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The home as enabler of more active lifestyles among older people

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RESEARCH PAPER

The home as enabler of more active lifestyles among older people

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Inactive lifestyles have negative health consequences, while time spent sedentary (sitting and lying) is related to morbidity and premature mortality. Older adults often form the most sedentary segment of the population. Much of this behaviour may be practised at home where this group can spend extended periods. Physical activity rates among older adults are particularly low. Even household physical activities can be beneficial for this group, while they can constitute much of an older person's total activity. Despite this context, the home's role in the active and sedentary behaviours of the older population appears critically understudied. Using interview and focus group data collected from 22 older adults (healthy volunteers, stroke survivors and people with dementia), this paper begins to address this issue. Aspects of the home that aid or impede a more active, less sedentary lifestyle are identified with three presenting particular capacity in this respect discussed: steps, space within the home, and the location and form of facilities, fixtures and fittings. The crucial role health status plays in structuring this capacity is identified. Simple design recommendations, devised to support older people to lead more active lives at home, are presented.

Keywords: active design, active living, age, built environment, design characteristics, home, housing, older adults, physical activity, sedentary behaviour

Introduction

Raising physical activity (PA) levels, with PA defined here as movements produced by skeletal muscles which result in energy expenditure (Samitz, Egger, & Zwahlen, 2011), can bring health benefits and improve life expectancy (Department of Health (DoH), 2011; Warburton, Nicol, & Bredin, 2006). Studies have documented the beneficial effects of PA on various conditions and diseases including stroke (Billinger et al., 2014) and dementia (Larson et al., 2006; Middleton and Yaffe, 2009), while easing the burden of chronic disease on health and social care services can save public funds (DoH, 2005). Despite such benefits, in many countries low levels of PA are common (World Health Organisation (WHO), 2010) with participation in regular PA being particularly low among older adults (Troiano et al. 2008; WHO, 2010). A fast growing population (United Nations Population Fund (UNFPA) and HelpAge International, 2012) which is variously defined but frequently refers to those aged 60 years and over. Relevant to this paper, among this population even household PA – defined as low-to-moderate-intensity habitual physical activities performed in and around the home, such as housework and preparing meals (Pescatello, Murphy, & Costanzo, 2000; Ratzlaff, 2012), activities often termed ‘instrumental activities of daily living’ (Lawton & Brody, 1969) – has been associated with health benefits (Buman et al., 2010; Pescatello & Murphy, 1998; Pescatello et al., 2000). Further, although PA studies with older people have usually focused on moderate-to-high-intensity activities such as walking (Barnett, van Sluijs, Ogilvie, & Wareham, 2014; Sallis et al., 2006), these home-based activities can account for much of an older person’s total activity, especially among older women (Baltes, Maas, Wilms, Borchelt, & Little, 1999; Benzinger et al., 2014).

Independent from PA, sedentary behaviour (SB) is a cluster of individual behaviours where sitting or lying is the dominant posture and energy expenditure is very low (Barnes et al., 2012). An increasing body of evidence indicates that too much time spent sedentary is related to poor health and premature mortality (Dunstan, Howard, Healey, & Owen, 2012; Owen, Bauman, & Brown, 2009), while tackling sedentary lifestyles has become a national (DoH, 2011) and an international (WHO, 2010) concern. Similar to PA, SB is unevenly distributed across the population with, in this instance, the highest rates concentrated in the oldest age groups (Matthews et al., 2008). A recent systematic review found that, when measured objectively, almost 70% of individuals aged 60 years and over were sedentary for more than 8.5 hours in their waking day (Harvey, Chastin, & Skelton, 2013). Research indicates that among this group time spent sedentary is independently related to functional fitness (Santos et al., 2012), while individuals with lower levels of SB appear more likely to

age successfully (Balboa-Castillo, Leon-Munoz, Graciani, Rodriguez-Artalejo, & Guallar-Castillon, 2011; Dogra & Stathokostas, 2012). Of concern to this paper, although relatively few studies have investigated SB in the older population (Chastin, Fitzpatrick, Andrews, & DiCroce, 2014), one might expect much of this behaviour to occur at home where this group can spend extended periods (Iwarsson et al., 2007). In a population-based random sample ($n = 11\ 918$), Brasche and Bischof (2005) found that individuals aged 65 years and over ($n = 2467$) spent, on average, 19.5 hours per day at home (more time than any other age group).

For older adults, then, the home emerges as a key site for and of active and sedentary behaviour. Whether it in any way *informs* these behaviours is, however, uncertain since comparatively little research has addressed this issue (Iwarsson et al., 2007). Indeed, pointing to a critical flaw in the evidence base, of the few studies that have examined the role of the environment in PA and SB in older people (Chastin et al., 2014; Van Cauwenberg et al., 2011), attention has normally focused on outdoor environments neglecting the role of the home. Responding to this flaw, and the particular concerns of this special issue, this paper draws on interview and focus group data, collected from a diverse sample of 22 healthy volunteers, stroke survivors and people with dementia, mainly aged 60 years and over, to provide insights into the *experienced and/or perceived* role of the domestic indoor built environment, *i.e.* the home, in older adults’ active and sedentary behaviours.

In order to situate this study, the paper begins with a short review of the existing empirical evidence on the environmental correlates of PA and SB in older adults. The research methodology and findings follow with simple design recommendations, developed from the findings and devised to support older people to lead more active lives at home, presented. To close, the conclusions summarize key findings and consider the implications for policy.

The environmental correlates of PA and SB in older adults

Comparatively few studies have investigated the potential environmental correlates of PA and SB in older adults (Chastin et al., 2014; Van Cauwenberg et al., 2011). Equally relevant to the research reported here, few have explored such associations in stroke survivors (English, Manns, Tucak, & Bernhardt, 2014) or people with dementia (Stubbs et al., 2014). Studies broaching these subjects have tended to concentrate on outdoor environments (*e.g.* Sugiyama & Ward Thompson, 2008; Van Cauwenberg et al., 2014) neglecting the home and other indoor spaces. For PA studies this is

likely to be a function of the forms of PA investigated, *e.g.* leisure PA (Benzinger et al., 2014; Ratzlaff, 2012). It has, however, been suggested that SB may be 'strongly influenced' by the physical environment (Owen et al., 2011, p. 192), which can be defined as the objective and perceived qualities and characteristics of the physical settings in which individuals spend time (Van Cauwenberg et al., 2011, p. 458), while others have identified environmental factors, such as the presence of pavements, as crucial in facilitating PA (Lavizzo-Mourey & McGinnis, 2003).

Studies, limited though they are, into the environmental correlates of PA in older adults reveal no consistent and many non-significant relationships creating a confused picture (Bauman et al., 2012; Van Cauwenberg et al., 2011), while the high proportion of North American studies (Van Cauwenberg et al., 2011) might make generalizations to other environmental contexts problematic. Indeed, Owen et al. (2011) suggest that the contradictory findings from different countries indicate that environmental factors might influence behaviour differently in different types of built environment, and in different social and cultural settings. With that being said, studies have linked various outdoor or neighbourhood/street-level environmental attributes to older adults' total and recreational PA. Perceived street connectivity (Morris, McAuley, & Motl, 2008), street lighting, pedestrian and cycling infrastructure (Chad et al., 2005), and perceived access to certain types of recreational facility (*e.g.* public parks) (Chad et al., 2005, Mowen, Orsega-Smith, Payne, Ainsworth, & Godbey, 2007; Shores, West, Theriault, & Davison, 2009) have been linked to total PA. Proximity to recreational facilities has been associated with recreational PA (Berke et al., 2006), while proximity to shops has been related to recreational walking (Michael, Beard, Choi, Farquhar, & Carlson, 2006). Perceived access to recreational facilities and perceived land-use mix have both been linked to transport walking (Shigematsu et al., 2009), while, among older adults reporting some degree of walking activity, the number of commercial establishments and the number of likely retail walking destinations have both been linked to increased walking time (Nagel, Carlson, Bosworth, & Michael, 2008).

The handful of studies that have investigated the environmental correlates of SB in older adults (Chastin et al., 2014) suggest that, as with PA, certain outdoor or neighbourhood/street-level environmental attributes might be important. Van Cauwenberg et al. (2014) found, for example, that access to facilities and safety from crime were both associated with older adults' television viewing time (indoor environmental factors were not considered). While the authors concluded that the observed effects of the physical environment were

small and alterations in a single factor might not lead to clinically relevant changes, they suggested that the additive effect of several favourable factors might result in notable reductions in television viewing time (Van Cauwenberg et al., 2014, p. 514). Exploring older women's perceptions of their own SB, Chastin et al. (2014) found that individuals identified neighbourhood design, particularly the absence of resting places, as an influence on time spent sedentary. A lack of regularly spaced resting spaces limited an individual's motivation or confidence to be active and their inclination to get and stay upright (Chastin et al., 2014, p. 777).

