below.

- Clients were not generally opposed to wearing the device (however, some did not understand the purpose of it);

- Despite some technical difficulties, clients were satisfied with the shape of the device and the way it is worn;

- Device malfunctions did cause considerable stress and frustration for clients and carers if/when they occurred;

- The website was found to be simple to use and navigate by carers;

- Families and carers experienced less anxiety and greater peace of mind knowing they could locate the client when they needed, or when the client activated the system;

- Improved the ability of clients to remain at home and delayed moving into a residential aged care facility; and

- For those living in aged care facilities, the device provided more independence and options to leave the premises when desired.

Overall, the feedback received from clients and their families and/or carers was predominantly positive. The technology displayed significant potential for people living with, or caring for someone with dementia despite some issues arising, including technical difficulties (with respect to mobile reception and coverage and intermittent unreliability) and reliance on community and residential care staff to charge the device and ensure the client wore it when they exited the premises.

### SUMMARY OF KEY FINDINGS

The Safe2Walk program originated through the use of mobile phones for those who wish to leave their home safely. This developed into a partnership with a local West Australian GPS technology company to devise a GPS device suited to the particular needs of those with dementia, as the existing devices were not appropriate for this cohort due to cost and design factors. An important component of the development of the device was the feedback from clients which has guided the subsequent development of the device.

The consultation with Alzheimer's Australia WA identified a number of barriers to successful implementation of assistive technologies, the principal barrier related to funding. It was reported that the Safe2Walk service did not align well with current community service funding streams due to the nature of the services provided (for instance an application to fund staffing for in home care is much simpler than applying for funding for a piece of technology). As a result, the Safe2walk service is only available in a number of states (NSW, Victoria, ACT and WA) and a limited number of services (at this stage approximately 100 families use the service). Other barriers and challenges included:

1. **Ethical considerations of tracking users.** In the initial years, an ethical debate emerged in respect to GPS tracking technology, causing some barriers to service delivery. Concerns were raised with respect to 'tagging' people with dementia and how appropriate this may be. Although this did result in some media interest, Alzheimer's Australia WA indicated that families and carers are, once the product has been adequately explained, very comfortable with the product and few ethical concerns has been raised in recent years. Further, rather than being seen as a tracking mechanism, many families value the "social inclusion" benefits, with the tool supporting people with dementia to live more safely and allow them to undertake the activities they enjoy with more confidence.

2. **Cost of the service.** Alzheimer's Australia WA currently funds half the cost of the device at $10.50 - $12.50 per week (determined by client membership); however, this price is still unsuitable for some clients, which impacts accessibility to the service. A lease model, rather than a purchase model, was established in order to assist clients financially and improve accessibility of the device.

3. **Reliance on mobile phone technology.** The device relies on mobile phone coverage where the service can be intermittent in some areas which limits use to locations with a reliable mobile phone services. Also linked to mobile phones, currently battery life means that clients (or their carers) must remember to charge the battery overnight.

4. **Product longevity.** Typically, when patients with dementia use the device, the functionality deteriorates on average after 9 months, due to eventual deterioration memory and cognition to the extent that safety issues arise. This results in a short return on investment timeframe for families and carers when considering whether to implement the device.

Critical factors for ensuring the success of the device were identified as:

- There is a need for appropriate assessment processes to ensure the most appropriate clients receive the device an assessment process is undertaken by qualified and experienced staff to determine whether:

  – The device will assist the client;

  – It is the appropriate device for their needs; and

  – Te client will be able to use the device appropriately.

- Re-assessment should be undertaken after 6 months of using the device to ensure that it is still meeting their needs.

- Formal evaluations of the service are also undertaken subject to funding.

- Alzheimer's Australia has found that the only clients who are not suited to the device are those who refuse to carry it on their person or those who find it difficult to understand the technology. However, careful assessment of each client tends to prevent such issues from arising.

- Development of relationships with device providers (as discussed above).

Overall the technology provides a safer method for people with dementia to leave their homes. It also provides confidence in the client base that they will be located quickly if they do happen to lose their way. It has also delayed entry into secure aged care facilities and relieved some of the burden and anxiety experienced by carers and families.
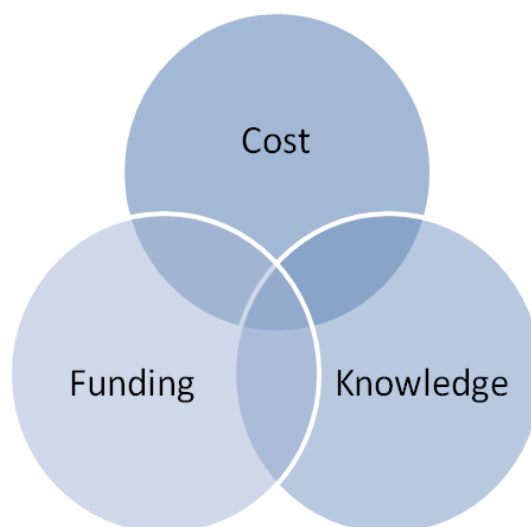
## 4.4    CONCLUSIONS FROM THE JURISDICTIONAL REVIEW

There are a number of conclusions that can be drawn from the jurisdictional review with respect to the use of assistive technologies and the current policy direction as summarised below.

1. **Positive client outcomes.** In terms of the effectiveness of smart assistive technologies, it has been evidenced that their use can result in positive client outcomes for people with disabilities and the elderly (outcomes include increased independence, confidence to live at home, delay of entry into residential facilities, less anxiety about one's safety and general improvement in quality of life). Overall, whilst at times technological malfunctions may occur, the benefits of the technologies or devices have been shown to far outweigh the negatives.

2. **Utilisation of assistive technologies.** It is clear from this review that some technologies are in use in the disability services sector in each jurisdiction that are provided under the auspices of specific programs at a Government and Non-Government Organisations. However, it is also clear that, whilst the Government policies provide general direction towards including assistive technologies in disability services, the policies currently lack the systematic planning framework that is necessary to integrate these devices into the service delivery model. The challenge will be transforming these general statements into a policy that specifies a detailed and well structured plan to roll out a well-integrated assistive technology service which will meet the needs of the relevant cohorts.

3. **Limited dedicated resources.** To some extent, the difficulty HOI had in identifying appropriate jurisdictional representatives to inform this research project illustrates the fact that, in general, jurisdictions are yet to dedicate resources towards supporting the development and use of smart assistive technologies. From HOI's discussion with jurisdictions we have formed the conclusion that jurisdictions have not yet determined what role they should play in respect of facilitating increased adoption of smartATs.

4. **Need to integrate assistive technologies into the design of future service models.** It has also been acknowledged by all jurisdictions that any future service model development or restructure to amalgamate assistive technology services will need to take in a variety of issues which naturally stem from the use of technology. The most common highlighted include:

   ▪ Education of people with disabilities (e.g. those with dementia or with severe dexterity disabilities) how to use the devices can be challenging, prolonged and at times unsuccessful;

   ▪ Knowledge of both the types of smartAT, and benefits, is still limited, and improving the knowledge of GPs, occupational therapists and the community care sector more broadly will need an important step to increase use;

   ▪ Certain devices can be expensive, particularly for individuals who receive a pension;

   ▪ The provision of maintenance and repair support will be necessary; and

   ▪ Medicare payments do not fully account for all clients using assistive technologies at this stage.

   These challenges and barriers to increased use of smartATs as an integrated component of service delivery for specialist disability and community care services can effectively be summarised into three broader categories, as illustrated in Figure 4.1 below, being:

**Figure 4.1: Summary of barriers identified in jurisdictional review**



5. **Other key themes.** Other common themes and conclusions from the jurisdictional review were:

- Ethical issues have not presented major barriers to the adoption of smartAT, particularly if clear and simple communication of benefits and risks are presented to users, families and carers;

- There are few examples of jurisdictions supporting the integration of smartAT through the funding of pilot projects or similar initiatives; and

- Access to a range of smartATs is currently available under the respective jurisdictional aids and equipment programs. However, there are some concerns that given the pace of change of technologies, whether the equipment lists inherent in these programs are up to date.

# ASSESSMENT OF RESEARCH OUTCOMES – HACC DEMONSTRATION PROJECTS

This chapter presents a discussion of the assessment of key research outcomes from the five Queensland smartAT demonstration projects that have been conducted by the following HACC funded organisations:

- Centacare (Bundaberg);
- Blue Care;
- Alzheimer's Association Queensland;
- Jymbilung House; and
- Golden Years Seniors' Centre.

The objective of this assessment was to identify the extent to which the experiences of the demonstration projects can inform responses to the research questions.  A "case study" approach was adopted to understand the extent to which the demonstration projects inform the use of smartAT as an integrated component of service delivery.  It was noted that these demonstration projects were due to be completed in June 2012. Each project is conducting its own internal evaluation at project completion, and as such each project has developed its own data collection approach.  The internal evaluation reports for the demonstration projects were not available at the time of completing this research report.

## 5.1   CENTACARE (BUNDABERG)

This section presents the findings of the assessment of outcomes for the Centacare Project.

### BACKGROUND

| Attribute | Comment |
|---|---|
| Project name | Centacare (Bundaberg) Assistive Technology Demonstration Project |
| Key features smartAT demonstration project (incl. technologies used) | Devices deployed:<br>• robotic cleaners & robotic lawnmower,<br>• iPads,<br>• communication software (Dragon dictation and omnipage reader),<br>• personal alarms with monitoring systems,<br>• portable oxygen concentrators |
| Geographic sites participating | Some rural but no remote areas. |

| Attribute | Comment |
|---|---|
| Target cohort | Elderly clients (65 years and over with a functional impairment) or any clients with degenerative conditions; including early dementia, Parkinson's Disease, vision impairment, mobility, and arthritis. |
| Number of participating clients | 40 |
| Summary of internal evaluation approach | • Data collection (through client journals and monthly assessments): abandonment and discontinuation, video footage of client feedback, uptake and ongoing use, <br> • Development of smartAT Program Forms: including assessment tools, evaluation tools, technology instructions, ongoing review mechanisms and agreements; <br> • Clients will have access to the devices for 12 months to ensure it is integrated into their daily lives; |
| Consultations held as part of case study approach | HOI consulted with the following representatives of Centacare through the facilitation of an in-person focus group: <br> • Janelle Baxter (Allied Health Support Worker) <br> • Karen Smith (Occupational Therapist) <br> • Jill Donaldson (smartAT Program Coordinator) <br> • Christine McJannett (Allied Health Coordinator) |

Among other services, Centacare provide support and case management for people with a disability. Staff found the innovative nature of this demonstration project to reflect the ethos of this particular organisation.

### OVERVIEW OF TECHNOLOGIES DEPLOYED

There were a range of technologies deployed by this demonstration project. They included the following:

- Robotic vacuum cleaners, floor scrubbers and lawnmowers;

- Personal alarms (including falls alarms) in conjunction with the Key Safe Lock (a device which enables safe and secure storage of a client's house keys outside, so that their door may be unlocked by carers of emergency services if necessary);

- iPads were used for improving functional arm and hand movements, and also communication purposes (one particular "app" was utilised as a communication device; it allows a client to type a word or picture and the iPad will proceed to speak the word/s; other useful applications include those that will read a book to a client if they are unable to themselves, either as a result of visual impairment or due to fatigue or ill-health on a particular day);

- Floor cleaners, mops and other sundry household items found to be useful and readily obtainable from local stores; and

- Portable oxygen concentrators (plugs into cigarette lighter of car).

