

ARTICLE

Community-dwelling older adults' experiences and perceptions of needs for home modification in Shanghai

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Abstract

Home environment is essential to older adults. While existing studies have investigated the positive implications of home modification strategies for older adults and proposed relevant policies and programmes, literature has remained relatively silent on how older adults perceive their needs for their home environment and its modification, especially during and after they go through home modification projects. This study investigated community-dwelling older adults' perceptions of needs for home modification in Shanghai. Informed by theories in environmental gerontology and tenets of awareness of age-related change, we conceptualised two intertwined, evolving processes of person–environment (P-E) interactions: older adults' interactions with their home environment, and the interactions between their perceptions of needs for home modification and the ageing process. Taking a qualitative approach, we interviewed community-dwelling older adults who were among the first to have received a pilot government-sponsored home modification project in Shanghai (N = 15). Our findings suggest that older adults' P-E dynamics evolved in response to their perception of their home environment and ageing process. Most participants initially were unaware of their underlying needs for home modification even when they had encountered challenges in their apartments. As the home modification project took place, participants gradually gained knowledge of their home environment and the following modification, which enabled them to better identify and articulate their needs to improve their daily living. After the project, participants' understandings of their home environments continued to evolve, expanding to their neighbourhood. This study informs policy and practice to focus on recognising the evolving aspects of older adults' needs in their home environment and better engaging older adults in the process of home modification.

Keywords: community dwelling; home environment; home modification; person–environment interaction; physical environment; urban China

Introduction

The importance of physical and social environments for population wellbeing is receiving increasing global recognition. In 2007, the World Health Organization (WHO) addressed the importance of building inclusive environments for older adults over 65 years old, to enable older adults ‘in performing all the functions of life and developing to their maximum potential’ (WHO, 2007: 13). Indeed, home is the nexus of older adults’ lives, a space that provides a sense of control, personhood and protection for their physical, psychological and social wellbeing (Rubinstein, 1989; Lawton, 1990; Gitlin, 2003; Oswald *et al.*, 2006, 2007a, 2007b). Home environment is essential to older adults (*e.g.* Gitlin, 2003; Oswald and Wahl, 2005; Wiles *et al.*, 2012; Stones and Gullifer, 2016) as they may become less mobile, less likely to make residential transitions and likely to spend more time at home than younger generations (Baltes *et al.*, 1999; Oswald and Wahl, 2005). Though we recognise that this term has other connotations, in this study, ‘home’ designates the concrete physical environment of older adults’ households (*i.e.* apartments).

The home is particularly essential to older adults in China. Given China’s tradition of filial piety, which entails unconditionally respecting, obeying and caring for older parents (Chou, 2011), Chinese older adults generally prefer to age in place and rely on family care-giving (Feng *et al.*, 2020) – a preference exemplified by Shanghai’s older adult population. A 2013 citywide survey found that over 89 per cent of older adults in Shanghai expected to age in place; even when they took functional and health declines into consideration, 73.1 per cent of respondents still maintained this preference (Yin, 2014). To better serve older adults in Shanghai, the city with the largest proportion of ageing population in China (*i.e.* 36.1% in 2019; Shanghai Research Centre on Ageing, 2020), Shanghai joined the WHO’s Age-friendly Initiative in 2005 and has since taken steps to improve the physical environment in neighbourhoods for older adults. Initiatives included installing elevators in multi-storey apartment buildings and age-friendly community construction (Shanghai Housing Construction and Development Centre, 2017). Such environmental modification initiatives have expanded to older adults’ homes. In 2012, the Shanghai Civil Affairs Bureau launched a pilot home modification programme for low-income older adults to improve their safety and independent living in the home environment (Shanghai Civil Affairs Bureau, 2012). As the first city in China to propose government-sponsored home modification for older adults, Shanghai represents an ideal setting for studying older adults’ experiences of home modification in urban China.

Existing initiatives designed to improve older adults’ living environments in China have primarily focused on architecture, planning and design (*e.g.* Tang *et al.*, 2015); relevant social scientific inquiries have just begun to investigate this topic (*e.g.* Xie and Chen, 2020). This means that while researchers have advanced understandings of strategies for modifying physical spaces to be more inclusive to older adults, older adults’ perceptions and understandings of the physical environment deserve more research attention to inform these strategies. Some studies conducted in Western contexts have investigated older adults’ intentions and decisions to modify their homes as examples of their proactivity in the ageing process (*e.g.* Yuen and Carter, 2006; Kahana *et al.*, 2014; Bercau, 2020). Yet the literature

remains relatively silent on older adults' experiences and perceptions of the process and implementation of home modification in China, even as the country is actively pursuing such initiatives.

To fill this research gap, we interviewed community-dwelling older adults in Shanghai to learn about their experiences and perceptions of home modification. Specifically, we interviewed older adults in the first cluster of those who received the pilot home modification project in Shanghai. Our research question is:

- What are community-dwelling older adults' perceptions of their needs for home modification during the process of the home modification project in Shanghai?

