

Enhancing healthcare in home and community settings through telecare and telehealth.

Jeffrey Soar

School of Information Systems, Faculty of Business & Law, University of Southern Queensland, Australia
soar@usq.edu.au

Abstract. *This paper discusses the available and emerging technology for healthcare at home, the potential it has to transform healthcare as a whole, the slow pace of adoption and introduces a new regional research consortium that aims to build the pathways to ubiquitous adoption. There is a plethora of intelligent technologies already available and new technologies are emerging to better support care in home and community settings. These include home networks to provide reminders and ensure people are safe and have access to care and services. Technologies are much more sensitive to changes in our physiology and can alert us and carers so as to delay or avoid the progression of the many chronic diseases, many of which only show symptoms at advanced stages.*

Keywords: telecare, telehealth, community healthcare

1 Introduction

The adoption of technologies for care in home and community settings remains low while demands on the health and community care service systems continue to grow. Hospitals are under increasing pressure from the impacts of ageing societies. A significant percentage of hospital admissions are avoidable. Key factors in the number of avoidable hospitalisations are age, socioeconomic status, and remoteness. Other factors include individuals' own perceived health needs and their choices about seeking health care. Almost two-thirds of avoidable hospital admissions were attributable to chronic conditions, with large numbers from diabetes complications and circulatory and respiratory conditions. Telecare and telehealth could help people avoid going to hospital through providing links between home and clinical care.

Challenges of ageing include increasing incidences of falls, social isolation, medication problems, cognitive decline and other needs. Much of these challenges could be relieved by intelligent care technologies in the homes of people with needs. Even a simple technology such as a home telehealth workstation for taking vital signs could have a major impact. Initial rollouts overseas of intelligent care technologies are showing up to 80% reductions in institutional care and up to a 10-fold increase in workforce productivity.

A regional research consortium SAIL (Smart Ageing & Independent Living) has been established with the aim of developing the pathways to improve adoption of

telecare, telehealth and other technologies where there are benefits to consumers, their families, carers and funders. SAIL is developing technology-supported solutions to improve the adoption of intelligent assistive technologies that will assist with the challenge of a growing ageing population and a pressured healthcare system. SAIL works with researchers involved in the design and development of technology innovations and with other stakeholders in evaluation and the development of business and care models leading to widespread adoption.

Technology has the potential to accelerate the health reform agenda through streamlining processes, eliminating unnecessary steps including avoidable hospital admissions and home visits, and can deliver information and access to care directly into the homes of patients

1.1 Technology innovation in healthcare

Continuing innovation and development in healthcare and technology are constantly creating new and improved opportunities to prevent, diagnose, treat and monitor diseases and promote wellness. Innovation in some areas has been rapid and exciting. For example, some surgery procedures are no longer required due to advances in medications. When surgery is required there are new techniques requiring less incisions, reducing damage and shortened recovery times. Robot surgery is being employed across a widening range of applications. The robot can be far more precise and capable of micro-procedures than would be possible manually. Procedures can be performed with greater precision leaving less damage to surrounding tissue. A new trend is towards surgery through natural body orifices.

Hospitals in the developed and much of the developing world are users of sophisticated information systems which reduce previous delays due to the flow of information. In primary and secondary care there is use of robotics in pathology laboratories and use of digitised imaging in radiology. Most results reporting is on-line resulting in a rapid turn-around time. Patients can be referred for diagnostic imaging services and return not long afterwards to the referring practitioner to discuss the results.

There is some way to go in taking advantage of modern technologies to reform work-practices both within hospitals and in healthcare in other settings. The potential of ICT is evident in the changes it has enabled in other industries. ICT simplifies processes, reduces intermediary steps (as well as reducing the jobs of intermediaries); it makes work and services much safer. Products and services can be provided to consumers in their own place, time and convenience rather than those of the service provider. ICT reduces the cost of transactions and allows a huge increase in transaction volume using the same or fewer resources.