Moving away from PA and SB studies, environmental gerontology studies provide insights into the role of the home in the active and sedentary behaviours of the older population. Multiple aspects of the home including layout, internal dimensions and circulation arrangements are identified as potential influences on an older person's ability to perform household tasks (Gitlin, Mann, Tomit, & Marcus, 2001; Oldman, 2002). Home modifications such as level access (Tinker et al., 2007; Lansley et al., 2004a), handrails, grab bars (Gitlin et al., 2001; Peace et al., 2012) and raised toilet seats (Haak, Fänge, Iwarsson, & Dahlin Ivanoff, 2007) are seen to support these activities (Kim, Ahn, Steinhoff, & Lee, 2014), and tackle risk factors such as falls (Lansley et al., 2004a; Lansley et al., 2004b). Studies in Europe identify such measures as successful and cost-effective (summarized in Tinker, Kellaher, Ginn, & Ribe, 2013). Conversely, items such as stairs, high or low cabinets, poor lighting, baths, heavy doors (Gitlin et al., 2001), uneven surfaces, and narrow corridors and doors (Lansley et al., 2004b; Tinker et al., 2007) are found to introduce difficulty. Relative to those with high functional capacity, individuals with low capacity are more vulnerable to environmental demands and, consequently, environmental details are critical to the type of everyday tasks and activities these individuals can accomplish (Benzinger et al., 2014, p. 378). All things being equal, one might therefore expect older adults with low functional capacity, with functional capacity declining with age, to be more likely to find aspects of the home more problematic (Benzinger et al., 2014).

Among older people, perceived and/or experienced pain, tiredness or risk can be associated with restricted participation in everyday activities (Gill, Desai, Gahbauer, Holford, & Williams, 2001; Lachman et al., 1998; Williamson & Schulz, 1992) and SB (Chastin et al., 2014), so too can a perception that activities cannot be accomplished independently (Haak et al., 2007). If problematic aspects of the home contribute to an older person experiencing/perceiving such conditions when attempting household activities, their participation in these tasks might be reduced (Lachman et al., 1998), or at the very least it will not be supported (Gitlin et al., 2001). Lachman et al.

(1998), for example, found that a fear of falling deterred some older people from reaching overhead for items, while Haak et al. (2007) found that some withdrew from certain activities when they felt unable to perform them independently. All things being equal, older adults with low functional capacity might be particularly likely to limit their participation in household activities as they might be more likely to find aspects of the home problematic. Restricting participation in household activities might result in a less active, more sedentary life (Chastin et al., 2014; Lachman et al., 1998). There might also be associated negative effects on an older person's physical abilities, potentially hampering their capacity to engage in everyday activities outside the home (Delbaere, Crombez, Vanderstraeten, Willems, & Cambier, 2004; Fletcher & Hirdes, 2004).

Against this background, the home could be conceived as a structured performance space where objective and perceived qualities and attributes influence the variety and volume of household PA and SB completed by older people. An individual's functional capacity will be critical in this, while factors like social support will be important (Benzinger et al., 2014; Delbaere et al., 2004). Steered by this understanding, and adopting an integrated focus on personal and environmental factors (Benzinger et al., 2014), this paper unpicks aspects of the home that were *perceived and/or experienced* by a diverse sample of older adults as influences on their household PA and SB. Based on the findings, simple design recommendations, devised to support

older people to lead more active lives at home, were developed. It is the authors' hope that the presented findings and recommendations will prove useful to researchers, designers, developers, healthcare professionals and policy-makers interested in identifying and providing appropriate and supportive housing for an ageing population.

Research design

Design

The study related here formed part of a large three-year project on the design of age-, stroke- and dementia-friendly environments. Interest in both indoor and outdoor environments shaped the research design, but here, reflecting the concerns of the special issue, focus rests on indoor environments, specifically the home. The study sat alongside, and provided input to, an educational project that saw postgraduate architecture students incorporate research findings into architectural proposals for age-, stroke- and dementia-friendly spaces (indoor and outdoor).

The study employed three interconnected phases of data collection to access older people's perspectives on, and experiences within, the home and outdoor environment. To understand an older person's experiences within the built environment it is important to listen as they describe their experiences in their own words (Hellström, Nolan, Nordenfelt, & Lundh, 2007; Silverman, 2000). With this in mind, and wishing to capture a variety of perspectives and experiences (Patton, 1990), the study employed focus groups and qualitative interviews and collected direct rather than proxy accounts from a diverse sample of participants. Discussed in more detail below, the three phases comprised: (1) an

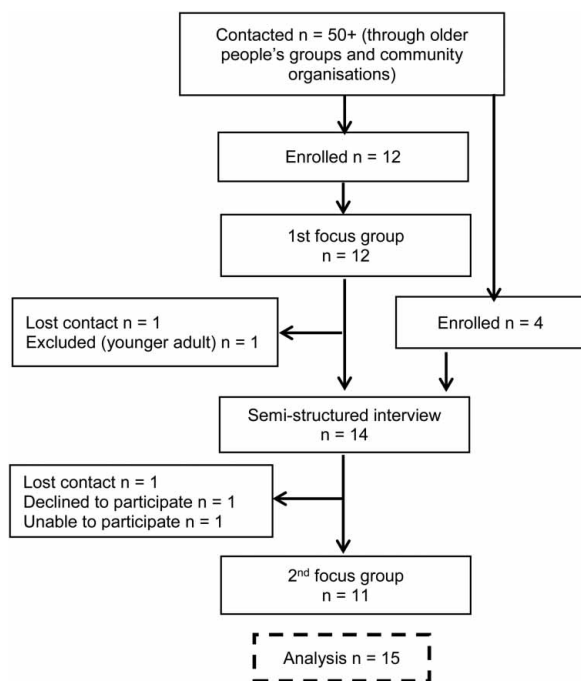


Figure 1 Healthy volunteers

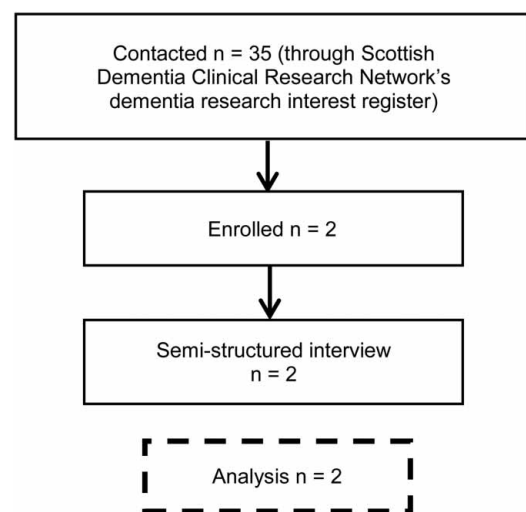


Figure 2 People with dementia

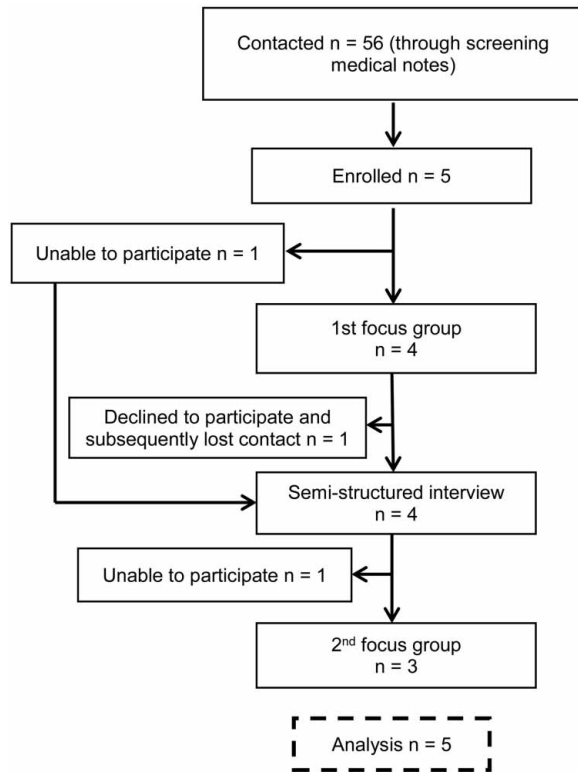


Figure 3 Stroke survivors

initial focus group, (2) a three-part, semi-structured qualitative interview completed in the participant's home and (3) a final focus group.