Literature review

Substantial research has identified how the physical home environment can profoundly influence an individual's ageing process and wellbeing (e.g. Gitlin, 2003; Wahl and Weisman, 2003; Wahl *et al.*, 2012; Wahl, 2015). The home forms a familiar sphere that continually nurtures older adults' self-identities and sustains their sense of personal control (Stones and Gullifer, 2016). The home is thus an essential environment for applying principles of universal design, which calls for designing the environment to be usable by people at all levels of physical and cognitive functioning in order to facilitate their environmental adaptation (Steinfeld, 2010).

Following the universal design principles, home modification, such as increasing accessibility and reducing physical barriers, has been recommended as an effective adaptive strategy to improve the usability of the home environment and facilitate care-giving for older adults (Steinfeld, 2010; Carnemolla and Bridge, 2014). By updating and improving the physical home environment, home modification aims to enhance older adults' capacity to function optimally and to age in their own homes (Gitlin, 2003, 2009; Fänge and Iwarsson, 2005; Oswald *et al.*, 2007a, 2011; Wiles *et al.*, 2012). Older adults can thus optimise their ageing process and postpone potential relocation to nursing homes (Fänge and Iwarsson, 2005; Wahl and Oswald, 2010). Recent systematic reviews affirm that home modification interventions can meet older adults' needs for ageing in place, especially the need for fall prevention (Stark *et al.*, 2017; Carnemolla and Bridge, 2020). These promising findings should encourage further research into and implementation of home modification programmes for older adults.

At the same time, despite the well-documented benefits of and strategies for home modification for older adults, social sciences researchers have comparatively made modest explorations of older adults' views following the implementation of home modification. Some scholars have found that older adults sometimes did not consider home modification helpful. For instance, Kruse *et al.* (2010) documented many American older adults' reluctance to undertake home modification, and their tendency to manage their homes based on their own ideas instead of external recommendations (e.g. from home modification programmes). Indeed, as older adults – like many adults – often navigate policy and service systems with their own beliefs, centring their understandings of home modification is essential to identify their needs and enhance implementation processes effectively (Johansson *et al.*, 2009).

Researchers have also found that when responding to challenges at home, older adults' understandings and reactions can be equivocal (Rowles and Bernard, 2013). For instance, Kelly *et al.* (2014) asked American older adults how they would overcome challenges to continuing to live independently at home in response to difficult hypothetical scenarios. Older adults opted for home modification only in scenarios involving limited physical and mobility, but not in hypothetical scenarios involving cognitive issues, such as dementia (Kelly *et al.*, 2014). Similarly, Korean older adults were only likely to be aware of their home environment during or right after hospitalisation, and this awareness often prompted their needs for home modifications (Hong *et al.*, 2015). Another study of Australian older adults found that while these older adults acknowledged their needs for home modification to adapt to changes associated with ageing, they did not have clear ideas or concrete plans of how to modify their homes to accommodate their needs (McKenzie *et al.*, 2014). Yuen and Carter (2006) similarly found that even older adults who believed home modification was beneficial and intended to modify their homes lacked specific knowledge of implementing or plans to implement home modifications.

Broadly, the literature to date has emphasised older adults' awareness of and reactions to possible home modifications, while remaining relatively silent on older adults' actual implementation and experiences of home modification. Yet we cannot assume that the former perceptions reflect the latter actions related to home modification. Studies have found that whether or not older adults actually implemented home modifications was related to their resources, capabilities and their perceptions of their own ageing process (Renaut *et al.*, 2015; Park *et al.*, 2017). To explore older adults' experiences of home modifications, Petersson *et al.* (2012) interviewed eight older Swedish adults to learn about their perceptions of their safety *after* home modification. These eight older adults identified three prerequisites to experiencing enhanced safety: physical health, support networks and, notably, feeling in control at home (Petersson *et al.*, 2012). Considering that the home environment provides a range of opportunities for and constraints to maintaining older adults' capability of performing activities of daily living (Renaut *et al.*, 2015), the interplay of older adults' perceptions of their needs for their home environment and its modification deserves further investigation.

In the Chinese literature on home modification for older adults, recent work from fields such as architecture, design and planning has yielded findings based on the perspectives of experts, practitioners, planners and service providers (*e.g.* Yu, 2016). Given China's rapidly growing ageing population, some studies have begun to incorporate older adults' insights into their experiences within the physical environments. For example, Chen (2017) used older adults' service utilisation survey data to inform a hospital design project to cater to older adults' preferences for inpatient and outpatient services. Given the essential role of the home environment for older adults' wellbeing, this present study calls for more evidence to better understand older adults' perceptions of their needs related to the home environment and its modification.

Conceptual framework

Since the ecological model of human ageing (Lawton and Nahemow, 1973), scholars have paid substantial attention to conceptualising and investigating the

relationship between older adults' environment and their identity, autonomy and wellbeing (e.g. Rubinstein, 1989; Lawton, 1990; Oswald and Wahl, 2005; Wahl *et al.*, 2009; Renaut *et al.*, 2015; Stones and Gullifer, 2016). Several theoretical perspectives from environmental gerontology inform this study. The congruence model of person–environment (P-E) fit emphasises that congruence between older adults' needs and their environment – a fit between environmental properties and the individual's characteristics – can foster environmental satisfaction and psychological wellbeing (Kahana, 1982). Since older adults' preferences for physical environmental configurations can vary (Kahana *et al.*, 2003), their understandings of these needs and preferences should be specified and centred in the congruence analysis in order to improve their environmental adaptation and salient competence optimally (Kahana, 1982; Kahana *et al.*, 2003).

