Article

Current Uptake of Technology Related to the Built Environment to Support Older Adults to Live Independently in Their Community

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Abstract
Current forecasts predict that, in line with increasing global populations and extended life expectancy, older adults will dominate the population structure. To accommodate this demographic shift, governmental policies point to 'ageing in place' as key. This article outlines research findings of an initial investigation into the uptake of technology to support 'ageing in place'. The study sets out to identify both incentives and barriers to the uptake under four key activity criteria— medical, monitoring, mobility and social—at three built environment scales—home, street and neighbourhood, for urban, semi-urban and rural locations—to support older adults to live independently in their community. Results show that whilst there are significant and justified concerns over the limitations of physical conditions to support 'ageing in place', most physical conditions along with age are not barriers to the uptake of technology, as uptake is high regardless of circumstances. However, the study revealed that uptake is dependent on level of training, if shown to lead to increasing independence, includes a level of 'enjoyment of use', and does not replace existing physical relationships. The study also identified that there is limited research around the use of technology for either mobility or social activities outside the home; rather, research focus is concerned with medical monitoring in the home. Finally, research overlooks the role of geographic demographics to support 'ageing in place'. The results of this research can provide useful guidelines co-created with older adults for the development of new policies to 'ageing in place'.

Keywords
ageing in place; geographic demography; independent living; older adults; technology

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1. Introduction

In line with current forecasts of increasing global population numbers and extended life expectancy, we are currently experiencing a demographic shift in the population structure (United Nations, 2017). This shift will result in the reversal of the age dependent ratio where, for the first time, the percentage of the working-age population is outnumbered by the non-working-age population and dominated by the older generations (UK Government, 2017). In addition, this trend is set to continue; the United Nations (2017) predict that by the 22nd century the global population of persons over 60 will triple from current levels to 3.1 billion, placing significant strain on resource efficiency, for both current and future generations (see Table 1 and Figure 1). To address the emerging tension between resource efficiency and the needs of an ageing and dependent population, research is be-

Table 1. Generation timeline: 1928–2100, alongside characteristics for current birth-cohorts.

	The Silent Generation	**Baby boomers**	**Generation X**	**Millennials**	**Generation Z**
Born Between	1928 and 1945	1946 and 1964	early-to-mid 1960's to the early 1980's	1981 and 1997;	1997-Present; (0–21 years old)
characterised by	rapidly improving schools and a free health care through the NHS—limited early exposure	analogue childhood and wary of digital technologies. Cold-War attitude	emerging digital age	high familiarity with communications, media, and digital technologies	fully integrated into smart technology with limited exposure to analogue technologies
Age 2030	between 102 and 85	between 84 and 66	between 70 and 50	between 49 and 33	between 33 and 12
Age 2050	105 and over	between 104 and 86	between 90 and 70	between 69 and 53	between 53 and 32
Age 2100				103 and over	between 103 and 82

ing undertaken that explores both the challenges and opportunities this demographic shift brings, much of which focuses on the benefits of 'ageing in place'.

'Ageing in place', defined as living in the community, with some level of independence rather than in residential care, has been identified as fundamental to autonomy, social participation and good health and well-being (e.g., Davey, Nana, de Joux, & Arcus, 2004; Tinker et al., 1999; Wiles, Leibing, Guberman, Reeve, & Allen, 2012). In addition, 'ageing in place' is considered a cost-effective solution lowering demands on specialised housing, whilst limiting impact on already overstretched care professionals (Age UK, 2016; World Health Organization, 2007). This position is reflected in both national and international policy on ageing and older adults which supports ageing in place as a key component of sustainable development goals (e.g., Fattah, Sung, Ahn, Ryu, & Yun, 2017; Peek et al., 2016). However, whilst the literature points to a successful 'ageing in place' agenda to be dependent on an effective, smart technology-led, health and well-being infrastructure, concerns have been raised over the development of appropriate technology suitable for the needs of its intended user group. These concerns focus around socioeconomic status, spatial inequality (geography) and health profiles (e.g., Le Deist & Latouille, 2016; Tsekleves, Darby, Whicher, & Swiatek, 2017; Zandieh, Martinez, Flacke, Jones, & van Maarseveen, 2016), as well as the limited experience and exposure to smart technologies of the current and near future cohort of ageing and older adults (Rogers & Mitzner, 2017).