Sample and recruitment

Using purposive sampling (Figures 1–3), 15 healthy volunteers ('healthy' in so far as these individuals were not recruited to present any particular diagnosed condition), five stroke survivors (patients discharged from hospital six months to two years previously), and two community-dwelling older adults with a confirmed diagnosis of dementia were included in the study, following ethical approval. The participants with dementia had an Addenbrooke's Cognitive Examination – Revised (ACE-R) Total equal to or greater than 10 (which excludes people with severe cognitive impairment) and had the capacity to consent. (Sixteen healthy volunteers were originally recruited to the study but one individual, aged less than 50 years, was excluded on the grounds of age (Figure 1).) Thus the final sample used for analysis comprised 22 individuals. Table 1 provides headline demographic data for these individuals. While this might be considered a comparatively small sample, small samples are commonplace in the type of qualitative research described here (Hannes & Lockwood, 2012) while, pertinent to this research, the single case study forms an established approach in dementia studies (Hellström, Nolan, & Lundh, 2005). Lastly,

past studies into SB and PA in older adults have employed small (Conn, 1998), sometimes very small (Chastin et al., 2014), samples.

To focus briefly on the interesting case of the stroke and dementia groups, here individuals were sent letters inviting them to participate. In most cases these failed to elicit a response, although on several occasions, particularly for the dementia group, a family member replied advising that poor health made participation impractical. This recruitment experience underlined the influence of gatekeepers and health status when seeking to involve certain groups in research (Galea & Tracy, 2007; Hellström et al., 2007; Sherratt, Soteriou, & Evans, 2007).

Individuals were invited to take part in all three phases of data collection with separate focus groups organized for the three sets of participant. Some participants did not wish or were unable to participate in all phases (see Figures 1–3 for participation in each phase) which, for the dementia group, meant that it was not possible to convene any focus groups (this is reflected in Figure 3). Note that difficulties in recruiting people with dementia to focus groups are reported by others (Parke et al., 2013).

Methods

The focus groups and interviews were facilitated by the first author with support from members of the study's research team. Each focus group lasted approximately one hour and each interview 1–1.5 hours. A set of broad talking points steered the focus groups and an interview schedule the interviews. Each was audio-recorded and transcribed. Field notes were made within each interview and focus group, capturing participants' comments, interaction etc., with further detail added immediately after. In reporting the results, all participants were provided with pseudonyms.

First focus group

Through a semi-structured discussion steered by the first author, the focus group explored participants' emotional responses to places and their favoured and less favoured indoor (domestic and non-domestic) and outdoor environments. Focus groups have been employed in studies with older people (Milligan, Gatrell, & Bingley, 2004; Reichstadt, Depp, Palinkas, & Jeste, 2007), stroke survivors (O'Connell et al., 2001; Sarre et al., 2014), and people with dementia (Bamford & Bruce, 2002; Robinson, Brittain, Lindsay, Jackson, & Olivier, 2009), while the advantages and limitations of the method are well documented (Barbour, 2007; Brookfield, Bloodworth, & Mohan, 2013; Kreuger & Casey, 2000).

Table 1 Participant demographics

	Healthy volunteers	Stroke survivors	People with dementia	Totals
Number of participants	15	5	2	22
Male	3	1	2	6
Female	12	4	0	16
Age confirmed as ≥ 60 years ^a	12	5	2	19
Lives in a flat ^b	9	1	1	11
Lives in a house ^b	4	2	1	7
Lives in assisted housing (flat) ^b	1	1	0	2
Lives alone ^c	10	4	0	14
Lives with a partner ^c	5	0	2	7

Notes: ^aAges were unavailable for three healthy volunteers.

^bDwelling types were unavailable for one healthy volunteer and one stroke survivor.

^cHousehold composition was unavailable for one stroke survivor.

Semi-structured interviews

The first section of the three-part semi-structured interview (Silverman, 2000) consisted of a words-alone interview on attitudes towards and activities within the participant's own home. The second section explored place perception using photo-elicitation; a method that introduces images into a research interview to inspire reflection and comment (Banks, 2001; Harper, 2002). Picture-based methods can help people with dementia and communication difficulties express their views (Allan, 2001; Capstick, 2011; Murphy, Tester, Hubbard, Downs, & MacDonald, 2005). Participants were shown six researcher-generated photographs of different outdoor environments (the focus on outdoor environments stemmed from the larger project's concern with indoor and outdoor environments). Half showed environments containing features and items, which, according to research by the WHO (2007), are viewed positively by older people (*e.g.* neighbours interacting) and half contained features and items which are viewed negatively (*e.g.* litter). Finally, the third section employed the Talking Mats communication framework to explore the relative importance of various aspects of the home and outdoor environment. Talking Mats is a low-technology, picture-based communication framework developed to help individuals with communication difficulties express their views (Murphy et al., 2005). Participants are asked to consider a picture that illustrates an activity, item, relationship etc. and indicate their views towards it by placing it somewhere along a visual scale (Murphy et al., 2005). Within the study, the visual scale explored the concept of importance, extending from not important to important, and the pictures illustrated 17 features of the home and outdoor environment. These were features identified by the WHO (2007) as necessary components of an age-friendly home and city. Features were varied and included storage space, kitchen facilities, green space and pavements.

Final focus group

Initial findings from the first two data-collection phases were incorporated into the educational project with students using these to develop architectural proposals for age-, dementia- and stroke-friendly indoor and outdoor environments. In the final focus group, members of the research team described these proposals in layman's terms, talking through the students' architectural drawings and models. Participants discussed and critiqued these proposals.

Ethics

Ethical approval for the study was granted from the NHS West of Scotland Research Ethics Committee (REC) 3 (and the first author's institution). REC required that the people with dementia be accompanied by a family member, carer or representative when taking part. Informed consent was obtained directly from all participants.

Analysis

Short summaries of the interviews and focus groups were prepared by the first author, shortly after each took place, through reference to the field notes. A preliminary thematic analysis, adopting an inductive approach to coding (Joffe & Yardley, 2004), was completed by repeatedly reading across and comparing between these summaries. The summaries relating to the three groups of participants were analysed separately to maximize opportunities to identify differences and similarities between, and core shared items within, each set. Themes identified included: residential preferences, environment and PA, health, ageing and PA, environment and affect, important components of a home/neighbourhood and activities/pastimes. The interview schedule and focus group talking points necessarily shaped the data

collected and thus influenced the themes identified. Their influence also helped explain the broad similarity in themes identified across the three groups of participants. A single coding framework was assembled by the first author from the identified themes. This framework subsequently steered the analysis of the focus group and interview transcripts. These transcripts were imported into NVivo 10 for analysis (Bazeley & Jackson, 2013). The transcripts for the three sets of participants were analysed separately, one set after another, by the first author. During the analysis process the coding framework was enriched through the addition of categories and codes identified within the raw data (*i.e.* identified through repeated reading of the transcripts) (Patton, 1990). This inductive analysis tended to uncover additional layers and facets in existing themes, bringing depth and nuance to the findings, rather than identify entirely new themes. Discussion now turns to the findings of this analysis, focusing on those related to the home.

Health and home

Numerous health complaints and conditions were reported, unprompted, by the stroke survivors and, particularly, the healthy volunteers; such information was not offered by the people with dementia. Participants reported diagnosed medical conditions and general health complaints. Impaired vision, joint and muscle pain, restricted movement, poor balance, heart conditions, fatigue and mobility problems were all cited, with some linking these conditions to the ageing process, ‘ageing is not for wimps [...] I’ll tell you’ (Alexandra, healthy volunteer). Certain stroke survivors reported that post-stroke they tended to become more tired more often (and so found themselves sitting for longer). These conditions and complaints *in combination* with attributes of the physical home environment (*e.g.* layout, design and circulation arrangements) served to restrict everyday low-to-moderate-intensity activities, like washing, cooking and moving between rooms, such that less active, more sedentary lives were sometimes the result. In a couple of cases, accidents within the home (*e.g.* falls), sometimes attributed to poor design (such as absent handrails), led to health events and conditions which further restricted mobility. Just over a third of participants were sensitive or anxious about falling or the potential for injury at home and highlighted perceived hazards such as high storage areas and stairs. For some, these anxieties (discussed below in more detail), which tended to be reported mainly by those who lived alone, influenced behaviour.