Furthermore, Wahl *et al.* (2012) constructed the integrative model of ageing well to trace interactions between older adults and their environment, which in turn influence older adults' emotions, interpretations of and bonding with their homes. Older adults' sense of control over their home is also related to their understanding of and ability to manage their home environment, such as by adapting, using and retrofitting spaces and objects in their homes (Wahl *et al.*, 2012). Thus, older adults' P-E interactions should be contextualised within their lifecourse to underscore their age-associated environmental needs, experiences, adaptations and salient behaviours. The integrative model of ageing well suggests that older adults' P-E interactions at home evolve with the changes and transitions that come at different lifestages (Wahl *et al.*, 2012).

This study also draws on the concept of awareness of age-related change (AARC) to understand the evolving nature of older adults' P-E interactions at home, *i.e.* the contingency between the ageing process and older adults' perceptions of home modification. Specifically, AARC refers to 'a person's state of awareness that his or her behaviour, level of performance, or way of experiencing life has changed as a consequence of having grown older' (Diehl and Wahl, 2010: 342). AARC accounts for both loss-oriented and gain-oriented aspects of the ageing process (Diehl and Wahl, 2010). As older adults often ruminate on their remaining lifetime, AARC generally brings negative perceptions of ageing. However, AARC can also be positive at the same time, serving as a motivation for older adults' continuous development (Diehl and Wahl, 2010). For example, when older adults face physical declines, they may exercise to compensate for such decline.

Informed by two aforementioned models and by the concept of AARC, we conceptualise that community-dwelling older adults' perceptions of their needs for home modification and their appraisal of P-E interactions at home evolve. We further consider that this evolution consists of two intertwined processes: older adults' interactions with their home environment and the evolution of their needs for home modification in response to the ageing process. These two processes are reciprocal and influence older adults' perceptions of their home environments and their needs for home modification.

Context of the home modification project in Shanghai

Despite the burgeoning development of age-friendly initiatives in Shanghai, less attention has been paid in policy and practice to the proximal environment for

older adults: their homes. Given that, in 2019, Shanghai residents had an 83.66-year overall life expectancy and a 70.01-year healthy life expectancy (Shanghai Research Centre on Ageing, 2020), a looming fact is that older adults in Shanghai are likely to spend over 13 years near the end of life with functional declines and/or a range of disabilities. During these 13 years, these declines and disabilities will likely further aggravate older adults' quality of life at home, as the human lifespan is highly sensitive to P-E interactions, such as the physical characteristics of the environment (Wahl, 2015). Although data on older adults' injuries in Shanghai were not available, recent news indicated that approximately 40 million fall accidents occur among older adults at home in urban China every year. Many of these falls are likely related to various home hazards that exist in apartments that are over 20 years old (Xinhuanet, 2020).

In 2012, the Shanghai Civil Affairs Bureau began to address potential home environment hazards for older adults by initiating a home modification project for 1,000 households of low-income older adults in order to reduce accidents related to apartment hazards, including fall risks, fire risks and gas poisoning (Shanghai Civil Affairs Bureau, 2012). Each district planned to modify 50–60 apartments every year beginning in 2012 (Xuhui Civil Affairs Bureau, 2019; Huangpu Committee of the Chinese People's Political Consultative Conference, 2020). More recently, the Shanghai government's Implementation Plan for Deepening Care Services for Older Adults in Shanghai (2019–2022) expanded the home modification project to include disabled, childless and low-income older adults, as well as those who are over 80 years old (Shanghai Government, 2019). In the 14th Municipal Five-Year Plan, the Shanghai government plans to modify another 5,000 low-income older adults' homes (Shanghai Government, 2019).

The pilot home modification project beginning in 2012 was financially sponsored by the Shanghai Social Welfare Lottery Funds and administrated by the Shanghai Civil Affairs Bureau. Each household to be modified received 20,000 RMB in subsidy (*i.e.* US \$3,000 at the current exchange rate). The Ageing Office of the Civil Affairs Bureau in each district was responsible for recruiting social organisations to hire renovation teams through a public bidding process to make the actual home modifications, and for monitoring and evaluating the modification work performed in each apartment (Shanghai Civil Affairs Bureau, 2012).

The pilot home modification project in Shanghai targeted three main areas of low-income older adults' homes: (a) safety maintenance, such as by replacing ageing electrical wiring, ageing water heaters and gas stoves; (b) barrier-free updates, such as installing a ramp at the apartment door if older adults are wheelchair-bound, and laying non-slippery floor tiles; and (c) renovations to improve the home's appearance and tidiness, such as fresh wall and door paint and cabinet installation (Shanghai Civil Affairs Bureau, 2012). For low-income older adults' reference, a modification list (hereafter referred to as 'the list') detailing these modifications and updates was compiled by the Shanghai Civil Affairs Bureau. This list enumerates key strategies for improving low-income older adults' basic home environment (Shanghai Civil Affairs Bureau, 2012). This list purposefully pays special attention to home safety, which echoes research evidence that low-income older adults with limited resources are in particular need of a supportive environment to achieve P-E fit (Golant, 2003; Park *et al.*, 2017).