The choice of devices trialled in the project was informed by a number of earlier trials conducted in Australia including: robotic trial through Supporting A as well as utilising the expertise of staff, OTs and device suppliers.

A summary of number of clients that used the technology is presented in Table 5.1 below:

**Table 5.1: Centacare participating clients profile**

| Technology | Clients participating |
|---|---|
| Robotics | 23 clients |
| iPads (vision) | 3 clients |
| iPads (speech) | 6 clients |
| Personal alarms monitoring system | 11 clients |
| Portable oxygen concentrator | 3 clients |

### SUMMARY OF KEY FINDINGS

- Overall the personal security alarms were most effective (and cost effective) in increasing client independence. The devices improved the client's confidence to perform tasks in the home that they would not previously have undertaken, thereby improving functional independence, particularly with respect to personal care (i.e. more clients were able to bathe themselves as opposed to being bathed by a carer, knowing that a fall would be detected; this is particularly important for clients who are incontinent and need to bathe multiple times a day).

- The key safe box was found to be effective in increasing the level of confidence of clients that carers and emergency services will be able to unlock their house if a fall occurs, which in turn reduced anxiety on the part of family members that clients will be accessible if need be, but simultaneously safely locked in their home.

- The robotic vacuum cleaner was instrumental in improving functional independence within the cohort. It resulted in clients not having to perform heavy vacuuming, thereby reducing pain levels, conserving energy, and increasing the likelihood of clients being able to perform other easier household tasks or even socialising outside the home (which in turn increases familial and community connection). The mower resulted in limited take up (one client) but it still achieved positive results for this client (a vision impaired person who can now mow their own lawn). The portable oxygen concentrator was successful in improving community access and allowing clients to perform everyday tasks, including those outside the home. It also relieved a significant amount of anxiety for clients who could comfortably leave the home without fear of running short of oxygen. Specifically, it has allowed one client to recommence their exercise regime and be placed back on the lung transplant waiting list.

- Finally, iPads were found to improve social connection and communication particularly through advanced communication "apps". They were particularly useful for vision impaired clients who could zoom in on text, use voice settings and in other clients to pay bills, listen to music and use the internet.

In order to assess suitability to participate in the project an ONI and IPPA assessment were carried out, with clients on the HACC waiting list being targeted first. Once identified, a follow up assessment was completed by an OT to ensure each client's functional capacity was appropriate for the trial. The Human Activity Assistive Technology Model (HAAT) was also used as a framework for assessing performance in tasks using assistive technologies. Initial set up of the devices took approximately two hours and clients were followed up monthly in person or by phone to assess their condition. Utilisation of the IPPA and HAAT measure were useful in determining when clients had mastered one device and were carrying out tasks accordingly. Once this was achieved clients and staff could turn their minds to tackling other problems identified by the client (e.g. making the bed, hanging out heavier washing).

### SERVICE DELIVERY AND CHANGE STRATEGIES

Marketing and education were identified as critical components of the change strategy in the formative months of the project. As such the devices were actively marketed to existing support groups and local networks by Centacare to ensure proper understanding and promotion. In addition a stall was staffed at a Seniors Safety Expo to provide education about the technologies to potential clients and carers (the technologies were demonstrated to provide a hands-on approach and assist the educational process generally). This approach was considered to be an integral and effective educational tool, for both the clients and clinicians. Due to a general lack of technological awareness, the demonstration was found to assist the clients in understanding the range of technologies and how they may be implemented in order to improve quality of life; this was described as a "see it to believe it" response implanted by staff in order to address the inherent scepticism and disbelief about what the technologies were able to provide.

A 'Learning Circle' was developed to provide education and support for those using the iPad. The focus of this group is for those clients with language and communication impairments. This Circle is supported by a speech pathologist. LifeTech and Tunstall provided intensive training and workshops to train staff how to use the technologies. They were reported by Centacare to be responsive when technological malfunctions occurred, and were attentive and willing to assist the process. Staff visited clients in their homes on a monthly basis and phone calls were made to check on clients. Training was not considered to be a barrier in terms of service delivery.

From a client perspective, the key barriers to service delivery, for some clients was attributed to the cost of technologies (particularly the oxygen concentrators) making access to this technology difficult, particularly given the majority of clients received fixed pensions. Another barrier concerned the availability of allied health professionals. Historically, there is a 3-6 month wait for assessment by an OT and at the commencement of this project Centacare was unable to access a community speech therapist. These issues will need to be addressed in future service development.

Staff identified a number of factors that needed to be addressed to ensure delivery of effective services. These included:

- Training and support provided by HACC, LifeTech and Tunstall;

- Understanding the use of the IPPA tool and the importance of client identification of how important they consider the task they were aiming to achieve;

- Demonstrations and promotion of the devices to local community clients and service providers;

- Dedicated staff and managers and a positive attitude from staff and clients with respect to using the devices and incorporating them into a client care plan;

- Empowerment of clients to order new parts and replace themselves if possible;

- Allowing clients to trial the devices before they purchased them;

- Keeping abreast of new and innovative technologies;

- Developing partnerships;

- Consultation with local visiting support groups and local allied health professionals; and

- Recording and monitoring client confidence throughout use of the device and regular home visits.

Centacare reported that the service would be sustainable providing a positive and committed staff and client response; and accurate initial and ongoing assessment was maintained. Assuming an appropriate funding scheme was implemented, this service should be able to be provided in an effective and sustainable manner, at least with respect to this particular client cohort. However, having

said this, the issues identified discussed above would require consideration when planning for future assistive technology initiatives as these factors will impact upon sustainability of outcomes.

### EVIDENCE OF OUTCOMES

There was a significant take up of the devices (and all clients continued using them). Some clients also reported that they had become quite reliant on them and suggested that they would not want to live without the technologies (in some cases, clients named their robots). This is a strong reflection of the effectiveness and quality of the service and of the outcomes being achieved. Some of these positive outcomes in particular include:

- Increased independence, confidence and an empowerment to make decisions and live independently;

- Delay of entry in the community or residential care;

- Increased energy, capacity and interest in social and familial connection;

- Reduction in the HACC waiting list;

- Improvement in goal directed behaviour and aspirations to undertake other activities;

- Increased pride in one's home and confidence in its cleanliness;

- Decrease in administration of pain medication due to not having to undertake pain inducing housework; and

- Clients empowered to order new parts for devices when necessary (e.g. filters).

Post IPPA scores demonstrated improvements in general functioning using assistive technology. Improvement in these scores (refer Figure 6.1) and client surveys all reflected clients benefited from the assistive technologies. Conversely, the pre and post ONI scores did not demonstrate a conclusive or significant change (Figure 5.1).

**Figure 5.1: Centacare pre and post IPPA scores (reduction represents improvement)**
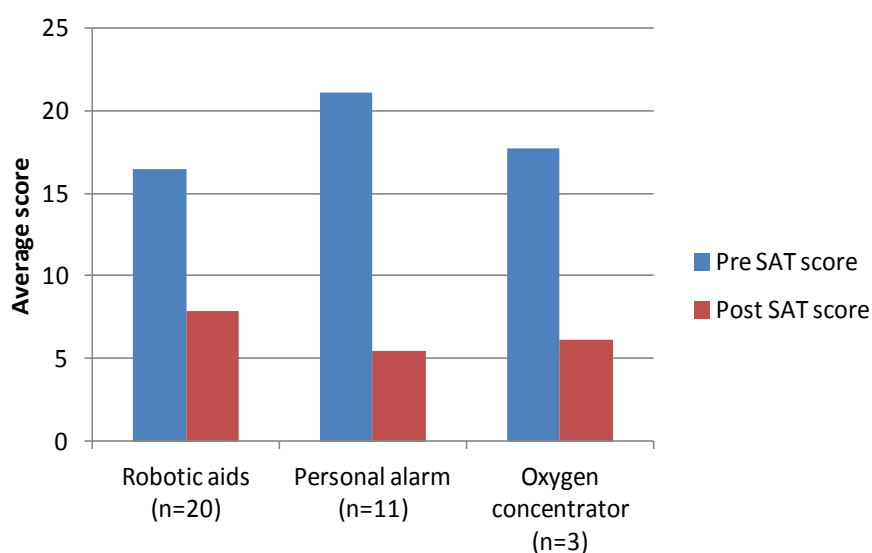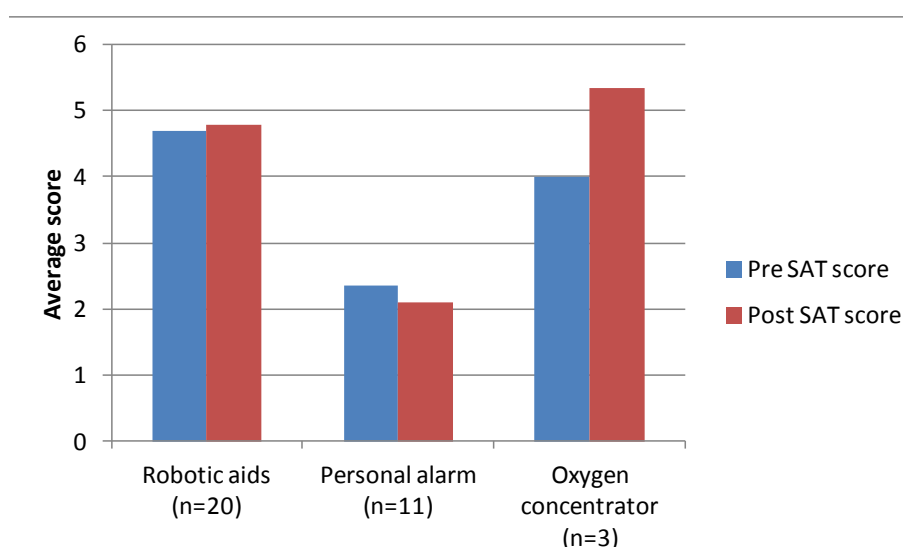
**Figure 5.2: Centacare pre and post ONI scores (increase represents improvement)**



An identified negative outcome related to concerns from clients already receiving some cleaning assistance and expressing concern that the social contact may ultimately be lost. However, as a result of this project no client actually lost any other services rather the technologies supplementing the support of clients. In addition, some clients were not suited to the devices, particularly dementia clients, as they felt uncomfortable with the technology. The devices were removed in these cases, despite the fact that their carers or partners found the devices useful.

### IMPLICATIONS FOR PLANNING FUTURE SMARTAT INITIATIVES

In order to provide assistive technologies that are effective and sustainable, a well constructed implementation plan and supported guidelines is needed. This is a necessity given that, whilst some of current generation being served are not technologically aware, the coming generation no doubt will be. This will result in an expectation of a well structured service incorporating assistive technologies. Further staff and training will also be required if smartAT it is to be rolled out on a broad-scale basis. Generally, clarification as to where assistive technologies fit into the current service delivery model (particularly with respect to goods and services, eligibility, purchase, education and monitoring costs, repair and refurbishment) is also necessary. Whilst Centacare had received adequate funding for the assistive technologies project, across the board, a detailed and comprehensive funding regime is still required.

