Enhancing healthcare through Technology – reducing hospital admissions and supporting care in Smart Home environments.

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Abstract

Ageing of populations and its attendant challenges will be a major international concern for the coming decades. There are issues of support for increasing numbers of people retiring from the workforce as well as impacts on healthcare services. Other challenges include maintaining the workforce participation of older workers, supporting family carers of the frail elderly as well as addressing the shortages of informal and professional carers. The expectations of ageing Babyboomers are likely to be different to those of more-stoic previous generation and there will be a need for social and policy changes to support demands for independence and consumer-driven care.

There is particular interest in technology to assist countries in meeting these challenges. Technology is expected to enhance productive lives, support independent living, reduce avoidable hospital admissions and facilitate care to be delivered according to consumer preferences for place and time, and increasingly in the home. In the USA, the UK and Europe governments are passing legislation and providing major incentives to facilitate the large scale adoption of telehealth assistive technologies. In the USA the Center for Aging Services Technologies (CAST) was established in 2003 to lead the national charge to develop and deploy emerging technologies that can improve the ageing experience in America. A complimentary centre TRIL (Technology Research for Independent Living) has recently been opened in Ireland. In Australia a consortium has been established to build a similar centre beginning with the Queensland Smart Home Initiative that opened its first unit in April 2007.

There are a number of projects around the world aimed at diverting people from hospital admission and others that provide technologies to support home delivery of care. This presentation will discuss a hospital avoidance project, a Smart Home initiative and a project to facilitate productive ageing. This will include a discussion of new and emerging innovative technologies and their impacts that will provide an indication of how health and aged care will be transformed through technology.

Introduction

Some of the countries that lead the world in ageing demographics are to be found in Asia. This demographic change poses significant challenges to Asia’s society and economy. ICT (Information and communication technologies) is seen as an important means for assisting societies in managing these challenges. ICT can help the older people to maintain or improve quality of life, stay healthier and live independently for longer. Assistive technologies are emerging to address problems related to frailty including
memory loss, vision, hearing, and mobility, which are more prevalent with age. ICT also enables older people to maintain or extend their productive lives.

The accumulated experience and skills is a great asset, especially in economies based upon knowledge assets. The demand for health and social services will grow with the increase of the number of very old people (the percentages of over 80 year olds will almost double by 2050 in many countries). Sustainability of health and aged care services will be an increasing issue along with the need of the smaller percentages of working people to support a growing retired community.

ICT will need to be used to enhance efficiency in health and aged care services, as well as enable more self-care, access to lower-cost services and innovation such as smart homes and assistive technologies that might substitute for the diminishing pool of available labour. Both informal family carers as well as professional carers are in diminishing supply due to a wide range of social changes. These include greater workforce mobility away from elderly parents, greater workforce participation of women and a broader range of career options for women that those in the past that may have been more oriented to nursing and other personal services.

Ironically the older populations in many countries has significant buying power and voting power, however the market of ICT and assistive technologies is still on its nascent phase. There is an increasing number and variety of technologies available but most of this is driven by innovators and technology vendors. There is no evidence of sustainable market demand as yet.

There may also be issues of the ease of adoption and fitness-for-use of available technologies, cost and the lack of a clear business case, the fragmentation of governance and funding of health and aged care can work against innovations, the current war-era generation of older people has been by-passed by the information age, ICT developers are often young and know a lot about young people (evident by the huge games industry) but may not understand the needs of older people, interoperability standards are under development, and high costs of development and validation.

The Collaboration for Ageing & Aged-care Informatics Research has the objective of enabling a better quality of life for older people with significant cost-savings in health and aged care. It also aims to help creating a strong industrial basis in Asia-Pacific for ICT and ageing.

CAAIR plans to address market barriers for ICT services and tools and seeks to realise the opportunities particularly for the older people of today and tomorrow, by raising awareness, building common strategies, removing technical and regulatory hurdles, and promoting adoption, joint research and innovation.

