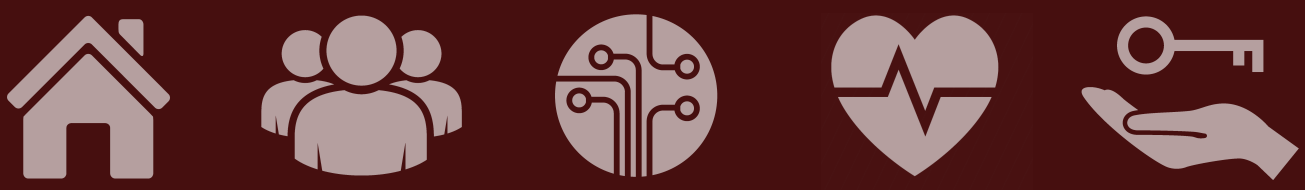
The University Of Sheffield.

Research report for ODESSA Project

Conference Publication I Feb 2018

ODESSA

OPTIMISING CARE DELIVERY MODELS TO SUPPORT AGEING-IN-PLACE



An international research venture investigating current long-term care delivery models for older people to allow them to live independently for longer.

CONTENTS

- **WP1:** Living arrangements of older people: causes and constraints
- **WP2:** Older people's housing and care expenses and residential mobility
- **WP3:** Healthy ageing-in-place: the role of social connection, networks and community belonging
- **WP4:** Age-friendly housing environments
- **WP5:** Innovative financial channels to promote ageing-in-place through property (dis)investment
- **WP6** - part 1: Scenario building for living arrangements of older people in china - Multi-agent system analysis
- **WP6** - part 2: Scenario building and evaluation for older people in China

The Sheffield School of Architecture

SSoA

PROJECT PARTNERS

The University Of Sheffield.

uclan
University of Central Lancashire

DAUPHINE UNIVERSITÉ PARIS

TSINGHUA UNIVERSITY 1911

FUNDED BY

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

Agence Nationale de la Recherche ANR

NSFC

AN INTRODUCTION TO THE PROJECT

ODESSA is a three-year €1 million venture with the aim to find new and innovative ways of adapting a person's home so that they can live independently for longer and avoid going into residential care as well as making it easier for them to access public services such as health and social services.

In March 2015 the ESRC (UK), ANR (France) and NSFC (China) awarded funding for the ODESSA project. Led by Professor Karim Hadjri, the ODESSA Project is a collaboration between The University of Sheffield and The University of Central Lancashire (UCLan) in the UK; Tsinghua University in Beijing, China; Université Paris Dauphine and Université Centre National de la Recherche Scientifique / Paris I-Panthéon Sorbonne in Paris, France. Together academics from partner institutions carried out important work to study how an increasing ageing population can be supported now and in the future.

The ODESSA Project will contribute to meeting the needs of older people by exploring the relationships between their living arrangements, living environment and the design of care delivery. This work has been done from technological, financial, political and social perspectives. Taking account of the factors that impact on the different ways in which older people in China, UK and France define care delivery, this project has produced a common framework for the study of care delivery mechanisms and the options available to older people in relation to cultural, socio-economic and welfare systems.

The study will help understand ageing-in-place in the three countries by identifying common features for integrated care under different policies and societies. It has examined the potential of such models, their impact on improvements to the health and social care provision, and their financial implications.

This publication highlights the work of this international, collaborative research project.

Since 2015, the ODESSA team has:

- Explored housing choices, needs, and preferences of older people.
- Acknowledged the importance of housing and living conditions and their links to social and health care delivery and in prompting ageing-in-place.
- Assessed older people's housing choices as expressed by residential mobility and their ability to improve their housing conditions and meet their needs in terms of housing ownership and mobility.
- Assessed the potential for engaging communities in effective and inclusive models of social care delivery to support healthy ageing, with reference to the different policy contexts of the three partner countries.
- Proposed design alternatives for age-friendly housing environments that support ageing-in-place, independence and enable effective, inclusive and easily accessible health and social care for older people.
- Assessed the efficiency and affordability of financial innovations for the long-term living arrangements of older people and propose delivery for an ageing population through development of funding options and associated proposals.
- Built a common framework for health and social care delivery mechanisms and housing options through scenario building and in-depth comparative analyses between the three partner countries.

Work Package 1

LIVING ARRANGEMENTS OF OLDER PEOPLE: CAUSES AND CONSTRAINTS

Dr Zan Yang, Shuai Fang
Tsinghua University, China

1 Objectives and Contributions

Understanding the causes, decision process and dynamic trend associated with living arrangements for older people is important to capture their needs and lay the foundation for the other work packages of the project. Based on the comparable datasets on older people, this Work Package focuses on the empirical studies of living arrangements in China and Europe to understand their similarities and differences in an individual, social and political context. In addition, restrictions of living choices of older people in China are further examined from social and housing perspectives.

WP1 contributes to the project and the study from several perspectives.

1. It develops a theory on living arrangements of older people.
2. It provides a comparative study on living arrangements for China and Europe.
3. It provides a survey on living conditions and living arrangements in Beijing.
4. WP1 and WP2 share the same dataset, so the data sorting and descriptions are all useful for WP2.
5. The findings of WP1 on socioeconomic distributions and key factors of living arrangements are important to WP6.

Th members of this WP were: Zan Yang (WP leader), Anne Laferrère, Louis Arnault, Cindy Hiu-ying Cheung, Ying Fan and Shuai Fang.

2 Data and Methodology

Based on CHARLS (China Health and Retirement Longitudinal Survey) waves 1 and 2 in 2011 and 2013, ELSA (English Longitudinal Study of Ageing) waves 1 to 6 from 2002 to 2013, and SHARE (Survey of Health, Ageing and Retirement in Europe) waves 1, 2, 4 and 5 from 2004 to 2013, we managed to produce comparative databases. We selected 9 European countries from SHARE sample countries and categorize them into 3 groups according to the region: northern countries (Sweden, Denmark, the Netherlands), central countries (Germany, Austria, France and Belgium), southern countries (Italy and Spain). We have focused on older people aged 60 or above in these databases, considering the cross-national differences in personal characteristics, family features, wealth issues and policy legislation. Due to the limited data, we did not analyse France alone but included it within central European countries.

Living arrangements have long been regarded as the foundation of care and wellbeing of older people. The concept of living arrangement is more than just choosing a place to live. It relates to the privacy and care of older people. It also reflects the social resources allocation that is important for public policy. There are different ways to classify living arrangements for older people. Among them, whether older people live with their children is very important to understand the social and economic effects. For international comparison, we pay more attention to living arrangements from a parent-

child perspective.

Figure 1 shows living arrangements of older people aged 60 or above in China and Europe. In China, 34.1% of older people live with children (10% with no partner), 40% with a partner, and 10% choose to live alone. More than half of British and European older people live only with a partner, and 25% and 30% live alone respectively. In Contrast to China, only 9.3% of British older people and 12.5% of older people in Continental Europe live with children.

As an example, in Figure 2 we present the number of children of older people aged 60 or above in China, UK and Continental Europe, showing the differences in family structure between China and Europe. We can see that older people have more children in China than in Europe. In particular, families with more than five children are far more than those in Europe. The number of children in the next generation is expected to decline significantly due to China's "One Child Policy". In Europe, most older people have two or three children.

For the estimation, we conducted Logit models to analyse the core factors affecting the choices of older people living with their children in China, UK and Continental Europe to conduct a comparative study. We paid attention to collinearity of the variables and the potential

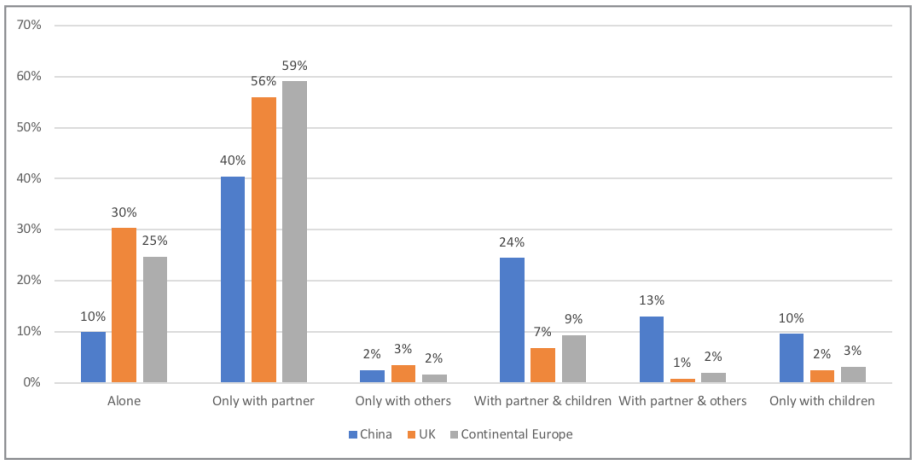


Figure 1: Living arrangements of the older people aged 60 or above in China, UK and Continental Europe (Source : Unweighted data from CHARLS wave 2011 and 2013, ELSA wave1-6, SHARE wave 1,2,4,5)

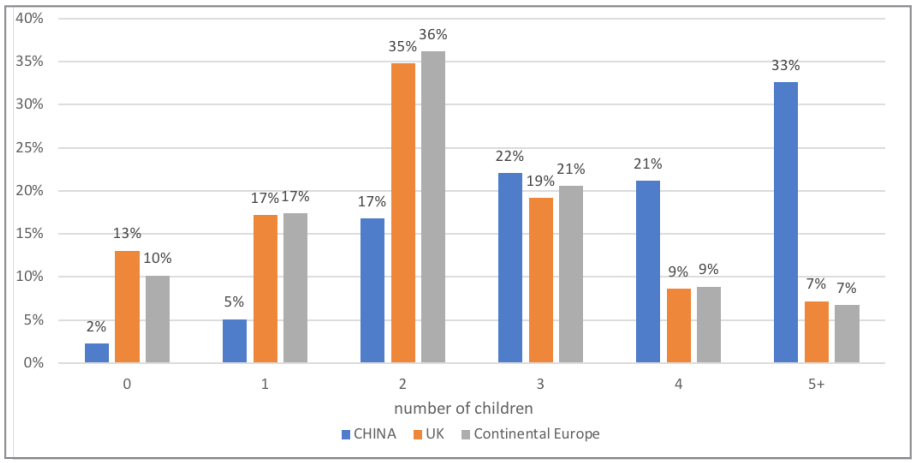


Figure 2: Number of children of older people aged 60 or above in China, UK and Continental Europe (Source: Unweighted data from CHARLS wave 2011 and 2013, ELSA wave1-6, SHARE wave 1,2,4,5)

Table 1: Preferred and actual choice of living arrangements of older people in China

		Preferred choice	
		Living with children	Living apart from children
Actual choice	Living with children	35.09%	14.79%
	Living apart from children	21.51%	28.61%

section bias. Based on the longitudinal datasets from the three surveys, we sort out a series of panel data, and we conducted xtLogit models with time and regional fixed effects to examine the cohort effect.

To further understand the constraints of older people's choice in China, we divided the whole sample into subgroups according to their preferred and actual choice. As shown in Table 1, around 63.70% of older people can match their preferred and actual choices, whereas the remaining 36.30% of older people cannot. The gap between the actual and the preferred choices is significant and reveals the constraints of older people choice in China. We established a standardized theoretical model of utility maximization to analyse the constraints on living arrangements of older people in China. The preference of living arrangements, sharing of housing cost and expenditure reduction due to informal care are all taken into account. Based on the model, we derived two hypotheses:

Hypothesis 1: The correlation between older people income and the likelihood of living together is non-linear depending on older people's preference and the relative income between older people and their children.