One implication which will affect service planning is the collection and analysis of data. It was noted throughout this project that client outcomes were difficult to measure or quantify. Whilst funding bodies require data such as staff hours and equipment use, it would also be useful to obtain data on maintenance, how the devices are actually used, the outcomes they generate (positive, negative, unintended), levels of independence, confidence, decreased levels of depression and other ailments. In term of meeting policy requirements, an issue also exists with respect to the differing interpretation of service types between the Federal Department of Health and Ageing and the former Queensland Department of Communities, particularly in terms of what exactly constitutes domestic assistance.

Finally, it was identified that policy makers need to recognise the effectiveness of advances in technology and how this can be translated into effective and efficient client care. The majority of assistive technologies are relatively cost effective, particularly given the extent of the positive outcomes that can be achieved through their implementation. The nature of some technologies means that devices (particularly mainstream devices such as iPads) decrease in cost as the market

changes and that cost effectiveness can be achieved in time. However, newer technologies will require a sound funding structure in order to ensure accessibility until their prices drop.

## 5.2  BLUE CARE

This section presents the findings of the assessment of outcomes for the Blue Care Project.

### BACKGROUND

This section provides a summary of the background and key components of the Blue Care project.  A summary of the key project and design attributes are summarised in the table below:

**Table 5.2: Blue Care project summary**

| Attribute | Comment |
|---|---|
| Project name | Blue Care HACC SmartAT Demonstration Project |
| Key features smartAT demonstration project (incl. technologies used) | The Blue Care project set out to develop a specific referral pathways and assessment tools that may assist in the appropriate identification of clients for whom assistive technology is of benefit.  Six technologies were trialled: <ul><li>Fall detectors</li><li>Movement detectors/pressure mats</li><li>Sensor lights</li><li>Medication dispensers</li><li>Clock prompting regular hydration and nutrition</li><li>Personal response systems</li></ul> Devices were trialled for an 8 week intervention period. |
| Geographic sites participating | Sunshine Coast, Redcliffe |
| Target cohort | HACC clients |
| Number of participating clients | 148 |
| Summary of internal evaluation approach | Ethics approval via Uniting Care Queensland. <br>Data collection approach: <ul><li>Client satisfaction survey</li><li>Carer satisfaction survey</li><li>Staff satisfaction survey</li><li>Quality of life measures pre and post:<ul><li>Canadian Occupational Performance Measure</li><li>PIADS - Psychosocial Impact of Assistive Devices Scale</li></ul></li><li>Time and cost modelling</li></ul> |

| Attribute | Comment |
|---|---|
| Consultations held as part of case study approach | HOI consulted with the following representatives of Blue Care through the facilitation of an in-person focus group: |
| | • Natalie Williams (Project Occupational Therapist) |
| | • Brent Hodgkinson (Senior Care Advisor) |
| | • Karen Hollard (Project Occupational Therapists/ Allied Health Service Manager) |
| | • Glenys Webby (Director of Service Planning) |

### OVERVIEW OF TECHNOLOGIES DEPLOYED

Blue Care identified six products to be trailed as part of the project. Blue Care initially identified some areas which had been anecdotally identified as impacting significantly on those living at home or with respect to the cost of services being delivered. Key issues targeted for smartAT responses were:

- Hydration;

- Medication;

- Independence; and

- Safety.

Importantly Blue Care emphasised that the project was not about testing individual devices but more about determining whether client outcomes could be achieved and whether staff time could be saved through the integration of smartAT into service delivery. Participating clients, following assessment, were eligible to use a single device (of highest need). A standard intervention period of 8 weeks was used, with outcome measures collected before and after the intervention period. Of other devices were suitable for the client's needs, subsequent devices could be utilised under the same conditions for 8 weeks, noting that only one device could be trialled an any given time.

A brief overview of each product is provided below. Blue Care advised that the sensor lights and personal response systems were the most successful devices:

1. **Fall detectors:** Only trialled by 3 or 4 clients. Device was difficult to use as they were set off frequently and unintentionally (e.g. client who enjoyed gardening would set it off every time she bent down, thus she had to abandon use of this device).

2. **Movement detectors and pressure mats:** Limited numbers trialled.

3. Sensor lights: Highly popular device for a number of reasons: free of charge and simple for clients to use, simple for staff to demonstrate it and all set up for them, not a lot of learning, had experience with them outside so not a new technology (familiar concept). For most clients it linked in practically with night toileting;

4. **Medication dispensers:** Some technical problems arose but some clients were still interested in continuing use of the device. Some difficulties were experienced in engaging with pharmacies, particularly as many clients wanted to use their local pharmacy but these businesses were often not interested in participating. This situation has improved recently though as some relationships have been further developed across a range of communities. The device was also costly, around $70 a month.

5. **Clocks/watches for nutrition and hydration:** These were found to be difficult to use and often nurses initiated use in a creative way (e.g. it was used for one client with depression for toileting purposes). Some use for the device for medication, but clients needed to have high cognitive functioning in order to understand what the alarm was for. Low functioning clients were actually in

most need of the device but were unable to use it (e.g. the device was not successful for a client who had an intellectual disability). However, sometimes carers used it as a reminder for themselves instead, but it was generally difficult to find uses for. The device was also large and disliked particularly by elderly women who found it heavy and uncomfortable to wear.

6. **Personal response system:** This device was added to the project after plan was submitted. The biggest barrier to adoption of this device was the ongoing cost, but regardless of this it still provided a sense of security and peace of mind for clients and their families or carers. Half of the clients who trialled this device continued on with this device. The cost was funded whilst they participated in project.

A key component of Blue Care's pilot was the use of validated tools to assess clients to determine the difference made in their lives due to the devices.

### SERVICE DELIVERY AND CHANGE STRATEGIES

Blue Care took a carefully managed approach to the introduction of smartAT, with the formative months spent investing in staff training and the development of the relevant tools to both market the initiative and assess the success of the pilot. Blue Care advised that apart from these set up tasks the changes required to internal process were relatively minor, and although the project did review referral and intake process there were no changes made. Key learning's in respect of service delivery impacts were:

- Staff needed to spend a reasonable amount of time with clients to explain and teach them how to use the devices, and support the client as required. It was observed that the devices actually increased nursing hours due to need to attend clients in their homes to fix technological malfunctions. This was an unexpected outcome. Blue Care has two OTs supporting the devices in this trial and noted that this could be managed better if ALL staff are trained and capable of supporting the smartAT devices, so that smartAT support can in incorporated into other client visits (i.e. special device visits would no longer be required).This would provide a more sustainable model;

- Video calls to check clients are taking medication could have benefit. This approach has been tested at other organisations. However, the aim and results of this approach would have to be to encourage clients to live safely and independently, with the technology assisting this aim as opposed to invading their privacy or creating dependency;

- It is crucial to provide a range of devices which provide the right fit at right time, and that the services are tailer made to meet the individual client's needs;

- Relationship, support and contract management of smartATs is time consuming and could be improved. As Blue Care commenced discussion with device suppliers to support this pilot it was observed that:

  – Device suppliers, although enthusiastic to partner with Blue Care, required Blue Care take on the risk. That is, suppliers wanted contract directly with Blue Care for all the devices, with Blue Care taking responsibility for all costs and some support. This created a significant barrier as funding was not available for such as investment;

  – There was a reluctance on the part of suppliers to enter into 1 on 1 contract with clients (although this does appear to be improving);

  – Devices should be distributed by service providers after an OT assessment has been conducted, as opposed to directly from the suppliers. This will ensure that devices are provided appropriately to clients and do not pose and safety issues (in short there needs to

be some interface between the client and service provider, and the service provider and supplier).

- The ongoing cost is barrier to acceptance of smartAT. Many could not support the cost of the device after the trial, though in some cases family members picked up the cost.

- The technology and infrastructure supporting the technology is still not reliable. Drop out of reception for phone reception left clients vulnerable. Whilst devices may provide good client outcomes, reliability is critical.

- Funding is a barrier, with Blue Care observing that there was reluctance in the HACC program to shift nursing "care" hours to dealing with technological issues. Blue Care considers that a "packaged care" or consumer-directed care package would better facilitate the adoption of smartAT.

### EVIDENCE OF OUTCOMES

To date Blue Care has not provided any evaluation data for HOI to inform this report. However, information was provided in relation to outcomes that were observed indicating that the success of smartATs was dependent on a number of factors:

- Choosing the appropriate device can be difficult and the complexity of client is a key factor. The devices may actually be extremely beneficial for some clients, but will not be in all circumstances, highlighting the need for appropriate assessment. Assessment needs to include cognitive ability.

- Inappropriate choice of device or malfunctioning can create a safety concerns and erodes any benefit obtained.

Blue Care reported there was evidence to demonstrate improved outcomes for those clients who participated in the trial:

- Although evaluation data is still being analyse, preliminary analysis of the Canadian Occupational Performance Measure (COPM), which incorporated both performance and satisfaction components, showed significant improvement pre and post trial and overall positive outcomes. 94% of clients rated overall impressions as positive;

- Clients were able to trial the device without having to pay for it and then evaluate whether they needed it, rather than purchasing it and wasting money through inappropriate choice.

- From a negative perspective, some devices were difficult to learn how to use reducing client satisfaction and increasing the support required (e.g. some Clinicians had to visit clients after hours to provide support);

- Other indicators of client satisfaction included:

  – Staff and clients were positive about the project, and a number clients facilitating referrals to the service by telling their friends/family; and

  – Most clients continued on with the sensor lights post-trial.

  – Critical success factors in ensuring positive outcomes:

- Educating client on what is available to support them;

- Skill of person assessing the client to get the right device for the right person (and not being driven by a supplier selling a product);

- Allowing appropriate time for the client to explain learn how to use the devices; and

- Evaluation of device outcomes to ensure that client needs are met.

IMPLICATIONS FOR PLANNING FUTURE SMARTAT INITIATIVES

Blue Care identified a number of important implications for future planning and implementation of smartAT initiatives:

- There is a need for smartAT suppliers to consider a revised contracting model that better facilitates the adoption of smartAT and provides for a more appropriate model for sharing risk, cost and responsibility. Perhaps more broadly, in the context of device accessibility and service funding, the question of whether community services organisations should be device owners and suppliers in their own right is one that should be debated at not only an organisational level, but should be also be considered by policy makers and funders.

- Visits from clinicians are important to clients (i.e. they represent social contact, as well as a clinical/care visit) and as such, completely replacing visits through the provision of smartAT is not considered ideal. Future service delivery models need to consider the impacts smartAT may have on social isolation;

- Understanding of smartAT is still low and an increase awareness by GPs and the broader community would facilitate greater an increased acceptance of the benefits of these technologies. Consideration should be given to implementing an appropriate education program and provision of information on a broader community level. In this regard, there may be a role for councils and other organisations to promote the services and technologies;

- The integration of the devices to support people to stay at home is a problem requiring a sector solution. An integrated technology platform is required and currently there are many options available, but all are running on different platforms and connections with different suppliers. This is difficult for clients and service agencies. Funding and support of pilots to develop and investigate interfaces between platforms would be of value;

- With respect to funding, key observations were that it is preferable that future funding models:

  – Support continuity - access to technologies should not be based on who funds the program across cohorts; and

  – Funding be provided based on a package of care where client's needs are considered in a person-centred way with a strong assessment framework to determine what will make a difference for each client. Flexibility to package care in a way suitable to the client is important, whether those funds be utilised to acquire nursing hours, or smartATs.

