Ageing People in Ireland: A Survey Perspective on Technology in the Home

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The Irish population aged 65 years and over is increasing and it is predicted that this trend will accelerate over the next 30 years. Projections highlight that those aged 65 and over will number 0.5 million by 2011, an increase of 26% representing 14% of the population. In order to anticipate the needs of this increasing segment of our population, a survey of ageing people’s needs in Ireland was commissioned. The overall aim of the survey was to determine the needs and requirements of ageing people with respect to assistive technologies in the home. The survey found that a majority of ageing people were willing to embrace the use of technology which would enable them to age in place. However, while acknowledging the benefits of technology and the automation of systems and functions, respondents were concerned that human interaction may be replaced by technical systems over which they would have no control. Furthermore, such technologies must be non-intrusive, failsafe, affordable, easy-to-use and their use must be ethical.

Background

Our global population continues to grow and within this, the percentage of ageing is also increasing. We now face the challenge of healthcare service initiatives driven by the goals of individual autonomy and quality of life. At a European level, during 2002, it was estimated that between 12-17% of the total population was represented by the ageing. These demographical changes will inevitably pose increased problems for social security and healthcare systems.

In Ireland, the population aged 65 years and over is also increasing and it is predicted that this trend will accelerate over the next 30 years. Projections highlight that those aged 65 and over will reach 520,000 by 2011, an increase of 26% and will represent 14% of the total population. Currently the needs of this cohort place a huge financial, medical and social care burden on the relevant agencies that provide services. It is estimated that between the years 2000 and 2050, public health expenditure for acute healthcare will rise from 5.9% to 8.2% of Ireland’s Gross Domestic Product (GDP).

We are faced with the challenge to increase the quality of care for increasing numbers of ageing people while reducing healthcare costs. However, healthcare is currently optimised for treating disease and traditionally innovation has been in the area of clinical and pharmaceutical advances. The challenge for providers of healthcare is to devise processes, which optimise wellness incorporating, health promotion, compliance with healthcare intervention and caregiver support. Non-intrusive technologies must become a part of the everyday lives of ageing people empowering them to take greater responsibility for their own health and social well-being. By
shifting the balance of healthcare towards individuals in their own environment it may be possible to decrease overall health costs in the long-term. By providing the ageing person with health information, which is timely, accurate and supports self-management, the ageing can expect to live longer and fuller lives. This notion of a personal health system must also reduce the burden of additional workload currently placed on caregivers.

This change in service delivery to accommodate the emerging demographic landscape has large-scale implications for the redevelopment of healthcare infrastructures and their service provision. Inevitably this results in shifting the allocation of resources from tertiary-care institutions towards the preventative management at the primary care level, as well as delivering services to individuals in their own home environment where they are likely to be most cost-effective (Nugent & Augusto, 2005). Resulting services and infrastructures will primarily focus upon the inclusion of socially disadvantaged people into today’s society. This is a complex scenario which can be addressed by the correct balance of the introduction and utilisation of Information and Communication Technologies (ICT) and the services they facilitate, to ensure that all citizens benefit from the information society.

**Implications of Using ICT**

The primary aim of service provision, or any intervention, should be to promote wellness and independence. Advances in medicine and technology have made many fundamental improvements in many areas of healthcare resulting in better management of multiple pathologies and chronic diseases thereby potentially increasing life expectancy. As people grow older their need for support in the home environment increases. Evolving models of service provision must provide a balance between the technological solutions offered and the needs for support in conjunction with the health needs of people. Efficient systems should consider a person-centred approach as opposed to a service-centred one. The needs of people very often emerge from the difficulties and risks encountered at home in their daily living. Rather than focusing solely on the health concerns of people, we must consider the person as a living human being in a social and geographic environment.

Technology has the potential to change lives, in general for the better and has contributed to fundamental improvements in many areas of our lives including communications, healthcare, transportation and leisure activities. For ageing people to benefit from the advances that technology brings it is essential that systems are designed with their capabilities and limitations in mind, that proper training is provided, and that the needs of the ageing users are considered in the development of future technologies.