Stairs, space within the home, and facilities, fixtures and fittings

Stairs, space within the home, and the form and location of facilities, fixtures and fittings proved

particularly limiting of household PA and were especially likely to be identified by participants as restrictive. (Indeed, participants sometimes employed terms such as ‘restricting’, ‘limiting’ and ‘difficult’ when describing their experiences within the built environment.) They also constituted the aspects of the home most associated with SB. They consequently seemed the natural focus for this paper. In terms of PA, when broken down by participant type, these items proved equally problematic for the healthy volunteers and stroke survivors but they were rarely mentioned by the people with dementia who generally failed to report any barriers to PA within the home (or outdoor environment). Only stairs attracted some negative comment, and this was only occasionally. Subsequent sections discuss, in turn, the role played by these three items in promoting and/or limiting SB and household PA. Where mentioned, these items played a relatively similar role among the three groups of participants and so their experiences are considered together. However, instances where experiences differed or were peculiar to a certain group are highlighted.

Stairs

They’re a nightmare these stairs.

(Janet, stroke survivor)

Stairs within the home were problematic, to a greater or lesser extent, to over half the participants, with the stroke survivors particularly likely to identify them as challenging. Most often a health condition lay behind the experienced difficulties. Conditions could make it painful to climb up and down stairs and/or restrict movement. Visual impairments, and problems judging heights, could make stairs difficult for some stroke survivors. Where a health condition was responsible, stairs could be a significant barrier. Individuals could restrict daily activity within the home to a single floor, or just a couple of rooms, avoiding stairs wherever and whenever possible, with a less active life the result. Beyond specific health conditions, for a couple of participants climbing stairs was simply tiring, while a fear of falling affected others. Both could have implications for an individual’s activity levels. Some individuals adapted their behaviour and use of the home to ensure only infrequent use of the stairs, while others scaled back the intensity of their activity by going slowly and resting. The physical design of steps and stairs shaped the relative impact of these factors on the individual. The tread, rise and number of steps; handrails, lighting and landings; and pitch and orientation of stairs (straight, spiral etc.) proved particularly important. Generally, straight, well-lit stairs (in the day and at night), double handrails, landings, a moderate pitch and a consistent approach to the tread and rise of steps, avoiding narrow, high and shallow steps, aided mobility with individuals feeling

more able (and confident) to use the stairs when these features were present.

Findings from the study might suggest that designers ought to consider incorporating, and policy-makers requiring, these relatively simple features in the design of stairs in order to enable older people to journey more easily between floors, and within a storey where there are level changes, and thus benefit from participation in a form of low-to-moderate-intensity PA. Addressed below (Table 2), the building control guidance in various countries (e.g. Scotland's Building Standards and England's Building Regulations) already requires some such features (Iwarsson, Wahl, & Nygren, 2004). They are mentioned here to underline their importance and to encourage their adoption in policy and application in practice more widely.

For a small minority (three healthy volunteers, one with reported/observed mobility impairments and two without), although stairs could prove tiring they were valued for introducing into the daily routine an appreciated episode of PA. They ensured regular exercise and this promoted health benefits. These participants thought stairs were particularly beneficial for older people: 'it makes them use their muscles, their joints, plus it's good for their heart, ask any doctor' (Margaret, healthy volunteer). When a lift was available, these participants, and a number who found stairs more challenging, preferred living, or wished to live, above the ground floor – as noted over half the participants lived in flats (although not high-rise flats). Better views, more natural light, increased safety, less disturbance, reduced noise and greater privacy were associated with living above the ground floor. Almost half the participants, a group where almost all were healthy volunteers, seemed willing to forego the potentially easier access afforded by a ground-floor home to enjoy these advantages: 'just put me up in the sky please' (Christine, healthy volunteer). Contrary to much accepted wisdom, then, such findings might suggest that policy-makers and designers ought to explore opportunities to provide age-exclusive housing on first and upper floors and create provision for residents to travel between floors by foot through the inclusion of well-designed stairs. Such an approach would provide opportunities for residents to incorporate into their repertoire of household activities a form of low-to-moderate-intensity PA.

Living space

I would like to have a bit more *Lebensraum*.
(Isabel, healthy volunteer)

Smaller properties and rooms were an impediment to everyday activities for just under half the participants. Participants knocked into furniture and fittings in

smaller rooms, sometimes resulting in serious injury. Manoeuvring within smaller spaces was difficult, while the range of activities possible within these places was limited. In contrast, wide corridors and doors were, for half the participants, an aid to mobility, while homes that were large enough to accommodate several rooms or demarcated spaces supported activity with individuals moving between spaces to undertake different tasks. They could eat in one room or space, cook in another and practise a hobby in another. However, whether they lived in spacious or smaller homes, from detached houses to compact studios, participants might consciously act to reduce the volume of space they occupied, restricting 'activity' to a single room or chair within a room. Possessions and hobbies/interests were arranged to be within reaching distance, producing a more sedentary lifestyle featuring extended periods of sitting or lying. Convenience, mobility impairments and difficulties in meeting the high costs of heating a larger, poorly insulated property helped explain this behaviour.

For a small minority (three healthy volunteers, two with reported/observed mobility impairments and one without) smaller rather than spacious rooms aided activity. These participants felt safer and more confident passing along narrower corridors and moving around smaller rooms because the closer walls and furniture provided some support and aided balance: 'my own flat, which is very small, I now appreciate the smallness of it because I can't really fall over' (Caroline, healthy volunteer). Indeed, Caroline reported that by holding on to the two facing walls in her narrow hallway she could safely carry out a range of exercises.

Reflecting on the issue of living space, a couple of broad principles emerge from the findings which, if incorporated into the design of homes, might support active living among older people. Homes should (1) comprise discretely spacious rooms – generous spaces that do not through their volume overwhelm the individual, and (2) feature several separate rooms or demarcated living spaces.

Facilities, fixtures and fittings

It got to the point when I couldn't even get into the bath so [...] for a while I was actually having to use the sink to wash, and that was all over, because it was impossible.

(James, healthy volunteer)

The location, height and/or design of cupboards, appliances, switches, sockets, toilets, taps, baths and showers introduced a level of difficulty into household activities for just over half the participants, frustrating their accomplishment. As with stairs, a health condition or complaint often lay behind the experienced difficulties.

Table 2 Enabling the home to support active living among older people

Recommendation	Scottish Building Regulations (Technical Handbook Domestic, 2013)	Lifetime Homes Standard (July 2010)
1. Stairs: Reflecting the following in communal and private stairs within a dwelling/residential complex may assist older people in journeying between floors, and level changes within a storey, by foot and, consequently, help facilitate a form of low-to-moderate-intensity activity:		
1a Well lit	Addressed. Clauses 4.6.1 and 4.6.2	Not addressed
1b Straight	Not addressed. Although Clause 4.3.10 notes that stairs formed from tapering treads can be more difficult to use than straight stairs	Addressed to an extent. Criterion 12 Additional Good Practice Recommendations (AGPR). Straight stair without winders recommended within a dwelling
1c Double handrails	Addressed to an extent. Clause 4.3.14. For a private stair (stair wholly within a dwelling) only a single handrail is needed, however the side without a handrail should permit installation of a second handrail in future, while on any other stair a double handrail should be provided where there is a change of level of more than 600 mm	Not addressed. Criterion 5a requires 'handrails' on communal stairs but does not specify if this is a single or a double handrail. Handrails are not mentioned in relation to stairs within a dwelling (Criterion 12)
1d Landings/resting points	Addressed. Clause 4.3.4	Not addressed
1e Consistent wide tread	Addressed. Clause 4.3.2	Addressed to an extent. Criterion 5a. Going not less than 250 mm on shared stairs. Criterion 12 AGPR notes the desirability of treads being a consistent depth on stairs within a dwelling (Criterion 12)
1f Moderate pitch and consistent moderate rise to steps	Addressed. Clause 4.3.2	Addressed to an extent. Criterion 5a. Shared stairs should have a uniform rise not exceeding 170 mm and going not exceeding 250 mm. Pitch and rise are not mentioned in relation to stairs within a dwelling (Criterion 12)
2. Age-exclusive housing: The following approach to the provision of age-exclusive housing would provide residents with the opportunity, and perhaps encouragement, to include in their repertoire of household activities journeying between floors by foot:		
2a Provide age-exclusive housing above the ground floor and incorporate well-designed stairs	Outside the scope of Building Regulations	Outside the scope of the Lifetime Homes Standard
3. Space and layout: The following approach to dwelling layout may support and encourage older people to move around the home more readily and easily and thereby (a) benefit from a form of low-intensity activity and (b) potentially reduce the amount of time spent sedentary:		
3a Discretely spacious rooms and areas (generous spaces which do not through their volume overwhelm the individual)	Addressed to an extent. Several Clauses (e.g. 3.11.1, 3.11.2, 3.11.3, 3.12.3 and 4.2.1) outline relatively modest minimum space standards and 'activity space' requirements for various rooms (e.g. bathrooms and kitchens) and areas (e.g. horizontal circulation space) within dwellings	Addressed to an extent. Criteria 6, 7 and 14 set relatively modest minimum space standards and 'clear approach zone' requirements for various rooms (e.g. bathrooms, living rooms and kitchens) and areas (e.g. horizontal circulation space) within a dwelling