- It became apparent that some smartATs have broader application than others. For instance, sensor lights were readily accepted, easy to implement and received favourable feedback from a broader range of clients. Consequently, there are opportunities to identify "tiers" of devices based along a continuum whereby some devices are identified as being of "universal" value (and supported and funded for broad introduction) and at other end of the more complex devices supplied for those with higher needs.

## 5.3 ALZHEIMER'S ASSOCIATION QUEENSLAND

This section presents the findings of the assessment of outcomes for the Alzheimer's Association Queensland (AAQ) Project.

BACKGROUND

This section provides a summary of the background and key components of the AAQ project. A summary of the key project and design attributes are summarised in the table below:

**Table 5.3: Alzheimer's Association Queensland project summary**

| Attribute | Comment |
|---|---|
| Project name | Alzheimer's Association Queensland SmartAT Demonstration Project |
| Key features smartAT demonstration project (incl. technologies used) | The project approach and objectives were informed by a literature reviews which identified that there is very limited information or research in relation to how smartAT can assist clients with dementia to remain independent in the community.<br><br>Assistance provided from University of Southern Queensland (data analysis, evaluation and final report) and Tunstall (provided workshop for AAQ staff and management, provide educational kit). |
| Geographic sites participating | Darling Downs and Brisbane North Regions |
| Target cohort | • Clients with dementia (suspected or diagnosed);<br>• Live in the Brisbane North or Darling Downs HACC region<br>• Live at home<br>• Is HACC eligible |
| Number of participating clients | 39 participated, 70 assessed. |
| Summary of internal evaluation approach | University of Southern Queensland (USQ) is conducting the evaluation.  Data collection approach:<br>• No standardised outcome measure<br>• Focus group of carer to collect qualitative perspectives<br>• Pre and post questionnaire/survey<br>Ethics approved received (managed by USQ).<br>Data collection should be complete by July 2012. |
| Consultations held as part of case study approach | HOI consulted with the following representatives of Alzheimer's Association Queensland through the facilitation of an in-person focus group:<br>• Brooke Medhurst (State Manager)<br>• Sanjeeta Mackrani (Allied Health Manager)<br>• Cindy Wilesmith (Occupational Therapist, Gordon Park Multi-services Centre AAQ)<br>• Morgan-Lee Larfield (Occupational Therapist, Toowoomba Multi-services Centre AAQ)) |

### OVERVIEW OF TECHNOLOGIES DEPLOYED

AAQ set out with the overall aim of implementing assistive technologies into clients' homes with dementia to:

• Increase safety in their own home (whether living independently or with carers);

• Decrease care burden and anxiety;

• Defer residential care admission;

• Reduce the need for in home, residential or community care;

• Reduce wandering; and

• Facilitate earlier reporting of falls and/or injuries.

The project approach and objectives were informed by a literature review that identified a paucity published research in relation to how smartAT can assist clients with dementia to remain independent in the community.

AAQ provided the lead on this project, supported by the University of Southern Queensland (providing data collection and evaluation). The project developed screening and assessment tools to ensure that clients were prescribed smartAT that is appropriate to their individual needs and promotes the client's functional independence. The project developed an equipment list as a guide to the types of technologies expected to be utilised by the pilot as follows:

- Emergency call systems (monitored and unmonitored)

- Environmental sensors

- GPS systems

- Key Safes as a partner device

- Stove cut-off systems and safety hotplates

- Thermostat shut-off systems for hot water

- Electronic reminders

- Talking clocks and watches

- Pictorial telephones

- Sensor lights

- Hearing Devices

The most successful products implemented were the sensor mate with remote page and bed exit sensor with interval timer and pager.

However, the project observed that interest in the technology was lower than expected, with client/carer acceptance reported by site as follows:

- Toowoomba: approximately 25 clients approach with 15 clients participating (most with one application)

- Brisbane: approximately 50 clients approach with 37 clients participating

Discussion on the lower than expected acceptance rates noted above identified that older carers found the technology a little confronting. In addition, many carers, even with equipment, did not feel comfortable leaving the family member alone for greater than a couple of minutes. AAQ observed that it can be difficult to correctly match a smartAT with a client, and with the client's carer, especially when working with a progressive disease. Effectively the assessment has three components and all need to be equally assessed and matched (refer Figure 5.3):

**Figure 5.3: AAQ identified domains for smartAT suitability**
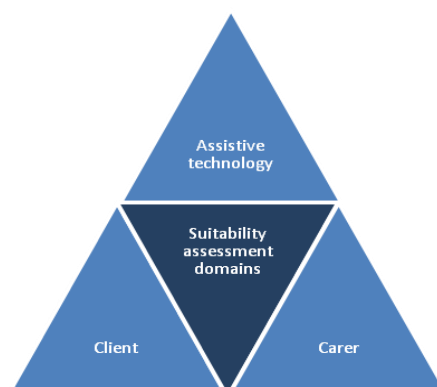


The technologies and devices themselves had varying degrees of success, with AAQ noting that some of the problems experienced reflected the fact that smartAT was in its infancy.

### Service Delivery And Change Strategies

The AAQ project identified a number of learning's in relation to the introduction of smartAT into the people's lives.  Perhaps most importantly the initial assessment and acceptance of smartAT was more challenging than initially expected (as noted above).  AAQ advised that steps necessary to improve assessment and acceptance are:

- Education of clients on the product and its use id the biggest barrier;

- It is preferable to provide clients with a forum to see equipment, and see a physical demonstration of the equipment in use, early in the client engagement process to facilitate of understanding of both the benefits and operation of the product;

- Allow clients to trial the product prior to committing - though this could be difficult with expensive and customised equipment (i.e. the cost of acquisition and set up my make client trials uneconomic); and

- Assessment and implementation of smartAT was more time consuming than expected, having implications for staffing and resourcing.  Furthermore, community referrals needed more work than AAQ clients (and in some cases these clients were referred for respite) and require specific procedure and approach.

In terms of other service delivery implications, AAQ observed there were few changes for staff, though it was observed that some time was necessarily invested in educating the two Occupational Therapists involved on the products. In addition, other service delivery implications include:

- Overall staff knowledge levels of smartAT are low and a theoretical knowledge not enough. A practical on the job knowledge required.  It is beneficial, in the formative phase of introducing a smartAT to fund the purchase of to acquire a shared knowledge (within AAQ) of how the device works;

- Skills are required in talking to clients/carers in the right language, and staff need to be conscious of this.

- It was necessary to redevelop the consent form for equipment;

- There is a need for promotional material to be ready early in the project to aid discussions with professionals and referrers;

- There needs to be a clear agreement above costs, and commitment from the client to pay ongoing cost if there is one and ultimately return equipment when no longer used;

- Project management: AAQ considered that for pilots of this nature that a 2 year timeframe would be preferable. This would allow for an initial six months for set up, marketing, developing knowledge & client recruitment, 12 months operation, and six months post evaluation wrap up & transitioning clients; and

- Progressive diseases pose a particular challenge when measuring outcomes.

### EVIDENCE OF OUTCOMES

To date AAQ has not provided any evaluation data for HOI to inform this report. However, some qualitative information was provided in relation to client outcomes, as well as some client quotes that were collected during the project. It was considered by AAQ that the main benefit for carers was peace of mind, and consequently more sleep. In general, clients and carers have found the product helpful, noting that benefits not guaranteed as dependent on a number of factors. Some observations made by AAQ in respect of outcomes noted:

- That although some clients tried client emergency call systems it was unreliable when linked with multiple products, resulting in some lack of trust in the product;

- To maximise client outcomes it is necessary to review on a regular basis to determine if the smartAT is achieving what set out to do;

- Many people stated that if they had to purchase themselves it would have a low priority (due to the set up and ongoing fees);

- Equipment functionality for purpose is the key (e.g. GPS watches were too large and no suitable if carer has no mobile phone);

- Hearing devices had improved communication between carer and client and the device had assisted when clients were attending respite; and

- Positive outcomes were achieved when carers could trial equipment at the respite centre prior to it being implemented in their home.

### IMPLICATIONS FOR PLANNING FUTURE SMARTAT INITIATIVES

AAQ identified a number of important implications for future smartAT initiatives, and observed that these are not dissimilar to the findings of the Feros Care telehealthcare pilot (Feros Care, 2012) or the Whole system demonstrator program in the UK (Department of Health UK, 2011). Specifically AAQ noted:

- Sites need product development capacity i.e. time and resources to identify what clients really need and ensuring maximum benefit from the product. AAQ observed that it the product is only "half useful" the client, ultimately, will cease using it;

- Further development of a specialised assessment tool would be beneficial;

- Access to an expert repository as to what products are available and the circumstances in which they have been successful would assist planning; and

- Assessment and support for smartAT is labour intensive and the identification of a funding stream for providers is considered necessary.

## 5.4  JYMBILUNG HOUSE

This section presents the findings of the assessment of outcomes for the Jymbilung House Project.

### BACKGROUND

Table 5.4 below provides a summary of the background and key components of the Jymbilung House project.

**Table 5.4: Jymbilung House project summary**

| Attribute | Comment |
|---|---|
| Project name | Jymbilung House SmartAT Demonstration Project |
| Key features smartAT demonstration project (incl. technologies used) | To project intends to demonstrate the practical application of 'Skype', 'Webex' and Google documents software to facilitate internet based allied health communication through online meetings, web conferencing, and video conferencing. The project will run over 16 months, with a 12-month trial demonstration of the smartAT. The smartAT that is considered for purchase includes notebook computers with headsets and webcams, and an electronic whiteboard to provide information and education sessions to clients, Internet access at Jymbilung House and for each notebook. |
| Geographic sites participating | Jymbilung House is located at Beaudesert in the southern end of the Logan River valley Region, 100 kilometres from Brisbane in a rural location. |
| Target cohort | Allied health clients. |
| Number of participating clients | 8 clients (with 10 additional clients recruited as a control group) |
| Summary of internal evaluation approach | Jymbilung House engaged an independent external organisation (Steve Begg Consulting) to evaluate the project. The evaluation and review will consider the advantages, disadvantages, efficiencies, effectiveness, suitability and limitations of the technological hardware items, software packages (e.g. Skype and Webex), internet access, user-friendliness, training and support, allied health professional interface, HACC worker interface, and client interface. |
| Consultations held as part of case study approach | HOI consulted with Matthew Moore, Aged Care Manager of Jymbilung House. |

### OVERVIEW OF TECHNOLOGIES DEPLOYED

Informed by recent development in the use of technology to provide remote allied health services, Jymbilung House invested in the acquisition if IT and communications technologies as identified below:

- Notebook computers for clients and for Jymbilung House to connect with clients' notebooks - These notebook computers allow Jymbilung House to ensure the technological compatibility and connectivity between clients' homes and allied health professionals and Jymbilung House.