New technologies are only as successful as they are easy to use by all members of the user population. Efforts to reach ageing consumers are often hampered by a lack of understanding of the abilities, requirements and preferences of this population. Many computer-based systems have been designed with little regard for the potential ageing adult users (Rogers et al., 2003). Dewsbury et al. (2002) highlight that designing assistive technology solutions for ageing people is fraught with problems due to the number of agencies involved. These problems are compounded by the lack of understanding, which can exist between the diverse ranges of professionals involved in the provision of such services. Despite these challenging factors, Connell and Sanford, (1997) state that technological interventions can reduce difficulty in
activities of daily living, enhance independence, safety and security for ageing adults and reduce the burden of care for caregivers. In the long run, environmental interventions can be cost effective if they allow elders to remain in their own homes as opposed to relocation to nursing homes (Lanspery, Callahan, Miller and Hyde, 1997). In addition to cost benefits, extending the time for which elders remain in their own homes has the additional benefit of maintaining their perception of independence.

The current and future needs of the ageing population must be researched and examined, the overall aim being to promote collaboration between all agencies ensuring an integrative approach to the delivery of services incorporating health, welfare and social dimensions thereby enhancing the well-being of this population. Design of such services should also take into consideration the elements of integration with existing practice and also the notions of interoperability with other similar models of care.

Smart homes have provided an opportunity to realise this vision where an environment than can promote levels of independence and increase personal autonomy (Helal, et al., 2003) can be established. Developments in the area have been prolific, ensuring an appropriate balance between technological solutions and service delivery provides a positive experience for the person in their own home environment.

### Smart Homes

A smart home is designed to offer technological support for the person in their home environment to promote levels of independence and increased personal autonomy. The benefits of a smart home may include the following:

- Increased liveability, comfort and peace of mind;
- Lower expenses and maintenance costs;
- Being able to stay in the home longer, amongst a network of family, friends and familiar neighbours;
- Helping the environment.

The smart home environment should be able to adapt according to how the person interacts with the environment either on a real time basis or over a period of time. Smart home technology offers a viable solution to the aforementioned increasing needs of the ageing by facilitating them to remain as independent as possible and to remain in their own homes. Many studies have highlighted that this is a desire of the ageing (Ruddle et al., 2001, Garavan et al., 2001) rather than being admitted to long-term care settings, as is often the case due to the current lack of alternatives. Nevertheless, Barlow and Venables (2004) suggest that design and technology innovations must be matched by new care delivery models. Hence we can consider that the successful uptake of Smart homes is a more complex task aside simply introducing technology into the home environment. The developments must be such that they are extensible and interoperable and support not only the persons within their home, but also their support networks (Ranganathan & Campbell, 2005).

Smart homes that incorporate electronic sensors, video-monitoring, remote health monitoring and equipment such as movement and fall detectors, door monitors, bed alerts, pressure mats and various alarms (smoke, heat, flood, burglar) can improve
patients’ safety, security and ability to cope at home. Nevertheless, it is important that the use of smart home technology and services is:

- Ethical: the use of smart home technology must take place under strictly controlled ethics;
- Economical: smart home technology must be cost effective for both the user and society;
- Technological: the smart home systems and services must:
  - be designed to suit the needs and requirements of the individual;
  - be as unobtrusive as possible;
  - ensure the safety and privacy of the individual.
- Psychosocial: smart home technology must be accepted and easily used by participants.

It is interesting to look forward into the technology future for smart homes and note the findings of Dishman et al. (2004) in Table 1 below. This is a listing of some key smart home technologies and their usefulness in supporting ageing in place and independent living.