Hypothesis 2: Given all else is consistent, the worse the health status of older people, the greater the likelihood of living together.

Moreover, we carried out a survey of 2000 older people in 124 residential communities in Beijing in 2016, supported by the Institute of Real Estate Studies at Tsinghua University. It was designed to obtain information on household socioeconomic characteristics, living condition and neighborhood and spatial characteristics of residential communities. Households in the survey were selected through two-stage quota random sampling, which is analogic to the methods used by National Bureau of Statistics in China. In the first stage, the total sample size in each administrative district was determined in proportion to population size and numbers of residential communities. In the second stage, within each community, building units were randomly selected, followed by the sampling of households on each of the selected units to obtain the desired sample size. The spatial distribution of the residential communities in the survey is shown in Figure 3. Based on the survey, we used a Logit regression to estimate the effects of housing condition and neighborhood environment on living arrangements of the older people in Beijing. In addition, we applied geographical models to analyse how hospital and public transport accessibility in the community affect their living arrangements.

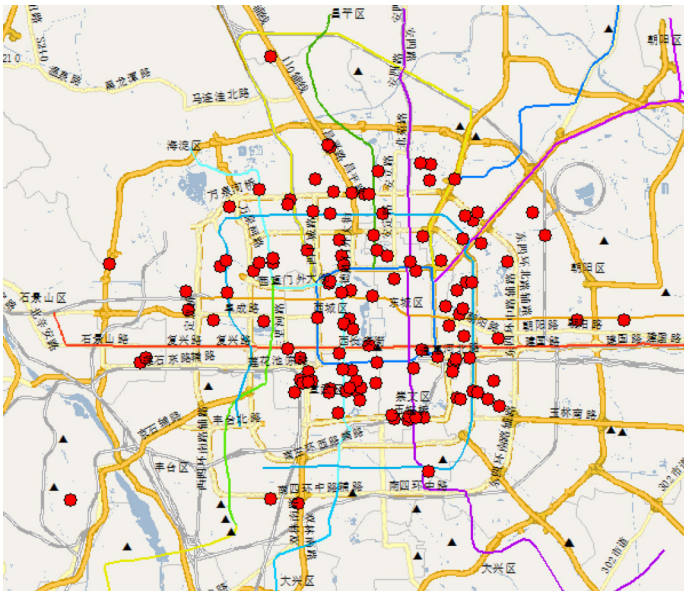


Figure 3: Spatial distribution of residential communities in the survey in Beijing

3 Results and Discussions

3.1 Living arrangements in China, the UK and Continental Europe: A comparative study

Personal characteristics

Personal characteristics including demographic characteristics, educational background and health condition, are important in living arrangements of older people. In China and Continental Europe, age has a significantly negative effect on the likelihood of a parent's living with their children, meanwhile, the square of age has a significantly positive effect on this likelihood. This reflects that in China and Europe the possibility of older people living with their children first decrease with their age until they reach the age of 73-76, of which point it rises. However, in the UK, we find that the higher the age, the less the likelihood of living with children.

The education level of older people has a significantly positive effect on the likelihood of living with children in China, but not in Europe. Females are less likely to live with children than males in all of these countries.

Health status does not have quite significant effect on living arrangements in the UK, while its effect is significant in China and Continental Europe. The self–reported health level on Activities of daily living (ADL) and instrumental activities of daily living (IADL) are used in the survey to measure health status of older people.

The number of limitations in ADL and IADL is positively linked to co-residence in all countries. It is found that the worse the health status of the older people, the more they are likely to live with their children.

Family features

In China and Continental Europe, living with a partner reduces the likelihood of living with children. This suggests that partners and children may both be important caregivers and can be substituted by each other. In the UK, living with a partner is not a significant factor for the decision whether to live with children. We find that the number of children is important for living arrangements decision of older people in China, the UK and Continental Europe. The more the children, the higher the possibility the older people live with one of them. In addition, whether the households have any underage grandchildren is also important in China. It is common in China that older people help to raise grandchildren. It is found that If there are underage grandchildren in the households, older people may have to live with their children and take care of their grandchildren in China.

Housing is another important factor in older people's living arrangements. The size of a house is significantly positive to the likelihood of living with children. The special facilities, like hand rails, all decrease the likelihood of living with children in urban China and the UK. This could be due to the fact that good housing facilities can help older people to do well in daily activities in the absence of help or care from their children. In SHARE, the data on housing facilities is quite limited, thus we do not include it in the empirical tests.

Wealth issue

Wealth is significantly influencing living arrangements of older people. Wealth issue here includes income and non-income wealth. Non-income wealth includes wealth with risk and wealth without risk. Wealth with risk refers to stock, fund, as well as loan, while wealth without risk includes deposit, government bond, housing fund, and housing wealth.

We did not find consistent effects of wealth for these countries. In China, the higher the wealth of the older people, the lower the likelihood of living with children. However, the effect of income is inverse. In the UK, income and wealth are both significantly negatively related to the likelihood of living with children. In Continental

Europe, the effect of a higher income level is positive, while that of wealth is nonlinear. The different effects of wealth might be due to the different portfolio of older people across countries.

Policy legislation

According to our results, whether older people have health insurance or life insurance has less association with older people's living arrangements in general. There are many differences between the old-age security systems in China and Europe. In China, the Government has borne the bulk of financial burden of providing care and medical services for older people. However, the social insurance system in China, including the social endowment insurance system and the social medical insurance system, still cannot meet the diversified service needs of older people. Only basic life standard can be supported by the social endowment insurance system. The basic medical requirement of older people depend on the social medical insurance system, Our results indicate that in China, the health insurance provided by the government has a slightly positive effect on the likelihood of living with children. In Continental Europe, we find that being covered by life insurance increases the likelihood of living together with children. In the UK, neither health insurance nor life insurance has a significant effect.

3.2 Constraints of living arrangements of older people in China

We find that the correlation between older people income and the likelihood of living together is non-linear. When older people prefer to live apart, their higher absolute income is important; however, when they prefer to live with their children, the actual living status depend on the relative income of the older people and their children. As for health issues, we find the worse the health status, the higher the need for informal care, and a greater need for living together. Further, by dividing the whole sample into subgroups, we find asymmetric effects of choice constraints. From income channel, a substantial increase in children's income has a significant positive effect on the likelihood of moving in, while a large decrease in children's income has no impact on moving. From the care-delivering channel, we find that health status only increases the likelihood of living with daughters rather than sons, because daughters are main source of informal care in China. We also find that relative income plays a key role in choosing whether to live with children or live near children, and that the health status has a significant impact only on the choice between living near or far from children. Our findings are robust when eliminating passive choices of older people because of the rural-urban migration as well as controlling for the consistency in preference of living arrangements across years.

In addition, based on the self-designed survey, we find that poor housing condition is an important constraint on ageing-in-place. The lack of supporting facilities and age-friendly room design significantly weakens the willingness of older people to age-in-place. The absence of lifts in the multi-story buildings and noises are the key community-level factors that impede ageing-in-place. In addition, the accessibility to hospitals is found significantly positive to the willingness to age in place, while the effect of accessibility to traffic stations is not significant.

Our findings also provide political implications in terms of pension system, tax policies, medical care support, community-based care delivery system and community environment.

Work Package 2
OLDER PEOPLE'S HOUSING AND CARE EXPENSES AND RESIDENTIAL MOBILITY

Anne Laferrère
Université Paris-Dauphine, France

1 Aims and Objectives: Assess Housing Preferences

The aim of this Work Package is to assess older people's housing preferences and constraints as expressed by their residential choices.

We define "ageing-in-place" as living "in the community", in a private dwelling, as opposed to living "within a community", in residential care such as nursing homes (NH). Ageing-in-place does not necessarily mean staying in the same place. Indeed, some of the 60+ move to other private accommodation. They will age "in place", but not in the place they had lived before. The choice to age in place is first that of (relative) independence versus (equally relative) dependence. It goes along with more freedom in the organisation of care. Depending on the context of care insurance and services costs and on the level of limitations, ageing-in-place may be less or more expensive than ageing in a nursing home. Such costs could also drive people to "downsize", i.e. reduce their housing consumption to finance care more easily.

People express their choice of housing clearly when they move. For this reason, knowing what makes older people move, and also a contrario what may prevent them to move, helps further understand how to adapt dwellings and care delivery to fit the needs of older people. We concentrate on the housing choices of the 60+ as revealed by their decision to move or not, and the type of home they choose: a private home in the community, or an adapted old-age facility.

We start by being agnostic about the desire of the older persons to live in place, or the desirability of ageing "in place" or in a NH. The hope is that by looking at the factors influencing choices, some insight will be gained of the preferences and constraints of the population.

2 Methods, Data Collection and Analysis: Rely on Longitudinal Quantitative Data

Because of the many factors influencing residential choices in old age, such a study is very data demanding. Very few surveys provide large nationally representative samples of older people and include information on income, wealth, health, housing, extended family relationship. This Work Package relied mostly on SHARE (keeping around 69,000 observations of 60+ individuals in 13 continental European countries: Sweden, Denmark, the Netherlands, Belgium, Germany, France, Austria, Switzerland, the Czech Republic, Spain and Italy). ELSA (for England and Wales) will be added in a next step. CHARLS did not provide enough waves to use the same method for China. SHARE and ELSA are reasonably close, and both have conducted interviews every two years since 2004 and follow people when they move, including when they move to nursing homes, and even try to assess where they died and spent the last year of their life.

Data preparation proved very time consuming. We first computed descriptive statistics to get a clearer idea of the mobility rates and the

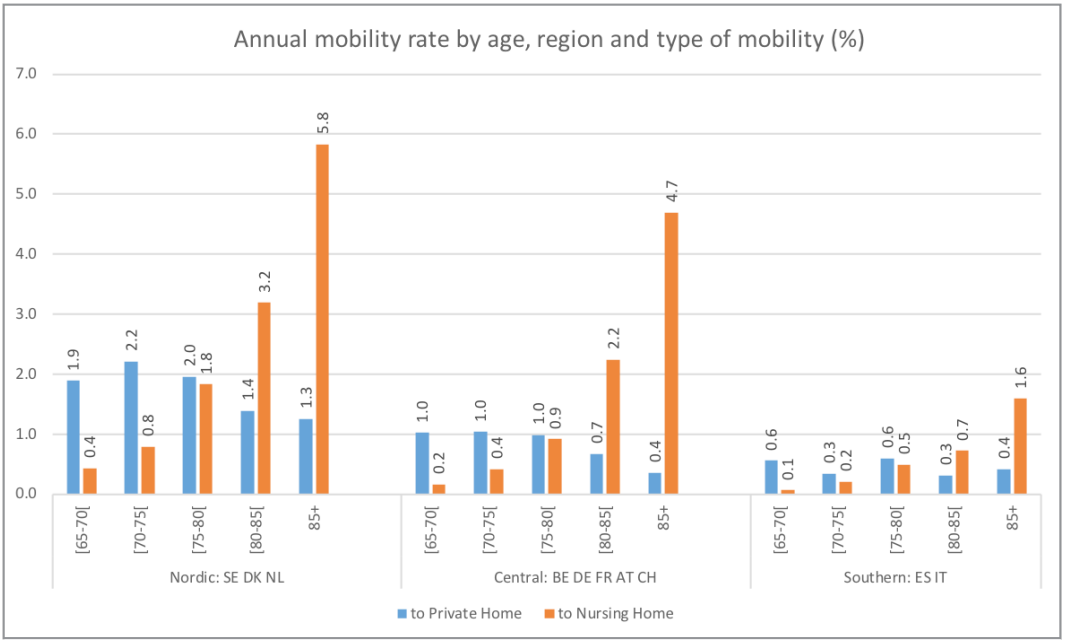


Figure 4: Annual mobility rates to private homes and to nursing homes, by age and country groups (Source : SHARE waves 1, 2, 4, 5, 6; Europeans aged 65 or more and interviewed at 2 survey waves)

main housing choices of Continental European older people. We then ran econometric analysis distinguishing mobility between private homes ("ageing-in-place"), from mobility to residential care, on those aged 60 or more at the time they were first interviewed. Within mobility between private homes, the "downsizing" decisions of owners moving to rent or of those reducing their number of rooms were distinguished from opposite "upsizing" moves. Within mobility to residential care, the 'last mobility' of those who died in nursing home after a short stay (of less than 2 years), could be separated from the mobility of those who stayed long enough in nursing home to be interviewed there. We also aimed to spot the influence of welfare state or legal contexts through country differences.