(Table continued)

Table 2 Continued

Recommendation	Scottish Building Regulations (<i>Technical Handbook Domestic</i> , 2013)	Lifetime Homes Standard (July 2010)
3b Floor plans/layouts featuring several separate rooms/clearly demarcated living spaces	Addressed to a limited extent. Clause 3.11.3. The kitchen area should be defined by a rectangle enclosing any floor-standing units, appliances and worktops where the kitchen forms part of an 'apartment' (defined in the <i>Technical Handbook</i> as rooms not used solely as a kitchen, store or utility room)	Not addressed
4. Bathroom: <i>Incorporating the following within bathrooms may assist older people in completing certain low-intensity everyday activities (e.g. washing):</i>		
4a Wet rooms or stand-alone shower cubicles with level access	Addressed to an extent. Clause 3.12.3. Dwellings should have at least one accessible bath or shower and, though not explicitly defined, an accessible shower appears to be a level-access floor shower. There should be scope to replace a bath with an accessible shower without compromising access to other sanitary facilities	Addressed to an extent. Criterion 14. An accessible bathroom should be provided in a dwelling and this should feature either a bath or an accessible floor-level shower
4b Grab bars/handrails	Addressed to an extent. Clause 3.12.3. Bathroom walls adjacent to any sanitary facility should be of a sufficiently robust construction to permit the secure fixing of grab rails or other aids	Addressed to an extent. Criterion 11. Bathroom and WC compartment walls should be capable of firm fixing and support for adaptations like grab rails. The associated AGPR extends this to all walls
5. Kitchen: <i>Incorporating the following within kitchens may assist older people in completing certain low-intensity everyday activities (e.g. cooking):</i>		
5a Pull-out larder units and work surfaces, and adjustable-height work surfaces	Not addressed	Not addressed
6. Electrical: <i>Ensuring the following within dwellings may support older people in completing certain low-intensity everyday activities around the home (e.g. vacuuming):</i>		
6a Sockets located within easy reach	Addressed. Clauses 4.6.4 and 4.8.5	Addressed. Criterion 16
Recommendation-guidance fit: <i>Out of 13 recommendations, the number that were:</i>		
Addressed in full or in part by guidance	10	7
Not addressed by guidance	2	5
Outside the scope of studied guidance	1	1

In the kitchen, cupboards could be too high or too low to support comfortable use and/or were too deep to allow access to items at the back. They could also be problematic to open, with arthritis and Raynaud's making it difficult to grip handles. Kitchen appliances could be poorly positioned, again being either too high or too low. To support household PA in the kitchen, echoing findings from Peace et al. (2012), pull-out larder units and work surfaces, adjustable-height work surfaces,

counter-top appliances, easy-opening cupboards and chest- or head-height units were favoured.

Throughout the home, everyday activities could be complicated by the inconvenient siting of sockets and switches which sometimes required painful bending, crouching or reaching. Some participants were anxious about being unable to stand up after kneeling down. Storage space throughout the home could also

be poorly located with individuals sometimes relying on family members to access high cupboards and shelves, hindering the ‘simple’ task of retrieving or storing items.

In the bathroom, the location and design of certain fixtures and fittings could introduce difficulty into activities such as washing. Toilets, and for one participant taps, could be too low, making their use painful or difficult. Just over a third of participants encountered difficulties when climbing into a bath such that three had elected to replace their bath with a shower or wet room. Shower cubicles and wet rooms were thought easier to use, although even here some encountered difficulties. Christine, who reported a visual impairment, struggled to see the dials in her shower. Amala found stepping up into her shower cubicle problematic. Janet was so worried about falling that she rationed her showers: ‘I’m not encouraged to have a shower, if you understand, there’s always that fear there. I think . . . I’ll need to have a shower . . . but I’m not, I’m not going to risk it every day’ (stroke survivor). Anxieties about falling were particularly noticeable in situations where there was a shower over a bath. To reduce the perceived/actual risk of falling, grab bars and handrails had been incorporated into around a third of participants’ homes. These created a sense of security.

Design recommendations to support active living in the home

The preceding discussion has outlined a small number of relatively simple design recommendations intended to support active living among older people in the home. Table 2 summarizes these recommendations. Noted previously, some find expression in certain national building regulations (Iwarsson et al., 2004). Addressing this, Table 2 compares each against Scotland’s statutory Building Standards (the research was conducted in Scotland). Two *Technical Handbooks*, one for domestic buildings and one for non-domestic buildings, provide detailed guidance on how to comply with the Standards (Scottish Government, 2013). Table 2 references the *Technical Handbook Domestic* (2013). It also compares the recommendations against the UK’s non-statutory Lifetime Homes Standard – Revised Criteria (July 2010) (Habin-teg, 2010). This Standard, established in the mid-1990s, comprises 16 criteria developed to enable homes to meet the existing and changing needs of diverse households (Gwynne, 2013). Sections of the *Technical Handbook* are said to be based on the Lifetime Homes Standard (Scottish Government, 2013).

As Table 2 demonstrates, many of the study’s recommendations are addressed, in full or in part, by Scotland’s Building Standards and the UK’s Lifetime Homes Standard, although the rather limited links to the latter seem surprising. Importantly, however, guidance

contained in the *Technical Handbook*, while recommended, is not mandatory. Designers can propose alternative solutions (Scottish Government, 2013) to address the broad, somewhat flexible, Building Standards which focus on performance (*i.e.* aspects of the home achieving certain goals such as accessibility and safety) as opposed to prescriptive detail (Gann, Wang, & Hawkins, 1998). These alternative solutions may relate less successfully to the study’s recommendations. As an aside, the present authors recognize that the precise, detailed nature of the study’s recommendations, in promoting, for example, particular approaches to the provision of handrails, would seem to sit in tension with the trend from prescriptive to performance-based building regulations observed in Scotland and various other countries (Gann et al., 1998; Meacham, Bowen, Traw, & Moore, 2005).

Noting the overlap between the study’s recommendations and, in particular, the *Technical Handbook*, developers building in accordance with the latter would address most of the former. No further alterations to dwelling design would be required and there would be no additional costs (above those linked to satisfying the guidance) to bear. While there is no readily available research on the costs associated with satisfying all relevant guidance in the *Handbook*, various studies have investigated the costs associated with meeting the Lifetime Homes Standard (Department for Communities and Local Government (DCLG), 2007; Sangster, 1997). The UK government estimates that addressing the Standard’s 16 criteria would increase costs by between £545 and £1615 per dwelling (DCLG, 2007). As these criteria address a number of the study’s recommendations, satisfying several recommendations in a new dwelling might add only a relatively modest amount to total development costs. However, further research on this subject is needed. High costs may, however, be associated with addressing the study’s recommendations in existing dwellings. Further, such efforts may prove complex, challenging and in some cases impractical. For example, some 204 000 households in Scotland live in pre-1919 tenement flats (Scottish Government, 2014) (*i.e.* a flat within a common block of two or more floors where some or all of the dwellings have a common or shared vertical access; Scottish Government, 2014, p. 97), where access to the home may be by stairs formed from tapering treads. Satisfying the study’s recommendation to provide straight stairs with a consistent wide tread may be impossible in such properties. Future research could usefully explore the potential costs and practicalities associated with realizing the study’s recommendations in existing dwellings.

Conclusions

Addressing critical gaps in the evidence base, through a combination of qualitative interviews and focus

groups, this study has identified and distinguished amongst aspects of the home that were perceived and/or experienced by a diverse sample of older adults as influences on their household PA and SB. Three aspects of the home with particular capacity in this respect – steps, space within the home, and the location and form of facilities, fixtures and fittings – have been identified and the crucial role health status plays in structuring this capacity highlighted.