Healthcare costs are seen to be spiralling out of control in many countries and consuming ever more of national GDPs. Internationally there has been a reform agenda in many countries sharing similar features. These include moving more

towards prevention; better coordinating care across providers and across sectors of care; electronic health records

1.2 Healthcare Reform

There has been interest in health sector reform across the world for several decades and the pace of change has been slow. The UK was an early leader with the introduction of patient registration with a general practice provider, some levels of primary-provider budget-holding for other services, healthcare trusts, and some aspects of purchase-provider split. Associated with that were several phases of large-scale national health ICT strategies with major investments in infrastructure. In New Zealand the reforms were introduced through four regional purchasing authorities, there was a plethora of innovations but little national standardisation. One of the health purchasing authorities even developed their own centralised patient databases which duplicated the national health information systems.

In the USA the HMOs (Health Management Organisations) were able to offer lower premiums through introducing measures such as using the patient's GP as the gate-keeper to other services. The HMOs tended to attract the young and well but were perceived to be more difficult for old or chronic illness sufferers. There was reported to be a more aggressive approach to scrutinising patient's claims.

In countries with part or full national health systems there have been many major national reform and ICT strategies. Countries such as the UK, Australia, Hong Kong, Singapore, Australia and New Zealand have taken repeated steps with varying degrees of success.

SAIL (Smart Ageing & Independent Living) is a new regional consortium that aims, through research, to help both consumers and care providers to enjoy the benefits of ICT, particularly in home and community-settings. The SAIL program of research which is aimed at discovering the pathways to large-scale adoption of home telecare and telehealth where there are demonstrable benefits to consumers, carers and funders. Individual projects apply telecare and telehealth as an intervention in home and community-based settings for care. The aim is to identify and measure the potential benefits, to develop new models for successful deployment of telecare and telehealth to benefit patients, carers and to test the concept through a small-scale deployment.

1.3 Telecare and Telehealth

Telecare and telehealth have the potential to transfer healthcare, in a similar way to how ICTs have transformed other industries. More care could be delivered in the place, time and convenience of the consumer rather than the care provider. Consumers could interact with health systems, to make and chance appointments at

their convenience, to access their own records, and to electronically interact with healthcare providers reducing the need to travel and wait.

The slow pace adoption of home telecare and telehealth is an issue that continues to confound technology developers and informaticians. There are many chronic conditions that could be supported and better managed by innovative telecare and telehealth technologies that are available yet rarely found in the homes of people who might benefit from their use. Intuitively, supporting people at home would at lower cost than hospital care. In Australia researchⁱ has shown that around 600,000 hospital admissions could be avoided. That there is national interest in reducing demand on hospitals through better managing chronic illness in the community is evident in initiatives in Australia such as HARPⁱⁱ, CHIC and similar schemes as well as strategy papers around the world. Further evidence is in telecare and telehealth pilots and projects in Australia and around the world and accounts of the benefits of these projects can be found. However few of these projects move beyond pilots to wider deployment. The program of research attempts to advance the evidence beyond the pilot stage. The SAIL program is an international collaboration involving partners in Hong Kong and China. Components of the research are undertaken by the research collaborators in Hong Kong, China and Australia. This enhances the quality of the findings and assists in the international applicability of approaches arising from the research.

2 Chronic Disease and Ageing

With ever advancing longevity there is an associated increased prevalence of chronic illness. Successive generations of older people are healthier than previous generations but because there are more of them in the form of baby-boomers and because people are living longer there is consequently an increase in the incidence of chronic illness.

Cardiovascular disease including Heart Failure is Australia's most costly chronic disease and largest cause of deathⁱⁱⁱ. It imposes a burden of disease, in terms of disability and premature death, second only to cancer. Despite falls in the incidence of Heart Disease in Australia, death rates remain higher than those in many other developed countries. It is a major cause of hospital admission with readmission rates from an exacerbation of heart failure of 30% to 60% at 30-day and 12 months respectively following discharge^{iv}. It is associated with high levels of health service utilisation across the settings of care as the disease progresses. Risk factors such as smoking, lack of exercise, being overweight, excessive alcohol use and poor diet can all be changed and improving them can greatly reduce the impact^v. There is evidence that cardiac rehabilitation can make improvements and reduce risk factors^{vi}. This is the goal of the Heart Failure Service at the Royal Brisbane and Women's Hospital which is the site for this paper.