3 Results and Discussion

Mobility of 60+ Continental European individuals is low: the average annual mobility rate is only around 2% in the selected countries. Moreover two-third of recent movers stay in the same place or municipality (interestingly the word "community" was used only in Austria – Gemeinde. Hence even for movers the choice is often to stay close to a familiar neighbourhood, and in a place loaded with personal memories that simplifies many daily activities.

There is a clear North/South gradient of mobility, those living in Northern European countries being more mobile than those in Central and eastern countries, in turn more mobile than in Southern Europe (Figure 4). The overall mobility rate is slowly increasing with age, especially after age 85 with the increasing probability of entering a nursing home.

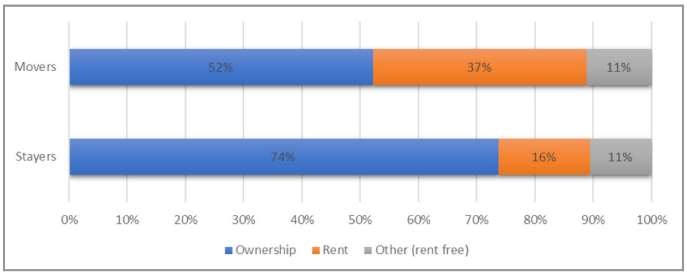


Figure 5: Housing tenure and mobility of the 65+ European individuals (Source: SHARE waves 1, 2, 4, 5, 6. Europeans aged 65 or more and interviewed at 2 survey waves)

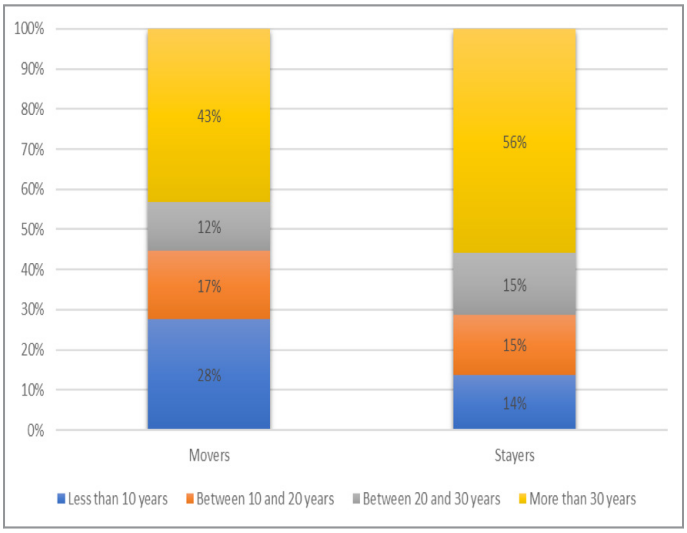


Figure 6: Time in home and mobility of the 65+ Continental European (Source: SHARE waves 1, 2, 4, 5, 6. Europeans aged 65 or more and interviewed at 2 survey waves)

The "movers" and the "stayers" have different characteristics. The movers are more often disabled or cognitively impaired. Moving is also positively associated with widowhood and it depends strongly on the housing tenure. According to Figure 5, the share of home owners is 74% among the group of "stayers" against only 52% among the "movers". Home-ownership is negatively associated with the probability of moving. Indeed, moving costs are higher for owners than for renters. The higher attachment of owners to their home may be an additional explanation. The time spent in the current home is positively associated with the probability of staying in the same place, another testimony of the links to communities. Only 43% of the movers had spent more than 30 years in their previous home against 56% of the stayers (Figure 6).

The determinants of mobility between private homes differ widely from those of moves to nursing homes. The probability to move to another private home declines after age 65, and even more after age 80; it increases with the number of rooms per person, is lower if the home is adequately equipped for older disabled individuals. The probability of moving to another private housing also significantly increases when individuals have children, emphasizing choices of location that bring family members closer. The onset of mobility problems or limitations in the activities of daily living (ADL) also influence changing residence.

Such problems have an even larger influence on the probability to move to a nursing home. Those moving to a nursing home are older, more severely disabled, and especially cognitively impaired (as measured by the word memory test) and have a higher probability of having been hospitalized during the previous year. Cognitive impairment had no effect on mobility between private homes. Interestingly, having no spouse, or no child living close by also increases the probability of moving to a nursing home: this emphasizes the role played by potential informal caregivers to enable a disabled person to stay in the community. Those who move to a NH are also less likely to be highly educated or in the highest quartile of economic resources. We interpret this as a sign that the preferred choice is to live in the community, and moving to a NH is a constrained choice, sometimes constrained by the inability to finance care at home.

Note that what we call the "last move" to a NH at the end of life, moving and dying there, is not linked to income, nor to the family situation but only to health and disability.

Among those who move "in the community", those who "upsize", i.e. move to a home with a larger or equal number of rooms, differ from those who "downsize". The former, who represent 44% of the movers, are wealthier and have a higher probability of living far from their children before the move. The latter are low-wealthy individuals, who have lost their spouse and who had more unoccupied rooms before the move. Mobility problems and limitations in ADL or IADL induce to downsize. Wealthy homeowners have a lower probability of "downsizing", i.e. of moving from owning to renting, than "small" owners. A bequest motive might prevent the former from reducing their

housing consumption by selling the family home.

Finally, the factors of residential mobility do not vary much by country, even if the rates of mobility and of nursing home mobility differ.

Discussion

We interpret our finding on the influence of economic resources as a preference for "ageing in the community" rather than in a community, a taste for independence, that translates into moves to residential care taking place later in life than in the past. Better health, higher pension levels, later widowhood because of longer life expectancy and higher probability to have children living close by than in the past, all lead to predict that the trend of "ageing-in-place" will go on in the near future.

It translates into the necessity to adapt private homes for all types of physical mobility limitations, to organize home care and its financing, and to reorganize some of the traditional "nursing homes" that risk to become obsolete. Some people used to move to NH at a rather young age to get better accommodation, which they now find in more comfortable homes. In the future, NH will receive people who are more heavily disabled, especially with dementia, or closer to the end of their lives, who will need highly qualified care.

Since older people choices express their preference to age in their own home "in the community" as long as possible rather than in residential care, it seems important to convert some of the current residential care homes into (1) care centres where a dependent older people could make short stays or come daily, if only to relieve the family carers, (2) care for very dependent persons with (mostly) dementia pathologies. This will imply training carers for more demanding jobs and pay them accordingly.

Some information was collected on out of pocket care expenses. We leave this analysis for the next step of WP2.

Work Package 3
HEALTHY AGEING-IN-PLACE: THE ROLE OF SOCIAL CONNECTION, NETWORKS AND COMMUNITY BELONGING

Professor David Morris, Dr Manjit Bola, University of Central Lancashire, UK
Dr Junjie Huang, University of Sheffield, UK
Professor Xiaomei Pei, Tsinghua University, China

1 Aim and Objectives

Work Package 3 sought to contribute to the overall understanding of the features of comparative ageing-in-place a specific understanding of the role that social and community network membership and activity could play in advancing effective ageing-in-place models. Informed by the learning from 'Connected Communities'[1] a five year community based action research study in which the WP3 UK team had been involved, our work aimed to draw as far as possible on the earlier study's two key principles: deliberative community engagement and social network analysis in meeting its aim of assessing the potential for engaging communities in effective and inclusive models of social care delivery to support healthy ageing with reference to the different policy contexts of the three partner countries.

The starting point for the work was to build on the shared identified values and purpose of ODESSA as a whole. Thus our work across the participating countries aimed to draw on common principles concerned firstly with respecting both the wisdom and life experience of older people as a source of citizen knowledge and secondly with the three countries as rich sources of knowledge in the development of an ageing-in-place framework drawn from distinct cultural, societal and policy diversity but incorporating universal parameters. From this starting point our WP objectives were to advance understanding of:

- What social and community network membership and activity means to older citizens and within this, gain knowledge of factors particularly associated with enabling it: e.g. service access, wellbeing, trust;
- The types of accommodation settings and ways in which they are perceived in relation to community belonging and activity;
- The development pathways for future ageing-in-place that incorporate the evidenced value and utility of social and community network membership and how to optimise its effect.

2 Methodology

A mixed methods approach was employed. A survey instrument was developed to collect a range of personal, accommodation and connection data. Qualitative data to provide additional information on perceived enablers and barriers was collected through focus groups.

The methodological cornerstones for 'Connected Communities' were firstly deliberative community engagement, in which community members are trained to undertake

1. www.thersa.org/discover/publications-and-articles/reports/community-capital-the-value-of-connected-communities

research in their own community, and secondly, social network analysis, in which the network relationships revealed by the community research data are analysed, presented inter alia in the form of social network maps (sociograms) and then 'played back' to community participants in dedicated meetings and selected focus groups for iteration, with the outcomes of this process providing for a local intervention to support improved wellbeing and inclusion to be locally determined, implemented and evaluated.

Initial meetings of the country lead researchers for WP3 held between March and September 2015 were to assess the viability and transferability of this methodological approach between the three countries. An adapted method was agreed to take account of differences between the countries in relation to their readiness to utilise a participative community research model that deployed community members. Thus, while a common methodology for the subsequent data analysis was agreed, it was also agreed that 'fidelity' to the Connected Communities model of community research would necessarily be mediated by national research circumstance. This resulted in data collection being undertaken by community members in the UK, students in China and junior research staff in France. During the same period, work was undertaken to establish a data collection instrument and identify suitable research sites. It was agreed that the data collection instrument would be a survey with name and place generators and comprise common core questions and certain additional country - specific fields where necessary to synchronising WP3 with health or demographic data bases, notably, SHARE[2]. Country leads collaborated in determining those data additional to the core questions that would be commonly collected and those that would be collected only within their own country site(s). The questionnaire in six data fields provided for data collection on personal circumstances; accommodation status; health and other support service need; community belonging; trust; networks and connectivity.

To add a further source of evidence for the social enablers and barriers to ageing well in their communities, UK focus groups were held with community researchers (aged>55) to obtain experiential insights from the community research process; their learning from the field; their own knowledge and experience of being an older person living in the communities in which the research was undertaken.

The selection of research sites, was made in line with the agreed desirability of achieving a reasonable collective spread of demographic characteristics across the participating countries, and resulted in the following study sites being identified:

- UK - Stratford on Avon, Warwickshire; semi-rural; pop: 27.5 k (2011)
- Norwich, Norfolk; small city and semi – rural; pop: 213 k (2011)
- Tipton, W. Midlands, urban, pop: 39k (2011)
- China - Ningbo, Zhejiang Province; urban; pop. 7.6 m (3.5m in urban district)
- France - Evry, Essone, outer Paris; suburban; pop: 50k (2014)

Community researchers (UK and China) were trained in early 2016. Data collection across the three countries was conducted during 2016/17, being completed first by China (July 2016), followed by the UK and France. 764 surveys were completed (UK: n.151; China: n.479; France: n.134) Seven focus groups held between March and October 2017 with 3-10 researcher or service providers or research participants in each.