Flag-ship projects of CAAIR have been in the areas of hospital avoidance, Smart Home innovation and productive ageing. This paper will report on both of these as well as the issue of productive ageing and regional economic.
Hospital avoidance

Patients over 65 years account for 46% of acute hospital bed days and 33% of hospital separations in Australia, although they represent only 12% of the total population. By 2051 the percentage of over-65s in Australia is projected to double. The largest increase will be in the over 85 group which will increase from 1% in 2002 to between 6 and 9% by 2051; a massive 500-700% increase (AIHW 2004). This cohort is more likely to experience frailty and their increase in the population will impact greatly on the cost of health services in Australia (MacMillan, Conway et al. 2001).

Aged patients commonly present to hospital ED (Emergency Department) with multiple, complex conditions and tend to be admitted because clinicians have insufficient time to explore other options and the patient’s suitability for these. There is no agreed definition in the literature of inappropriate attendance at ED. Van Konkelenberg and Esterman (2003) in their research in South Australian hospitals found a range of factors for ED attendance which related to GP services, to the ED, and to personal situations. Health system strategies to manage attendance at ED and admission have included demand management strategies such as telephone triage, ED-based GP services, minor trauma centres, and triage-based systems within the ED. In Victoria, Australia there are a range of approaches to demand management under HARP (Hospital Admission Risk Program). These analyse hospital admission data to identify “frequent flyers” and to offer them better management of their conditions to avoid or reduce admissions. HARP interventions are “after the event” whereas the approach reported on in this research involves “real-time” interventions at the point where a decision will be made about admission of an individual patient (Victorian Department of Human Services, 2006).

There is increasing international interest in diversion from hospital admission to alternative services such as home care. Patients receiving care in the home express a higher level of satisfaction than patients receiving care in hospitals (Shepherd and Iliffe, 2004) and is often preferred by patients. Caplan, Coconis and Woods (2005) found that treatment in a Hospital in the Home arrangement resulted in less confusion and fewer bowel and bladder problems for older patients.

ICT is central to the South Australian government funded hospital admission minimisation pilot project (Whittaker and Soar 2005) which identified candidates for hospital avoidance, maps services to patients, automates communication between hospitals and community service providers, and tracks and audits service delivery by agencies.

The business case for this type of service was evident in that the cost per episode of each diversion from hospital Emergency Department to home care is around half of the cost of one hospital bed day. The home care provider would ensure a person was better managed in their home setting including accessing the full range of services they needed and were entitled to receive.
The project involved the use of a Rapid Assessment Tool which supports the rapid identification of ED presentations and in-patients to avoid an admission, or flag the potential for early discharge. It incorporates an “intelligent” filtering agent to identify candidates that might be suitable for referral to home-based care. This agent has algorithms and rules that analyse the data gained from digital data sources within the participating hospital, including the patient administration system, emergency department information system, laboratory system, radiology system, and pharmacy system.

The intelligent agent software continuously monitors the digital data obtained for all patients who either attend the emergency department or are inpatients within the hospital. The algorithms, developed in conjunction with clinicians, calculate each patient’s stability and clinical risk levels based on their primary diagnosis, co-morbidities, age, medication usage, blood assessments, and other clinical factors. Rules constrain the agent so that it only identifies potential patients with clinical conditions/needs that the hospital is agreeable to passing to community care.

Patients identified as candidates are prioritised and displayed in a list that can be accessed by referring clinicians. This list has the ability to be sorted by date/time, ward, and priority. The referring clinician also has the option of manually identifying candidates for home-based care and adding these patients to the list by entering the patient’s hospital identity number.