Home-based healthcare support has the potential to proactively manage problems through regular self-monitoring and early intervention, thereby reducing the need for

the patient to leave their home to seek advice and care, and reduce the requirement for clinicians to visit patients in their homes. Through access to on-line patient vital signs and other indicators the technology can help prioritise home visits and reduce visits just for check-ups or taking vital signs. Having a personalised care plan with specific targets, supported by immediate access to quality information sources, and timely access to healthcare professionals when required from within their home would enable many people with chronic health needs to take charge of their own care.

Home care services are multi-disciplinary and also depend on effective working relationships with members of other health disciplines such as General Practitioners, Community Care, Medical Specialists, Aged Care and others. There are few means of electronically sharing patient information across sectors and across the many carers that a patient interacts with. Home care workers work in a field where there is a high level of adverse events, conditions and unmet needs. Many of their patients have multiple and complex conditions. Home care workers are often isolated in their work and usually time, information and resource poor. There is not as yet an expectation of providing ICT tools such as telecare and telehealth for efficiency, effectiveness and productivity.

The age-related demographic changes in Australia and the rest of the world are well-documented^{vii}. Associated with ageing is an anticipated increase in demands for support and increasing incidence of chronic illnesses such as chronic obstructive pulmonary disease and heart failure^{viii}. Ageing increases the likelihood of such conditions and can expose consumers, their families and carers to well-known challenges of social isolation^{ix}, depression, polypharmacy^x, medication errors^{xi}, reduced mobility and risk of falls^{xii}, and “carer burnout” amongst many others. Families are often ill-prepared to deal with issues that confront them suddenly when a family member needs support following, for example, a serious fall or the advancement of their condition. The experience of navigating the complexity of services to meet the needs of a family member with chronic illness can be daunting^{xiii}. To date care delivered in the home has remained largely labour-intensive and poorly supported by modern technologies to help the workforce, consumers or their families in better managing conditions and providing the best-possible quality of life.

Better quality data can assist in development of national policy, particularly as it relates to funding models for home care services. Quality research can assist funders and providers in resource allocation decisions and investment in new services and systems. Telecare and telehealth can help the workforce in becoming more “information rich” to optimize the effectiveness of their services to their elderly clients. Telecare and telehealth technology has the potential to be a key enabler for change in healthcare, by allowing information to be available when and where a client needs are. It can drive communication and partnerships between providers and consumers, reduce the risks of adverse events for consumers and, ultimately, reduce costs and improve outcomes.

There is a need to promote how telecare and telehealth will contribute to the national telecare and telehealth agenda to contribute evidence of the potential of these

technologies for workforce effectiveness and greater efficiencies in healthcare. The program of research works within and supports the frameworks established by NeHTA (National EHealth Transition Authority) and the NHHRC (National Health and Hospitals Reform Commission) reports. Australia's National Primary Health Care Strategy and also the recommendations of both the NHHRC and the National Preventative Health Taskforce identify the need for improving access, better managing chronic disease, a more systematic focus on prevention, and the appropriate use of technology^{xivxxvi}.

2.1 National Strategies

One of the national health issues, cardiovascular disease (CVD) is a significant contributor to the overall burden of disease and the major cause of mortality in Indigenous Australians. The need for improvement in the following areas has been identified: supporting primary health care in the diagnosis and management of CVD; improving care processes at acute and post-acute phases; and improving the uptake and support of clinical guidelines across all settings at all stages of CVD.

One of several national strategies for improving healthcare in Australia is the National Research Priority Goal of Ageing Well, Ageing Productively. It is about promoting health strategies to ensure that older Australians enjoy healthy and productive lives, and encouraging all Australians to adopt healthier attitudes, habits and lifestyles. Researchers have an opportunity under this National Research Priority to propose projects that will better enable home care clinicians to redefine their roles to have more time for hands-on care, to reduce unnecessary steps, to be better supported through access to relevant information, and better service their clients through innovative technology.