Quantitative data was examined by means of statistical analysis, correlations analysis, and principal component analysis (PCA), to reveal the underlying relationship between different variables or variable sets. Key variables of the data were identified by each country according

2. www.share-project.org

to local research interest. Commonly concerned variables further led to comparative studies within the work package. Qualitative data was analysed using systematic thematic analysis using a coding frame developed from the survey instrument questions to enable comparison and synthesis of data across community researcher teams.

3 Results

A comprehensive range of data and analysis of key variables supports many of ODESSA's overall findings and the case for an ageing-in-place framework with trans–national potential. More specifically, it reveals important associations in the fields of central importance for a work package concerned with highlighting dimensions of community connectivity as an essential aspect of that framework. Key findings in this respect concern community belonging, neighbourhood trust, loneliness and social network participation.

Community belonging was found to be positively associated ($p \leq 0.01$) with respondents' neighbourhood trust level; the level of place connectivity; the number of activities with which an individual is involved; the extent to which they are currently secure in maintaining a life at home and to a lesser degree ($p \leq 0.05$) with whether they have provision at home of officially provided care or support.

Neighbourhood trust was found to be positively associated ($p \leq 0.01$) with increasing age; the level of good health (self-assessed) and the least number of health conditions; the absence of organisational or place-based barriers; the extent of community belonging; the level of satisfaction with the extent of comfort within the home environment and to a lesser degree ($p \leq 0.05$) with their proximity to an adult child; the number of activities in which they are involved; the place connection size; the frequency at which they walk and the level of their internet and social media usage

Loneliness (being lonely) was found to be associated positively with the reporting of organizational/place-based barriers (such as bullying in sheltered housing; difficulties in accessing church services; poor availability of transport); whether receiving professional nursing and personal care; whether receiving care from a specialist physician and the number of health conditions. It was found to be associated negatively with home ownership; partnership status (having a partner); living in specific/ specialist older people's accommodation; frequency of contact with an adult child; the degree of satisfaction with available transport and the size of the network of any carer that the individual has.

Social network participation. Perspectives on the value and importance of social network participation, including on the significance of the relationship between family and community components were explored in focus groups (UK and China). These highlighted:

- The importance of a catalyst in realising access to social networks and opportunity:

  "Making and keeping social interactions is a skill which if unpractised will deteriorate. Engaging in social interaction/groups will in itself grow the social skills of the community and nourish/encourage new social groups and networks. Elderly people need to be encouraged to develop and use their social skills as part of pathway into old age and as part of the 'wider strategic social plan." (UK)

- The significance of family connectivity as that catalyst for other forms of social participation (e.g. grandchildren relationships may have multiple primary value and secondarily enable realisation of other positive ageing-in-place benefits such as social media literacy, or negative value in generating a child care - based impetus for severing long established, locality network ties for elders).

- the value of the mainstream places and ordinary activities in providing social network opportunities:

  "I usually see Gladys at the butchers and after that John at the post office. Certain common times develop around these locations when their social groups were more likely to be there. Key amongst such locations were where respondents got cash, be it the post office or building society or where they shop. Butchers, supermarkets, cafes libraries and in particular doctors and health providers all adopt a social function far in excess of their original purpose" (UK)

- That constraints to providing support, can be strongly linked to systems of service organisation:

  "Lack of a linked up approach to delivering 'elderly provision' across both time and geography. Many charities housing providers and social service seen to compete for clients rather than strategically plan" (UK)

- The vital nature of accessibility in social interaction:

  "Accessibility is a vital component in building and maintaining social groups and interactions. Accessibility may have many components. Social networks must either come to the elderly or the elderly have to want to find ways to get to where social interactions take place. These don't just happen they have to be made to happen either by the elderly person themselves or by some intervention" ..."Social interaction needs social scaffolding around which the elderly can build their lives and own social circles. A vibrant elderly community requires places to go and to interact that are accessible." (UK)

- How shifting demographic trends drive architectural housing solutions that can work against social network participation:

  "The differences between rural and urban area (some residents moved from rural area. Their original living environment is flat, which allows them to get familiar with neighbours. But now they all live in high-rise building, which is quite different. Families are isolated." (China)

- The value of volunteering and keeping active in later life in relation to social participation:

  The innovative use of older people volunteers from Ningbo community centres in working with pairs of trained student Community Researchers, alongside the UK's volunteer community researchers demonstrated the significance of volunteering to the study. Multiple (and culturally specific) explanations for volunteering were cited in focus groups: returning something to the community; the personal benefits of this community interaction experience:

  "My involvement in the study came about as a consequence of my role as a Trustee/ Director of Age UK Norwich. I was born in Norwich ... the public sector has been good to me over the years. Participating was in part about putting something back." (UK)

  "It means doing something about issues rather than just whinging." (UK)

  "The Chinese traditional ideological education helped them build up the thought to serve people, to help others, so they are willing to participate in volunteer works." (China)

  "It (volunteering) can help old people connect with their community." (China)

  "I've enjoyed being a community researcher; it's given me an insight into the issues affecting older people. It's been good for me and I've learnt a lot. I've made some good friends through the process" (UK).

Work Package 4
AGE-FRIENDLY HOUSING ENVIRONMENTS

Professor Karim Hadjri, Dr Tulika Gadakari, Dr Junjie Huang, Jingjing Wang
University of Sheffield, UK

The world population is ageing owing to rising longevity and declining fertility rate. More older people are nowadays living alone in housing that is generally not adapted to their new needs and requirements. Evidence suggests that the majority of older people want to remain in their own homes for as long as possible to retain a sense of familiarity and independence which has shown positive effects on people's overall health and wellbeing. Responding to this trend, the large mainstream housing stock needs to be easily retrofitted with the intervention of technology such that it can respond to older people's changing needs.

1 Description of Work Package

Aim: To propose design alternatives for age-friendly housing environments that support ageing-in-place, independence, and enable effective, inclusive and easily accessible health and social care for older people.

Description: Work package 4 examined best practice in age-friendly and smart homes available in UK, France and China, and proposed retrofitting solutions for integrated health and social care with potential to achieve ageing-in-place. It established guidelines for age-friendly housing environments that support ageing-in-place and enable easy access to health and social care. It also identified existing technology trends and their potential for application as part of retrofitting alternatives for mainstream housing.

There is a need to identify what combination of environmental-based support mechanisms, environmental improvements and ambient assisted living (AAL) technology could potentially keep older people's quality of life above the threshold i.e. better than that at home, in long-term care or within AAL space. Smart Homes currently include a range of technologies and applications such as monitoring falls to more complex functions for example turning off appliances and accessing remote health care. In addition to satisfying physical, sensory and cognitive needs the use of technology can also enable older people to feel connected, thus reducing social isolation.

2 Details of Methodology

a) A review of existing best practice of age-friendly housing environments that promote ageing-in-place in the three partner countries;

Selection criteria were defined through a comprehensive literature review of

- possible outcomes (e.g. impact on quality of life, cost savings for service and care providers),
- operational aspects (e.g. number of user involved, running time) and
- available evidence (e.g. quality of research done).

b) This produced a baseline that informed potential retrofitting solutions for mainstream housing with regards to both design and technology;

c) An explanatory case study analysis was carried out for each selected ICT-based solution:

- Review of literature and case studies using available quantitative and qualitative data sources (including scientific publications and grey literature), as well as
- In-depth interviews with national experts and initiative coordinators.

The purpose is:

- to review and identify best practice age-friendly and smart homes in Europe and China;
- to identify the contextual factors and phenomena (technological, social, economic, cultural, political, legal, ethical) leading to success/positive adoption in the delivery of smart home technologies; and
- to establish whether there are practical replications, similarities or differences between the various case studies.
- Additionally, this review allowed access to the latest technologies and feedback on their use. A number of case studies from each country were visited and assessed to identify design responses to older people's needs and requirements and user satisfaction levels using questionnaire surveys.
- Stakeholders' consultation through focus groups were organised to take place in the three countries where findings and recommendations for retrofitting were presented and discussed. Fifteen stakeholders and residents in smart homes in each country were recruited to take part in the three focus groups.

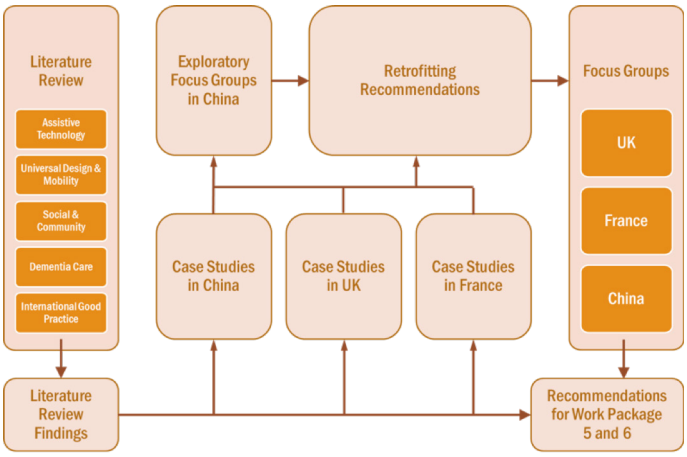


Figure 7: WP4 research strategy

3 Results and Discussion

The ODESSA project's Work package 4 identified 16 good practice case studies from the UK, France and China that are age-friendly living environments, equipped with assistive technology and designed using the principles of inclusive design, and with care provision when required. These independent living schemes supported the development of a design framework for retrofitting options for mainstream housing where people can age well and with dignity, without having to move out of their own homes and communities.

3.1 Case studies

The 16 case studies were shortlisted based on factors such as inclusive design, assistive technology, provision for care, recent development and when possible catering to an ethnic minority. They were visited and analysed based on five user requirements namely mobility, sensory, cognitive, health and safety and social inclusion, using various domains such as universal, light, visual, hearing, indoor air quality, personalisation, access, fire safety, telecare and telemedicine. The user requirements and the domains were established as key issues affecting older people following a comprehensive literature review and exploratory focus groups. The case studies were evaluated to assess the design of the built environment in both private and communal areas, along with the assistive technologies used. The observed features recorded and analysed helped identify current best practice in design for assisted living that are available in the UK, France and China. This helped produce a design framework for retrofitting options for mainstream housing so

Figure 8: WP4 case studies in the UK, France, and China

that people can age well in their own homes and among their local social network.

3.2 Focus groups

The main purpose of the focus groups was to assess the feasibility of proposed recommendations for age-friendly housing environments. Since all three countries have different approaches to housing as well as the type of services available to older people, this research aimed to conduct similar focus groups in all of them so as to gather information about older people's experiences within their home environment and the assistive technologies used to support them.

Three exploratory focus groups were conducted in China. Twelve retired professors took part in the first focus group and 14 participants representing three generations took part in the second focus group, both held at the School of Architecture of Tsinghua University. Lastly, 15 older people from the Chaoyang Minjin Committee (an older people's committee in central Beijing) took part in the third focus group held at Beijing Union University.

