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## Ageing and technology: Creating environments to support an ageing society

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Johannes Doll before his audience in a session 'Research on digital inclusion, work and aging' (photograph by H.S.M. Kort)

tive technologies in the country. Most of these resources are currently imported and unaffordable for end users. There is a widespread lack of awareness by patients, family members and professionals of the existence of these resources which potentially can have major impact on the quality of life of elderly with dementia. Although strides have been made in developing assistive technology devices, particularly regard-

ing the development of ICTs and robotics, assistive, accessible and controlled environments; challenges remain in the fields of ethics and information technology. Issues related to the privacy of the subject monitored, involvement and duty of families and of the state in care stand out. An increase in studies on assistive technology for persons with dementia is evident, with a rise in the number of national publications. However, the training of professionals in this field of knowledge is lagging. The production of national knowledge and funding of studies in this area are incipient.

### Conclusion

In the future, it is envisaged that the products produced in partnerships between academia and business can meet the needs of the national market and expand the use of these devices, seeking to broaden the acceptance and use of technological resources in the care of the population afflicted by functional loss in the real world.

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## AGEING AND TECHNOLOGY: CREATING ENVIRONMENTS TO SUPPORT AN AGEING SOCIETY (KEYNOTE)

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### Abstract

Ageing populations have raised specific challenges, in terms of how best to support older adults to age-in-place i.e. to live independently at home and in the community. This is particularly important in developing countries, many of which are experiencing rapidly ageing populations, yet without the necessary investment or infrastructure in health and social care. There is increased recognition of the potential of assistive technologies to support the everyday lives of older adults including social participation, activities of daily living and lifestyle monitoring. This paper assesses the potential contribution of assistive

technologies in supporting older adults to age-in-place, identifying some of the cultural, organisational and institutional opportunities and barriers to widespread adoption. The paper concludes by identifying gaps in current understanding and recommendations for the future development of assistive technologies if they are to become a more pervasive aspect of the home environment.

### Background

The world population is ageing, with those over 80 projected to increase by 233% between 2040, compared to 160% for the population aged 65 and over and 33% for all other ages<sup>1</sup>. Brazil (as

a developing country) and the UK (as a developed country) are undergoing profound, albeit very different, social changes driven by the challenges of an ageing population. As a developing country, Brazil has the sixth largest population of elderly people in the world. The proportion of the older population (60+ years) increased from 4.7 per cent in 1960 to 10.8 per cent in 2010 and is expected to reach 29 per cent by 2050<sup>2</sup>. As a developed country, the UK population has been ageing since the 1870s (most rapidly between 1970 and 2000); recent projections indicate that the proportion of people aged 65+ will rise from 17.7% in 2015 to 23.5% in 2034 and the number of people over 85 is predicted to double in the next 20 years and treble in the next 30<sup>3</sup>. What is different is the speed at which the population is ageing across Brazil and the UK. The same ageing trajectory that has unfolded over more than a century in the UK (and other developed countries in Europe) will occur over two decades in Brazil. This has raised specific challenges in terms of how to support older adults to live a high quality of life, whilst finding solutions to reduce the health and social care costs of caring for an older population.

## *Ageing-in-place*

The ageing-in-place agenda has been an important policy development in recent years, the objective of which is to support people to age at home and in the community, where older adults can retain a sense of independence, safety and belonging<sup>4</sup>. Realising these benefits is dependent on having supports within the home and community which support a high quality of life; i.e. ageing in the right place. There is widespread recognition that innovative approaches, including technological solutions, can help support the health and social care needs of an ageing population<sup>5</sup>. These interventions have the potential to promote the independence and well-being of older adults, whilst alleviating the demand on formal and informal care i.e. by providing older people with supports for active ageing, enabling self-care and self-management and facilitating the everyday social inclusion of older people. Recent developments in the area of gerontechnology have centred on the design of technological innovations to enable 'active ageing' i.e. the process of optimizing opportunities for health, participation and security in order to enhance quality of life as people age<sup>6,7</sup>. Many older adults want to lead active and meaningful roles in old age and challenge the passive social role that society has placed upon them but often lack the supports to do so. Feelings of passivity in old age are symptomatic of the deficit model of ageing which has conceptualised old age as a period of frailty, illness and old age, concerned with the absence of ill health, rather than the promotion of

healthy and active ageing<sup>8</sup>. Increased global life expectancy should be seen as a significant success, yet only if older adults are living more 'active, healthier' lives, rather than simply extending the period of frailty and dependency in old age. Technological interventions can play an important role in enabling older adults to lead healthier and more productive lives, for e.g. through lifestyle monitoring, self-management and emergency response systems that enable the active participation of older people in society according to their individual needs, preferences and capacities and which encourage people to participate fully in community life<sup>9</sup>. The realisation that technology offers a potential intervention to support ageing-in-place has been evidenced in the emergence of ICTs and Ambient Assisted Living technologies.