There is a need to take advantage of the ever increasing availability and capacity of telecommunications. In Australia the NBN (National Broadband Network)^{xvii} strategy has as one of its aims the delivery of better health care. This is particularly for people living in regional, rural and remote areas who are expected to have improved access to specialists and doctors, without having to travel long distances; and better collaboration between health professionals and the instant transmission of diagnostic images. Research will need to deliver data on where and how this new communications capacity might offer opportunities.

Technology by itself is rarely a complete solution in any setting. There is a need to better understand current work practices, clinical practices and client interaction to form a new model of care based on the use of home telecare and telehealth technology. This is likely to include new functions for advising and supporting clients in their use of the equipment and providing on-line consultations. The model should include how information will be captured and managed by the technology reducing much of the need for paper-work and manual data entry. The technology can provide new tools for patient assessment, monitoring and alerts along with communication and documentation along with clinical protocols for clinical management.

3 SAIL – Smart Ageing & Independent Living

The model for SAIL is consumer-needs-based research with a focus on developing the pathways for adoption of new and emerging technologies where there are expected benefits for consumers, their families, carers, communities, care provider organisations and care funders. SAIL's research outcomes will enable people with health and other needs to live more independently, to remain longer in their homes and choose to delay or avoid residential care, to reduce attendances at care facilities through access to services from home and to have ready access to quality information for self-care.

This involves rigorous research on the benefits and approaches to implementation to realise potential benefits, innovation to address gaps in the range of available hardware and software, the development of new models of care and care funding models. Under this model, the researched needs of stakeholders are used to focus the objectives of SAIL.

The outcomes from SAIL's Research Program will include:

- Compelling evidence on social, clinical and economic benefits to inform policy development and resource allocation that will help shift the focus more to disease prevention and care in home and community settings supported by intelligent technology
- User interface design to improve adoption so that older people, people with disabilities and others can use technologies with ease to support daily activities
- Privacy & security approaches that will ensure personal information is never compromised and protected through secure exchanges of information
- Research and development collaboration between core segments of health care, aged care and disabilities support including different levels of government to help break down the silos and achieve a seamless consumer experience
- New Models of Care, Business models, new services and start-up companies for the specification, selection, installation, maintenance and response of assistive technologies

4 SAIL Research Program

SAIL Research Stream 1: Preventative Health and Communities of Care

There is growing development of intelligent home care technologies which provide benefits to consumers, carers, provider organisations and care funders. Such developments support independent living and active ageing. There is currently limited research on the cost benefit of such technologies, but existing research suggests that

home care can reduce institutional care by up to two thirds, with consequential cost savings.

This stream involves the development of policy based on rigorous research including RCTs (randomised controlled trials) demonstrating the benefits, including economic benefits, of intelligent assistive technology. It includes new funding models for services, new models of care to take advantage of the benefits of technology, new workflows and work-practices, education and training for carers and consumers. The starting points are a Systematic Review which will inform the Research Program on the gaps in research. Analysis of Workflow and use of information is important foundation research that will measure the potential benefits from home telecare and telehealth. The development and testing of an Evaluation Methodology is essential for a subsequent large-scale randomized controlled trial of home telecare and telehealth. There are five projects in this stream that are already underway or for which funding is currently being sought. These include a Systematic Review, A Workflow Study of Community Care Nurses, Workflow Study and Deployment Model for Home Heart Failure Service, A Large-scale Trial of Home Telehealth, Acceptability and Useability for Consumers and a Workflow Study in Residential Aged Care.

SAIL Research Stream 2: Independent Living

Stream 2 is concerned with developing the pathways for people to obtain the technologies that will support them in continuing to living independently in the community. Through the technologies families and carers will know loved ones are safe. Vital signs and other checks and measures can be taken without the consumer needing to leave home. They can use the same technology for an on-line consultation with a qualified clinician who will have their full clinical record available to them. This stream will develop new services that will assess consumer's needs, specify the required technologies, and provide installation and maintenance, consumer self-care information, monitoring and case management. This will ensure people have the innovations for functional independence, safety and access to care when needed.