Discussion questions were based on key issues identified through the comprehensive literature review. The questions prompted discussion in the areas of accessibility, sensory, cognitive and technology to identify older Chinese people's awareness, needs and challenges to ageing-in-place in the current cultural, economic and political context. Seven over-arching themes emerged from the focus groups: Accessibility, Sensory, Cognitive, Technology, Social Inclusion, Care and Safety. Additionally the discussion

Figure 9: WP4 focus group in Beijing

was based on the participants' perceptions of ageing 'well' in place in a larger context of their cultural, economic and political views. Some of the key words the participants used to convey the idea of 'ageing well' were to live together, live independently, live with convenience, comfort and ease. Safety, accessibility and health, were seen as a means to achieving a better quality of life. Improving indoor air quality and designing ergonomically for older people with health and mobility issues were also considered to be contributing factors. Participants also encouraged ergonomically designed spaces and equipment specifically for older people that would take into account impaired vision, hearing, restrictive body movements and mental illnesses. The analysis of the three focus groups has identified the challenges and the positives of ageing well at home in China and provided an insight into the special design considerations required to design barrier-free, comfortable environments that are technologically enhanced to encourage better health, safety, independence, and a sense of community in China.

For the final feedback on proposed retrofitting recommendations, focus groups in the UK and France were organised. The main purpose of these focus groups was to assess the feasibility of these proposed recommendations for age-friendly housing environments, based on the views, experiences and needs of diverse stakeholders. A questionnaire type checklist was used to rank the various recommendations using a 5-point scale (Very important. Important, Moderately important, Of little importance, Not important). Two checklists were provided, one for mainstream housing retrofitting, and the other for Assisted living using Technology. Images were provided for most recommendations to help participants understand these and make an informed decision. Checklists were structured using Domains, User requirements and proposing specific items for building design

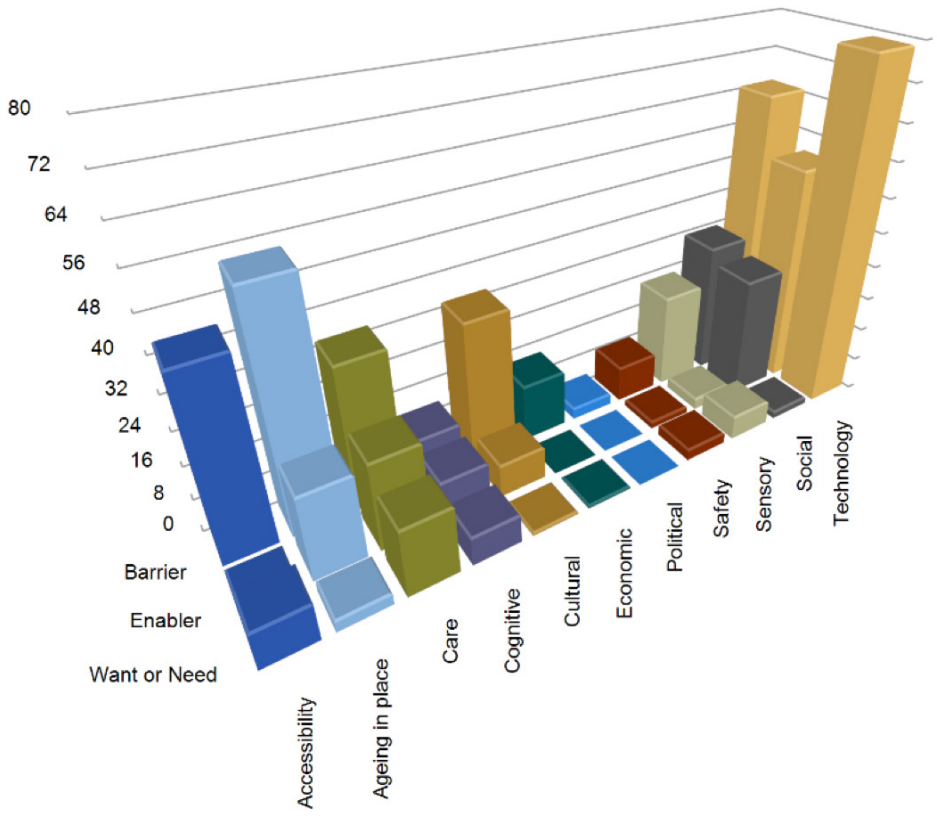


Figure 10: Results of the identification of barriers, enablers, and needs

or retrofitting. The analysis below used the user requirement elements of mobility, sensory, cognitive, health & safety, and social inclusion. The data from the questionnaires was tabulated and statistically analysed to collectively rank the various recommendations. The discussions were recorded, transcribed verbatim and analysed to seek common patterns that supported and enriched the statistical findings from the questionnaires.

In the UK, there was consensus between the groups while deciding on retrofitting recommendations for design in the mobility theme. When discussing mobility features (both design and technology) it was visible that older people gave less importance to those features that would be needed in the future or features that were perceived to be of high assistance for frail adults such as reclining shower seats, ceiling hoists, bath hoists, etc. Better lighting, convenient light and temperature control, having good outdoor views and outdoor spaces was rated highly in the sensory theme for both design and technology recommendations. Additionally easy to use, convenient systems that allowed older people a degree of personal control over their environment were given importance. Both design and technology that helped with memory and orientation was highly significant. The concept of 'homes for life' or adaptable housing that evolves as people age was well received and discussed by all participants but a couple of challenging aspects of implementing the concept were highlighted. These included habitation by young families, perception of home environments, individual needs and keeping up with new technologies.

In France, there was most consensus between the groups while deciding on retrofitting recommendations (both design and technology) in the mobility theme. Better lighting, temperature control and having good outdoor views was rated highly in the sensory theme for both design and technology recommendations. It was observed that technologies which

Figure 11: WP4 focus group in UK

ensured safety during a fire for people with sensory impairments were considered highly valuable. Both design and technology that helped with memory and orientation was highly significant. Notably older people would consider using home automation systems if they were developed for their specific needs, and were easy to understand and use. It was observed that Emergency Call Systems (pull cords or buttons) were important to have in all rooms and blending grab bars and handrails with home décor was only considered moderately important. This perception seems slightly contradictory to the notion of 'normalness' in the home environment and it could be interpreted that concerns of health and safety have overtaken the need to have a homely environment. Additionally, though technology to maintain contact with friends and family was deemed highly important, having a guest room to accommodate visiting friends and family was relatively not as important.

Figure 12: WP4 focus group in France

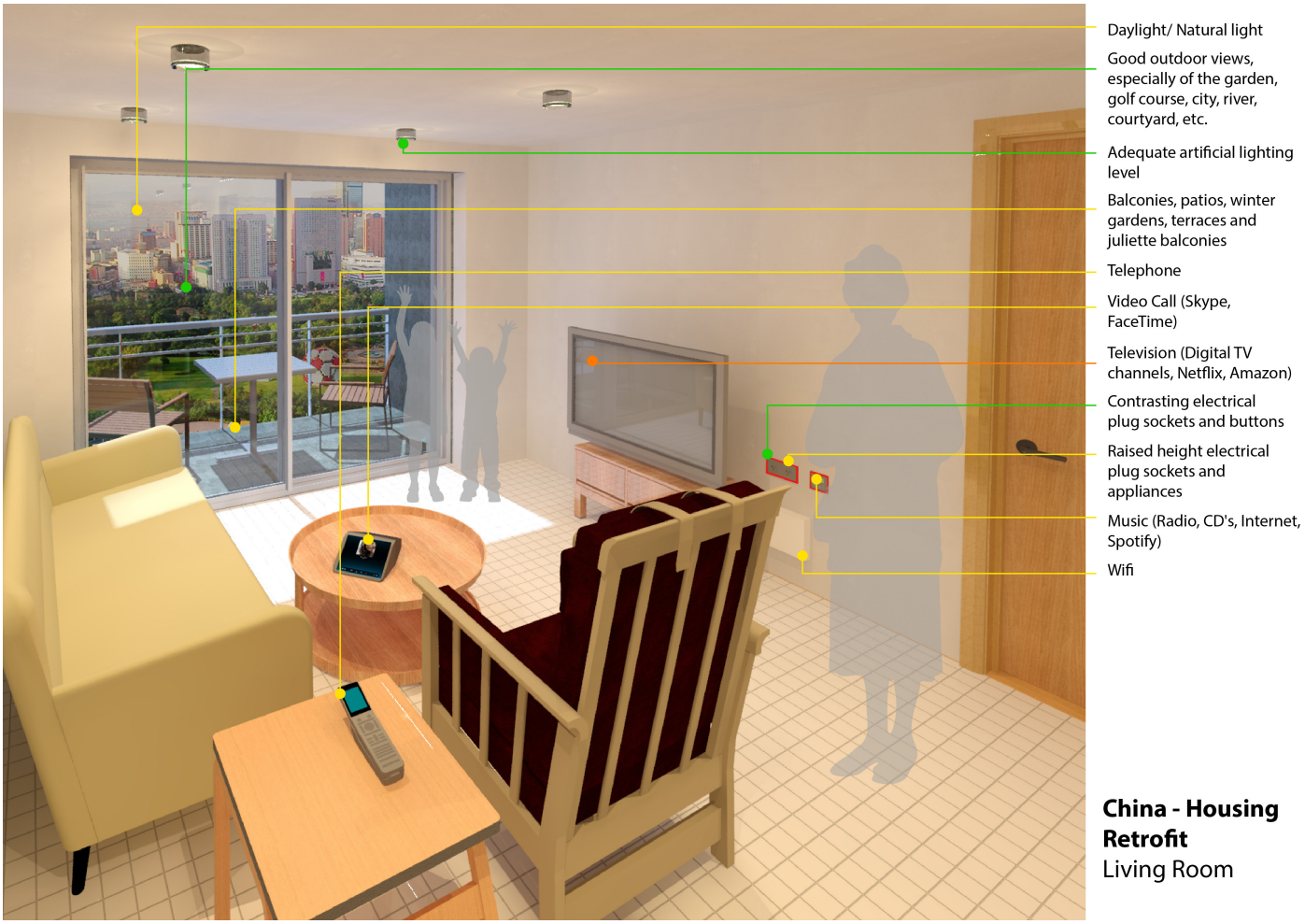


Figure 13: The example of retrofitting

3.3 Retrofitting proposals

The case studies and literature review helped established recommendations for retrofitting of mainstream housing and technology for assisted living. These were structured into user requirements and domains. For user requirements the following were used: mobility, sensory, cognitive, health and safety, and social inclusion. For domains the following were used: universal, visual/hearing, light, indoor air quality, normalness, memory, mental health, telecare, telemedicine, fire safety, access, maintain contact. Detailed description were provided for each requirement and domain. These informed retrofitting that were illustrated for ease of understanding and to use them for the final focus groups in China (see Figures 13 & 14). These recommendations were also discussed at the UK and French focus groups mentioned above.

Figure 14: Retrofitting model

Work Package 5
INNOVATIVE FINANCIAL CHANNELS TO PROMOTE AGEING-IN-PLACE THROUGH PROPERTY (DIS)INVESTMENT

Natacha Aveline-Dubach
CNRS, University Paris 1 Panthéon-Sorbonne, France

The purpose of Work Pacakge 5 is to examine the emerging channels of investment and 'dis-investment' in real estate that are being developed to ensure adequate living arrangements for older people. In a context of structural decline of public welfare, financial investment is expected to take an increasing part in the provision of nursing homes and healthcare facilities. Pensioners' homes have also come to be regarded as a potential way of (co)funding ageing-in-place if the capital locked in property can be released. Several schemes involving the financialisation of healthcare real estate and the 'liquidisation' of pensioners' homes have recently gained importance in UK and France. China has not significantly engaged in this route, but could be led to turn to such options given the forecasted tremendous growth of its ageing population. Confronting the experiences of France and the UK is therefore needed to assess the sustainability of these funding schemes, not just in terms of efficiency, but also of affordability and spatial neutrality. WP5 focuses on four schemes that have been identified as the most likely to grow in the coming years, i.e. Healthcare Real Estate Investment Trusts (REITs), Private Public Partnerships (PPPs), the equity release system in the UK and its viager equivalent in France.