### Table 1. Selected Core Technologies and Their Capabilities (Dishman et al., 2004)

<table>
<thead>
<tr>
<th>Technology</th>
<th>Values to Aging in Place</th>
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<tbody>
<tr>
<td>Wireless broadband</td>
<td>Anywhere in the home, any device connectivity</td>
</tr>
<tr>
<td></td>
<td>Rich and multiple streams of health information delivery</td>
</tr>
<tr>
<td>Biosensors and bodily diagnostics</td>
<td>Real-time, routine chemical analysis</td>
</tr>
<tr>
<td></td>
<td>Targeted drug delivery and effects analysis</td>
</tr>
<tr>
<td>Activity sensors and</td>
<td>Location, object, and person tracking around the home</td>
</tr>
<tr>
<td>behavioural diagnostics</td>
<td>Regular activity and activities of daily living measurement and assessment</td>
</tr>
<tr>
<td>Information fusion and inference</td>
<td>Personal baselines and alerts to meaningful deviations</td>
</tr>
<tr>
<td>engines</td>
<td>Reliable data even from temperamental technologies</td>
</tr>
<tr>
<td>Personal health informatics</td>
<td>Central repository for personal and professional health information</td>
</tr>
<tr>
<td></td>
<td>Tools for easy visualization of long-term trends</td>
</tr>
<tr>
<td>Ambient displays and actuator</td>
<td>Lightweight ways to notice “okayness” of loved ones</td>
</tr>
<tr>
<td>networks</td>
<td>Smart home controls of all devices and appliances</td>
</tr>
<tr>
<td>Agents, assistants, coaches,</td>
<td>Reminding and coaching of activities of daily living that are declining</td>
</tr>
<tr>
<td>companions</td>
<td>Companionship for intellectual stimulus and support</td>
</tr>
<tr>
<td>Adaptive, distributed interfaces</td>
<td>Any device interactivity—do not have to use a personal computer to compute</td>
</tr>
<tr>
<td></td>
<td>Interface experience personalized for familiarity and function</td>
</tr>
<tr>
<td>Remote community and collaboration</td>
<td>Multiple modes and media for communicating across distance</td>
</tr>
<tr>
<td></td>
<td>Ways of representing and feeling “presence” at lonely times</td>
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</tbody>
</table>

Dishman makes the interesting point that currently many of the devices that facilitate the services in Table 1 are designed for use by medical professionals. However, as they become cheaper and smaller, they are more available to the rest of us and are being incorporated into simple household devices, while being inter-connected and embedded into household networks.
The 2005 Nestling Technology Survey

In order to prepare for the expected impact of increasing care requirements, a study was commissioned in 2005 covering an area in Dundalk, Co Louth, which is situated in the North-East of Ireland. The overall aim of the study was to determine the needs and requirements of ageing people and their circle of carers prior to the commencement of a major smart housing development planned for Barrack Street, Dundalk. This development is planned under the auspices of the ‘Nestling Technology’ project, a multi-stakeholder project which consults and shares information with all agencies involved ensuring that requirements for independent safe living in the community setting are met.

A random sample of 100 subjects aged sixty-five years or over was selected from lists of people attending active retirement groups, social clubs and day hospitals in the area, people currently receiving services in the community setting, discharges from the acute hospital setting, ageing people residing in both public and private long stay institutions for no longer than twelve months and ageing people on social housing lists. Clients were contacted by phone and invited to participate in the study. Recruitment only took place following a verbal and written explanation to clients and the signing of written informed consent. Face to face interviews were held in clients’ own homes or their current place of residence following arrangement by phone. Clients were under no obligation to participate in the study and were free to withdraw at any time.

The scope of the survey itself was intended to be broad. This current paper only describes the early findings relating to use of technology in the home. It is expected that further analyses of the information collected will lead to relevant findings in other specific areas such as potential impact on service delivery, reductions in care giver burdens and presentation and recommendations healthcare care-related needs for adapting environments.

The Technological Environment

The specific portion of the survey of interest in the current paper dealt with assistive technology (i.e., adaptations to the physical environment and the use of equipment and ICT, sensors and other devices), which would enable people to age in place. Awareness of assistive technology among participants in the population sample was high. However, the assistive technology, which interviewees were more familiar with were those which dealt with adaptations to the physical environment such as grab rails, level showers and wider doorways. Interviewees were less familiar with information and communications technology, the sensor technologies and remote health monitoring technologies.

81% of those interviewed currently used some form of assistive technology in the home environment. All respondents but one (99%) were amenable to using assistive technology in the future and were willing to be trained in the use of the same. It was noteworthy that only 14% had access to home computers and even smaller numbers (6%) had access to the internet.

The use of assistive technology was considered in a number of different areas to include, home access and security, environmental and appliance controls, movement, activity and fall detectors, medicine/medical management, memory aids and social contacts. These are discussed in the following sections.
Home Access and Security

Home access and security were considered. Within this area the majority (76%) preferred to access their home from the front entrance, while (1%) cited preference for back door access and 23% thought it was important to have access from both the front and back. A large majority of respondents (98%) highlighted that access to a garden was an important feature for them.