The research found a number of benefits including
- Improved care coordination
- Improved tracking of referrals
- Improved confirmation of receipt and feedback
- Single-point for referrals and a common user interface
- Reduces duplication of information, errors, paperwork and saves time
- Happier patients and carers, reduced anxiety for patients and their families
- Meaningful reports and audit trail

**Smart Home for aged care, chronic illness and disabilities**

Most people have become familiar with the computer controlled devices increasingly available in motor vehicles. These include central locking, electric windows, climate control, electric adjustments for seats and mirrors, hands-free mobile telephones, GPS, and ease-of-use entertainment systems. It is somewhat surprising that little of that technology has yet made its way into homes where it could be of particular assistance to a range of people. That may be about to change with increasing numbers of frail elderly people in communities.

A case study of forming a consortium of stakeholder organisations to build Smart Homes for use by frail elderly, chronic illness sufferers and people with disabilities has been QSHI (Queensland Smart Home Initiative). The consortium members cover a spectrum of entities concerned with this domain. To develop the research program stakeholders were interviewed individually as well as in focus groups to determine their visions for the
concept, needs, expectations and desired projects. This formed the basis of a research program to be undertaken using the homes as a platform.

The first unit of the QSHI was opened at an aged care facility in Brisbane in April 2007. A research project was then undertaken to distill the vision, research needs, priorities and expectations of the stakeholder organisations (Soar and Croll, 2007). The aim was to inform a collective vision on the potential of the Smart Home project and the development of a research program. This involved individual consultation with managers and senior executives of each of the participant organisations. Semi-structured interviews covered vision, what stakeholders would like to see in 3-5 years, desired outputs, desired projects, anticipated benefits and other impacts. This was followed by 2 focus group sessions. Participants were drawn from care providers with first-hand aged care experience, technologists, e-health researchers, government aged care strategy and policy officials, telecare call centre operators (with first-hand experience of communicating directly with the aged in their homes), and representative of owners and operators.

The findings are reported in Soar and Croll (2007) and identified the following issues associated with Smart Home technologies:

1. need for technologies to be user friendly
2. need for respect in dealing with older people
3. to provide more consumer choice
4. the technology should address pressures of workforce shortages
5. to enhance the quality, safety and diversity of care, and to reduce risk
6. to provide greater equity in delivering services over distance
7. to allow for installations in new buildings as well as to retrofit into existing
8. to be standards-based
9. to address privacy, security and trust in systems

As a consequence the first phase of QSHI research projects was prioritised to include:

1. Evaluation of the installed suite of technologies
2. Barriers to adoption of assistive technologies
3. Technology-User-interface using familiar devices such as a client’s television set linked to a set-top box as the communications hub
4. Call centre technologies – review of existing to identify gaps and opportunities for improvement
5. Standards – exploring existing standards development work to identify gaps and develop approaches for addressing those
6. Hospital avoidance – providing the intelligent links, client assessment tools and organisational arrangements to divert patients from hospital admission when appropriate.

The QSHI aims to contribute to the national and international agendas for quality care and independent living through assistive technologies based upon the research program as developed through stakeholder consultation.
Informatics, technology and seniors’ productive ageing

Education and learning are regarded importantly by seniors as assisting them to more fully engage in a rapidly changing society (Cameron, et al 2001). Seniors being actively engaged has positive health benefits (Butler 2002). Cruikshank (2003) argues that one of the ways older people can self-reinvent themselves is through education and learning, but that institutions are not yet particularly supportive in terms of the provision of access to technology and modes of education despite the rhetoric of life-long learning.

Garlick and Soar (2007) examined the impacts of low economic growth and high service and infrastructure costs in non-metropolitan regions that are increasingly attractive to lifestyle-seeking seniors. They recommended harnessing the knowledge, networks and skills of seniors to contribute positively to regional growth outcomes.

The path of productive ageing is not always readily available. An Australian study identified six barriers facing older workers in obtaining and benefiting from education and training: These were: the absence of paid work; a decline with age in the capacity to learn; particular education and occupational characteristics of the current older age cohort; a policy environment that encourages early retirement; discrimination by employers, and; older persons’ self perceptions about the lack of value in undertaking further training (Wooden, VandenHeuvel, Cully and Curtain, 2001).