A Comparative Perspective of Healthcare REITs across UK, France and Japan

Natacha Aveline-Dubach
University Paris 1, France

The recent decade has seen the emergence of listed funds, known as 'Healthcare REITs' (H-REIT), that are engaged in the long-term management of income-producing properties dedicated to both cure and care services (medical facilities and nursing homes respectively). H-REITs is new channel for diversification within the broader REITs markets. From an investor's perspective, H-REIT shares offer comparably attracting characteristics, with returns of the underlying assets being de-correlated from business cycles and further secured by long-term leases to healthcare providers. Beyond ageing demographics and state support, the development of H-REITs is driven by a process of "sale and lease back" of healthcare facilities. Evolving medical technologies and shrinking welfare provision bring healthcare providers to outsource their working facilities in order to dedicate their capital resources to the restructuring of their core activities. However, healthcare real estate should not be regarded merely as a rewarding "asset class". Recent studies on financial investment in social facilities, including some carried out by REIT funds, have shed light on harmful effects on people's living conditions. This research aims at assessing the social sustainability and spatial equity of H-REIT

investment in major European and Asian REIT markets, more specifically UK, France and Japan.

The method involved semi-structured interviews with the major H-REITs asset managers in each country. Respondents were questioned about their business model, investment strategy, relations with their main partners, and the socio-economic composition of their nursing homes' residents. Complementary information on their property portfolios was collected through websites and annual reports. Data collection also relied on reports on welfare policies and healthcare industries.

The study fund that, although H-REITs were promised with a bright future in the three large REIT markets, mainly due to state's full coverage of medical expenses (90% in Japan), the growth of this sub-market has fallen short of expectations. This is especially the case for Japan, where the value of H-REIT assets amounts to a mere GBP583 billion as compared to 3,300 and 3,500 billion in UK and France, respectively (Table 2). One explanation of the difference it that Japanese REITs have not yet been allowed to invest in medical facilities. Indeed, cure assets are far more 'REIT-able' than care ones. Hospitals and clinics involve larger investment volumes than nursing homes, which allows economies of scale. Nearly 90% of the total H-REIT assets value in France is in the hand of a single REIT entity, Icade Santé, which holds 96 public and private clinics/hospitals. In the UK, cure assets also have an overwhelming share (86%) but are in much larger number (778), mainly in the form of small GP surgeries. Here the deseconomies of scale are offset by a lesser risk of investment, as more than 90% of REITs' tenants are funded by gouvernment bodies. In the two countries, H-REITs play an instrumental role in helping healthcare providers to modernise and adapt their facilities to evolving medical practices. However, while UK's REIT cure properties show a well balanced spatial distribution across regions, Icade Santé tends to concentate in core regional cities and near costal zones. This REIT contributes to the process of "industrialisation" of healthcare by which physicians regroup into multi-purpose medial centres in big cities. There is thus a risk that a significant faction of French territory, especially where older people are concentrating, becomes deprived from specialized medical care.

As for the care facilities, they are regarded as higher risk level because of the difficulty to built a portfolio justifying the entry cost of an IPO. Nursing homes are of small size (below 100 beds, and often 20-40 beds in Japan), and the industry is fragmented into a large number of players.

Table 2: Compared characteristics of the Healthcare REITs markets in UK, France and Japan (Source: N. Aveline-Dubach, drawn from interviews and H-REIT websites. *As of January 27, 2018)

	Number of REITs (% of aggregated value of property assets)	Number of assets	Asset value in £UK millions *	Monthly average fees for H-REITs' nursing care homes (dependent older people)
UK	2 cure (86%), 2 care (14%)	881	3,310	Asset value < £23,250: no fees Assets >£23,250: £2,500
France	1 cure (89.5%), 1 care (0.5%), 1 cure & care (10%)	146	3,546	£2,500 outside Paris (very few number)
Japan	3 care (100%)	61	583	£1,000-1,300 (+entry lump sum +10% of medical care)

While UK REITs manage well to obtain high quality healthcare services by small tenants in diversified regions, their Japanese counterparts face a serious lack of proven reliabilty of healthcare providers, along with a shortage of skilled careworkers. In France, the care industry is much less fragmented but state regulations impose stringent limitations to the supply of new nursing homes for dependant older people (EHPAD). Two REITs have recently retreated from healthcare, divesting some 60 EHPAD. The rare EHPADs still managed by H-REITs target upper (middle) class residents, whereas Japanese and UK facilities host a certain share of middle-class older people. However, in the two latter cases, older people often have to sell or downsize their home to afford the fees of the nursing homes; in the UK because self-funded residents have to cross-subsidise poorer ones, and in Japan because newcomers must pay a high entry lump-sum to healthcare providers. To conclude, the securitisation of nursing homes does contribute to the provision of modern(ized) facilities with high-quality care, but the room for expansion of this sub-sector is limited and will depend on future welfare policies.

Public Private Partnership for Health and Long-Term Care of Older People

Professor Akintola Akintoye, Felix Villaba-Romeo
Leeds Beckett University, UK

The public sector is currently working with the private sector through a process of public private partnerships to deliver housing infrastructure needs of older people in the social and voluntary housing sectors. This has helped the housing associations and local authorities in the UK to tap into this investment source coupled with the involvement of Registered Providers and Pension Funds.

It is generally recognised that neither social housing providers nor local authorities (i.e. public sector) will be able to fully provide the funding required alone either to adapt the ageing housing stock or build much needed new ones to support ageing population infrastructure requirements. The role of private sector through a process of public private partnership therefore has become imperative.

The research predominantly uses a case study approach and contents analysis of the documentation in the public domain in respect of PPPs for provision of social housing and supporting infrastructure for older people. Consistent information was collected from the case studies. The case studies are PFI/PPP projects undertaken from 2005 to 2014; these projects are now in operation stage. The six UK case studies show different Private Finance Initiative (PFI) care housing developments type of PPP at different locations in the UK, range of capital value, schemes, SPV composition, type of accommodation, type of PPP, financial context, revenue mechanism and context in which the projects were developed.

The case study projects constitute innovative example of service partnership between housing, health and adult social care, for the delivery of a preventative and enabling sheltered housing service, under either Housing Revenue Account (HRA) or Non-HRA PFI scheme adopting financial innovation with some of them through bonds debt. Some of the projects typically have specific features to cater for the social, accommodation and health needs of older people either living in their old adapted buildings or new built. For example, Stroke-on-Trent PPP, offer airy, spacious open plan apartments within a community setting, with a range of communal facilities on site – including catering facilities, fitness suite hairdressers and beauty salon.

A typical example of the projects is Cheshire East - Extra Care Housing which is a 30-year project developed under PFI Non-HRA scheme consist of a Design, Build, Finance, Operate and Maintain

(DBFOM) contract to provide 433 new flats for older people in 5 sites, in the form of Extra Care Developments. The revenues mechanism is unitary payment based on housing availability and upfront costs. The project facilitates the development for outright sale homes and homes for shared ownership.

The case studies reinforce adequacy of the PFI model to support capital infrastructure provision of housing and ancillary building and resources, as well as the FM maintenance services. The provision of the care services is in some instances provided through a specialized company or agency. All the projects involved the procuring of considerable capital infrastructure.

However, it is recognised that further developments of PFI model may be required to support care service and capital provision required to remodel / adapt / retrofit existing houses and provide assisted technologies for ageing-in-place. This new approach may mean a new type of PFI model will be required to support a reduced capital infrastructure (for remodel / adapt / retrofit existing houses) and concentrate more on the main portion of care services contract.

Equity Release in the UK

Sylvie Dubuc
University of Reading, UK

The UK government is determined to encourage self-funded care, through promoting a mixed system combining local authority and private sector funding (Care Act, 2014). The main asset of the large majority of pensionners is their house and the Equity Release (ER) financial products, actively promoted by the Equity Release Council (ERC) in the UK as a policy option to complement pension and fund ageing. ER plans allow older home owners to unlock some of their housing wealth when remaining living in their home. The cost of the service in the form of an interrest repaid when selling the property, typically at the death of their owner (or permanent move into nursing home). This research investigated the potential for Equity Release to fund ageing-in-place in the UK.

The research combined a litterature review, interviews with ER professionals (providers, advisors, actuary) and the analysis of reports and data made available by the ER providers and other UK stakeholders. The review of previous published work on ER was especially useful to undestand the organisational structure of the ER industry and produce an overview of the history of the ER market in the UK and its regulations. Recent reports, data and interviews allowed to produce an updated description of the ER products on the market, eligibility criteria, their cost and conditions of applications and to characterise the ER customers. Insights from ER professionals and stakeholders point to some of the barriers to the development of ER.

Currently ER under the form of a single lump sum, or increasingly an initial smaller lump sum and additional reserve, is on average about 30% of the total value of the property, subject to owner age, life expectancy and property estimated value. ER is used by better-off customers to improve their house and other activities to enhance their quality of life (e.g. long holidays). It is used by others to repay depts and complement their pension to make ends meet. It is sometimes, and apparently increasingly used to help children and only marginaly used to pay for social care so far. With a counpounded interest rate just below 6% on average, plans over 15 years may cost most of the estimated value of the property, although the ER sector argues that continous increase in housing prices should compensate (at least in part) the interest costs. Overall the baby boom generation has indeed benefited from steady increase in UK house prices, especially in London and the South East region but housing market fluctuations and geographical variations make

ER cost much uncertain. ER may work for the asset rich pensioners. In the current economic and social policy context, it remains unclear, how older homeowners, especially those asset below average – income poor (socially and/or geographically relatively less advantaged), are going to be able to help their children while using their house value to compensate for their pension shortages and support their care cost. Mainstreaming ER to support ageing costs encompass a risk to reinforce social and geographical inequalities, in comparison to a welfare system based on people's work income, through intergenerational processes of wealth redistribution. We recommend this risk to be investigated.

The French Viager System in France

Natacha Aveline-Dubach, Coline Meunier
University Paris 1, France

France has a similar mechanism to the equity release, although it is not a reverse mortgage but a dismemberment of ownership into usufruct (right to use) and bare ownership. Called 'viager', this scheme allows older owners occupants to sell their property for approximately 40% of the appraised value ('bouquet'), and stay at home while enjoying a "monthly life annuity" (as income from usufruct) until their death. Despite a very long existence, the viager market has remained a niche market of 2,500 transactions/year over the past years (less than 1% of all housing transactions). The purpose of this research was to explore the characteristics of the viager system, and to assess its efficiency in supporting ageing-in-place for all social groups.

The method consisted of a literature review, in-depth interviews with real estate agencies specialized in viager, data collection through a wide range of documents and reports, exploitation and cartography of the database of viager transactions in the Paris area compiled by the Chambre des Notaires (BIEN database).

Our findings indicate that viager has three weak points. First, it involves too great a risk for the buyers, not to mention the macabre dimension of a 'speculation on the seller's death'. To alleviate risk, the buyers —mainly individuals in their 40s— tend secondly to select the most attractive residential regions, which results in a concentration of transactions in the South-eastern 'wealthy sunbelt' and in the Paris metropolitan area. Third, given the case-dependency and relative complexity of the assessment methods, viager transactions are undertaken by specialized real estate agencies, which limits further their geographic scope. In conclusion, viager is a well-functioning system for 'asset rich, cash poor' people who generally use the monthly life annuity to complement their pension and support their relatives. This system could be improved and better distributed by developing specialized knowledge within the real estate industry, and, above all, by mitigating the risk for purchasers through tax incentives, dedicated insurance products and/or pooling transactions through collective investment schemes. However, given that a vast majority of older people live in areas that are far removed from buoyant housing markets, it is doubtful that the current attempts to modernize viager will have significant impact.