The work presented here sets out to identify both incentives and barriers to the uptake of technology to support activities of daily living (ADL) and to determine if environmental and geographical characteristics influenced the uptake of technology to support 'ageing in place'. Outcomes from this initial investigation are presented in the following sections.

2. Methods

This study focuses on both incentives and barriers to the uptake of technology under four key activity criteria: medical, monitoring, mobility and social. These activity criteria were identified in the early stages of the research as key supporting activities to aid independence of an ageing population, in both their homes and the wider environment. This was investigated through a mixed research methodology, which combined a scoping study (abbreviated here as ScSt) that reviewed both the grey (policy, reports, standards, etc.) and the academic literature along with the focus group sessions that discussed personal use of technology to support ADL. Both the ScSt and the focus groups (abbreviated here as FGs) investigated the uptake of technology related to three built environment scales (home; street; neighbourhood) and for three geographical scales (inner urban; semi-urban; rural). These scales were chosen to explore the uptake of technology outside the home and in the wider community.

Whilst an ScSt can be undertaken using a range of different methodologies, in general it refers to the mapping of evidence or research across an area of interest as background to "inform future research", and no formal methodology exists (O'Brien et al., 2016). Here a "preliminary assessment of the potential size and scope of the research literature", as defined by Grant and Booth (2009), was conducted to explore both incentives and barriers to the current uptake of technology related to the built environment to support older adults to live independently in their community. This included a review of the grey literature, alongside key policy and statistical data to identify studies relevant to 'ageing in place'. This was followed by a review of the academic literature.

The academic literature was identified by using the database Scopus. The definition of the keywords took
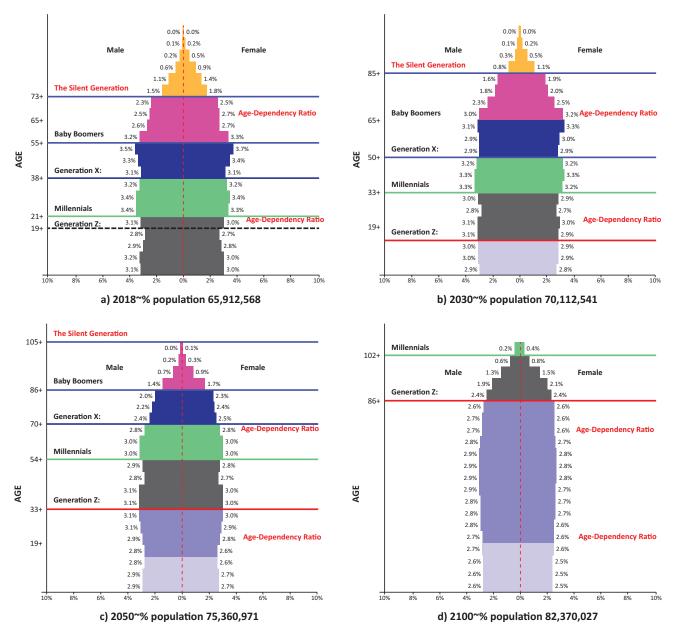
Figure 1. Population pyramids for the 5 generational birth-cohort (the Silent Generation, Baby Boomers, Generation X, Millennials and Generation Z) in England and Wales. Notes: The Y axis shows variation of age range for each generation cohort for the target years changes in population structure; age groups based on age distributions of United Nations (2017).

place in stages by selecting the words among the numerous ones relevant to the topic. The process led to the establishment of eleven words that were placed in relation to each other through the Boolean operators AND and OR. The keywords chosen are: ((old* OR ag* OR senior OR elderly) AND (hous* OR home OR neighb??rhood) AND (technolog* OR "smart technolog*" OR sensor* OR digital)). In terms of the academic literature review, the search was limited by five boundary conditions:

1. Research field: Title-Abstract-Keywords;
2. Document type: Papers;
3. Publication years: 2016–2018;
4. Language: English;

5. Subject areas: Medicine; Engineering; Social Science; Compartmental; Environment; Nursing; Health Profession; Arts.

Under these parameters the search identified 210 academic papers (Figure 2), these were categorised under the four key activity criteria, then further divided into 19 subcategories, allowing various trends to be identified (Figure 3).