This stream will build links for seamless, consumer-driven care in community settings. A current challenge in healthcare is the fragmentation and lack of coordination between primary, aged care, hospital care and community care. Building on SAIL's expertise to develop the links for seamless care in community settings that link hospitals and consumers' own homes the stream will research the required architecture, infrastructure, rules, risk management, governance and operational responsibilities for exchange of personal clinical information between carers, and between carers and consumers. SAIL will identify and test new service models for holistic case management ensuring the right care in the right place. Technology-based service innovation will include hospital avoidance, cross-sector referrals with full information, shared views of patient records and consumer access and control.

SAIL Research Stream 3: Design

This program focuses on design issues including Universal Design principles for technologies and user interfaces. It will develop pathways to implementation of the standards and technologies that will produce a total environment that does not deny access to groups of people. Universal design produces products and environments that are useable for everyone and not just the fit and able-bodied. People with disabilities are often denied access and full involvement in life due to barriers that in many cases could have been avoided at the design stage. This stream will engage consumers, carers, designers, engineers, architects and other stakeholders to develop pathways for greater adoption of Universal Design.

5 Conclusion

The business case for SAIL is evident in the high rates of adverse events, the known avoidable admissions to hospital, and other pressures of ageing populations that intelligent assistive technology would reduce. Exciting innovative technologies for home and personal care are increasingly available but their adoption remains low.

SAIL will raise funds for a collaborative research program in this field with a particular focus on missing components including pathways to adoption, evidence on the benefits, business models, work-practice change, new models of care, user-interface issues and technology integration. SAIL will influence and defend policy development and resource allocation through compelling research on the benefits of intelligent assistive technology.

Potential conflict of interest: The author reports no conflicts of interest relevant to this paper.

Acknowledgments: The Author acknowledges the support of the Australian Research Council for research that supported some of the information in this paper.

References

ⁱ AIHW (2009) Atlas of Avoidable Hospitalisations in Australia. Australian Institute of Health and Welfare, Canberra

ⁱⁱ About HARP, Hospital Admission Risk Program, Department of Health, Victoria <http://www.health.vic.gov.au/harp/about.htm> accessed 18 April 2011

ⁱⁱⁱ AIHW (2010) Cardiovascular disease mortality: trends at different ages. Australian Institute of Health and Welfare, Canberra

^{iv} Prentice, L. (2010) RBWH Heart failure service guidelines, Queensland Health, Brisbane

^v AIHW (2011). Cardiovascular disease: Australian facts 2011. Cardiovascular disease series. Cat. no. CVD 53. Australian Institute of Health and Welfare Canberra

^{vi} Ibid: 162

^{vii} Productivity Commission (2010) Caring for Older Australians, Australian Government, Canberra

^{viii} AIHW (2011). Cardiovascular disease: Australian facts 2011. Cardiovascular disease series. Cat. no. CVD 53. Australian Institute of Health and Welfare Canberra

^{ix} Findlay, R. (2003) *Interventions to reduce social isolation amongst older people: where is the evidence?* *Ageing and Society* (2003), 23: 647-658

^x Gorard, D. (2006) Escalating polypharmacy. *QJM: An International Journal of Medicine*, Volume 99, Issue 11: 797-800.

^{xi} William B. Runciman, W., Roughhead, E., Semple, S. and Adams, R. Adverse drug events and medication errors in Australia. *Int. Journal for Quality in Health Care*. Volume 15, Issues suppl 1: i49-i59

^{xii} AIHW (2009) Hospitalisations due to falls by older people, Australia 2005-06. Australian Institute of Health and Welfare Canberra

^{xiii} Ballantyne A., Cheek, J., Gillham D. and Quan J. *Information about the information: Navigating services and supports for older people.* *Quality in Ageing and Older Adults*. Volume 6, Number 3 / November 2005

^{xiv} Department of Health and Ageing (2009) Building a 21st Century Primary Health Care System. A Draft of Australia's First National Primary Health Care Strategy, Commonwealth of Australia, Canberra

^{xv} NHHRC, (2009) National Health and Hospitals Reform Commission Report, Commonwealth of Australia, Canberra

^{xvi} National Preventative Health Taskforce (2009) National Preventative Health Strategy, Australia: The Healthiest Country by 2020, Commonwealth of Australia, Canberra

^{xvii} DBCDE (2010) National Broadband Network—overview. Australian Government, Department of Broadband, Communications and the Digital Economy