Security in the home was an extremely important feature for all ageing clients who reported a particular sense of vulnerability to thieves and vandals. The majority of participants indicated their preference for a security alarm, for having lights turn on automatically on their return home and having the facility to view visitors before opening the front door to them. There were also significant but reduced majorities (between 74% and 96%) indicating a preference for automatic illumination on entry to a room and automated opening and closing of curtains at dawn and dusk.

When respondents were asked to consider their preferred method of unlocking their front door, although none had experienced it, iris recognition was the most popular option (69%). 20% opted for standard key, 4% for a number code, 3% for a smart card and 4% for palm recognition.

Environmental and Appliance Controls

All respondents stated that control of their environment from a heating, lighting and ventilation perspective was very important both in terms of reducing financial running costs and being environmentally friendly. Nevertheless, participants expressed the concern that in the environment where things were becoming increasingly automated they would also like to have manual control over these amenities.

With regard to detectors; smoke, flood, fire and burglar systems were considered as very important features in the home for the majority (99%). In addition to this, 99% of respondents felt that sensors in the home to control electrical appliances and different systems such as water were essential for personal safety.

Personal Detectors and Medical Management

All respondents were agreeable to their movements and activities being continuously monitored in the home in the interests of their own safety and welfare. It was explicitly stated by all respondents that this should only take place with their consent when the need arose, otherwise, it would be considered as an invasion of privacy. An external agency (61%) was the preferred choice for the monitoring of these movements, followed by family (36%). The remaining options included friends (1%) and healthcare personnel (2%).

A high proportion (96%) took prescribed medication on a daily basis and stated that where the need arose it would be beneficial for them to have a system in place to ensure they were taking the right medication at the right time. In addition to this those (53%) who had their vital signs (blood pressure, blood gases, oxygen saturation and blood glucose levels) measured on a regular basis favoured a system being in place whereby these signs could be monitored at a remote site with the aim of detecting irregularities at an early stage, obtaining early intervention and preventing acute hospital admission.
**Memory Aids**

8% of respondents had a diagnosis of Alzheimer’s disease and the remaining respondents were very aware of the debilitating effects of dementias and almost all knew of someone who suffered from memory problems. All but one of the participants were in favour of memory aids being installed in the home environment to enable them to remain at home should their memory fail. Participants were asked in what form they would like memory aids/prompts and the overwhelming majority (93%) stated a speaking voice. Results are shown in Table 2.

**Table 2. Types of Memory Aids Preferred by Clients**

<table>
<thead>
<tr>
<th>MEMORY AID</th>
<th>N (%) (CLIENTS N=100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speaking voice</td>
<td>93(93)</td>
</tr>
<tr>
<td>Telephone call</td>
<td>2(2)</td>
</tr>
<tr>
<td>Light signal</td>
<td>1(1)</td>
</tr>
<tr>
<td>Message on television screen</td>
<td>1(1)</td>
</tr>
<tr>
<td>Message on computer</td>
<td>2(2)</td>
</tr>
<tr>
<td>Not applicable</td>
<td>1(1)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100(100)</strong></td>
</tr>
</tbody>
</table>

**Past-times and Social Contacts**

Participants were questioned on how they spent their free time. This information is presented in Table 3. A large percentage of the sample watched television and listened to the radio with many finding that this was the only way they had to spend their free time. Although, only a small proportion of respondents had access to a computer (14%) and the internet (6%) they did realise that this would increasingly become the mode of communication in the future.

**Table 3. Activities in which interviewees spent their free time**

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>N (%) (CLIENTS N=100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sedentary</td>
<td>65(65)</td>
</tr>
<tr>
<td>Active</td>
<td>8(8)</td>
</tr>
<tr>
<td>Both</td>
<td>27(27)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100(100)</strong></td>
</tr>
</tbody>
</table>

When asked how they would like to stay in contact with family and friends using technology the majority (92%) stated video-conferencing and the preferred method for interacting with the computer was by voice (60%). Participants stated that enhanced acoustics (65%) and magnified visual displays (30%) were additional features required to make technology user friendly.