In order to verify the key findings identified in the ScSt as representative of the ADL of older adults, a series of four FGs were arranged. These FGs were devised to investigate how we engage with technology as we age, alongside how/if technology enables and/or encourages
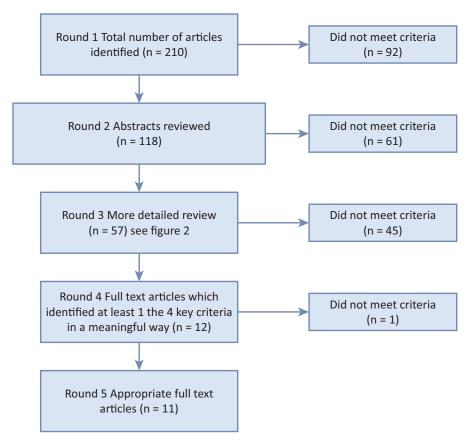
Figure 2. Flow diagram outlining selection process to identify papers that address the four key activity criteria in a meaningful way.

mobility and social activities. In addition, we were interested to find out if, how, and where we live results in users relating to the four key research activity criteria in different ways. It was believed that the FG discussions could generate information and viewpoints of personal experience not currently available.

The FGs were selected from existing support and community groups as they satisfied the geographical requirements (i.e., inner urban, semi urban, rural). Each existing community group had a different focus of activity or common interest. The two semi urban groups (Group 1 and Group 2) were based in a low density urban area; Group 1 was an existing bowling club and Group 2 a Type 2 diabetes support group, both groups met regularly. Group 3 comprised of participants of a lively community centre in a high density inner urban environment and the participants in Group 4 were all members of a knitting club based in a relatively isolated rural village pub. The FGs were organised through a key community contact for each of the existing groups and were held on the same day and at the same location as the groups' usual regular meetings. The four FGs took place at three different geographical locations in order to help identify if the geographically-related demographic factor influences the uptake of technology, and to identify who, when and why technology is being used by participants. Background data, i.e., where and how the individual participants lived, their age group and gender,

alongside type and length of time spent living in their present home, was collected during the FGs. These results are presented in Table 2.

The group discussions were driven by the results of the ScSt and divided into four sections:

Section A. We identified more background and demographics of the group. These included details on how participants saw themselves living as they age, alongside their health profile;

Section B. Enabled us to identify current level of use of technology in the home and wider community, including if levels of use and acceptance were as high as suggested in the literature, alongside if each group gave different insights into the relationship between technology, the four activity criteria and geographical location;

Section C. We aimed to identify how technologies for ADL were perceived and used for socialising and accessing social activities; the ability of users to access services and travel easily;

Section D. What opportunities in terms of both incentives and barriers to mobility outside the home exist? This included both personal characteristics and contextual factors.

Table 2. Focus group demographic: Information gathered through a short questionnaire.

	Group Activity	(1) Bowling Club	(2) Type 2 Diabetes	(3) Community Centre	(4) Village Pub
	Date	15/06/2018	27/06/2018	07/08/2018	21/11/2018
Geographical scale	Inner Urban			5	
	Semi-Urban	8	6		
	Rural	2	4		10
Group age	Group size	10	10	5	10
	50–54				3
	55–59		1	2	2
	60–64	1		1	1
	65–69	5		1	1
	70–74	3	3		
	75–79	1	4		
	75–79			1	
	80–84		1		
	other		1 @ 18yrs		
Gender	male	4	3	1	5
	female	6	7	4	5
	Living with at least 1 other person	9	2	0	9
Type of accommodation	house	10	4		10
	sheltered HSG flat		5	4	
	bedsit			1	
Years at accommodation	<1				
	<5	3	1	1	3
	<10	4			3
	>10	3	9	4	4

FGs discussions were digitally recorded (using two devices) and notes were made during each discussion. There were always at least two researchers at each FG meeting, and at least two researchers made additional notes from the digital recording following the FG. These notes were compared for accuracy and key themes identified. Full transcription of the recordings of the FG discussions was not undertaken due to time and budget limitations. The research was approved through the institutions research ethics committee.

3. Results

The review of academic literature identified a total of 210 papers, 92 were considered outside the scope of the study and were disregarded in the first round (Figure 2). From the remaining 118 papers, 97 identified at least one of seven technologies subcategories: information and communications technology and assistive technology (IT/ICT/AT); surveillance/security/monitoring; prompting wearable / sensors; mHealth; robots and automation, and smart home technology (SHT). As expected, there were a number of interconnected topics, with papers falling under more than one category. The highest-ranking single subcategory was 'case studies' (54), followed by 'medical/health and wellbeing' (49). However, only six of these studies were considered suitable for further review; this was followed by 'independent living' (43) and 'understanding needs' (40). Thirteen studies were concerned with future scenarios, and 16 concerned with mobility, a key 'activity' criterion; however only six of these were suitable for further investigation (Figure 2). Twenty studies were specifically concerned with falls in the home and although technically fell within our four activity criteria, were considered in one way or another outside the scope of this study (Figure 3).