The home modification project has four key eligibility criteria: (a) participants must be low-income, older adults over 70 years old, especially those who live alone and/or are childless; (b) participants' apartments must constitute poor living conditions; (c) participants must be home-owners; and (d) if the modification requires older adults to move out of their apartment, they should have sufficient financial resources to afford rent for 1–2 months of transition time (Shanghai Civil Affairs Bureau, 2012). Residents' committees (*i.e.* semi-governmental organisations that handle civil and welfare affairs for designated neighbourhoods) can arrange for childless older adults to stay in nearby nursing homes during the transition. The residents' committees can also help potentially eligible households with the application process. After the residents' committees have screened all applications, they submit a list of eligible applicants to the Ageing Office of the Civil Affairs Bureau in each district for another round of screening based on the urgency, apartment condition, financial hardship and living arrangements to finalise the households to receive home modifications (Shanghai Civil Affairs Bureau, 2012).

Methods

Study design

We took a qualitative approach to conduct this study. Qualitative methods helped us to better understand community-dwelling older adults' perceptions of their needs for home modification and their experiences of going through the process of applying for and participating in the pilot home modification project in Shanghai. This approach addresses environmental gerontologists' calls for more research *with* older adults rather than research *on* them (Scheidt and Windley, 2006).

Study site and recruitment

We chose as our study site the neighbourhood in the Putuo District in Shanghai where the pilot home modification project first took place. Older adults' needs for renovation and modification in their apartments and apartment buildings have risen noticeably in the Putuo District over the past decade (Shanghai Putuo District Government, 2020), in part because the majority of apartment buildings in most of the neighbourhoods in the district were constructed in the 1950s, with insufficient accessible facilities (*e.g.* elevators) for individuals with functional declines. These buildings' electrical wiring and gas pipes have also suffered wear and tear due to a lack of proper maintenance. As such, these apartment buildings were not well suited to the needs of the increasing ageing population of residents (Shanghai Putuo District Government, 2020).

After receiving ethical approval from the university and the study funder, recruitment took place in the neighbourhood from 2020 to 2021. The neighbourhood's residents' committee helped us to recruit participants by providing us with a roster of the first cluster of 15 households that received home modification from 2013 to 2015. These 15 households accounted for approximately 10 per cent of all households receiving the pilot home modification project in the Putuo District. We conducted an information briefing session to introduce the study purpose and study procedures to the heads of all 15 households and invited them to participate in the study. All of them agreed to participate (N = 15).

Participants

Ten of the participants were women. Participants' average age was 81.3 years, ranging from 76 to 91 years. Seven participants lived alone, four lived with their spouse, and four lived with their spouse and adult children. All the participants reported low income: namely monthly income lower than 3,000 RMB (*i.e.* US \$154 at the current exchange rate). All 15 apartments had multiple items modified and updated, including installing ramps and/or grab bars, changing kitchen countertops, changing toilets, changing water heaters, laying non-slippery tiles and changing bathtubs to showers, among other modifications. None of the participants lived in a nursing home during the transition time when the modifications were being made. [Table 1](#) presents detailed demographic characteristics of the participants and lists their home updates.

Data collection

SC (a trained graduate student) conducted all the face-to-face, in-depth interviews. All interviews took place in a private conference room in the resident's committee office or in the participant's apartment. Family members accompanied four participants during their interviews in the resident's committee office. SC collected written informed consent from each participant before each interview. Participants were fully aware of their opportunity to refuse to answer questions or to withdraw from the study with no consequences.

Each interview began with a general question about the participant's experience of their home modification (the interview guide is available in the online supplementary material). Then the interviewer asked detailed questions about participants' experiences of home modification from the beginning of the application process to the completion of the modification, paying particular attention to participants' interactions with renovation teams and probing their evolving perceptions of the process of home modification. The interviewer asked follow-up questions about participants' expectations before the home modifications and their perceptions of the home modifications after they were finished. The interview ended by soliciting participants' suggestions for the development of the home modification project. Each interview took from 1 to 2 hours. The interviewer conducted all interviews in Mandarin or Shanghai dialect and audiotaped all the interviews with permission.

Data analysis

The interviewer transcribed all the interviews verbatim into Chinese immediately after each interview. She also kept detailed field notes after each interview to record information not captured in the transcripts (*e.g.* participants' behaviours and facial expressions) to supplement the audio recording. LC used these field notes to monitor the overall data collection process.