Among diverse older people, including stroke survivors, people with dementia, healthy volunteers and individuals reporting mobility and visual impairments, similar aspects of the home appeared to complicate everyday activities with a less active, more sedentary lifestyle sometimes the result. Stairs, for example, were widely seen to introduce difficulty into the everyday task of journeying between floors. Relatively simple adaptations targeting these ‘problematic’ items might support older adults to complete these activities more easily. Many participants found, for example, that showers aided personal care, while straight, well-lit stairs aided travelling between floors.

Reflecting on the implications for policy, the findings suggest that by directing and maintaining attention in residential development policy and practice to a few, relatively simple measures (Table 2), older adults may be enabled to lead more active, less sedentary lives at home. Such an outcome could support ‘ageing in place’, a UK (DoH, 2014) and international (Iwarsson et al., 2007) concern. Many of the study’s recommendations find expression in full or in part within existing national building regulations and/or guidance. However, the emphasis on precise detail found within these recommendations would seem to sit in tension with the international trend towards flexible, performance-based building regulations. Lastly, and of note, while somewhat straightforward in new dwellings, addressing the study’s recommendations in existing dwellings may prove costly, complex and in some cases impractical. Future research could usefully explore the potential costs and practicalities associated with realizing the study’s recommendations in existing dwellings.

There are recognized limitations to the study. It was based on a relatively small, unrepresentative sample of participants with it proving particularly difficult to recruit older people with dementia. Future research could engage with family members and caregivers to collect proxy accounts of the impact of the built environment on these latter individuals, while it could also usefully target underrepresented groups within the study, e.g. men. The study focused on ‘perceived housing’ (Iwarsson et al., 2007) and utilized self-report data. Future research could gather objective data on both the home and the home’s use by older people. Alternatively/additionally, ethnographic

research involving observations of older people within the home, or a simulated home environment (Helle, Iwarsson, & Brandt, 2014), and in-depth interviews could provide a ‘thick description’ of the home’s role in the active and sedentary behaviours of this group (Holloway, 1997).

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References

- Allan, K. (2001). *Communication and consultation: Exploring ways for staff to involve people with dementia in developing services*. Bristol: Policy Press.
- Balboa-Castillo, T., Leon-Munoz, L., Graciani, A., Rodriguez-Artalejo, F., & Guallar-Castillon, P. (2011). Longitudinal association of physical activity and sedentary behavior during leisure time with health-related quality of life in community-dwelling older adults. *Health and Quality of Life Outcomes*, 9, 47. doi:10.1186/1477-7525-9-47
- Baltes, M. M., Maas, I., Wilms, H-U., Borchelt, M. F., & Little, T. (1999). Everyday competence in old and very old age: Theoretical considerations and empirical findings. In P. B. Baltes & K. U. Mayer (Eds.), *The Berlin aging study: ageing from 70 to 100* (pp. 384–402). Cambridge: Cambridge University Press.
- Bamford, C., & Bruce, E. (2002). Successes and challenges in using focus groups with older people with dementia. In H. Wilkinson (Ed.), *The perspectives of people with dementia* (pp. 139–164). London: JKP.
- Banks, M. (2001). *Visual methods in social research*. London: Sage Publications.
- Barbour, R. (2007). *Doing focus groups*. London: Sage Publications.
- Barnes, J., Behrens, T. K., Benden, M. E., Biddle, S., Bond, D., Brassard, P., ... & Wilson, J. (2012). Letter to the Editor: Standardized use of the terms “sedentary” and “sedentary behaviours”. *Applied Physiology Nutrition and Metabolism*.

- Physiologie Appliquee Nutrition Et Metabolisme*, 37(3), 540–542. doi:10.1139/h2012-024
- Barnett, I., van Sluijs, E., Ogilvie, D., & Wareham, N. J. (2014). Changes in household, transport and recreational physical activity and television viewing time across the transition to retirement: Longitudinal evidence from the EPIC-Norfolk cohort. *Journal of Epidemiology and Community Health*, 68, 747–753. doi:10.1136/jech-2013-203225
- Bauman, A. E., Reis, R. S., Sallis, J. F., Wells, J. C., Loos, R. J., & Martin, B. W. (2012). Correlates of physical activity: Why are some people physically active and others not? *The Lancet*, 380(9838), 258–271. doi:10.1016/S0140-6736(12)60735-1
- Bazeley, P., & Jackson, K. (2013). *Qualitative data analysis with NVivo*. London: Sage Publications Limited.
- Benzinger, P., Iwarsson, S., Kroog, A., Beische, D., Lindemann, U., Klensk, J., & Becker, C. (2014). The association between the home environment and physical activity in community-dwelling older adults. *Aging Clinical and Experimental Research*, 26(4), 377–385. doi:10.1007/s40520-014-0196-0
- Berke, E. M., Ackermann, R. T., Lin, E. H., Diehr, P. H., Maciejewski, M. L., Williams, B., Patrick, M. B., & LoGerfo, J. P. (2006). Distance as a barrier to using a fitness-program benefit for managed medicare enrollees. *Journal of Aging and Physical Activity*, 14(3), 313–323.
- Billinger, S. A., Arena, R., Bernhardt, J., Eng, J. J., Franklin, B. A., Johnson, C. M., ... & Tang, A. (2014). Physical activity and exercise recommendations for stroke survivors: A statement for healthcare professionals from the American heart association/American stroke association. *Stroke*, 45, 2532–2553. doi:10.1161/STR.0000000000000022
- Brasche, S., & Bischof, W. (2005). Daily time spent indoors in German homes—baseline data for the assessment of indoor exposure of German occupants. *International Journal of Hygiene and Environmental Health*, 208(4), 247–253. doi:10.1016/j.ijheh.2005.03.003
- Brookfield, K., Bloodworth, A., & Mohan, J. (2013). Engaging residents' groups in planning using focus groups. *Proceedings of the ICE – Engineering Sustainability*, 166(ES2), 61–74. doi:10.1680/ensu.12.00012
- Buman, M. P., Hekler, E. B., Haskell, W. L., Pruitt, L., Conway, T. L., Cain, K. L., ... & King, A. C. (2010). Objective light-intensity physical activity associations with rated health in older adults. *American Journal of Epidemiology*, 172(10), 1155–1165. doi:10.1093/aje/kwq249
- Capstick, A. (2011). Travels with a flipcam: Bringing the community to people with dementia in a day care setting through visual technology. *Visual Studies*, 26(2), 142–147. doi:10.1080/1472586X.2011.571890
- Chad, K. E., Reeder, B. A., Harrison, E. L., Ashworth, N. L., Sheppard, S. M., Schultz, S. L., Bruner, B. G., Fisher, K. L., & Lawson, J. A. (2005). Profile of physical activity levels in community-dwelling older adults. *Medicine & Science in Sports & Exercise*, 37(10), 1774–1784. doi:10.1249/01.mss.0000181303.51937.9c
- Chastin, S. F., Fitzpatrick, N., Andrews, M., & DiCroce, N. (2014). Determinants of sedentary behavior, motivation, barriers and strategies to reduce sitting time in older women: A qualitative investigation. *International Journal of Environmental Research and Public Health*, 11(1), 773–791. doi:10.3390/ijerph110100773
- Conn, V. S. (1998). Older women's beliefs about physical activity. *Public Health Nursing*, 15(5), 370–378. doi:10.1111/j.1525-1446.1998.tb00362.x
- Delbaere, K., Crombez, G., Vanderstraeten, G., Willems, T., & Cambier, D. (2004). Fear-related avoidance of activities, falls and physical frailty. A prospective community-based cohort study. *Age and Ageing*, 33(4), 368–373. doi:10.1093/ageing/afh106
- Department for Communities and Local Government. (2007). *The future of the code for sustainable homes: Making a rating mandatory*. London: DCLG.
- Department of Health (DoH). (2005). *Choosing activity: A physical activity action plan*. London: DoH.
- Department of Health (DoH). (2011). *Start active, stay active – A report on physical activity for health from the four home countries' chief medical officers*. London: DH.
- Department of Health (DoH). (2014). Government's response to the house of lords committee on public service and demographic change report 'ready for ageing? One Year update. CM 8872. London: TSO.
- Dogra, S., & Stathokostas, L. (2012). Sedentary behavior and physical activity are independent predictors of successful aging in middle-aged and older adults. *Journal of Aging Research*, 2012, 1–8. Article ID 190654, 8 pages, 2012. doi:10.1155/2012/190654
- Dunstan, D. W., Howard, B., Healy, G. N., & Owen, N. (2012). Too much sitting – A health hazard. *Diabetes Research and Clinical Practice*, 97(3), 368–376. doi:10.1016/j.diabres.2012.05.020
- English, C., Manns, P. J., Tucak, C., & Bernhardt, J. (2014). Physical activity and sedentary behaviors in people with stroke living in the community: A systematic review. *Physical Therapy*, 94(2), 185–196. doi:10.2522/ptj.20130175
- Fletcher, P. C., & Hirdes, J. P. (2004). Restriction in activity associated with fear of falling among community-based seniors using home care services. *Age and Ageing*, 33(3), 273–279. doi:10.1093/ageing/afh077
- Galea, S., & Tracy, M. (2007). Participation rates in epidemiologic studies. *Annals of Epidemiology*, 17(9), 643–653. doi:10.1016/j.annepidem.2007.03.013
- Gann, D. M., Wang, Y., & Hawkins, R. (1998). Do regulations encourage innovation? The case of energy efficiency in housing. *Building Research & Information*, 26(5), 280–296. doi:10.1080/096132198369760
- Gill, T. M., Desai, M. M., Gahbauer, E. A., Holford, T. R., & Williams, C. S. (2001). Restricted activity among community-living older persons: Incidence, precipitants, and health care utilization. *Annals of Internal Medicine*, 135(5), 313–321. doi:10.7326/0003-4819-135-5-20010940-00007
- Gitlin, L. N., Mann, W., Tomit, M., & Marcus, S. M. (2001). Factors associated with home environmental problems among community-living older people. *Disability & Rehabilitation*, 23(17), 777–787. doi:10.1080/09638280110062167
- Gwynne, A. (2013). *Guide to building control*. Chichester: John Wiley & Sons.
- Haak, M., Fänge, A., Iwarsson, S., & Dahlin Ivanoff, S. (2007). Home as a signification of independence and autonomy: Experiences among very old Swedish people. *Scandinavian Journal of Occupational Therapy*, 14(1), 16–24. doi:10.1080/11038120601024929
- Habinteg. (2010). Revised lifetime homes standard July 2010.
- Hannes, K., & Lockwood, C. (2012). *Synthesizing qualitative research: Choosing the right approach*. Chichester: Wiley-Blackwell.
- Harper, D. (2002). Talking about pictures: A case for photo elicitation. *Visual Studies*, 17(1), 13–26. doi:10.1080/14725860220137345
- Harvey, J. A., Chastin, S. F., & Skelton, D. A. (2013). Prevalence of sedentary behavior in older adults: A systematic review. *International Journal of Environmental Research and Public Health*, 10(12), 6645–6661. doi:10.3390/ijerph10126645
- Helle, T., Iwarsson, S., & Brandt, Å. (2014). Validation of housing standards addressing accessibility exploration of an activity-based approach. *Journal of Applied Gerontology*, 33(7), 848–869. doi:10.1177/0733464813503042
- Hellström, I., Nolan, M., & Lundh, U. (2005). 'We do things together': A case study of 'couplehood' in dementia. *Dementia*, 4(1), 7–22. doi:10.1177/1471301205049188
- Hellström, I., Nolan, M., Nordenfelt, I., & Lundh, U. (2007). Ethical and methodological issues in interviewing persons