Studies concerned with technology formed a large section of the reviewed papers. However only four studies were concerned with technology outside the home, and eight studies concerned with mobility. In addition, seven studies were concerned with social activity and/or social isolation, five of which were concerned with both mobility and social activities; again, these fell outside the brief. In total only 12 papers identified at least one of the four key activity criteria in a meaningful way (Table 3). On further review one of the 12 papers was disregarded and considered unsuitable as it did not meet the criteria and categories of the remaining 11 papers.
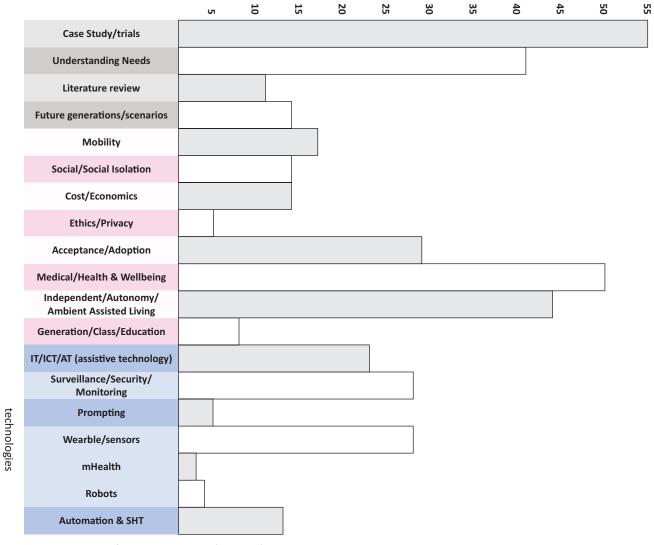
Figure 3. Summary of literature review (round 2). Note: Seven technologies are highlighted in blue.

To ensure these findings were not limited by the research methodology itself, two further actions were taken. The first was to conduct a second search of the database using the additional terms of 'ageing and mobility', 'ageing and activity'; the second was to review the references cited in the full text articles identified in 'round 5' of the ScSt (Figure 2). Although under both actions additional papers were identified, these fell outside the five boundary conditions and therefore did not provide evidence to challenge the original findings.

Overall, the studies presented here revealed the uptake of technology is high and the target audience, current and near future ageing adults, are comfortable using a wide range of technologies to support their ADL regardless of personal circumstances. However, uptake was shown to be dependent on a level of 'enjoyment of use' and when shown to increase independence. In addition, training was also shown to encourage use, although level of uptake was also found to be dependent on demonstrating that the specific technology served a purpose and did not to replace existing physical relation-ships (Le Deist & Latouille, 2016; Rogers & Mitzner, 2017; Tsekleves et al., 2017).

These results are supported by the 2018 Office of National Statistic findings on *Internet Access: Households and Individuals*, that reports on how, where, i.e., at home or 'on the go', and by whom the internet is accessed (Figure 4); another important resource is the Nielsen (2015) report which shows which devices are used by which generation for video viewing, both in and outside of the home. Whilst both report on specific use rather than the uptake of technology per se, they give insights into the perceived opportunities technology offers towards both independence and levels of enjoyment to an ageing society as a whole.

The ONS (2018) findings demonstrate that whilst age may have once been a barrier to the uptake of technology, it can no longer be viewed as such. The report identified that whilst only 59% of households with one adult aged 65 years had internet access, this same age group were experiencing the highest growth rate (23% over 2012). The report also identified that although this
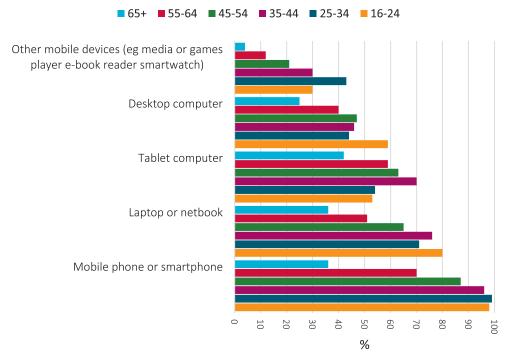
Figure 4. Devices used to access the internet by age group in Great Britain. Source: ONS (2018).

age group accessed the internet via a tablet rather than a smart phone (the most widely used internet device across all age groups), 28% of them accessed the internet 'on the go' using a smart phone. Other statistics in this study showed that online shopping for this cohort rose from 16% to 48% between 2008 and 2018, and that the household goods (25%), clothes or sports goods (24%) and holiday accommodation (24%) were significant purchases.