The research team performed a thematic analysis following the data analysis spiral (Creswell and Poth, 2017). LC and XM did initial line-by-line open coding of the transcripts. After open coding, LC and XM discussed and extracted meaningful segments related to participants' experiences and perceptions of home modification. We identified similar codes, excerpts and quotations, and grouped them

Table 1. Demographic characteristics of the participants

	N (%)
Age (years):	
Average	81.3
Range	76–91
75–79	7 (46.7)
80–89	6 (40)
90–91	2 (13.3)
Gender:	
Women	10 (66.7)
Men	5 (33.3)
Marital status:	
Married	8 (53.3)
Widowed	7 (46.7)
Living arrangements:	
Living alone	7 (46.7)
Living with spouse	4 (26.6)
Living with spouse and adult children	4 (26.6)
Individual participants' retirement plan:	
1,000–2,000 yuan ¹	10 (66.7)
2,001–3,000 yuan	5 (33.3)
Home remodelling:	
Installing handrails	15 (100)
Modifying kitchen countertops	14 (93.3)
Changing non-slippery floor tiles	13 (100)
Changing toilets	11 (73.3)
Rearranging electrical outlets/replacing electrical wiring	10 (66.7)
Changing water heaters	6 (40)
Installing ramps	4 (26.7)

Notes: N = 15. At the current exchange rate, 1,000 yuan equals roughly US \$154.

into various categories related to participants' initial understandings of acceptable living conditions for older adults, home modification, the home modification application process, their interactions with renovation teams and their perception of home modification after the renovations were completed (Strauss and Corbin, 1998; Creswell and Poth, 2017). Next, we discussed the relationships across categories to form themes. Themes emerged from participants' experiences of the home modification process, their perceptions of their needs for home modification,

their perceptions and understanding of home modification, and their evolving perceptions of home modification after its completion. LC and XM discussed and agreed upon the definitions and dimensions of each theme. After finalising the themes, we reviewed all the Chinese transcripts again to ensure that we did not miss any salient information. Because LC and XM are proficient in both Chinese and English, we translated all the themes, including their dimensions and related quotations, into English for the purpose of writing up the findings.

We complied with standard qualitative research techniques to ensure the trustworthiness of the study (Lincoln and Guba, 1985). LC and XM analysed all 15 interviews independently. We then extensively discussed the development of coding categories and the definition and dimensions of each theme. All categories and themes were determined by consensus of the research team. To resolve uncertainties or disagreements, we referred back to interview recordings and field notes for reference. An audit trail of coding and categorising decisions as well as discussion memos were kept throughout the data analysis process (Shenton, 2004). At the end of data analysis, EK offered feedback on the analysis, serving as ‘peer scrutiny’ (Shenton, 2004: 67), which strengthened the credibility and trustworthiness of the study. After the research team finalised the data analysis, the interviewer contacted all 15 participants again for member checking. Three participants responded and all approved our analysis and interpretation. This member check process buttressed the credibility of our data analysis.

Findings

We traced participants’ perceptions of their needs for home modification before, during and after the home modification project. In general, before the home modification project, participants rarely if ever considered their underlying needs for changing their home environment as they aged. During the home modification project, participants became knowledgeable of the home modification project, which encouraged them to discuss their needs with the renovation team. After the project completion, participants reflected on their evolving needs for and understanding of the home environment.

Unaware of underlying needs for home environment

Before the home modification project, most participants were not fully aware of their needs for improvement of their home environment. Although they noticed the growing inconveniences of living in their own apartments, they attributed it to their declining functioning and increasing frailty. For example, 78-year-old Mr Chen (all participants’ names are pseudonyms), who lived alone, recalled, ‘I only thought that my lower back and knees were getting weaker but it’s normal for an old man, isn’t it?’ In other words, participants believed that their challenges in performing daily living were inevitable by-products of their ages. This perception consequently made participants overlook their underlying needs for modifying their home environment and participating in the home modification project.

Several participants believed that needing home modifications implied that they were not capable of living alone in their own apartments. For example, Mrs Zhang, who was 76 years old and lived alone, had slipped in the bathtub twice and, in her

view, 'I was quite stubborn at that time. I put a non-slippery mat in the bathtub. I could still manage. Why bother changing anything?' As long as they could manage to perform daily living, several participants reluctantly admitted, they decided to tolerate the challenges they faced in their apartments rather than undertake 'troublesome' modifications of their home. This perception may have skewed participants' perceptions of their needs for improving their home environment.

Even when it occurred to some participants that they could update their apartments to make their life easier, they hesitated to do so. For example, Mr Tang, who was 76 years old and lived alone, shared his thoughts after he had his son-in-law installed two grab bars in the bathroom before the home modification project:

I should've just renovated the entire bathroom since my hips were getting worse. Considering the expenses, labour and the whole process [of the renovation] ... I just decided to forgo the idea. I didn't think I could manage [home modification] myself.

The amount of work involved in modifying their home environment and the lack of essential support, such as finance and manpower, prevented these participants from fully acknowledging their needs for home modification and taking action.

Contemplating needs for modifying apartments

Identifying needs for home modification

Participants began to recognise their needs for improving their home environment during the application process for the home modification project. However, some participants initially misunderstood the project. For example, before the residents' committee's information briefing session, 82-year-old Mrs Wang and her husband mistook the project for a furniture repair service. The residents' committee and the social organisation who were responsible for carrying out the project held two information briefing sessions for eligible older adults living in the neighbourhood, which informed participants about the meaning of home modification and home environment.

After the home modification project began, participants acquired more knowledge of specific items, updates and procedures. For example, 77-year-old Mrs Mao learned that grab bars could help her better use the toilet, which had already been a problem for her for several years. Participants also began to understand that features of their apartment could also jeopardise their wellbeing. As 91-year-old Mr Lu pointed out, 'I hadn't known that so many older adults had fallen at home. Changing our home environment, installing non-slippery floor tiles for instance, can be a precaution.' As such, participants began to identify some necessary modifications and updates in the apartment and understand how these configurations could better accommodate their functioning status.