- with dementia. *Nursing Ethics*, 14(5), 608–619. doi:10.1177/0969733007080206
- Holloway, I. (1997). *Basic concepts for qualitative research*. London: Blackwell Science.
- Iwarsson, S., Wahl, H. W., Nygren, C. (2004). Challenges of cross-national housing research with older persons: Lessons from the ENABLE-AGE project. *European Journal of Ageing*, 1(1), 79–88. doi:10.1007/s10433-004-0010-5
- Iwarsson, S., Wahl, H. W., Nygren, C., Oswald, F., Sixsmith, A., Sixsmith, J., ... & Tomsone, S. (2007). Importance of the home environment for healthy aging: Conceptual and methodological background of the European ENABLE-AGE Project. *The Gerontologist*, 47(1), 78–84. doi:10.1093/geront/47.1.78
- Joffe, H., & Yardley, L. (2004). Content and thematic analysis. In D.F. Marks & L. Yardley (Eds.), *Research methods for clinical and health psychology* (pp. 56–68). London: Sage Publications.
- Kim, H., Ahn, Y. H., Steinhoff, A., & Lee, K. H. (2014). Home modification by older adults and their informal caregivers. *Archives of Gerontology and Geriatrics*, 59(3), 648–656. doi:10.1016/j.archger.2014.07.012
- Kreuger, R. A., & Casey, M. A. (2000). *Focus groups: A practical guide for applied research* (3rd ed.). London: Sage Publications.
- Lachman, M. E., Howland, J., Tennstedt, S., Jette, A., Assmann, S., & Peterson, E. W. (1998). Fear of falling and activity restriction: The survey of activities and fear of falling in the elderly (SAFE). *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 53B(1), P43–P50. doi:10.1093/geronb/53B.1.P43
- Lansley, P., McCreadie, C., Tinker, A., Flanagan, S., Goodacre, K., & Turner-Smith, A. (2004a). Adapting the homes of older people: A case study of costs and savings. *Building Research & Information*, 32(6), 468–483. doi:10.1080/0961321042000269429
- Lansley, P., McCreadie, C., & Tinker, A. (2004b). Can adapting the homes of older people and providing assistive technology pay its way? *Age and Ageing*, 33(6), 571–576. doi:10.1093/ageing/afh190
- Larson, E. B., Wang, L., Bowen, J. D., McCormick, W. C., Teri, L., Crane, P., & Kukull, W. (2006). Exercise is associated with reduced risk for incident dementia among persons 65 years of age and older. *Annals of Internal Medicine*, 144(2), 73–81. doi:10.7326/0003-4819-144-2-200601170-00004
- Lavizzo-Mourey, R., & McGinnis, J. M. (2003). Making the case for active living communities. *American Journal of Public Health*, 93(9), 1386–1388. doi:10.2105/AJPH.93.9.1386
- Lawton, M. P., & E. M. Brody. (1969). Assessment of older people: Self-maintaining and instrumental activities of daily living. *The Gerontologist*, 9(3 Part 1), 179–186. doi:10.1093/geront/9.3_Part_1.179
- Matthews, C. E., Chen, K. Y., Freedson, P. S., Buchowski, M. S., Beech, B. M., Pate, R. R., & Troiano, R. P. (2008). Amount of time spent in sedentary behaviors in the United States, 2003–2004. *American Journal of Epidemiology*, 167(7), 875–881. doi:10.1093/aje/kwm390
- Meacham, B., Bowen, R., Traw, J., & Moore, A. (2005). Performance-based building regulation: Current situation and future needs. *Building Research & Information*, 33(2), 91–106. doi:10.1080/0961321042000322780
- Michael, Y., Beard, T., Choi, D., Farquhar, S., & Carlson, N. (2006). Measuring the influence of built neighborhood environments on walking in older adults. *Journal of Aging and Physical Activity*, 14, 302–312.
- Middleton, L. E., & Yaffe, K. (2009). Promising strategies for the prevention of dementia. *Archives of Neurology*, 66(10), 1210–1215. doi:10.1001/archneurol.2009.201
- Milligan, C., Gatrell, A., & Bingley, A. (2004). ‘Cultivating health’: Therapeutic landscapes and older people in northern England. *Social Science & Medicine*, 58(9), 1781–1793. doi:10.1016/S0277-9536(03)00397-6
- Morris, K. S., McAuley, E., & Motl, R. W. (2008). Self-efficacy and environmental correlates of physical activity among older women and women with multiple sclerosis. *Health Education Research*, 23(4), 744–752. doi:10.1093/her/cym067
- Mowen, A., Orsega-Smith, E., Payne, L., Ainsworth, B., & Godbey, G. (2007). The role of park proximity and social support in shaping park visitation, physical activity, and perceived health among older adults. *Journal of Physical Activity and Health*, 4(2), 167–179.
- Murphy, J., Tester, S., Hubbard, G., Downs, M., & MacDonald, C. (2005). Enabling frail older people with a communication difficulty to express their views: The use of Talking Mats™ as an interview tool. *Health and Social Care in the Community*, 13(2), 95–107. doi:10.1111/j.1365-2524.2005.00528.x
- Nagel, C. L., Carlson, N. E., Bosworth, M., & Michael, Y. L. (2008). The relation between neighborhood built environment and walking activity among older adults. *American Journal of Epidemiology*, 168, 461–468. doi:10.1093/aje/kwn158
- O’Connell, B., Hanna, B., Penney, W., Pearce, J., Owen, M., & Warelow, P. (2001). Recovery after stroke: A qualitative perspective. *Journal of Quality in Clinical Practice*, 21(4), 120–125. doi:10.1046/j.1440-1762.2001.00426.x
- Oldman, C. (2002). Later life and the social model of disability: A comfortable partnership? *Ageing and Society*, 22(06), 791–806. doi:10.1017/S0144686X02008887
- Owen, N., Bauman, A., & Brown, W. (2009). Too much sitting: A novel and important predictor of chronic disease risk? *British Journal of Sports Medicine*, 43(2), 81–83. doi:10.1136/bjism.2008.055269
- Owen, N., Sugiyama, T., Eakin, E. E., Gardiner, P. A., Tremblay, M. S., & Sallis, J. F. (2011). Adults’ sedentary behavior: Determinants and interventions. *American Journal of Preventive Medicine*, 41(2), 189–196. doi:10.1016/j.amepre.2011.05.013
- Parke, B., Hunter, K. F., Strain, L. A., Marck, P. B., Waugh, E. H., & McClelland, A. J. (2013). Facilitators and barriers to safe emergency department transitions for community dwelling older people with dementia and their caregivers: A social ecological study. *International Journal of Nursing Studies*, 50(9), 1206–1218. doi:10.1016/j.ijnurstu.2012.11.005
- Patton, M. Q. (1990). *Qualitative evaluation and research methods*. Newbury Park, Calif: Sage.
- Peace, S., Percival, J., Maguire, M., Nicolle, C., Marshall, R., Sims, R., & Lawton, C. (2012). *Transitions in kitchen living*. NDA Research Programme, NDA findings 13. Sheffield: University of Sheffield.
- Pescatello, L. S., & Murphy, D. (1998). Lower intensity physical activity is advantageous for fat distribution and blood glucose among viscerally obese older adults. *Medicine and Science in Sports and Exercise*, 30(9), 1408–1413.
- Pescatello, L. S., Murphy, D., & Costanzo, D. (2000). Low-intensity physical activity benefits blood lipids and lipoproteins in older adults living at home. *Age and Ageing*, 29(5), 433–439. doi:10.1093/ageing/29.5.433
- Ratzlaff, C. R. (2012). Good news, bad news: Sports matter but occupational and household activity really matter—sport and recreation unlikely to be a panacea for public health. *British Journal of Sports Medicine*, 46(10), 699–701. doi:10.1136/bjsports-2011-090800
- Reichstadt, J., Depp, C. A., Palinkas, L. A., & Jeste, D. V. (2007). Building blocks of successful aging: A focus group study of older adults’ perceived contributors to successful aging. *The American Journal of Geriatric Psychiatry*, 15(3), 194–201. doi:10.1097/JGP.0b013e318030255f
- Robinson, L., Brittain, K., Lindsay, S., Jackson, D., & Olivier, P. (2009). Keeping in touch everyday (KITE) project: Developing assistive technologies with people with dementia and their carers to promote independence. *International Psychogeriatrics*, 21(3), 494–502. doi:10.1017/S1041610209008448