The results of the ONS study demonstrate the changing background experience of the emerging 65+ age group have been more exposed to technologies than previous generations (i.e., those who were 65 or older 10 years ago), and therefore demonstrates that technologies are more integrated into day to day activities. This is reflected in a study by Young and Tinker (2017) which points to the UK's baby boomer generations having somewhat "different needs and preferences than the generations they follow"; in other words, the needs of this generation as it ages is different to those of the current old, demonstrating that as each generation ages its level of exposure influences uptake for the various activity criteria. In addition, these results suggest both current and future generations of older adults are willing to not only adopt traditional adaptive technology but smart assistive technology including robotics, monitoring, alarms and sensors. Together these studies support the grey literature that points to this demographic already having a high uptake of smartphone and smartphone APPs to monitor and record various health and wellbeing activities. On the other hand, in terms of health and wellbeing, Meng Ni et al. (2017) suggest the health of near future older adults will be similar to current levels due to the "current culture of managing over prevention" and

highlights a move towards increasing "collaborative care" and a move away from a traditional "physician-centred medical model" as a requirement of 'ageing in place'.

The ScSt pointed to four areas where day to day assistance may be required: 'self-maintenance', activities essential to maintaining independence; 'instrumental', tasks and activities that can be cognitively demanding; personal growth activities those that enhance life; and social activities including social connectivity and relationships (Rogers & Mitzner, 2017). In addition, the literature also pointed to three health profile types: robust (those living a non-sedentary, autonomous lifestyle without major health problems); fragile (those often living with chronic disease, or gradual decline in health and autonomy); and dependent (with serious diseases and generally in a care institution or hospital; Wick, 2017). Overall the review highlighted the 'fragile' group as the significant challenge. The ScSt also raised questions around the development of the appropriate technology suitable for its intended user group based on activity and heath profiles and asks what are the drivers for the development of this type of support technology, i.e., is this manufactured or a need driven industry (Le Deist & Latouille, 2016)? This was also addressed by Tsekleves et al. (2017) who, through a series of workshops, questioned if technological advances are addressing the real needs of the intended users. The workshops also identified that the UK's 'ageing in place' policy has left many older adults feeling "a burden on society".

The study revealed that whilst the four key activity criteria are often interconnected, there is an academic research bias towards medical and monitoring in the home, with little reported on the impact of technology and ageing in the wider environment and on social ac-

tivities. The ScSt also highlighted that whilst there is a high level of research around the uptake of technology for various home-based activities particularly monitoring and medical support, there was comparatively little that investigated the role of technology for mobile activities outside the home or for social activities, both identified as important activity criteria to support 'ageing in place'. This is at odds with the uptake of mobile devices and Voice over Internet Protocol (VoIP) for social activities suggested in the grey literature and reflected in the FGs. What was reported focused on infrastructure (transport and pavement) to encourage activities outside the home rather than smart technology, or how technology can be used to improve these experiences. Baldwin Hess, Travis Norton, Park and Street (2016) focused on mobility outside the home, and report on a survey of car use for a group of old, and oldest old car dependent adults in a metropolitan suburban location near Western New York State, USA. The authors argue mobility and access to services is essential to independence and ageing, and it is the "need to access services" which is influencing these "driving" decisions, pointing to driving as often the only realistic means of daily travel for both local and non-local journeys (Baldwin Hess et al., 2016). This research highlights planning mobility for an ageing population in the suburbs of particular importance. These results are also reflected in Rafael-Palou, Vargiu, Dauwalder and Miralles (2017), who highlight the shortage of data on demographic transport needs but argue that even this limited evidence demonstrates an under developed transport system and the lack of local and accessible community stores as barriers to 'ageing in place'.