- Web Cam and Head sets for notebooks (combined speaker and microphone) - Web Cams and Head sets are essential to provide video and audio connection between the client and the allied health professional or Jymbilung House.

- Electronic Whiteboard - The electronic whiteboard allows the allied health professional to provide visual information and educational material and instructions to a client in an easy format.

- Security and internet modem to receive audio and video feed

- Internet access to receive audio and video feed

- Internet access for notebook computers

- Hardware setup

- Training of staff and clients - Training was required for clients, carers, HACC workers and allied health professionals on the use of the hardware and software to ensure the smartAT works efficiently and effectively.

- IT support over twelve months - Ongoing technical support will be provided and available for clients, carers, HACC workers and allied health professionals throughout the life of the twelve-month project.

Despite the benefits that were expected to the accrued from these technologies, and the close proximity of Jymbilung House (located at Beaudesert, 64km south of Brisbane, 44 km west of Surfers Paradise) this Jymbilung House project experienced extensive set-backs and difficulties with the broadband and IT infrastructure in the region. The infrastructure was unable to support multiple clients attending online sessions with allied health professionals. Single sessions were able to be established, however, these too experienced difficulties and it took a significant amount of project time before these could be successfully completed. Jymbilung House explored a number of options and solutions (including directional antennae, satellite services etc) and these were unable to solve the problem. Jymbilung House's enquiry with respect to the first phase of the NBN also indicated that it will be many years before a suitable service will be available in Beaudesert and the surrounding region.

### SERVICE DELIVERY AND CHANGE STRATEGIES

Jymbilung House introduced a number of changes in order to facilitate the introduction of the proposed services, including:

- The in-house development of an assessment tool to screen and assess the suitability of clients to participate in the project. Of particular interest this tool also assess the participant's communication infrastructure (download speeds, mobile phone reception).

- Additional resources were built into the roster to provide support to the project participants

- A working group was established to monitor progress and consider challenges and problems encountered.

Apart from the significant communication technology challenges above, another service delivery challenge experienced was ensuring appropriate communication with middle management in respect of frontline service delivery. In the early months of the project, managers that had little to do with the project expressed concerns about staff time and productivity stemming from the support they were providing to clients.

### EVIDENCE OF OUTCOMES

Jymbilung House considers the results of the pilot, from an outcomes perspective to be disappointing. Both staff and clients had significant enthusiasm at the commencement of the project but the constant technology challenges eroded those emotions to the point where the technologies were a

source of frustration. Many consider that, as a consequence, this type of service is too much hassle to consider further.

On a more positive note, there are a few examples where clients are continuing to use Skype for social contact with other clients.

### IMPLICATIONS FOR PLANNING FUTURE SMARTAT INITIATIVES

Despite the problems experienced, Jymbilung House still maintains an enthusiasm for delivering remote allied health services to its clients.  Initiatives, such as the one trialled, provide an opportunity for clients to access allied health professionals that would not have otherwise visited the client in a face-to-face session.  That is, significant benefits are accrued to the client.  Although Jymbilung House did not consider a cost/benefit calculation for its service provision under this pilot, it is evident that with the extensive support required that such a calculation (from a service provider perspective) may not be favourable. However, Jymbilung House considers that it is less about service provider cost/benefit and more about the improved access and service that is delivered to clients in a remote setting.

A potential solution, for a similar service, would be to identify community hubs at strategic sites and invest in ensuring that the communications structure is appropriate and reliable.  Clients could then be encouraged the visit this location to participate in the hosted allied health services.

The critical learning, however relates to the challenges associated with systems connectivity in rural locations that present significant barriers to the introduction of assistive technologies.

## 5.5  GOLDEN YEARS SENIORS' CENTRE

This section presents the findings of the assessment of outcomes for the Golden Years Seniors Centre (GYSC) Demonstration Project.

### BACKGROUND

Table 5.5 below presents a summary of the background and key components of the GYSC project.

**Table 5.5: GYSC project summary**

| Attribute | Comment |
|---|---|
| Project name | Golden Years Seniors' Centre SmartAT Demonstration Project |
| Key features smartAT demonstration project (incl. technologies used) | The GYSC project planned to recruit 20 clients to trial three different smartAT products:<br>• Emergency call systems (provided to 18 clients)<br>• Remote communication systems, incorporating internet-based social networking systems (provided to 10 clients)<br>• Robotic aids (provided to 5 clients)<br>GYSC and its technology partners (Tunstall and Community Vision System), as well as Life Tec provided support and training for staff, clients and carers in using the technologies. A qualified OT and physical exercise therapist also assisted in the assessment of clients for suitable technologies (the exercise therapist also provided video support by way of a gentle exercise program). |
| Geographic sites participating | North Brisbane |

| Attribute | Comment |
|---|---|
| Target cohort | HACC eligible clients in North Brisbane |
| Number of participating clients | 18 clients |
| Summary of internal evaluation approach | Data collection approach:<br>• Client survey<br>• Carer survey<br>• Pre and post assessments using IPPA |
| Consultations held as part of case study approach | HOI consulted with the following representatives of GYSC through the facilitation of an in-person focus group:<br>• Don Rudd (Project Manager)<br>• Lin Huntley (Centre Activity Officer)<br>• Steven Turrell (HACC Services Officer)<br>• Ian Gordon (Computer Technician)<br>• Kristine Eyles (Occupational Therapist)<br>• Peter Glen (Brisbane Seniors Online)<br>• Brendan Williams (President, Brisbane Seniors Online)<br>• Sue Battams (Tunstall Healthcare) |

### OVERVIEW OF TECHNOLOGIES DEPLOYED

GYSC is a social activity provider for elderly people and for people with disabilities. The organisation provides services not just for clients who are medically at risk, but also for those who are socially at risk (in that they have limited or no familial support and are experiencing anxiety with respect to their safety and (potentially) declining independence. GYSC participated in this demonstration project in order to generate new ideas and insight into the integration of smart assistive technologies for this client-base.

There were a range of technologies deployed during this demonstration project. They included the following:

• Personal Emergency Response service (including a range of monitored emergency call systems tailored to individual client needs). It comprises a personal alarm interfaced with a mobile personal trigger which allows for hands-free, two-way communication with the response centre from anywhere with a 50m radius of the fixed alarm unit (specific devices included vibrating fire alerts and falls detectors);

• Internet-based social networking systems such as webcams, headsets, microphones, internet, Skype WebEx, Google tools, Facebook and voice recognition systems (these devices were utilised to provide social interaction and integration); and

• Robotic aids such as vacuum cleaners and lawn mowers for those unable to undertake such tasks.

Email, Skype and YouTube, computer games and the internet were taken up the most by clients. In addition, interactive computer sessions (with video) were extensively trialled in the project and were a huge success in opening up communication opportunities for client. However, this was mostly one-on-one communication using Skype. Project coordinators attempted to introduce a live video feed to support multiple concurrent clients but this provide to be beyond the technical and budget constraints of the project (due largely to bandwidth limitations in the internet service and in GYSC intranets relating to computers, cameras and projection equipment. In comparison, more success was

found with YouTube which was used to demonstrate gentle exercise sessions. Interactive computer sessions were not trialled during this project, but a webinar was demonstrated through the use of Web-ex. However, this program was found to be insufficient to carry out the requirements and was generally ineffective. Similar webinar programs/software with stronger performance and support tools were found to be too expensive for the scope of this project.

### SERVICE DELIVERY AND CHANGE STRATEGIES

Identification and assessment of clients was a key component of the GYSC project.  As such, after the identification of potential or available devices, a strict assessment process was undertaken in order to determine (a) which clients were suitable to engage in the demonstration project and (b) which device/s would assist the clients and meet their individual needs. To begin, a pre-selection process was conducting, involving the identification and selection of potentially suitable clients across the demographic board, and in particular, those clients who possessed the requisite aptitude and need for the technology. Most clients had not previously undergone any formal OT or other assessment, however, a qualified OT was engaged to complete a formal assessment for the purposes of this project. The assessment included the following determinations:

- Functional screening

- Basic cognitive screen (utilising the 10 step Abbreviated Mental Test)

- Mobility (utilising the Timed up and Go Test

- Needs and goals (utilising the IPPA)

- Falls history

- General health.

The IPPA was used for the initial assessment (which typically lasted approximately 1.5 hours). This was identified as a longer than usual period of time which was attributed to undertaking the IPPA. Devices were accordingly provided to the appropriate cohort and home support visits were arranged and conducted.

Training in the use of the devices was carried out by GYSC staff (in the use of computers, PERS and robotics), Tunstall (PERS) and external consultants who set up the customised computer interface (Calmon Computing).  GYSC staff created tailored user manuals for the computers and robotics and issued them to clients.  Training in use of the computers was conducted both centrally (in group sessions in-Centre) and at the clients' homes by GYSC staff on an ongoing basis by phone, Skype and in person. Seniors Online provided another tier of support for the computer-using clients, following the initial rollout and training to assist individual clients to extend their computer skills in their individual direction of interest.

After six months clients were re-assessed to determine whether use of the devices was still appropriate and at this stage only two clients were identified as no longer suitable for the project. This assessment took approximately half an hour, and a final assessment at the conclusion of the project took approximately one hour.

The key barriers and challenges identified from a service delivery perspective were identified as:

- The focus group identified that the IPPA tool impeded delivery of assistive technology services throughout the project. However, GYSC subsequently acknowledged that some of the comments in the focus group reflected the expertise and background of staff competed the IPPA assessment and supports the need for assessment to be conducted by staff with appropriate training and expertise and psycho-social wellbeing. Despite this, the issues which arose in the focus group as a result of the utilisation of this tool included the following:

- It prolonged the time spent with clients;

- The requested information was broad and subjective and consequently difficult for clients to respond to accurately;

- Clients required prompting by staff in order to answer or respond appropriately;

- Some questions were difficult for clients to answer or quantify (particularly those with respect to the technologies themselves); and

- Generally it was not considered by staff to be a useful pre and post measure to apply in this care setting considering as they considered it was developed for use in an institutional environment where clients are monitored continually, not intermittently.

However, GYSC posit that this tool is useful in providing a "before and after snapshot" of client needs as opposed to an ongoing measure, however, it does take skilled clinicians to extract the information from the client in an informative manner. This difference in opinion highlights the need for a sound understanding and comprehension of the assessment tools being implemented.

- Cost of the devices was a barrier, as many clients, whilst interested in continuing on with using their respective technologies; were unable to afford the cost. PERS were leased from Tunstall and clients have the option of entering new leases. Some have continued with the equipment, whereas others have elected to return the PERS equipment. Where clients have the capacity and desire to pay for their computers, they are being offered to clients. Where clients indicated a desire to retain computers but have difficulty paying for them, GYSC have left them in place for now and GYSC are seeking other means of funding. This is an issue which continues to be a barrier; particularly in relation more complex devices may provide robust outcomes in terms of application and safety.

- Given the cohort of clients and the nature of the devices, it was evident that significant training and support would need to be provided to ensure the devices were used accordingly, and to their full potential. Whilst the support was necessary (particularly with respect to the client's own safety), to some extent, it also created a barrier to service delivery.