## *ICTs and Ambient Assisted Living (AAL)*

Information and communication technologies (ICTs) have evolved as a potential solution to improve the health, safety and social participation of seniors. These technologies utilize environmental and person-based (i.e. body-worn) sensors, and communication networks to provide important information on the health and care needs of seniors<sup>11</sup>. As well as clinical applications, ICTs offer huge opportunities for gerontological research, particularly in respect to the collection of real-time data on the daily lives and health behaviors of older individuals with a range of conditions<sup>12</sup>.

Evidence suggests that ICT supports for older people can bring about significant benefits of care for older people, for example, to assist with diagnoses, treatment, consultation, and patient education<sup>13</sup>. Service providers have given positive feedback regarding the use of telecare technology in patient management, reporting stronger relationships with patients, better patient monitoring and potential for cost-savings<sup>14,15,16</sup>. Systematic reviews have highlighted the potential benefits of using telehealth to assist with the management of patients with chronic diseases, with significant reductions in hospital admissions and mortality rates, improved lifestyle behaviours, clinical outcomes and reduced healthcare utilization<sup>17,18</sup>. Studies have also shown that ICTs can be used to support self-management and monitoring in patients with a range of chronic conditions and can be effective in improving self-management skills, managing risk factors and improving symptoms<sup>19,20</sup>.

Ambient Assisted Living (AAL) combines ICTs, stand-alone assistive devices and smart home technologies to help support older people to live independently within the community<sup>21</sup>. Technological interventions such as AAL offer a number of opportunities: to allow people to 'age-in-place' by increasing their autonomy, self-confidence



Two foreign key note speakers, Helianthe S.M. Kort (left) and Ryan Woolrych (right), with Marina Bernardes, a member of the organization team, in the middle (photograph by Helianthe S.M. Kort)

and mobility; to support health and functional capability; to promote active and healthy lifestyles; to enhance security, prevent social isolation and maintain the support network of the individual; and to increase the resource efficiency and effectiveness of health and social services<sup>22</sup>. It is possible to identify three generations of AAL technology for supporting older people<sup>23,24</sup>. The first generation is characterized by an alarm (e.g. alarm button on pendant) worn by the older person in the home providing them with the ability to raise an alarm (call centre or caregiver) should a problem requiring assistance arise. The benefits of these first generation community alarms include reduced levels of stress among caregivers, reduced hospital admissions, earlier hospital discharge, and delayed entry into long-term care facilities<sup>25</sup>. A key weakness is that if the person is incapacitated, or is not wearing the device for some reason, then they are not able to trigger the alarm. A second generation of technology uses sensors (e.g. device sensors or accelerometers) to detect potential emergency situations such as a fall or environmental hazard (e.g. flood or gas leak) and summon help without action on the user's part. Sensors monitor the person in their home and software analyses the data in order to automatically detect emergency situations<sup>26,27,28</sup>. Recent developments within ICTs have heralded a third generation of technologies<sup>29</sup>, where computing systems and assistive devices can be integrated within everyday living contexts to provide a wide range of services, help and support to seniors who may require assistance in living independently. For example, environmental and wearable sensors can monitor vital signs or changes in mobility and activity patterns which may be indicative of changes in health status, while smart interfaces can provide information, support and encouragement to people in staying active and mobile.

## *Barriers to widespread adoption*

Despite this evidence, the widespread deployment and mainstreaming of gerontechnological interventions has been low<sup>30</sup>. This suggests that there are a number of barriers to the adoption of technologies within the home environment. At present, there is still little hard evidence to suggest that technology-based products and services, particularly AAL, have had significant benefits to end-users or service providers<sup>31,32</sup>. To a large extent this reflects the relative novelty of the area and evidence about the effectiveness of technology is still emerging. However, three key criticisms can be raised in respect to the evaluation of gerontechnological research.