The social demographic was picked up by Zandieh et al. (2016) that examined the "perceived built environment attributes (i.e., safety, pedestrian infrastructure and aesthetics) and their possible influences on older adults' outdoor walking levels". The study highlights that whilst there is a proven relationship between the quality of the built environment and older adults' walking levels, both psychological and physiological barriers exist to mobility outside the home, and that with ageing spatial inequality, a direct result of socioeconomic demographics, becomes increasingly important. The ScSt suggested that whilst the top and lower end of the seven recognised socioeconomic groups (BBC, 2013) of the current ageing population would be covered under either private or social care, the middle socioeconomic groups do not fall under the same mechanism and 'ageing in place' offers significant challenges (UK Government, 2017).

In addition, whilst much of the literature made clear that there were limited barriers and uptake was high as long as some background conditions were fulfilled i.e., appropriate training, overall the literature fell short in identifying how the current ageing population perceived technology to support their ADL, in both their home and the wider built environment.

As identified in the ScSt, all participants of the four FGs felt comfortable using technology as long as they had been given a level of instruction. Each focus group comprised between five and ten participants, 35 in total, with ten in each of the semi urban groups (Groups 1 and 2), five in the inner urban group (Group 3) and ten in the rural group (Group 4). Each group was selected as they belonged to one of our stakeholder groups and included a range of ages of current or future ageing adults (Table 2). In all instances, participants saw themselves continuing to live independently in their own home. Overall participants fell under the robust health profile; however, within the Type 2 diabetes group (Group 2) there was an expected decline from the robust health profile into either the fragile or the dependent group; in saying this, this was the group with the oldest participant (aged 80 to 84). Female numbers were highest in all groups. The average age was between 65 and 79, with most people living with at least one other person, except in the inner-city group where all lived alone. Whilst accommodation type varied, none of the participants lived in sheltered accommodation.

All groups had identified various places where training and/or instruction could be found; these ranged from "a friend knows about it…he's our guru, we go to him", to the library and the bank. Along with various jokes about the ability of young grandchildren being able to resolve issues. There was a lot of debate from all groups around the uptake of VoIP technologies, talking to friends and family. These tools were seen as very useful for communicating on a day to day basis—but again concerns were raised at the impact of technology on the family dynamic. Concerns of use were raised over cybercrime, replacing 'real' jobs and the breakdown of the family.

All groups recognised technology to play an important role in their day to day lives but raised concerns with regards to it replacing physical relationships with friends and family. On the other hand, it was acknowledged that when physical interaction was not possible, technology offers a useful link in continuing relationships. All groups recognised obvious benefits, for example its value for people with serious illness 'ageing in place', or those who experience social isolation, although it was argued that these benefits could be achieved through caring for each other in the community. All groups pointed to transport barriers to 'ageing in place', but these were shown to have different weighting depending on geographical location of the demographic, i.e., rural/urban, with the inner urban FG having the least concern as public transport links are well developed.

When asking the groups what they thought about technology, Group 1 (semi-urban) thought their "hand had been forced". Group 2 "trusted the technology but don't trust the system", whilst Group 3 described technology as "just a tool". Group 4 described it as "not just one thing". In addition, although the uptake of technology was high within the groups, with some using more than others, it was considered addictive, overtaking lives and jobs, and was not trusted. Group 1 demonstrated little trust in technology and reported that they are felt

that they were being led along the technology route with a decreasing number of alternatives. Although the group were aware of the advantages of monitoring, medical and prompting technology, they viewed technology to be developing too fast, and have little confidence in it. When groups were prompted with questions around technology and mobility, the responses included lists of various organisations (i.e., local groups) that actively support people with mobility issues and day-to-day activities and stressed that technology, however efficient, should and could not replace physical contact; they also found the idea of a robotic companion as a bit of a joke. The importance of physical contact was a recurring comment with all groups.

Whilst there were similarities between the first and second groups in terms of social and geographic demographics, Group 2, a Type 2 diabetes support group that faces a significant risk of a declining health compared to the physically-active bowls club (Group 1), had a much more positive outlook on technology than Group 1. The group recognised technology as anything that makes life easier. This group also had a high uptake of technology both in and outside the home, they were confident users who considered technology as very useful. The group was very well informed about internet fraud and had received training. They acknowledged a downside to technology but considered themselves in control; the group trusted technology, but "didn't trust the system". Whilst this group also raised concerns over technology replacing existing relationships, they considered technology to make things easier and to offer a sense of security and reported a sense of security with statements such as: "Someone's watching me, I am going to be OK" and "There's a button on my phone—if I am unconscious you can press the button and it will tell you all you need to know about any medical condition I may have". This reflected the general attitude of the group.

