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The potential of information and communication technologies to support ageing and independent living

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Abstract This paper discusses the potential of Information and Communications Technology to support ageing and independent living. It reports on the expected impact of ageing Baby Boomers, the environment for ageing, chronic illness and other challenges of ageing, developments in Smart Homes and Assistive Technologies and on the available research evidence of the benefits.

Keywords Ageing · Technology · Healthcare

1 Introduction

Ageing of populations is an issue of international significance that few would fail to be aware of. As [56] have graphically demonstrated, it is an issue that impacts almost all regions and countries. Ageing of populations is the result of a set of phenomena that are unprecedented in history and which are occurring simultaneously around the world, although more recently in developing countries. These include reduced family size, delayed age of mothers having their first child, innovations in healthcare particularly in medications, economic development, reductions in infectious diseases and longevity.

The sustainability of social and health services is a concern for most countries as needs for care and support will increase with the ageing of populations ([44], 5). By 2056, there will be a greater proportion of people aged 65 years and a lower proportion of people under the age of 15 years in Australia and similar changes in other countries. In 2007, people aged 65 years and over made up 13% of Australia's population. This proportion is projected to increase to between 23% and 25% in 2056 and to between 25% and 28% in 2101 [1–4]. There are similar demographic changes and predicted increases in the percentages of the elderly in the populations of most countries [21, 40].

There are many issues associated with ageing that societies will need to develop strategies for. These include the likely surge in demand for support of numbers of older people who may not be able to participate in the workforce or otherwise have financial independence; social inclusion; social isolation; a large increase in the numbers of people living alone; discrimination against older people which may limit access to employment, access to services and participation in society; increased prevalence of chronic illness due to larger numbers of older people; reduced availability of family carers; increased demands on health and aged care services; increased prevalence of chronic illness and dementia in particular; a shortage of workforce to meet growing demands; design of the built environment to better facilitate access and to allow older people to choose to remain in their own homes; shifting resources towards home and community-based care and support; design of signage and media to ensure access for larger numbers of older people with poorer eye-sight and reducing the potential for tension between generations.

Most of a person's lifetime consumption of health services occurs during the final years of life, and utilisation spirals upwards from around the age of 65 [12]. Older people account for around half of hospital beds days in Australia. Healthcare systems are already under pressure in most countries. Whether these are slip-ups in otherwise well-functioning systems or whether they reflect profound

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dysfunction is debatable. The Australian Government's Intergenerational Report indicates that much of the pressure in the growth of healthcare costs is due to medications and medical technologies rather than the pressures of ageing per se [15]. The first of the Baby Boomers (BBs) are now moving into their mid 60s, and this is likely to mark the beginning of an upward spiral in demand for healthcare and support services.

The healthcare reform agenda is likely to be accelerated to help countries plan for the impacts of ageing Baby Boomers. Around the world, there has been a shared agenda for reform for several decades [36]. This includes moving from an episodic focus to a more holistic approach; from fragmentation to better coordinated care; moving from end-stage intervention focus to more prevention; from an acute care focus to more public health and primary care and from provider-driven care to a more consumer focus [60]. A notable example of this is the current and previous attempts to introduce reforms to the health system in the USA. In Australia, the 2009 National Health and Hospitals Reform Commission report advocated for greater prevention, individual responsibility, e-health and use of technology [49].

The current generation of old people experienced the Great Depression and the Second World War. The War Generation (WG) grew up in a very different world to that which the BBs experienced. The life-experience of BB's, at least in developed countries, has included sustained periods of economic prosperity and growth, social stability, employment opportunities and peace in those countries. The WG looked after their own parents when they became frail. They may have still lived in the same town or region as their parents. There was not the degree of social and geographic mobility that BBs and later generations experienced. There was not full employment for women, and there were greater expectations that they would be the main family carers for ageing parents. There will be huge differences in the retirement environment for Baby Boomers compared with that of the War Generation.