Work Package 6 - Part 1

SCENARIO BUILDING FOR LIVING ARRANGEMENTS OF OLDER PEOPLE IN CHINA: MULTI-AGENT SYSTEM ANALYSIS

Dr Zan Yang, Shuai Fang
Tsinghua University, China

1 Objectives and Designs

This part of WP6 examined how Chinese older people's living arrangements will develop in the future years. It aimed at studying the evolution of living arrangements in China from household, social and economic perspectives. The input to the analysis are based on the WP1 study. The specified factors are from four aspects studied in other WPs:

1. Income of the older people
2. Care and services received by the older people (WP3).
3. Housing conditions (WP4)
4. Government financial supports (WP5).

Figure 15 is a flowchart of this part of analysis. Based on China Health and Retirement Longitudinal Survey (CHARLS), we classified older people into 15 groups according to their income, age, sex, health, the number of children, the number of grandchildren, housing features and coverage of health insurance. Using a Multi-Agent System (MAS), we analyse the possible changes in living arrangements for each of the 15 groups given the potential evolutions in pensions, housing retrofitting, care services and financial methods suggested by the other WPs. These results can help forecast the living arrangements of older people in the future China.

All project participants contribute to this part.

2 Methodology

2.1 Multi-Agent System(MAS)

A multi-agent system (MAS) is a computerized system composed of multiple interacting intelligent agents within an environment. Multi-agent systems can be used to solve problems that are difficult or impossible for an individual agent or a monolithic system to solve. An agent is anything that can perceive its environment through sensors and act upon that environment through actuators. An agent that always tries to optimize an appropriate performance measure is called a 'rational agent'[1]. A 'rational agent' can act flexibly and autonomously in order to meet its design objectives. This means that the rational agent must be:

- Responsive: agents should perceive their environment (which may be the physical world, a collection of agents, the Internet, etc.) and respond in a timely fashion to change that occur in it.
- Proactive: agents should not simply act in response to their environment, they should be able to exhibit opportunistic, goal-directed behavior and take the initiative where appropriate.
- Social: agents should be able to interact with other artificial agents and humans in order to solve their own problems and to help others.

1. Vlassis, N. (2007). A concise introduction to multiagent systems and distributed artificial intelligence. Synthesis Lectures on Artificial Intelligence and Machine Learning, 1(1), 1-71.

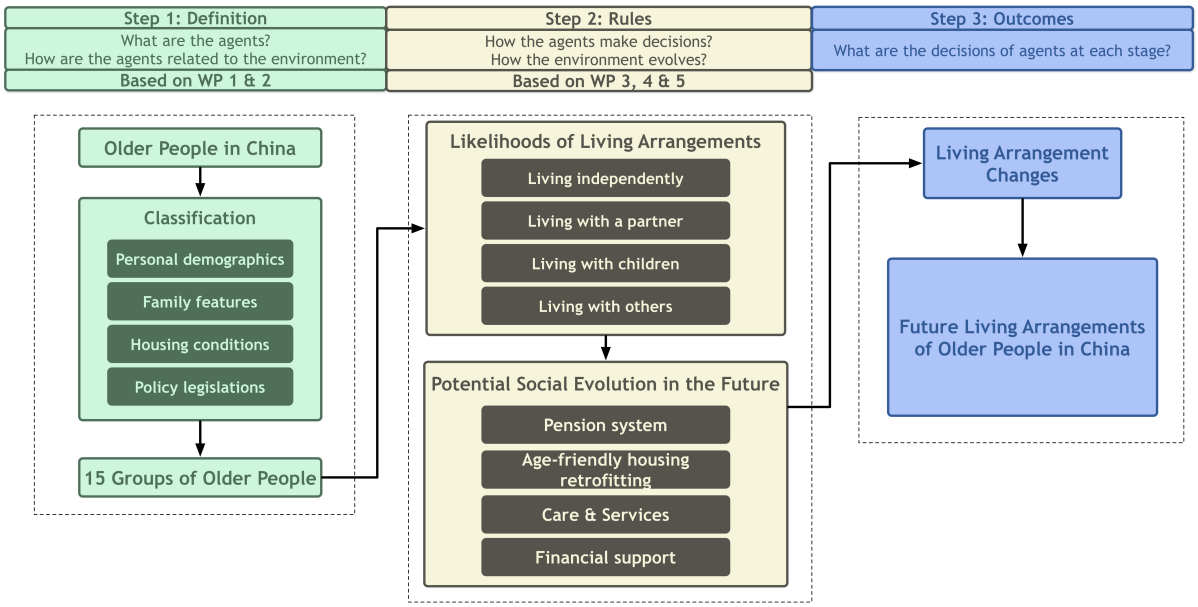


Figure 15: WP6 multi-agent analysis flowchart

The process of MAS modelling consists of 3 steps:

1. Determine the attributes that can describe the state of environment and the agent respectively, and set objects for agents. Determine the inputs and outputs of every state.
2. Design the rules. To meet design objects, what rules agents shall follow when choosing their behaviour as conditions change? How environment changes as conditions change?
3. Quantify the behaviours and decisions of agents at each state, and choose the strategies of the next state according to these evaluations.

Based on multi-agent systems, we apply Netlogo for dynamic simulation modelling. We set the parameters of the various types of agents within the system environment and the rules of action, so that the agents can follow these pre-set goals and rules to make decision, at the same time, each decision-making or action will also affect the system environment. Therefore, the interaction between the agent and the agent at micro level, and the interaction between the agent and the environment eventually come into the macroscopic simulation result.

2.2 Classification of the Older people

In this research, the classification of older people is completed by a decision tree model, and the probability of living arrangement in each group is calculated respectively. The factors that affect the living arrangement of the Chinese older people are (results from WP1): income, age, sex, health, relative income, the number of children, the residential area, living in urban or rural areas and whether to be covered by health insurance. In CHARLS waves 2011 and 2013, there is a total of 8,859 qualified individuals. The classification of them is shown in Figure 16. There are 15 groups classified by the characteristics of housing area, health, age, income. The proportions of living arrangements in each group were calculated

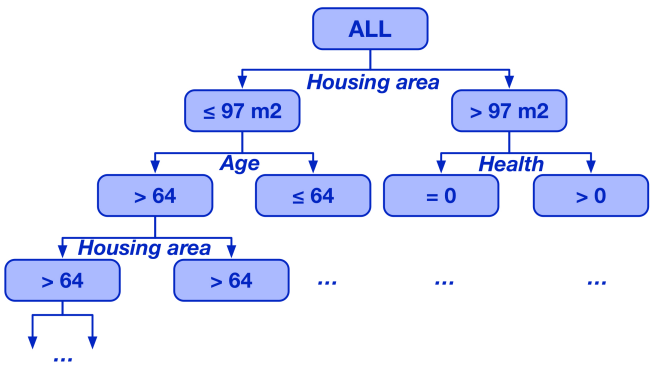


Figure 16: Classification process using Decision Tree

Table 3: Classification of the older people and likelihoods of living arrangements

Group	Characteristics				Living arrangement/(%)	
	House area	Age	Health	Income/ (RMB/m)	Live with children	Live without children
1	>124	-	>0	-	65.60	34.40
2	97-124	-	>0	-	58.34	41.66
3	>146	-	=0	-	57.07	42.93
4	97-146	>66	=0	-	47.74	52.26
5	97-146	≤66	=0	-	53.42	46.58
6	68-97	>64	>0.426	-	57.81	42.19
7	68-97	>64	≤0.426	>33600	5.56	94.44
8	68-97	>64	≤0.426	≤33	40.56	59.44
9	26-68	>64	>0.712	-	100.00	0.00
10	26-68	>64	≤0.712	-	28.57	71.43
11	≤26	>73	-	-	9.68	90.32
12	≤26	64-73	-	-	23.86	76.14
13	≤97	59-64	-	-	42.70	57.30
14	≤77	≤59	-	-	48.70	51.30
15	77-97	≤59	-	-	62.76	37.24

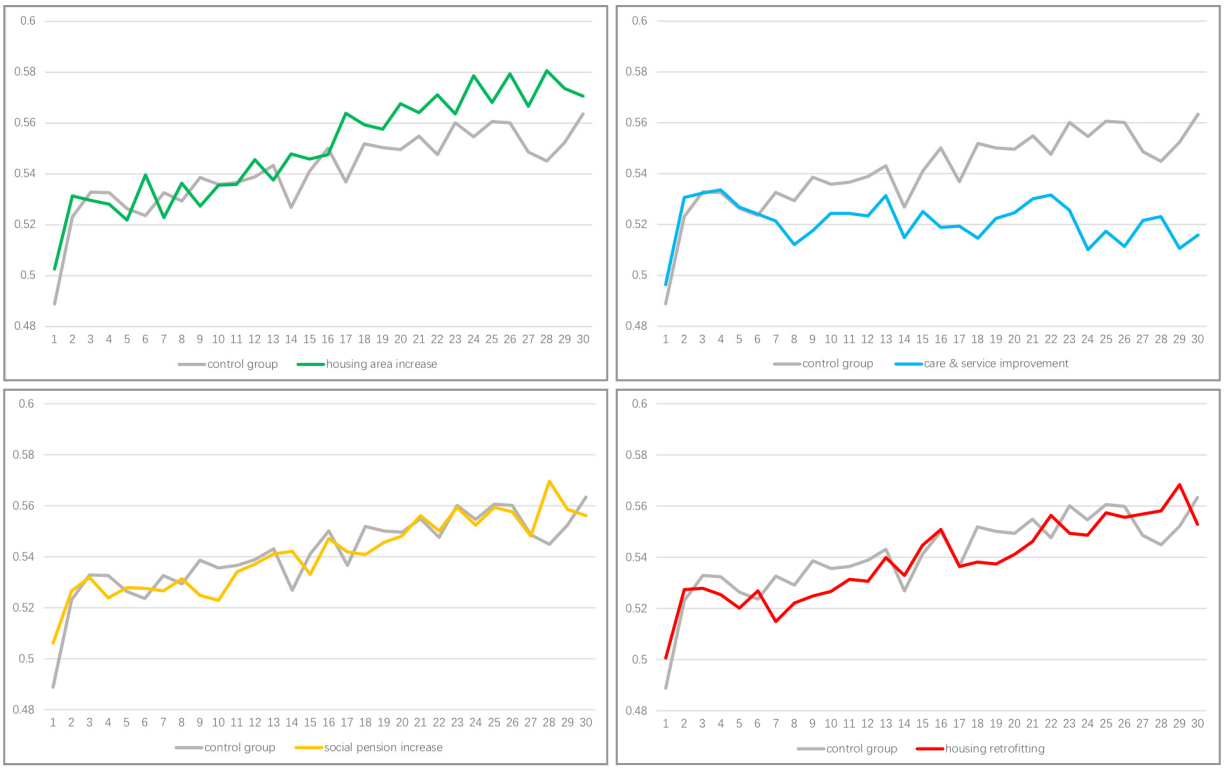


Figure 17: Forecasted percentage of older people living with children in China

separately and were used in the subsequent simulations (Table 3).

3 Results and Discussions

Figure 17 shows the forecasted percentages of older people living with children in the period of 30 years in China. In the control group, we can see that during this period, the proportion of those who live with children increases slowly from about 50 % in the first year to 56% in the 30th year.