Articulating needs for home modification

As they had just learned about home modification before the project, some participants felt too timid to communicate with the renovation team at the beginning of the renovations process. For example, 83-year-old Mrs Tian, who lived alone, mentioned that she was not clear about the subsidised 20,000 RMB maximum expense for each apartment. She recalled with regret, 'I just let [the renovation team] decide

everything. I was afraid of paying out of pocket so I didn't make any extra requests.' Because low income was one of the eligibility criteria for the home modification project, four participants expressed concerns about the cost of their home's renovation exceeding the subsidy, which may have prevented them from fully articulating their needs to the renovation team.

As the project progressed, most participants felt encouraged to acquire more information about home modification and express their needs to the renovation team. For example, both Mr Chen and Mr Tang mentioned that they had gone through the specific items on the list that their apartments needed to update and their prices. They compared the models and prices contained in the list to those on the market. Mr Tang stressed:

Most prices [of items] were the same as or relatively cheaper than those with the same brands on the market. I discussed with the renovation team about the models of cabinets and sinks based on my habits. They helped me to decide the model that suited me best. It's like an old Chinese saying, 'Know yourself and the enemy.'

Throughout the project, participants acquired relevant knowledge regarding home modification. As such, participants were able to clarify their needs, and were empowered to communicate with the renovation team about their needs.

Concerned with mismatched needs

Participants also reported their concerns about how the project at times left their needs unfulfilled or overfulfilled. Many participants asserted that the home modification project was not tailored enough to each household, as the renovation team strictly adhered to the list to determine which items could be updated. For example, 83-year-old Mrs Wu, who lived with her blind husband, wanted the renovation team to help her lay some tactile ceramic tiles to help her husband better navigate, especially after he had had a stroke. Mrs Wu was confused when the renovation team told her, 'They could only lay [the tiles] in the bathroom, instead of the entire apartment, according to the list. I wondered whether they wanted to help or not.' When following the mandates of the list, the renovation team may not have been able to address properly certain needs that particularly mattered to specific participants. This could leave those participants feeling confused about why their needs went unaddressed by a programme purportedly designed to address those very needs.

Furthermore, renovators' strict compliance with the list sometimes resulted in a mismatch between needs and services. For example, 80-year-old Mr Zhu, who was walker-bound and lived with his wife, recalled his experience:

I told the renovation team that it's really not necessary to install a ramp at my door as I live on the third floor and there is no elevator in the building. But they insisted that the list required installing ramps for all the older adults who are wheelchair or walker bound.

Although the list was designed to improve the home environment for older adults in general, it may have failed to address specific circumstances and needs in each household. This lack of tailoring confused participants and left their needs unmet.

Appraising success of the modified home environment

When the home modification project was completed, all participants were impressed with their improved home environment, as it satisfied to some extent their needs for safety, independence and convenience. Consequently, they reported re-establishing control over their homes. First, the project's modifications improved the accessibility of participants' apartments, making it easier for them to move around in the apartment, perform activities of daily living and leave the apartment to socialise in the neighbourhood. Remodelled homes were particularly liberating for participants who were reliant on a walker or wheelchair for mobility. Both wheelchair-bound Mrs Wang and Mrs Yao felt a renewal of their life following their homes' modifications. As Mrs Wang put it, 'I can decide what I want to do and where I want to go out now. I'm not useless anymore.' In general, home updates strengthened participants' environmental competence.

The project also enhanced apartments' usability in ways that strengthened participants' performance of activities of daily living. For example, 79-year-old Mrs Zhao, who lived alone and had had multiple hip and knee surgeries, said, '[The renovation team] readjusted the width of room doors to fit my walker. This has saved me a lot of trouble.' Mrs Tian praised her newly installed shower, saying, 'I've been able to take showers by myself since the modification. This capacity is very important to me.' Renovations buttressed participants' sense of control over essential facilities to perform activities of daily living, such as cooking, showering and laundry. At the same time, these renovations enhanced participants' physical safety. For example, Mrs Mao and her husband were very pleased with the replaced gas stove and electric wiring in their kitchen. Mrs Mao said, 'We thanked the renovation team for replacing the old gas stove. It was pretty dangerous if it had leaked.' As such, the home modification project enhanced the usability, accessibility and safety of participants' apartments, which in turn improved their P-E interactions in their home.

As our interviews took place an average of six years after participants' home modification projects were completed, participants shared their views on and feelings of their current home environment. In general, participants were satisfied with their modified apartments while underscoring that new needs for home modification had emerged in the years after the modification projects were completed. These new needs related to the changes in participants' health conditions. For example, 81-year-old Mrs Qian, who lived alone, considered further modifying her bathroom due to the fact that she had been unable to shower alone since experiencing a heart attack in December 2019. Similarly, nine other participants who experienced accelerating functioning declines and some major health issues considered further modifying their homes in response. Participants' evolving needs for home modification also related to their changing living arrangements. For three participants whose spouses had passed away in the previous six years, the renovated apartments seemed inadequate to accommodate their current situation of living alone. Changes in the bathroom and kitchen were most needed for these participants. For example, since Mrs Yao's husband passed away, she had to cook in her wheelchair, and the kitchen countertop and sink were too high for her. With the experience of the home modification project, participants were able to more precisely

identify their needs for updating their home environment to facilitate their daily life under altered circumstances.