- Sallis, J. F., Certero, R. B., Ascher, W., Henderson, K. A., Kraft, M. K., & Kerr, J. (2006). An ecological approach to creating active living communities. *Annu. Rev. Public Health, 27*, 297–322. doi:10.1146/annurev.publhealth.27.021405.102100
- Samitz, G., Egger, M., & Zwahlen, M. (2011). Domains of physical activity and all-cause mortality: Systematic review and dose-response meta-analysis of cohort studies. *International journal of epidemiology, 40*(5), 1382–1400. doi:10.1093/ije/dyr112
- Sangster, K. (1997). *Costing lifetime homes*. York: Joseph Rowntree Foundation.
- Santos, D. A., Silva, A. M., Baptista, F., Santos, R., Vale, S., Mota, J., & Sardinha, L. B. (2012). Sedentary behavior and physical activity are independently related to functional fitness in older adults. *Experimental Gerontology, 47*(12), 908–912. doi:10.1016/j.exger.2012.07.011
- Sarre, S., Redlich, C., Tinker, A., Sadler, E., Bhalla, A., & McKeivitt, C. (2014). A systematic review of qualitative studies on adjusting after stroke: Lessons for the study of resilience. *Disability & Rehabilitation, 36*(9), 716–726. doi:10.3109/09638288.2013.814724
- Scottish Government. (2013). *Technical handbook domestic*. Edinburgh: Scottish Government.
- Scottish Government. (2014). *Scottish house conditions survey 2013*. Edinburgh: Scottish Government.
- Sherratt, C., Soteriou, T., & Evans, S. (2007). Ethical issues in social research involving people with dementia. *Dementia, 6*(4), 463–479. doi:10.1177/1471301207084365
- Shigematsu, R., Sallis, J. F., Conway, T. L., Saelens, B. E., Frank, L. D., Cain, K. L., Chapman, J. E., & King, A. C. (2009). Age differences in the relation of perceived neighborhood environment to walking. *Medicine and Science in Sports and Exercise, 41*, 314–321. doi:10.1249/MSS.0b013e318185496c
- Shores, K. A., West, S. T., Theriault, D. S., & Davison, E. A. (2009). Extra-individual correlates of physical activity attainment in rural older adults. *Journal of Rural Health, 25*, 211–218. doi:10.1111/j.1748-0361.2009.00220.x
- Silverman, D. (2000). *Doing qualitative research*. London: Sage Publications.
- Stubbs, B., Eggermont, L., Soundy, A., Probst, M., Vandebulcke, M., & Vancampfort, D. (2014). What are the barriers and facilitators to physical activity participation in community dwelling adults with dementia? A systematic review of physical activity correlates and implications for physical therapy practice. *Archives of Gerontology and Geriatrics, 59*, 195–203. doi:10.1016/j.archger.2014.06.006
- Sugiyama, T., & Ward Thompson, C. (2008). Associations between characteristics of neighbourhood open space and older people's walking. *Urban Forestry & Urban Greening, 7*(1), 41–51. doi:10.1016/j.ufug.2007.12.002
- Tinker, A., Hanson, J., Wright, F., Mayagoitia, R. E., Wojgani, H., & Holmans, A. (2007). *Remodelling sheltered housing and residential care homes to extra care housing: Advice to housing and care providers*. London: King's College London and University College.
- Tinker, A., Kellaher, L., Ginn, J., & Ribe, E. (2013). 'Assisted living innovation platform: Scoping report for the long term care revolution SBRI challenge. The status of housing provision for older adults in the UK and other EU countries'. The Technology Strategy Board Reprint of (2013) 'Assisted Living Platform – The Long Term Care Revolution', Technology Strategy Board Knowledge Transfer Network, Housing LIN. September 2013.
- Troiano, R. P., Berrigan, D., Dodd, K. W., Masse, L. C., Tilert, T., & McDowell, M. (2008). Physical activity in the United States measured by accelerometer. *Medicine and Science in Sports and Exercise, 40*(1), 181–188. doi:10.1249/mss.0b013e31815a51b3
- United Nations Population Fund (UNFPA) and HelpAge International. (2012). *Ageing in the twenty-first century: A celebration and a challenge*. New York and London: UNFPA and HelpAge International.
- Van Cauwenberg, J., De Bourdeaudhuij, I., De Meester, F., Van Dyck, D., Salmon, J., Clarys, P., & Deforche, B. (2011). Relationship between the physical environment and physical activity in older adults: A systematic review. *Health & Place, 17*(2), 458–469. doi:10.1016/j.healthplace.2010.11.010
- Van Cauwenberg, J., De Donder, L., Clarys, P., De Bourdeaudhuij, I., Owen, N., Dury, S., ... & Deforche, B. (2014). Relationships of individual, social, and physical environmental factors with older adults' television viewing time. *Journal of Aging and Physical Activity, 22*(4), 508–517. doi:10.1123/JAPA.2013-0015
- Warburton, D. E., Nicol, C. W., & Bredin, S. S. (2006). Health benefits of physical activity: The evidence. *Canadian medical association journal, 174*(6), 801–809. doi:10.1503/cmaj.051351
- Williamson, G. M., & Schulz, R. (1992). Pain, activity restriction, and symptoms of depression among community-residing elderly adults. *Journal of Gerontology, 47*(6), P367–P372. doi:10.1093/geronj/47.6.P367
- World Health Organisation (WHO). (2007). *Global age friendly cities: A guide*. Geneva: WHO Press.
- World Health Organisation (WHO). (2010). *Global recommendations on physical activity for health*. Geneva: WHO.