- Computers posed significant difficulties for **some** clients, many of whom it took 2 months to become comfortable in using the device, and required intensive and time/labour consuming training. Having said this, the younger cohort required less training in this device, but for many clients, carers used the computer on their behalf, or clients chose to simply use one application despite there being numerous useful choices.

- Seniors Online reported difficulty in comprehension (and hence lack of take up of the devices) could have been a result of a lack of motivation on the part of clients to learn how to use the devices, which was identified as a contrast to this organisation's own client base. A key learning is that adoption of new technology, particularly by aged people, takes time, patience and support. On the other hand, Tunstall reported that use of the personal alarms was successful and appropriate given the fact that most of the alarm activations were genuine. Staff training was found to be successful and appropriate, however despite this; some clients were simply not suited to the devices, particularly those with an intellectual disability. This posed a challenging situation given their carers found them useful.

Overall, GYSC reported that the effectiveness of the technologies employed relied on carers promoting their use to clients to ensure that they (a) use the devices and (b) use the devices in the appropriate manner. GYSC reported that most assistive technology is likely to complement rather than entirely replace human care. Various types of smart assistive technology such as computers are likely to require a higher level of support (and investment) initially after implementation. Accordingly, the assessment of the efficacy of any client intervention needs to be taken over the whole of life of the

intervention. This can be particularly challenging with respect to dementia clients who require constant reminding by carers and families to, for example, wear their personal alarm and activate it when required. Similarly, success can be, or is, dependent on how interested clients are in participating in the project, using the devices, and incorporating them into their daily routine. Education is required in order to encourage clients to use their devices simply to ensure their safety. This is a particular issue with respect to the personal alarms. Staff found that clients, particularly elderly clients, were not using their falls alarms (even when a serious fall has occurred) due to a desire not to 'bother anybody'.

### EVIDENCE OF OUTCOMES

Overall, the project demonstrated positive client outcomes, despite the issues discussed above and included:

- Computers improved communication, provided mental stimulation, an intellectual challenge and stimulated social connection with the community and client's families, who could in turn provide clients with encouragement and motivation;

- Improved quality of life and interest in being involved in particular activities;

- The personal alarm systems have provided security and confidence for clients and reduced anxiety in clients and carers with respect to a client's safety (although they did not have to be used to fulfil a life saving function during this project);

Clients varied with respect to the following characteristics:

- Age (59-97 years, average 82 years)

- Gender (15 female, 6 male)

- Mobility (13 had reasonable mobility, 8 had poor mobility)

- Sensory capacity (15 had good or reasonable sensory capacity, 6 had poor sensory capacity)

- Sensory issues (2 had severe hearing impairment, 2 had severe vision impairment, 1 had substantial speech impairment)

- Social support network (12 had good or reasonable support, 9 had poor social support)

- Living arrangements (11 were living alone, 3 were living with a partner and 7 in a group setting)

- Cultural background (1 client was Aboriginal, 5 from CALD background)

- Cognition (including dementia) (15 had good or reasonable cognitive capacity, 4 had poor cognitive capacity)

- Risk status (14 had high risk status, 7 had low risk status)

- Risk issues (12 had high falls risk, 1 had risk of wandering and 2 had a risk of medical emergency)

- Agility in undertaking household chores (11 were managing reasonably well, 10 had difficulty with chores). In terms of demanding chores, 9 had difficulty vacuuming floors and 14 had difficulty with mowing, and 9 with cleaning)

- Aptitude for internet-enabled social networking (11 had sufficient aptitude to use a computer)

An assessment of outcomes achieved with respect to the personal alarm system/pendant is presented in Table 6.6 below (this data was provided by Golden Years in their mid-term report):

**Table 5.6: GYSC outcomes indicators**

| Measure | % |
|---|---|
| Client consistently wears the pendant | 77% |
| System has been in operation continuously since installation | 100% |
| Client knows who to contact for maintenance and support | 100% |
| Recommended additional home safety measures have been implemented | 85% |
| Client's opinion of the impact of the PERS system on quality of life: | |
| Greatly improved | 62% |
| Moderately improved | 23% |
| No change | 15% |
| Client is satisfied with the system | 100% |

### IMPLICATIONS FOR PLANNING FUTURE SMARTAT INITIATIVES

Overall, with respect to technologies other than the computers, staff and clients experienced a successful and straightforward implementation of technologies into their service. Implementation of the passive, single-function PERS and robotic technologies was more straightforward than for the computers. However, there are still a number of implications which have been identified through this demonstration project which will impact upon and guide future implementation and integration of assistive technology services. The most principal implication is that a high quality central management system will be required in order to establish a large scale service. This in turn requires sound planning and organisation to ensure services are integrated and delivered seamlessly and deliver positive outcomes to clients. One element which can only be dealt with appropriately by strong policy development is the ethical processes around ensuring that clients receive an OT assessment before being provided with assistive technologies. This will ensure that the device is suitable, appropriate, will meet their needs and does not pose any safety issues. A clearly defined interface between funders, service providers and manufacturers will be necessary, in order to achieve this. Guidelines around insurance, professional indemnity and public liability also need clear definition.

There are two principal issues which at this stage are affecting sustainability of the provision of assistive technologies. The first is the provision of computers which, as discussed, is mainly affected by the amount of training that is required. The amount of training required is a function of the user interface and the complexity of the applications that the client uses. Both are highly tailorable so that the client can get started quickly with simple applications and move to progressively more complex applications as and when they desire. The second relates to the cost of technologies (though the cost of smart technologies is continually falling relative to their capacity). Some devices, although not all, are intrinsically expensive to obtain or expensive to maintain in working condition. This causes a serious issue in terms of sustainability as significant funding would be required, particularly given that the cohort of clients who require the devices tend to be low-income earners due to inability to work or pensioners.

Some form of technological development needs to occur in order to produce devices which meet the needs of clients appropriately (this may involve adapting other devices to make them useable for people with a disability so that the interface is not so complex). This will be a necessary occurrence given that it may not be suitable or appropriate to apply devices which have been developed for other purposes (as was found by Alzheimer's Australia during the Jurisdictional Review, or for other client

cohorts. This will involve capital expenditure to ensure that newly developed devices or existing devices which have been adapted to suit the needs of people with a disability, work accordingly.

Policy and funding bodies will also need to address the cost that is incurred by clients using assistive technologies. A funding model that provides functioning devices to those who cannot afford the cost will need to be formulated, as will a funding structure to guide organisations in provision training and support for clients. This is particularly so given the fact that staff reported that significant amounts of their own time were spent providing support in this way, at least with respect to the computers. In terms of the future provision of such a services it is noteworthy that the coming generations will be much more adept at learning how to use the technologies and that inevitable advancements in computer technology will further reduce the implementation burden. This may lessen the financial and service implications for training and support at least to some extent (perhaps especially for aged care clients as opposed to, say, clients with a severe intellectual disability). Furthermore, this new generation will also come to expect this service as part of their care plan and furthermore, expect it to be well integrated and functioning accordingly. Another impact on funding is the fact that technologies quickly become more accessible over time due to the pace of development. At the beginning of this project computing tablets such as iPads could not be supported remotely, however, they are now much more accessible given the market changes which occur over time as new products enter and prices fall.

With respect to using technologies to reduce cost, it has been identified that the most cost effective method of disseminating information to clients (for example in the form of cooking demonstrations or exercise classes) would be to utilise YouTube-like applications and develop a recognised and publicised site to access the information. It may even be possible to obtain support from major corporate sponsors to assist in the cost of this endeavour. At this stage, live or interactive broadcasts, on a budget of this size, have been found to be too challenging to support technically or organise, and generally, the issues already identified with respect to the provision of, and training in computers, would need to be addressed before broad-scale provision of this piece of assistive technology could occur.

The GYSC project produced some sound results and positive outcomes. Representatives undertaking this project found the parameters provided by HACC to offer a great deal of freedom in how those projects were structured as agencies were encouraged to consider novel approaches which resulted in substantial diversity of proposals.

## 5.6 SUMMARY OF CONCLUSIONS

Despite the variation in approach and technologies deployed across the five funded pilots of smartAT, there are a number of key themes and conclusions which can be drawn from the case study investigation, particularly with respect to the use and introduction of assistive technologies. The key conclusions from the case studies can be summarised as:

1. Although quantitative data is still being analysed by sites (in the majority of cases), qualitative information and anecdotal feedback confirms that smartATs can provide positive outcomes for clients, particularly in the domains of:

   ▪ Increased independence, confidence and an empowerment to make decisions and live independently;

   ▪ Delay of entry into community or residential care;

   ▪ Improvement in goal directed behaviour and aspirations to undertake other activities; and

   ▪ Increased pride in one's home and confidence in its cleanliness.

2. The effectiveness of smartATs to achieve positive outcomes for clients is closely correlated to:

   ▪ An appropriate and effective assessment of client need and a matching of technologies. This includes three domains: correctly matching the technology, the carer and the client;

   ▪ Training and support provided to the clients;

   ▪ Dedicated staff and managers and a positive attitude from staff and clients with respect to using the devices and incorporating them into a client care plan; and

   ▪ Recording, monitoring and evaluating client use and outcomes.

3. Ethical issues were not identified as significant barriers to the introduction of smartATs.

4. Many technologies were considered to still be developing and the rate of change and product development is high. This has implications for service providers in terms of being flexible enough to incorporate new technologies into programs as they develop, and investing in keeping up to date of what is available;

5. Significant limitations in product effectiveness were experienced due to broader infrastructure limitations, such as mobile phone coverage and reliability. Planning for the implementation of smartATs needs to ensure such limitations are appropriately considered.

6. There is a need for smartAT suppliers to consider a revised contracting model that better facilitates the adoption of smartAT and provides for a more appropriate model for sharing risk, cost and responsibility. Perhaps more broadly, in the context of device accessibility and service funding, the question of whether community services organisations should be device owners and suppliers in their own right is one that should be debated at not only an organisational level, but should be also be considered by policy makers and funders.

7. Understanding of smartAT is still low and greater awareness by GPs and the broader community would facilitate greater adoption by clients. Consideration should be give to an appropriate education program and provision of information on a broader community level. To that end, there may be a role for councils and other organisations to promote the services and technologies;

8. The integration of the devices to support people to stay at home is a problem requiring a sector solution. An integrated technology platform is required and currently there are many options available, but all are running on different platforms and connections with different suppliers. This is difficult for clients and service agencies. Funding and support of pilots to develop and investigate interfaces between platforms would be of value;

9. All pilots identified costs of smartATs and the current funding arrangements are a barrier to greater adoptions and implementation. One solution suggested is that of a revised funding model focussed on a package of care environment where client's needs are considered in a person-centred way with a strong assessment framework to determine what will make a difference for each client. Flexibility to package care in a way suitable to the client is important, whether those funds be utilised to acquire nursing hours, or smartATs.

10. The social impacts (i.e. of reduced face to face carer and support time) need to be carefully considered in the implementation and assessment of smartATs to ensure social isolation does not become an unintended outcome.