Based on the control group, we modify the circumstances of the older people, and we get the following results:

1. Due to improvement of living conditions with support of governmental policies, if the housing area of 10% older people living in the smallest size increases by 10%, the proportion of older people living with children will increase to 58%.
2. In our model, we consider future promotion of care delivery system in China. Specifically, we set a 50% discount in the probability of experiencing a health issue and examine the changes in living arrangements. The proportion of older people living with their children will slightly decrease after the 5th year and will eventually reach 51%. In this case, we can assume that social care support can substitute care from children.
3. If we adjust the income levels of older people below the median income level, to allow their income to increase by 10% due to the improvement of the pension system in China, no significant changes in percentage of older people living with children are observed.
4. Considering the potential housing retrofitting, we assumed a 20% increase in the income level of the older people who are below median income level. Similarly, no significant changes are found. This could due to the data limitation. We have to simplify the states in our simulation because of lack of quantified information on housing retrofitting, government subsidies and social pension. If more information is available, we believe the analysis can be improved.

The MAS developed in this study built a theoretical and practical foundation to understand how the factors that we focus on ODESSA project are important in promoting ageing-in-place in China in the future. So far, due to the data limitation, we only study a case on living with children. More living arrangements can be developed in the future. In this case, we simply account for the role of housing retrofitting, financial models from the income perspective. Deeper analysis on their roles in the system can be further developed. In addition, this system can be developed to capture the policy changes and interactions between the government, enterprises and older people when there are relevant new data.

Work Package 6 - Part 2

SCENARIO BUILDING AND EVALUATION FOR OLDER PEOPLE IN CHINA

Professor Karim Hadjri, Dr Tulika Gadakari, Dr Junjie Huang, Jingjing Wang
University of Sheffield, UK

This Work Package also contributed a set of data to develop scenarios for China. This has allowed the synthesis of results from WP1 & 2 on longitudinal surveys which informed the scenario building. Further data results from WP3-5 were added to these scenarios to produce a coherent set of possible developments that China can benefit from in order to provide age-friendly environments and adequate care provision to its ageing population.

1 Description and Objectives

We identified different potential effects of a housing and care delivery model in China through scenario building, to investigate how it changes in existing conditions, and enable value judgement, and allow future predictions with same concept and model under different probable scenarios [1].

Scenarios were developed to highlight current challenges in terms of housing, health and social care provision for the ageing population. This informed the 12 scenarios so that they reflect current realities in China and provide a platform for an effective framework that will support stakeholders in China address age-friendly environments and better health and care provision for the older population.

2 Details of the Methodology

2.1 Scenario building

Findings from WPs1-5 were mapped using variables for scope definition, driving forces and trends, possible scenarios, and strategic

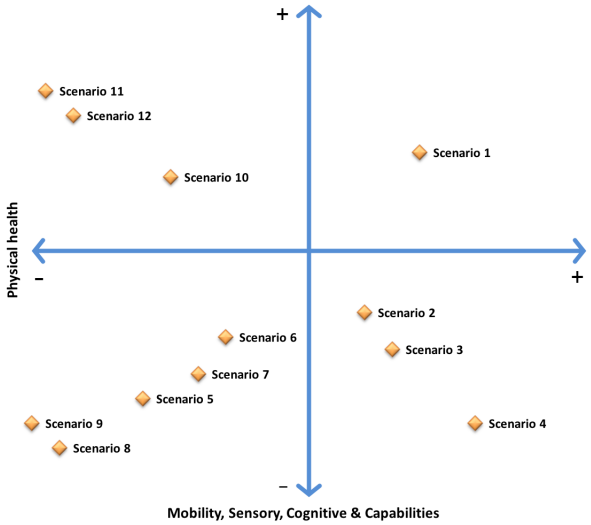


Figure 18: Position map of 12 scenarios

Figure 19: WP6 scenario evaluation poster example

1. Phelps, R., Chan, C. and Kapsalis, S.C. (1998), 'Does scenario planning affect performance? Two exploratory studies', Journal of Business Research, Vol. 51, No. 3, pp.223–232.

options. Data from longitudinal surveys (CHARLS, ELSA, SHARE) were examined for comparative analysis. Then CHARLSs data was used to generate possible scenarios for China (age, gender, number of grandchildren, distance to children and co-residence, living with partner, education, type of building, special equipment for mobility, etc.). This led to the development of 12 scenarios as highlighted by the position map (see Figure 18).

Each scenario has a description, current needs for this person, existing support, and proposal for future-proofing adjustments in home design, health, social care and technology. Illustrations developed or retrofitting as part of WP4 were used to illustrate these potential adjustments (see Figure 19).

For example, scenario 1 states:

> *"A 60 year old couple who will be retiring shortly are planning for their future. They are currently in good health though one of them anticipates the occurrence of a stroke due to familial medical history. They realise that currently the apartment and building in which they live is not equipped to support their future needs for independent living. They are keen on using technology to alert their children who live in the same neighbourhood (less than 5km away), as well as manage other activities of daily living. They are currently physically active and enjoy gardening as well as many other social activities."*

2.2 Evaluation of scenarios

These scenarios were evaluated at two public events in China where Likert feedback was collected on their plausibility and robustness

Figure 20: WP6 scenario evaluation events in Beijing

(5 point scale), importance (5 point scale), value (5 point scale), and whether the scenarios were optimistic or pessimistic (3 point scale), and whether they accepted it or not (3 point scale). Qualitative feedback was also collected as comments.

2.3 Analysis of the feedback data

Both detailed qualitative and descriptive statistical means (e.g. the value of mean, median, mode, standard deviation, minimum and maximum) of the feedback data were examined, to identify the most important issues of each scenario and to enable further evidence-based scenario improvement derived from WPs 1-5. Furthermore, the relationship between each feedback questions on plausibility, importance,

Table 4: Overview of the WP6 scenario evaluation feedback data

	Total number	Female	Male	Mean Age	General feeling	Acceptance
All scenarios	215	152	57	68.41	0.76	0.89

value and general feeling and acceptance of the scenarios were also examined by means of correlation.

3 Results and Discussion

3.1 General results

In total, 215 valid feedbacks were collected. Generally speaking, 71% of the participants were female, while 26% of them were male. The mean age of all participants is 68.41 (see Table 4).

The mean score of optimism is 0.76, and the mean score of acceptance is 0.89. The score of optimism is slightly lower than acceptance. This is because in the respondance of optimism, 73% of the participants felt optimistic with the 12 scenarios, but 22% of them replied as fair, even though only 1 participant (0.4%) feels pessimistic of scenario 12. While for acceptance, 91% of the respondants chose to accept the 12 scenarios, although 5% of the respondants chose rejection in 8 of the 12 scenarios (see Figure 21).

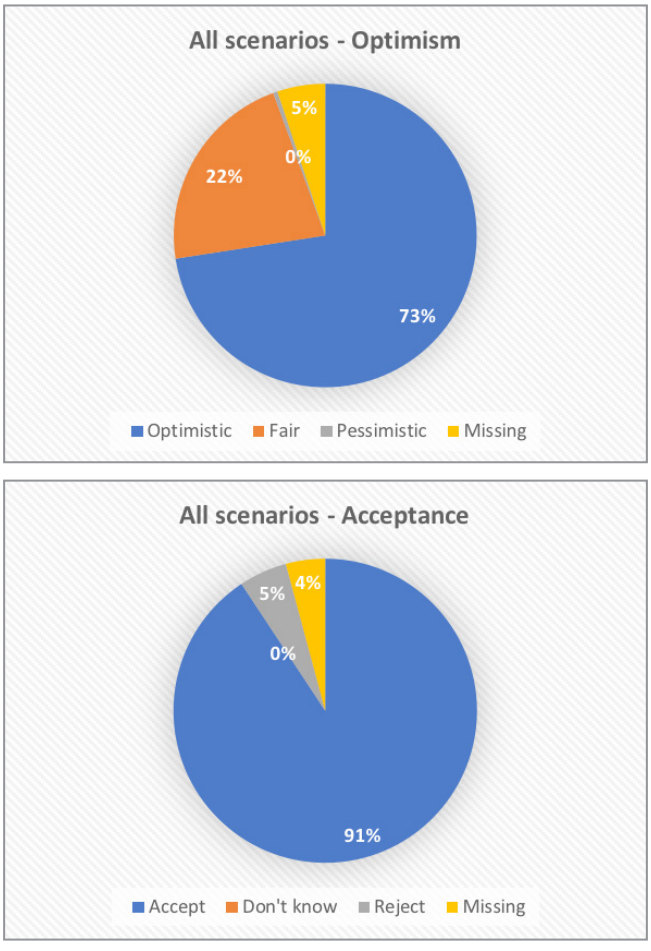


Figure 21: Overall result of General feeling and Acceptance of the scenarios

3.2 Detailed analysis of each scenario

Detailed examinations of all 12 scenarios have been carried out to reveal in-depth findings. The analysis examined both statistical and qualitative means of the evaluation data. The analysis has enabled follow-up scenario improvements.

For example, for scenario 1, 86% of the participant chose to accept this scenario (mean value 0.90, slightly higher than overall mean value 0.89), but only 64% of them considered the scenario as optimistic (mean value 0.67, below overall mean value 0.76). Participants are not satisfied with the plausibility of realistic issues and usefulness, the importance of family, community and social connectivity, and its value to the older people.

Besides, comments from participants show their concerns of more retrofitting needs in:

- Housing physical environment (e.g. hand rail, double bed, outdoor spaces).
- Technology (e.g. alarm system, hearing aids).
- The needs of a training system and professional inspectors.

Based on the results, the suggestions below were provided for further scenario development:

- Provide more efficient family, community and social support (WP3).
- Provide more environmental and technology retrofitting options for ageing-in-place needs, e.g. hand rail, alarm system (WP4).
- Provide policy, regulation, and professional inspectors (WPs 1-5).

3.3 Conclusions and suggestions for further work

Conclusions from the WP6 scenario feedback analysis and further work are summarised below:

1. Living arrangements suggestion (WP1+WP2): In China, a large amount of older people live together with their children. The living arrangement suggestion is one of the key concerns in the participants' responses to the scenarios in which the older person/couple is living with their family members. WP6 feedback research suggests to include this information in the improved solutions for related scenarios.
2. Social, community, and family support (WP3): The feedback result shows relatively low satisfaction level in social, community and family support solutions of the scenarios. It is a key concern in the scenarios in which the older person/couple has mental health issues or dementia difficulties. Better family, community and social support model will benefit the improvement of the scenarios.
3. Health solutions (WP3, WP4): Participants paid significant attention in the health solutions of the scenarios in which the older person/couple may have emergency needs. The key concern is how to acknowledge the health centre/hospital under emergency situation. The system between the older people and the health centre/hospital and the technology to enable the system are both important to the improvement of these scenarios.
4. Housing retrofitting options (WP4): Feedback from participants showed significant interest in providing additional environmental and technology retrofitting options, such as electronic beds, and technology for emergency alarm system. A careful check of the retrofitting option list and the up-to-date environmental and technology options are necessary and helpful to build up better guiding scenarios.
5. Financial issue (WP5): In some of the scenarios, participants would like to have more information regarding a proper financial model to help with the cost of retrofitting needs. The WP6 feedback research suggests to build up realistic financial solutions for each scenario, to improve the guidance for ageing-in-place scenarios.
6. Policy, regulation, and professional inspection needs (WPs1-5): Participants' comments indicated that related regulations and policies are important to enable older people's better ageing-in-place opportunities. In addition, the establishment of professional inspections is a way to secure the implementation of regulations and policies.

The University Of Sheffield.

PRINCIPAL INVESTIGATORS

UK: Professor Karim Hadjri, The University of Sheffield

China: Dr Zan Yang, Tsinghua University

France: Professor Marie-Eve Joël, Université Paris-Dauphine

CONTACT US

n.rowland@sheffield.ac.uk

www.sheffield.ac.uk/architecture/odessa

@Odessa_Ageing