2 Chronic illness and disability

Chronic illness and disability increases with age. About one quarter (23%) of all people aged 65 years and over in Australia has a profound or severe core activity limitation, and chronic illnesses such as dementia, hypertension, asthma and diabetes are common conditions [9]. Associated with increasing life-expectancy is an increase in the incidence of chronic disease, and chronic illnesses are the leading causes of disability and mortality. Age-related decline is, however, reducing, and current and future generations of older people are healthier than previous generations. Rice and Fineman [54] found that the prevalence of disability amongst the elderly in the USA is declining, and expenditures for their care are increasingly concentrated at the end of life rather than during extra years of relatively healthy life. Health care costs will undoubtedly increase as a result of the large numbers of Baby Boomers entering late life.

In the USA, about 80% of older adults have at least one chronic condition, and 50% have at least two [20]. These conditions can cause years of pain, loss of function and depression. More than 15 million Australians are directly affected by at least one chronic disease [9–11]. One-third of problems presented in primary care general practice are chronic in nature ([6]). It may also be the case that some elderly people are admitted to hospital because adequate facilities for their care are not available in the community ([46]). People who identify as having a disability account for almost 20% of the Australian population [1–4], and on average, people can expect to live with a disability for almost 20 years ([10], 210).

Dementia is of particular concern for the quality of life of individuals and their families as well as for the demands for support and care. More than 35 million people worldwide will have dementia in 2010 ([7], 2). This is a 10% increase over previous global dementia prevalence reported in 2005 [31]. Alzheimer's Disease International predicts that dementia prevalence will nearly double every 20 years, to 65.7 million in 2030 and 115.4 million in 2050.

The Australian Health Ministers' Council [8] developed a national strategic policy approach to chronic disease prevention and care. Better coordination of chronic illness care in community settings aided by technology can be expected to improve the effectiveness and safety of care for the frail aged population, in particular, and for people who generally need support [19].

3 Technology and social change

Transformation of society through technology has been accelerated since the advent of information and communication technology [34]. Technology provides many-fold increases in productivity, higher quality, greater convenience, lower costs and lower prices. It usually results in a range of changes including simplification of work processes and disintermediation as whole steps in the production process are eliminated; it also provides for both greater standardisation and individual customisation. Technology has transformed shipping and stevedoring with massive reductions in labour demand and huge increases in productivity [27].

Technology has the potential to provide the elderly with better access to support, information, care and other services. Technology can also reduce travel often across

vast distances and sometimes just for routine checks which could be provided more safely and conveniently through telecare and telehealth systems. The opportunities for the support that smart homes and assistive technology can provide is evident in the rates of events such as falls, medication difficulties and social isolation. Technology can help to maintain social connections, provide access to information for self-care, enhance access to professional services, and it can also help to ensure people are safe, receiving needed support and participating in activities of daily living [61].

The Internet provides people with a flexible and personalised way to learn. It offers learning-on-demand opportunities and reduces learning cost ([72], 204). There is a lower level of use of Information and Communication Technologies by older people [43]. There is much to be done to provide seniors with better access to technology and information services.

4 Coordinated care and self-management

Coordination of care can be challenging in countries such as Australia with fragmentation of funding and payment systems, a mix of public and private funding and care provision and a complexity of reporting lines and accountability ([28], 5). There is interest internationally in providing more health care for the aged and chronic ill in their homes [24], and this fragmentation can be a barrier.

People living with a long-term illness often develop knowledge and expertise about their condition and want to participate in making decisions about their own health care [71]. There is interest in self-management and how to best manage it [41, 48, 51]. Patients with effective self-management skills make better use of health care professionals' time and have enhanced self-care [39]. The UK's Expert Patients Programme [50] is a lay-led self-management programme that has been specifically developed for people living with long-term conditions. It aims to support people to increase their confidence, improve their quality of life and help them to better manage their condition.

The World Health Organisation's framework for innovative care of chronic diseases recognises self-management for effective health care organisations [69]. Self-management needs to be guided to be most effective and to guard against patients being misinformed or influenced by the poor quality information that is also available through the Internet. Successful self-management is related to the engagement of health care professionals [39]. Technology offers the means to link consumers, family carers and professional carers to provide timely access to quality information and to enhance the patient–clinician partnership [23].