11. A high quality central management system will be required in order to establish a large scale smartAT service. This in turn requires sound planning and organisational systems to ensure services are integrated and delivered seamlessly and result in positive outcomes for clients. One element which can only be dealt with appropriately by strong policy development is the ethical processes around ensuring that clients receive an OT assessment before being provided with

assistive technologies. This will ensure that the device is suitable, appropriate, will meet their needs and does not pose any safety issues. A clearly defined interface between funders, service providers and manufacturers will be necessary, in order to achieve this. Guidelines around insurance, professional indemnity and public liability also need clear definition.

# SUMMARY RESEARCH FINDINGS

This Chapter provides a summary of the key research findings research that outline the evidence base to support future decision making regarding smartAT policy development, service planning and implementation. The findings have been presented under the key research domains contained in the Research Framework that have also been mapped to the research objectives.

## 6.1 POLICY CONSIDERATIONS

1. The smartAT definition used by the State of Queensland

   – Technology to enhance safety, independence and quality of life for people with a disability

   – Technology applications to increase efficiencies in direct client service delivery, and

   – Technology applications to achieve greater integration across service providers.

   Meets requirements for a definition in the area of electronic technology that is used to support people's health and wellbeing well, and incorporates all the elements of the many definitions used in the literature.

2. The introduction of smartAT is often carried out in a context of uncertainty in which several alternatives are possible, because reasonable evidence on the effectiveness, efficiency and costs of the technology is not available. A major issue for stakeholders is that they are able to discuss and decide which decision-making criteria should be used in the selection of promising smartAT applications. To truly facilitate the adoption of smartATs as an integrated component of service delivery in the disability sector, service providers identified greater support is needed in terms of:

   – Policy and legislation,

   – Identification of and management of risk; and

   – Certainty and flexible funding models to accommodation clients' needs.

3. Ethical considerations are perhaps the most frequently mentioned concerns when discussing smartAT. The two dimensions most highlighted are privacy and trust. However, the experience in Australia (and in the pilot sites) demonstrated that if these issues are dealt with in a transparent manner, then ethical concerns and risks can be managed and mitigated.

4. It is clear from this review that technological advances are occurring very quickly, so that funders and service providers have to be adaptable to capture the benefits of the new, although not so fast to engage with the new that they embed systems that may be redundant very quickly, and not so slow that they miss out on the advantages that the new technology brings. These challenges were experienced at a number of sites where a different approach may have been adopted to the pilot had existing products been available at the pilot commencement.

5. To some extent, the role of government in respect of facilitating increased adoption of smartATs is still evolving. It is evident from this review that some technologies are in use in the sector in each jurisdiction, provided through particular programs at a Government and non-Government level.

However, it is also clear that, whilst the Government policies provide general direction towards including assistive technologies in disability services, the policies currently lack the systematic planning which is necessary to integrate this service into the current service delivery model. The challenge here will be transforming these general statements into a policy which specifies a detailed and well structured plan to roll out a well-integrated assistive technology service which will meet the needs of the relevant cohorts.

6.  It has also been recognised by all jurisdictions that any future service model development or restructure to amalgamate assistive technology services will need to take in a variety of issues which naturally stem from the use of technology. The most common highlighted include:

    −   Educating some cohorts (e.g. those with dementia or with severe dexterity disabilities) how to use the devices can be challenging, prolonged and at times unsuccessful;

    −   Knowledge of both the types of smartAT, and benefits, is still limited, and improving the knowledge of GPs, occupational therapists and the community care sector more broadly will need an important step to increase use;

    −   Certain devices can be expensive, particularly for individuals who receive a pension;

    −   The provision of maintenance and repair support will be necessary; and

    −   Medicare payments do not fully account for all clients using assistive technologies at this stage.

## 6.2  SERVICE DELIVERY

1.  As assessment of the cost-effectiveness of smartAT is hampered by a lack of available data regarding clinical effectiveness, efficacy, and costs, which requires the adoption of assumptions that decrease robustness of the analyses. Although the pilot sites and other projects identified in the literature review have identified the capacity of smartAT interventions to be cost-effective, delivery of these sorts of results in the real world still needs to be tested.

2.  The user groups for smartAT that are identified in the literature are identified mainly as older people who are becoming frail or have chronic health conditions, and other people with disabilities.

3.  There are no standardised change strategies for implementation, except that engagement with all stakeholders particularly at a local level is essential. Initial enthusiasm is important to create impetus to support the introduction of the intervention, but after implementation has taken place, there will be rejection and a diminishing of support if some stakeholders consider the impact of the interventions to be negative or disappointing. A high quality central management system will be required in order to establish a large scale smartAT service. This in turn requires sound planning and organisational systems to ensure services are integrated and delivered seamlessly to provide positive outcomes to clients.

4.  The main benefits for rural and remote clients and their families have been reported as focused on three key themes: lessening the burden (costs of travel, accommodation issues, lost wages, lost time), maximising supports (access to family, friends, familiar home environment, and care providers) and the need for smartAT systems to be tailored to enhance client and family needs. However, in order to ensure service sustainability, all service provider staff need to be trained and capable of supporting the smartAT devices; so that smartAT support can be provided by local staff and incorporated into other client visits (i.e. special device visits would no longer be required).

5. There is clear evidence that Indigenous populations in all parts of the world have shown rapid uptake rates for new technology when it meets certain conditions, though this was not largely tested in the five demonstration projects;

6. Key matters that need to be considered by service providers in considering the adoption and use of assistive technologies are:

   – Is the design of the technology relevant and user-friendly?

   – What is the value of the technology?

   – Is there a sustainable business model?

   – Is the technology promoted to users and service providers?

   – Have partnerships been formed and what is the relationship between funder, provider and device supplier?

   – Have technology champions been identified?

   – Is there a process to coach users?

7. One core principle of successful implementation of smartAT support for people with disabilities would seem to be summed up by the term 'co-production', the design and/or delivery of services by some combination of state and non-state agents, involving active participation by communities using innovative forms of state support to deliver services.

8. This review has identified that identification of key criteria for evaluating success is needed, but getting the correct technological responses for a person's needs, experiences and wishes is what is critical.

## 6.3 OUTCOMES

1. In terms of the effectiveness of smart assistive technologies, it has been evidenced that their use can result in positive client outcomes for the elderly and for people with disabilities (outcomes include increased independence, confidence to live at home, delay of entry into residential facilities, less anxiety about one's safety and general improvement in quality of life). Overall, whilst at times technological malfunctions may occur, the benefits of the technologies or devices have been shown to far outweigh the negatives.

2. The research illustrates a number of potential benefits for users of smartAT. Users who can benefit from smart assistive technologies have been reported to be:

   – People living alone who are unable to seek help in emergencies (unconsciousness, falls, strokes, myocardial infarction, etc.);

   – Older or disabled people who suffer from cognitive (Alzheimer disease, dementia, etc.) and/or physical (visual, hearing, mobility, speech, etc.) impairment;

   – People who need assistance in daily life to perform personal care activities (eating, toileting, getting dressed, bathing, etc.) and instrumental activities (cooking healthy meals, dealing with medication, and doing laundry;

   – Informal (family, friends, neighbour people) or formal (care provider) caregivers for older people or the disabled;

   – People living in rural and remote communities or in urban communities with inadequate health and social service provision ;

- People who suffer from chronic disease, and who need continuous monitoring (diabetes, cancer, cardiovascular disease, asthma, COPD, etc.); and

- People involved in telehealth care undertaking health care at a distance or telemedicine, with health and social service professionals practising 'virtual visits'.

# APPENDIX A - LITERATURE REVIEW BIBLIOGRAPHY

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# A

# APPENDIX B - RESEARCH FRAMEWORK

This chapter provides a discussion of the research framework that will provide the blue print for systematically addressing the research objectives (refer section 1.2).  More specifically, the framework has been designed to address the following issues:

- A description of the area to be reviewed;

- The specific questions to be addressed;

- The data sources that will be used during the review process;

- Performance indicators and other measurement units that reflect, directly or indirectly, the extent to which anticipated outcomes are achieved; or there are quality processes in place leading to that outcome; and

- Types of analyses to be undertaken.

## RESEARCH FRAMEWORK COMPONENTS

This section contains the research framework components that been designed to address the research objectives.

The key components of the research framework are outlined below.

1. **Research domains** that focus on an assessment of policy responses and implications, service delivery approaches and service integration, and impact and outcomes.
2. **Research questions** for each research domain that will guide the conduct of the research.
3. **Performance indicators and analysis** that will be used to address the research objectives.
4. **Data sources** that will be used in order to collect the relevant data to support the analysis of the research objectives.

## RESEARCH FRAMEWORK

The research framework illustrated in Table below outlines the research domains, research questions, key performance indicators, form of data analysis and proposed data sources

**Table A1: Research framework**

| Domain | Research questions | Performance indicator and analysis | Data source | | |
|---|---|---|---|---|---|
| | | | Literature review | Jurisdictional Review | Case studies |
| Policy | 1. What is an appropriate definition of smartAT in relation to the disability and community care sector? | Assessment of literature review findings and qualitative analysis of stakeholder feedback and jurisdictional policy documentation. | ✓ | ✓ | |
| | 2. What are the international and national trends in policy and program responses that support the integration of smartAT in service delivery in the disability and community care sectors? | | ✓ | ✓ | |
| | 3. What are the ethical issues associated with the introduction of smartAT, and to what extent are policy makers addressing those risks? | | ✓ | ✓ | |
| Service delivery | 4. What are the best practice strategies and service models that support the ongoing use of smartAT with clients and service providers with regard to:<br>• Human resources<br>• Service delivery costs<br>• Service delivery efficiency and effectiveness. | • Assessment of literature review findings<br>• Qualitative analysis of stakeholder feedback<br>• Jurisdictional/service provider documentation | ✓ | ✓ | ✓ |
| | 5. What does a situational analysis of all (or a representative sample of) disability and community care funded service providers' current policies and practices indicate about client and organisational use of smartAT including the range of smartAT used, the types of clients who use smartAT and any perceived improvement in life domains as a result of its use? | • Assessment of literature review findings<br>• Qualitative analysis of stakeholder feedback<br>• Jurisdictional/service provider documentation | ✓ | ✓ | ✓ |
| | 6. What change strategies should be considered when integrating smartAT into service delivery models | • Assessment of literature review findings<br>• Qualitative analysis of stakeholder feedback<br>• Jurisdictional/service provider documentation | ✓ | ✓ | ✓ |
| | 7. What do the findings of the smartAT demonstration projects undertaken suggest in relation to the application of smartAT into specialist disability and community care service delivery? | • Qualitative analysis of stakeholder feedback via cases studies | | | ✓ |

| Domain | Research questions | Performance indicator and analysis | Data source | | |
|---|---|---|---|---|---|
| | | | Literature review | Jurisdictional Review | Case studies |
| | 8. To what extent have smart assistive technologies been tested in rural and remote settings? | • Assessment of literature review findings<br>• Qualitative analysis of stakeholder feedback<br>• Review of jurisdictional evaluations and/or research (demographic and outcomes measures) | ✓ | ✓ | ✓ |
| | 9. To what extent have smart assistive technologies been tested with Indigenous populations? | • Assessment of literature review findings<br>• Qualitative analysis of stakeholder feedback<br>• Review of jurisdictional evaluations and/or research (demographic and outcomes measures) | ✓ | ✓ | ✓ |
| | 10. To what extent have "innovative" approaches been adopted? | • Assessment of literature review findings and comparison to analysis of jurisdictional approaches | ✓ | | ✓ |
| | 11. To what extent have "active service models"/"independence models" been tested (particularly in relation to the younger cohort) and what are the key learning's for future service provision? | • Assessment of literature review findings and comparison to analysis of jurisdictional approaches | ✓ | | ✓ |
| | 12. What are the barriers and success factors of the introduction of smart assistive technologies? What are the barriers how are they being addressed? | • Assessment of literature review findings<br>• Qualitative analysis of stakeholder feedback | ✓ | | ✓ |