First, developments have primarily been technology-driven, without assessing how they impact on the everyday lives of older people and how it could positively enhance their quality of life. Importantly, there has been a lack of research into how technology can be integrated across different cultures. For example, attitudes to technology, everyday activities, familial relationships, living arrangements and care expectations are all culturally bound and will impact technological requirements. Technology, if it is to be successful, needs to reflect cultural sensitivities in its design, implementation and evaluation. This suggests that more user-driven research is needed across different national and cultural contexts; otherwise technologies will be ill-conceived and fail to meet the demands of the older person<sup>33</sup>. Technologies have tended to take a functional/needs-based approach to supporting older adults, rather than examining how technology can support cultural aspects of place i.e. as a tool for social engagement and participation across different community contexts.

Second, technology is often developed with the end user in mind, yet can impact upon various stakeholders in the care delivery process. There is a need to understand how new technologies can best fit with existing forms of health and social care delivery that the older person may draw upon. For example, an older person may engage with formal and informal care providers, local voluntary and community sector providers and more formal service providers. This care relationship might differ across countries where access to formal care is lacking and where there is emphasis on familial support. This potentially creates different technological requirements i.e. in terms of what older adults, family members and healthcare professionals want from the system. Technology needs to be seen as part of an integrated care solution tailored to meet the varying needs of the end user and different care providers<sup>34</sup>.

Third, whilst systems have been developed to address specific conditions, technological developments have not been intuitive enough to adapt

to the changing needs of the person as they age. Technology has to be flexible and responsive to the requirements of the older people in terms of what they want from the technology. A 'one size' fits all approach is unlikely to be effective. Experiences of old age are not homogenous and needs are diverse, for example, by age, community context and household circumstances (those living alone). The challenge for technology is how to reflect this diversity, moving away from generic solutions towards flexible supports that accommodate the often complex and diverse needs of different groups.

### *Next steps: technology and ageing*

These challenges need to be effectively understood and addressed in order to be able to achieve the successful deployment of gerontechnology and to fulfil the promises of improved quality of life for older people, people with chronic conditions and family carers, of better quality of care services, and to achieve increased efficiencies in service provision. Much of the technology development thus far has been funded through institutions in the developed world, and there is the tendency to assume that what works there will work elsewhere. This is misleading as financial, cultural and institutional supports will vary across different national contexts. In working towards this, technology development needs to adopt a more culturally sensitive approach to ensure functionality (needs, requirements), accessibility, usability, acceptability and fit to everyday life. For this to happen, older adults need to be more closely involved in the design, implementation and deployment of the technology.

There is also the need to address the issue of what constitutes effective evidence for the relevant stakeholders involved in the implementation of the technology. A randomised control trial might constitute evidence for physicians but not for end users who are likely to respond to 'softer' well-being benefits, such as independence, confidence and security. A broad evidence base is needed that convinces different stakeholders e.g. end users, professionals, technologists, commissioners. Moreover, there is a need to address the context within which this evidence is generated; small scale trials are more context-specific and may constitute evidence for local service providers and end users but can these be generalised/are they directly comparable across other contexts.

There is a need to scale-up small-scale interventions which can be achieved through various mechanisms: expand the geographical coverage of interventions from small-scale and local to city, regional and national, urban and rural; develop local capacity-building and support for delivering gerontechnology interventions; mobilise local providers (healthcare professionals, commissioners, formal and informal carers,

service providers etc); identify how technology can compliment broader cultural, institutional and organisational practices. It is necessary for technology to be adaptable to changing cultural contexts, whilst ensuring that technology is standardised and simplified for widespread application. There is also a need to develop partnerships with providers and those responsible for healthcare delivery to ensure top-down support so that technology can become a deeply embedded institutional and organisational component of service provision. Here, the mapping of local health and social care delivery is necessary to establish where interventions can be optimally integrated to support stakeholders. Lastly, to address the economic challenges of an ageing population, mainstreaming technological interventions will require strong business cases which establish clear cost/efficiency savings for implementing them. This will require an understanding of costs/benefits in terms of hospitalisation, alleviating the burden on existing formal care delivery in the home, preventing long-term/expensive institutional care, as well as social and psychological impacts.

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