Recent studies and reports into the spatial economic implications of an ageing population in Australia have generally focused on two areas. First, the disproportionate negative cost impact of providing enabling local community and health services and infrastructure. Second, there is an apparent correlation between high levels of senior in-migration driven population growth in some regions and their poor economic growth performance. This point is argued on the basis of the cumulative impact of reduced per capita consumption expenditure from fixed incomes, low non-housing investment expenditure and the low realised productivity of this cohort (National Economics 2006).

Thus, the spatial incidence of an ageing population in economic terms is at risk of being seen only in a negative way, or at best as unpaid volunteerism. This view sees the regional economy with a high concentration of senior aged people, only in service support terms rather than as a potential source of high value-added production and professional skills, and it sees no worth in further realising the tacit knowledge of years of sunk investment in human capital. The only ameliorative policy suggestions for the spatial economic impact of an ageing population relate to the subsidisation of local service provision in high senior-aged migration areas (National Economics 2003), or boosting regional economic growth in these areas through initiatives that seek to offset the so-called ‘negative spatial effect’ of this growing cohort (National Economics 2006).

Technologies offer the potential to better enable seniors to access education and innovation and better equip them to participate productively in economic activity. Many Australian and overseas universities provide much of their teaching through distance education enabled by the Internet.
There is a need for research to identify opportunities to better enable seniors to access education services. Issues might include access to high-speed broadband telecommunications which are usually more available in major cities than in less populous areas. There may be a need to assist seniors in feeling more comfortable with accessing goods and services through the Internet. Younger generations happily use online environments such as YouTube, MySpace, Second Life, online games and e-commerce solutions. Most of these innovations have largely bypassed seniors and there is a risk that they might be further disadvantaged in accessing other innovations in online services that could provide them with benefits. There has been a recent surge of interest in providing ‘mental gymnastics’ by electronic game companies with an expected demand from seniors. The marketing of these services might increase awareness and interest from seniors in other electronic services.

**Summary**

Population ageing will possibly be one of the major issues of our time. It is the product of a variety of improvements including diet, food production, hygiene, sanitation, family planning, pharmaceuticals, engineered safety, medical and healthcare advances. Human society has never before encountered population ageing on such a scale and the phenomenon is widespread impacting many nations and across most continents.

Much of the literature is negative about the impacts yet there may be positive outcomes. Technology innovation is likely to be a major tool to assist both individuals and nations in managing ageing. These include technologies to assist family carers in meeting dual obligations of caring for older relatives while maintaining their own careers and immediate family obligations; devices to enable seniors to maintain their own productive and independent lives; systems to enable delivery of care in home settings and to delay or avoid a move into institutional care or higher dependency care.

The technology will enable seniors to better participate in their communities and for the communities to benefit from their experience and wisdom.

Similar projects to those reported on in this paper are to found in many countries around the world. Increasing collaboration will speed the development and adoption of products and devices into homes of seniors around the world and for them to begin enjoying the benefits.

**References**


Commonwealth of Australia, 2001 *A National Strategy for An Ageing Australia* (Commonwealth of Australia)

Essen A and Conrick M, Visions and realities: developing 'smart' homes for seniors in Sweden, eJHI - electronic Journal of Health Informatics, Vol 2(1), e2


Philipson G and Roberts J, 2007, Caring for the future: Caring for the future: The impact of technology on aged and assisted living (Invited Paper) eJHI - electronic Journal of Health Informatics, Vol 2(1), e1


Soar J, Conrick M and Barnett M, 2007a, Guest editors' introduction to special issue on aged care informatics eJHI - electronic Journal of Health Informatics, Vol 2(1), e0


Soar, J. 2005 ‘Informatics in health and aged care: a research program to support strategy development and implementation’ in Ledingham I, Soar J and Breton, Paper presented at the 2nd Middle East Conference in Healthcare Informatics, 9-10 April, Dubai.


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