| Domain | Research questions | Performance indicator and analysis | Data source | | |
|---|---|---|---|---|---|
| | | | Literature review | Jurisdictional Review | Case studies |
| Outcomes | 13. To what extent are the demonstration project offerings suitable to participants? | • Analysis of demonstration project data (where collected) including:<br>  – Demographic data<br>  – Consumer satisfaction measures<br>  – Outcome measures (incl. IPPA)<br>• Qualitative analysis of stakeholder feedback | | | ✓ |
| | 14. What is the profile of the participants in the demonstration projects? | • Analysis of demonstration project data | | | ✓ |
| | 15. To what extent are the demonstration projects delivering an appropriate level of support? | • Analysis of demonstration project data (where collected) including:<br>  – Consumer satisfaction measures<br>  – Outcome measures (incl. IPPA)<br>• Qualitative analysis of stakeholder feedback | | | ✓ |
| | 16. What evidence is there that people have benefitted from smart assistive technologies? | • Assessment of literature review findings<br>• Analysis of demonstration project data (where collected) including:<br>  – Consumer satisfaction measures<br>  – Outcome measures (incl. IPPA)<br>• Qualitative analysis of stakeholder feedback | ✓ | ✓ | ✓ |

| Domain | Research questions | Performance indicator and analysis | Data source | | |
|---|---|---|---|---|---|
| | | | Literature review | Jurisdictional Review | Case studies |
| | 17. What are the outcomes for the target cohort? | • Assessment of literature review findings<br>• Analysis of demonstration project data (where collected) including:<br> – Consumer satisfaction measures<br> – Outcome measures (incl. IPPA)<br>• Qualitative analysis of stakeholder feedback | | ✓ | ✓ |
| | 18. What are the unintended outcomes from the implementing smart assistive technologies | • Assessment of literature review findings<br>• Qualitative analysis of stakeholder feedback | ✓ | | ✓ |

## LITERATURE REVIEW FRAMEWORK

This section outlines the proposed literature review framework that will address the scope, database identification and search terms.

### SCOPE

The purpose of the literature review is to identify information that will present the Queensland Government with an overview of what is happening globally with respect to the implementation and evaluation of smart assistive technologies, the opportunities that are available, and the ramifications of implementation of the technologies that are available.

The literature review process will deliver a literature scan, not a formal systematic literature review (as articles will not be formally assessed to determine the quality of any research method). The search strategy will be to review published literature from 2007 to the current day. Literature before 2007 will not considered because of the rapid development of technology, and because there have been systematic literature reviews that have included earlier periods.

### DATABASE IDENTIFICATION

The databases included in the search will be MedLine (medicine, nursing, dentistry, health care systems, and preclinical sciences), CINAHL (nursing, allied health, biomedical and consumer), SCOPUS (Science), IEEE Explore (Electrical engineering, electronics and computer science), PsychINfo (psychology and the behavioural sciences) and ABI/Inform (business and financial information).

Key words for the search have been chosen to ensure sufficient coverage (refer below). Articles will be narrowed down to the specific topic areas. Within each topic area, articles will then be scanned for relevance, and those remaining used as the basis for this report.

### SEARCH TERMS

The proposed search terms have been informed by conducting an initial scan of the literature to identify the main keywords being used by journal publishing in this area. The keywords that are detailed in this framework may be extended or reduced as the search continues. At this stage we are suggesting that the search terms are:

*ambient assist*,ambient intelligence, assistive device, assistive technolog*, communication aids for the disabled, intelligen* and (device* or technolog* or control* or system*), optical sensor based system, pervasive cognitive assist*,self-help devices, sensor network, smart assist*, smart assistive technolog*, smart cane, smart home, smart house, smart technolog*, smart walker, smart wheelchair, teleassist* or tele-assist*, telehealth of tele-health, telemedicine or tele-medicine, telemonitor or tele-monitor, televigilance or tele-vigilance, wearable comput*.*

The results of these searches will then be combined and linked with other search terms such as health policy, social control policy, healthcare policy, organisational policy, cost effectiveness, efficiency, human resources, implementation strategies, indigenous people, people from culturally and linguistically diverse backgrounds, client/patient outcomes, etc.

## JURISDICTIONAL REVIEW

This section sets out the methodology for conducting the jurisdictional review.

### OBJECTIVE

The objective of the jurisdictional review is to investigate and provide a summary on initiatives that have been implemented in other Australian jurisdictions to build and expand service delivery applications of smartAT in relation to the disability and community care sector.

### APPROACH AND STAKEHOLDER IDENTIFICATION

HOI will conduct telephone interviews with policy makers and NGO service providers in all jurisdictions (excluding Queensland). All stakeholders will be provided with a copy of the key research questions and project scope (based on this document) in advance of the consultation to ensure they can make an effective contribution to the research.

The table below outlines the stakeholders have been identified for inclusion in the jurisdictional review.

**Table A2: Suggested stakeholders for jurisdictional review**

| Ref | Stakeholder | Reason for inclusion in jurisdictional review |
|-----|-------------|-----------------------------------------------|
| 1 | Department of Families, Housing, Community Services and Indigenous Affairs, | Explore the existing and future policy directions in relation to smartAT, with particular focus on the National Disability Strategy and recent developments. |
| 2 | Ageing, Disability and Home Care, NSW | ADHC NSW services the largest population base in Australia and has published research in relation to "sustainable approaches to meeting increasing demand". |
| 3 | Department of Human Services, Victoria | Victoria supports the second largest population of people with a disability. |
| 4 | Disability Services Commission, WA | WA has a significant ATSI population, combined with significant rural and remote communities. |
| 5 | Alzheimer's Australia (Safe2Walk) | Pilot project conducted in two jurisdictions (WA and VIC) with published results |
| 6 | Feros Care | Feros Care project provides home-based tele-health and tele-care services. The reported pilot findings had a focus on cost effectiveness. |

## CASE STUDIES OF DEMONSTRATION PROJECTS

This section sets out the approach to conducting the case studies of demonstration projects.

### OBJECTIVE

The objective of the case studies is to identify the extent to which the experience of the five Home and Community Care organisations involved in the smartAT demonstration projects answer the research questions.

### APPROACH

Working effectively with the five demonstration projects will be a critical component of this project. The project will need to extract information in an effective way that minimises the impact on service providers.

A "case study" approach has been adopted to understand the extent to which the demonstration projects inform the use of smartAT as an integrated component of service delivery. The two key components of this approach incorporate:

A **broad based consultation strategy** involving a range of stakeholders including:

- o Demonstration project program managers (all 5 projects) and key program staff
- o NGO Management (demonstration project participant NGOs)
- o Departmental staff

**Collection of evaluation data** (from existing information sources, collected by the demonstration projects) and where appropriate build on these to reduce the data collection burden on the demonstration projects.

### EVALUATION APPROACHES AND DATA COLLECTION

These demonstration projects are due for completion in approximately June 2012. Each project is conducting its own internal evaluation at project completion, and as such each project has developed its own data collection approach.

It is acknowledged that the internal evaluation reports for the demonstration projects will not be available within this research project's timeframe, and as such, will not be available to inform HOI's work. However, it will be important to take account of the information currently collected and the extent to which it supports conclusions regarding the research objective.

A summary of each demonstration projects evaluation approach and data is provided in the Table below.

### Table A6.1: Demonstration project evaluation and data approach

| Project | Project's evaluation approach | SmartAT research approach |
|---|---|---|
| **Alzheimer's Association Queensland** <br><br> *Key contact:* <br> *Brooke Medhurst* | University of Southern Queensland (USQ) is conducting the evaluation.   Data collection approach: <br> • No standardised outcome measure <br> • Focus group of carer to collect qualitative perspectives <br> • Pre and post questionnaire/survey <br> • Ethics approved received (managed by USQ). <br> • Data collection should be complete by July 2012. | HOI approach to comprise: <br> 1. Review of client profile and usage data <br> 2. Review of pre and post survey results <br> 3. Review of qualitative data collected (to the extent it has been analysed by the evaluator) <br> 4. Consultation with: <br>    a. Project Manager <br>    b. Two Occupational Therapists <br>    c. USQ Evaluator |
| **Blue Care** <br><br> *Key contact:* <br> *Emily Needham* | Ethics approval via Uniting Care Queensland. <br> Data collection approach: <br> Client satisfaction survey <br> Carer satisfaction survey <br> Staff satisfaction survey <br> Quality of life measures pre and post: <br> • Canadian Occupational Performance Measure <br> • PIADS - Psychosocial Impact of Assistive Devices Scale <br> Time and cost modelling <br><br> Data collection should be completed by July 2012 | HOI approach to comprise: <br> 1. Review of client profile and usage data <br> 2. Review of pre and post results <br> 3. Review of cost modelling data <br> 4. Consultation with: <br>    a. Project Manager <br>    b. Site Manager (Redcliffe only) <br>    c. Community Care Advisor <br>    d. Business Improvement Officer <br>    e. Project occupational therapists |
| **Centacare Bundaberg** <br><br> *Key contact:* <br> *Jill Donaldson* | Data collection approach: <br> • Pre and post assessments using ONI and IPPA <br> • Collection of qualitative data using "client diaries" <br> • Considering use of a client survey (at the end of the project) | HOI approach to comprise: <br> 1. Review of client profile and usage data <br> 2. Review of ONI and IPPA results <br> 3. Review of qualitative data collected (to the extent it has been analysed by Centacare) <br> 4. Consultation with: <br>    a. Project Manager <br>    b. Community Care Team Leader <br>    c. Community Care Allied Health Coordinator <br>    d. Relevant Allied Health Staff (focus group) |

| Project | Project's evaluation approach | SmartAT research approach |
|---|---|---|
| **Jymbilung House** <br> *Key contact:* <br> *Matthew Moore* | Independent external organisation to evaluate (BEG Consulting) | HOI approach to comprise: <br> 1. Review of client profile and usage data <br> 2. Review of evaluation results and data <br> 3. Consultation with: <br>   a. Aged Care Manager <br>   b. Physiotherapist <br>   c. OT <br>   d. BEG Consulting |
| **Golden Years** <br> *Key contact:* <br> *Don Rudd* | Data collection approach: <br> • Client survey <br> • Carer survey <br> • Pre and post assessments using IPPA | HOI approach to comprise: <br> 1. Review of "progress report" (November 2011) <br> 2. Review of client profile and usage data <br> 3. Review of IPPA results <br> 4. Review of qualitative data collected via surveys <br> 5. Consultation with: <br>   a. Project Manager <br>   b. HACC Services Officer <br>   c. HACC services coordinator <br>   d. Relevant occupational therapists <br>   e. External stakeholder - Brisbane Seniors Online |