Healthcare consumers in most countries still have little access to or control over their own information [30]. There are particular challenges for older consumers in accessing and managing health information. In Australia, 44% of people over the age of 65 have never used the Internet [5].

5 Ageing and technology

Assistive technology can facilitate the independence and well-being of people and contribute to preventative health models [45]. Assistive technology (AT) can be defined as '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' (UK Audit Commission 2004). Some common examples include mobility equipment, aids to daily living, personal alarm systems, communication devices, home modification, accessible building design and computer access hardware and software [17, 35].

There is recognition of the potential for technology to enhance the safety and independence of frail older people, enable access to quality care services and to extend their ability to remain in their own homes. Intelligent monitors can keep a continuous watch on older people's vital signs, activity patterns and their safety and security [61]. There is an increasing interest in telecare, telehealth, smart homes and assistive technologies [59]. The benefits include a reduction in the level of incidents of adverse events, providing support and new service interventions for conditions amongst the elderly such as chronic illness, falls, dementia, medication problems, wandering and social isolation [38]. Telehealth can be of particular value for isolated communities [66].

5.1 Adoption and rejection of assistive technologies

High levels of assistive technology abandonment are well documented [57, 67]. Not only do they need to be user friendly (Livingstone, [60]), but other issues such as how they are viewed by users need to be addressed. Any stigma associated with disability can extend to assistive technology devices [52]. The design of the device itself and having a supportive social environment can positively be the acceptance of assistive technology [67].

An important consideration is inappropriate selection of a product or mis-prescription. Mis-prescription of assistive technology can result from several factors including a lack of clinical assessment, lack of expert knowledge, equipment-centric rather than people-centric provision of options, limited range of options available and commercial bias. Wessels et al. [67] identifies factors associated with

acceptance which include the level of communication with a user, consideration of the user's opinion, and the quality of ongoing instruction, training and maintenance. A reluctance to seek advice in the acquisition of assistive technology or more generally can be associated with a denial of disability [42].

People who acquire a disability can have a very different view of assistive technology compared to those born with disability [67]. Where the latter sees assistive technology as a means to attain new levels of independence and quality of life, people with acquired disabilities see the same devices as a reminder that function and quality of life has been lost. Similarly, people with slower-developing, progressive conditions more frequently tend to view technology as a reminder of their limitations [37].

5.2 Large-scale rollouts

Technology has the potential to provide access to care, social connectivity, improved quality of life and increased security for older people. There is now an increasing body of evidence from the experiences of large-scale provision of telecare and telehealth services into homes that demonstrate a range of benefits including reductions in hospital attendances and admissions, reductions in hospital length of stay and reduced nursing home stays.

There are reports of reductions in health service use associated with the availability of home telecare [16]. Tribal (2006) reported that AT projects in Scotland were considered to be helping people to continue living in their own homes and that users had become accustomed to the technology and appreciated the benefits it afforded them. Bowes and McColgan [18] found that the people with the technology had a lower requirement for hours of care, fewer admissions and fewer visits to GPs than a control group. Home telehealth for clients of the Veterans' Health Administration in the USA [25] resulted in a 19% reduction in numbers of hospital admissions and a 25% reduction in numbers of hospital bed days. Clients reported a high level of satisfaction with the telecare/telehealth service with a satisfaction score of 86%.

There is some level of use of robotics including to assist stroke victims with limb movement [22] and to support eating, bathing, dressing and toileting [33]. Robotic pets have been shown to provide pleasure and interest to people with dementia [32]. In France, the Alcatel-Lucent research laboratory enhanced a robot dog as a personal carer [14]. This has not been commercialised.

6 Conclusion

There is high incidence of adverse events that technology would assist with such as falls, memory loss, medication problems, social isolation and others. There is a plethora of innovative smart home and assistive technology available, yet the level of adoption remains low indicating a need for quality research data on the benefits of assistive technologies so as to assist governments, care funders and providers in developing policy so as to deploy resources to encourage adoption and realisation of benefits.

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