Participants also appraised their current needs for improved surroundings in their extended home environment, and in particular the importance of an age-friendly neighbourhood. For example, Mr Zhu commented, '[The home modification project] inspired me. As I am with a walker, I've noticed that many places need some updates, such as subway stations and movie theatres.' Mr Chen reported he had recommended further modification of the neighbourhood by 'suggest[ing] to the residents' committee to install more low-impact exercise facilities in the neighbourhood for us [older adults]'. Like Mr Chen, other participants became increasingly aware of their home environment and their recognition of the need for modifications expanded beyond their own apartments and into public spaces.

Discussion

This study investigated community-dwelling older adults' perceptions of needs for home modification in Shanghai. Most participants initially knew little about home modification, which sustained their lack of awareness of their needs for home modification even when they encountered challenges in their apartments. As the home modification project took place, participants gradually gained knowledge of home modification, which enabled them to identify and articulate their needs. Despite their general satisfaction with the modifications, they also expressed concerns about unaddressed or over-addressed needs during the project. After the project, participants' perceptions of their needs for home modification continued to evolve in light of their changing health conditions and living arrangements. Further, their perceptions of needs for modifying their environments also expanded beyond their homes to their neighbourhood. In sum, these findings highlight the multiple facets (detailed below) of participants' perceptions of their needs for home modification. Participants engaged with their home environment and the modification project in a dynamic, reciprocal relationship (Tanner *et al.*, 2008).

Participants' functional levels and abilities to perform daily living were essential to their perceptions of needs for home modification. This finding corroborates prior evidence that physically functional impairments and hospitalisation were the strongest factors resulting in older adults' recognition of their needs for home modification (Kim *et al.*, 2014; Hong *et al.*, 2015). Participants' understood that a key goal of home modification was to help them maintain their functional level and optimise their performance of activities of daily living (Wahl *et al.*, 2009; Oswald *et al.*, 2011; Renaut *et al.*, 2015). Participants' functional level was also related to their sense of control over their home environment. Such a sense of control is crucial for older adults as they continue to establish P-E fit and preserve their independence in their home environment (Oswald *et al.*, 2007a; Tanner *et al.*, 2008; Wahl *et al.*, 2009; Renaut *et al.*, 2015). In line with existing evidence, modifying the home environment to upgrade its usability and accessibility preserved this sense of control for participants (Petersson *et al.*, 2012).

Participants' perceptions of their needs for home modification gradually developed with their awareness of P-E fit. Most participants initially were not clearly aware of the necessity of home modification or concerned about environmental

challenges they faced at home, aligning with prior findings that older adults prefer keeping their homes in their customary condition (Kruse *et al.*, 2010). For older adults, ageing in place has not only prompted their thinking about independent living and safety, but about what their home means and represents to them (Oswald and Wahl, 2005). Participants believed that it was inevitable to face growing challenges at home, due to their age. As a result, participants' lack of awareness of the concept of P-E fit prevented them from identifying their potential needs for home modification, and may have caused some to hesitate or even struggle to spot potential hazards in their homes (Bercaw, 2020). Notably, such home hazards may continue to diminish older adults' sense of control within their own apartments (Oswald *et al.*, 2006). At the same time, however, participants were vigilantly aware that their needs would change as they aged. Participants realised that they could face potentially greater hazards from their home environment that might not have been a threat when they were younger and healthier. This finding suggests that older adults' experiences of ageing and perceptions of home are essential to understanding their use of home environment and their corresponding adaptation to it (Renaut *et al.*, 2015). As such, participants' perceptions of needs for home modification developed with their age and depended on their current home environment configurations (Gitlin, 2003).

Resources were also crucial to participants' willingness to actually modify their homes. In particular, for our low-income participants, their limited resources hindered not only their ability to renovate their apartments, but also their ability to acquire necessary information about home modification. Even for the few participants who attempted to update their apartments before the pilot home modification project, a lack of resources hindered their actual implementation. This finding indicates that professionals in home modification should facilitate environmental modifications for low-income older adults by supporting them in locating necessary resources and navigating home modification procedures (Johansson *et al.*, 2009; Park *et al.*, 2017). Future research should examine the relationship between older adults' income and resource status and their P-E interactions.

Participants' accumulated knowledge and implementation of home modifications continually influenced their perception of their needs. After the modification project began, most participants felt empowered to express their ideas of specific updates and retrofitting, and their proactivity increased alongside their growing awareness of home modification (*e.g.* Fänge and Iwarsson, 2005, Johansson *et al.*, 2009; Kahana *et al.*, 2019). Meanwhile, participants realised that discrepancies remained between their and the renovation team's understanding of their needs. Indeed, participants expected to have more tailored modifications to meet their specific needs and personal goals. These findings emphasise that aligning older adults' and renovation teams' understandings of home modification could enhance older adults' satisfaction with the modification process and results (Johansson *et al.*, 2009).