The inner-city community project urban group (Group 3), described technology as "frustrating". The majority of the group found smart technology intrusive i.e., it knows what you like and follows your habits, this concern was not echoed in the other groups. One member of the inner city group did not have a phone, smart or otherwise, and was "not keen" on technology for personal use, rather wanted a quieter life, on the other hand another member "just loves it". The group could see many advantages to ageing in their inner-city environment, they perceived ageing with or without technology in an inner-city environment easier than outside the city, for example transport and other shared resources. This group demonstrated a level of independence and had a different group dynamic to the other groups. For example, they explained that they didn't need technology to identify the location of places they could simply ask someone; overall the group expressed concern that technology can be a bit intrusive. However, they recognised that it was about striking a balance between technology and finding their own amusement. As with

Group 2, they thought of themselves in control, however they considered this as a result of the level and quality of amenities within easy reach, they acknowledged that in their environment everything was a lot easier, with much more choice.

Group 4, the rural group, was different again; here uptake of technology was high and positive. Overall the group view was that technology made life easier. The group viewed social interaction whether physical or via technology as important; and the significance of strong social relationships with family and friends emerged early in the conversation, highlighting the importance of a social network in this rural environment. The group recognised that their limited access to amenities had resulted in a level of reliance on technology, which in turn brings with it a level of trust. However, the group did not feel that they had all the information they needed to make informed choices about technology. In terms of 'ageing in place' the group reported that they see technology to increase the possibility to age in place and offered a welcome alternative to moving to a more urban environment. They felt that without technology the rural environment is not conducive to 'ageing in place'. Technology was considered as "not a single thing". However, the group pointed out that whilst you need to have an interest in embracing technology, where attitude is a driver, technology is being forced on them, as limited amenities are closing. As a group they recognised that technology will dominate (if it doesn't already), and that this will happen at the expense of personal contact.

4. Conclusions

In light of the findings of both the ScSt and the FGs, it was evident that the uptake of technology to support 'ageing in place' is high, and that although barriers exist, they can be overcome. Our findings demonstrate that age is not a barrier to the uptake of technology, and that people adapt and use technology according to their wants. Whilst there is a generational difference in the use and uptake of technology it can be argued that this is not age related, but experience and value driven.

In addition, the ScSt highlighted several limitations in the type of research that is being conducted, i.e., it focused on medical and monitoring activity criteria to support ageing in the home, with little evidence to suggest that research into 'mobility' outside the home and social 'isolation', both requirements of 'ageing in place', are being undertaken for current or future generations of older adults. Conversely, the FGs demonstrated that the uptake of technology for these activities was high, particularly for those with limited physical opportunities.

Whilst the literature review did not uncover research related directly to social activity, the FGs demonstrated strong incentives to why the uptake was high even in the upper age ranges. However, this observation could be a limitation of the participants of the FGs that were already engaged with physical and social activities.

The academic literature for the most part reported on how technology was used to assess barriers to 'ageing in place' rather than the use of technology to aid 'ageing in place' per se, and tenuously pointed to demographics, both socioeconomic and geographical conditions, to influence both mobility and social opportunities. However, the FGs revealed that with ageing, geographical conditions become increasing significant and where necessary technology is recognised as providing opportunity to age in place. Overall the research findings suggested that for most, technology is recognised as a useful tool to support 'ageing in place' and therefore little in the way of incentive is needed. Whilst this uptake might be as a direct result of an increasing ratio of a technology savvy cohort moving through the population structure, it also points to enjoyment of use alongside and increased independence as significant up-take factors. These findings, although not fully resolved in the literature, highlight the need to better understand the use technology to achieve autonomy in the wider environment. The ScSt did not identify geographic demographic as an influence on the uptake of technology, which was a clearly identifiable parameter from the FGs. Therefore, future policies will have to consider the different circumstances and requirements of older adults living in a range of built environment scales when planning how to support older adults to age in place.

Finally, although the ScSt did not identify research concerned with the uptake of technology outside the home, it did identify evidence that age and most physical conditions are not barriers to the uptake of a wide range of technology in the home. Therefore, it follows that age and most physical conditions will not be a barrier to the uptake of a wide range of technologies outside the home.

The next step is to explore further the various geographical challenges faced by an ageing population, and consequently how each generation and social group perceives use or usefulness of technology in solving mobility and social connectivity to encourage 'ageing in place'.

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Conflict of Interests

The authors declare no conflict of interests.

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