**Summary of Key Findings of Nestling Technology Survey**

In summary, 100 people were interviewed and qualitative data was obtained regarding the use of technology. The original sample was varied and consisted of those who were living independently in the community, those who were being cared for by family members in the community and those who were residing in long-term care
facilities. It was the expressed wish of the majority (97%) to remain in their own homes even though a high proportion (44%) felt isolated in their own homes. For many there were multiple physical barriers in the home environment associated with baths and showers, the toilet, stairs, access to and from the house, the risk of falls and accidents and difficulty in performing routine daily tasks such as dressing and grooming, hygiene, preparing meals and shopping.

With regard to assistive technology, the majority of the sample was both aware of assistive technology and amenable to using it to enable them to remain in their own homes. All interviewees were familiar with home adaptations to the physical environment, however, they were less familiar with ICT and sensor technologies. Only 14% had access to computers with only 6% of these having access to the Internet. The predominant types of technology currently used were burglar alarms and personal pendant alarms. Despite this, ageing people were willing to embrace new technologies with the potential to promote aging in place.

Ageing people were concerned that in the technological environment where things are becoming increasingly automated, the use of technology could possibly result in a substitute for human interaction. Nevertheless, the use of technology was favoured for increasing security in the home environment and included the following measures:

- Security alarms;
- Automatic turning lights on and off when arrival at home and on entry to a room;
- Automatic opening and closing of curtains at dawn and dusk especially during periods of absence;
- Facility to view visitors at door prior to opening door to them.

Control of the environment using technology (heating, lighting, ventilation) was favoured from the point of view of reducing running costs and being environmentally friendly. The use of technology to control the environment would also serve to reduce human labour costs (home support services), as functions would be automated.

The use of fall detectors and movement detectors were accepted as methods of ensuring personal safety; however, it was stipulated that these measures should only be used where the need arises and with the consent of the ageing person and/or their carers.

Ageing people who very often had no close relatives or friends living nearby agreed that an external agency at a remote site should monitor movements whereas others who had family in the vicinity preferred them to monitor their movements.

Remote medical management (telecare) was favoured in that problems would be detected and diagnosed early, intervention commenced and the trauma, often associated with admission to healthcare settings avoided. In addition, this was seen to possibly prevent frustrating visits to doctors’ surgeries and out-patient departments where very often physical environmental barriers, lack of suitable public transport and physical frailty make this difficult.

Systems to ensure that the right medication was being taken at the right time were seen to be advantageous as many people suffered multiple pathology and took numerous medications on a daily basis.
Memory aids were also deemed to be of benefit in certain instances with reminders in the form of a speaking voice being favoured.

**Recommendations & Conclusions from Nestling Technology Survey**

Following analysis of the survey it has been possible to present a number of technological recommendations. Technology must be unobtrusive, non-intrusive, failsafe, affordable, easy to use and its use must be ethical. Where there is a possibility of the ageing person’s privacy being invaded the consent of the ageing person must be obtained where possible. The use of technology must not replace human interaction. Technology should be used where it:

- Promotes and maintains functional independence of the ageing person, via the automation of functions, for example, turning on/off lights, taps and electrical appliances, opening and closing curtains;
- Promotes cost savings via heating, lighting and ventilation settings in the home;
- Enhances safety in the home environment and the personal safety of the ageing person (burglar alarms, smoke, flood and fire detectors, facility to view visitors before opening the door to them, fall and movement detectors, systems to ensure they are taking the right medication at the right time and memory aids where necessary to enhance cognitive ability).

A high prevalence of falls was reported among ageing people in the community. Almost half of the ageing people surveyed (47%) possessed personal pendant alarms, however, compliance with the use of these alarms was poor and reasons cited for this were that they were not user friendly, they were not cosmetically pleasing and false alarms were reported to annoy other people.

The challenge for healthcare providers is to introduce appropriate technologies that support people, in this case ageing people. The conclusions from this study indicate that assistive technologies are perceived by ageing people to have the potential to promote ageing in place. Nevertheless, ageing people must be assured that they are in control of the technical environment, not vice versa. These technologies must be unobtrusive, non-intrusive, failsafe, affordable, easy to use and their use must be ethical. Where there is a possibility of the ageing person’s privacy being invaded the consent of the ageing person must be obtained. The use of technology must not replace or be seen as a substitute for human interaction.

**References**