After the project was completed, new needs continued to emerge because of participants' life changes, and seeing that the P-E dynamics needed readjustment, and more than two-thirds of participants sought to modify their home further. In addition, participants' conceptions of their environmental needs extended beyond their homes and into their neighbourhood as their experiences of home modification

broadened their understanding of the ‘environment’ portion of person–environment dynamics. This finding reflects that attention to various environmental characteristics and complex P-E interactions occur at different stages of people’s ageing process (Oswald *et al.*, 2011).

Conceptual reflection

The findings of this study suggest that participants experienced two intertwined processes: older adults’ continuous P-E interactions at home and the evolution of their needs for home modification in response to the ageing process. The first process synchronised the process of the home modification project. Participants’ P-E fit with their home environment was inhibited by their declining functioning. The home modification project helped to sustain their control over the usability and accessibility of their apartments and maintain their environmental competence (Wahl and Weisman, 2003). After the home modification project took place, the modified home environment helped restore their feelings of security, safety and comfort, which in turn reinforced their identity, self-esteem and sense of control (Tanner *et al.*, 2008). Participants realised that home modification could help improve their performance of activities of daily living and compensate for changes in their functional status (Oswald *et al.*, 2006; Gitlin, 2009). As such, home modification became a motivation for participants to improve the P-E interaction and re-establish P-E fit at home.

The second process involved participants’ understanding of the relationship between home modification and their ageing process. Participants’ awareness of P-E interactions and their home environment related to their conceptualisation of the ageing process. The progressing nature of the ageing process gave participants a reciprocally evolving understanding of home modification, *i.e.* home modification evinced their functional declines and compensated for these declines at the same time. This reflects that AARC tends to combine both negative and positive awareness of the ageing process (Diehl and Wahl, 2010). Participants were initially concerned that home modification would imply their reduced capability to perform activities of daily living and to maintain mobility at home, which is one of the major concerns of AARC (Diehl and Wahl, 2010). After home modification, changes in participants’ lives still prompted them to seek further readjustments of their P-E dynamics. Participants appraised their evolving needs for home modification as an opportunity to continue to adapt their home environment and refine their P-E fit. Thus, older adults’ perceptions of their needs for home modification and their understandings of P-E dynamics should be conceptualised in terms of stages of the ageing process that bring both opportunities and constraints (Diehl and Wahl, 2010; Oswald *et al.*, 2011).

Policy and practice implications

The findings of this study offer important guidance for the future development of government-sponsored home modification for older adults in Shanghai. From the policy perspective, policy makers (*e.g.* Shanghai’s Civil Affairs Bureau) should situate home modification in the context of older adults’ lifecourse to better address their diverse and evolving needs (Oswald and Wahl, 2005). Providing home

modification services only once may not be adequate given older adults' changing (and likely deteriorating) health status and other life changes. Service providers should assess older adults' home environment periodically to identify their evolving needs and adapt services accordingly. Further, policy makers should better engage older adults and their families when implementing the home modification project to determine the most pressing needs to address. By contrast, home modification services initiated by the municipality are not always specifically designed for individual clients (Fänge and Iwarsson, 2005).

From the practice perspective, professionals in gerontology should participate in and monitor the home modification process. These professionals can engage older adults throughout the process, encouraging a participatory approach (Stark *et al.*, 2017). In doing so, these professionals can help older adults better identify specific performance challenges as well as understand their needs and preferences (Gitlin, 2009) in order to obtain meaningful environmental support in a timely manner (Pettersson *et al.*, 2009). These professionals should also be aware of older adults' physical and psychological characteristics as they relate to home modification. For example, home modification may be too burdensome for some older adults who may worry about expenses and project duration. Programme protocols should clearly list the home modifier's guidelines, subsidies and expense cap, including publicly funded items and out-of-pocket items, and time required to complete the work (Aplin *et al.*, 2020). By closely monitoring the process of home modification, the professionals can keep older adults engaged and up to date. In addition, professionals in gerontology should provide older adults with educational opportunities about age-friendly environments in order to increase their awareness of P-E fit and empower them to modify their living environment.

Limitations

Our findings, while promising, should be interpreted with caution. First, Shanghai is one of the most advanced cities in China in terms of eldercare infrastructure and the first city in China to implement home modification services for older adults. Our findings may not be generalisable to other cities in China. Second, our sample size is relatively small. The home modification programme for older adults in Shanghai is still in the pilot stage and has been implemented in a very limited number of households compared with the municipal ageing population. Studies with more diverse and larger samples are needed in the future. Third, our study only focused on low-income older adults, as only these adults were eligible for the home modification project. Medium- to high-income older adults may have different perceptions of their needs for home modification and diverse experiences of interacting with their home environments.

Conclusion

This study is among the first to investigate community-dwelling older adults' experiences and understandings of their home environment and their evolving perception of their needs for home modification in urban China. The pilot home modification project raised participants' awareness of aspects of their home environment in terms of P-E fit. With the implementation of the home modifications,

they gradually understood that modification could help them better adapt their home environment and re-establish P-E fit in their own apartments. Given their life changes after the home modification project, participants further identified newly emerging environmental needs at home and in the neighbourhood. This study sheds light on older adults' evolving needs for seeking environmental solutions to face future adversities. To an array of stakeholders, including older adults, their families, policy makers and professionals, it offers suggestions for the future enhancement of home modification policy and practice in urban China.

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