Housing, health and wellbeing of older persons in China and India

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R. Antczak, A. Zaidi. Housing, health and wellbeing of older persons in China and India. Gerontechnology 2016;15(1):45-57; doi:10.4017/gt.2016.15.1.009.00 **Background** This paper presents an analysis of the wellbeing of older persons in China and India, with a focus on the linkages between different features of housing and life satisfaction and self-rated health as elements of wellbeing. The motivation of the paper is drawn from the fact that housing is a critical aspect of living conditions in later life. Older persons experience decreasing functional capacities and require greater support in their times of rising frailty and vulnerability. Additionally, a large majority of Indian and Chinese older persons live in their own homes, without the obligation of an outstanding mortgage, and they are more likely to have emotional, subjective attachment with their homes than younger persons. Housing conditions can contribute to wellbeing both as a stressor and as an enabling factor. Therefore, one of the aims of this study is to assess in what way, positive or negative, housing conditions influence wellbeing of older persons in the context of India and China, two most populous countries in the world with the fastest ageing populations in the world. In 2015, persons aged 60 and over living in those two countries constitute 36% of worldwide population of 60+ and this share will grow to 39% in 2030. This paper also examines whether housing influenced one or both commonly used measures of older people's wellbeing, namely life satisfaction and self-rated health. We also examine which housing features have the highest influence on subjective wellbeing. **Method** This paper uses micro data derived from the first wave of the WHO Study on Global AGEing and Adult Health 'SAGE' carried out in India and China during 2007. For the assessment of housing conditions, the paper constructs a composite index of housing quality (QoH) drawing from data on a number of housing attributes available in the SAGE survey. The relationship between housing conditions and wellbeing indicators is then examined using multivariate modelling methods (viz. ordered probit regression). The use of interaction terms allowed highlighting the differential impact of varying housing attributes for persons. **Results and discussion** Housing conditions vary significantly between the two countries analysed. Older population in China experienced much better conditions than those observed for India. The key findings confirmed the importance of housing conditions for the subjective wellbeing indicators of older persons. However, surprisingly, this relationship is stronger in the case of the life satisfaction measure, and rather limited for the self-rated health measure, leading to conclusion that housing features do not have influence on all aspects of wellbeing. Additionally, notable differences are found in these relationships between India and China, which implies that perception of housing and its importance may be dependent on other external public services as well as on the context of culture and environment.

Keywords: housing, amenities, self-rated health, wellbeing of older persons, China, India

Individual ageing is a process of human adaptation to external environments alongside changes in intrinsic capacities with time. In this dynamic process, biological, behavioural as well as environmental factors affect health and wellbeing of persons, as argued in the seminal work of Lawton and Nahemow[1]. It is the late phase of one's life that is said to be particularly sensitive to the nature and character of person-environment interactions. Four sectors comprising 'the good life' are: behavioural competence, psychological wellbeing, perceived quality of life, and objective environment[2], where housing is an important part of the objective environment. Housing is the foundation of family life, a platform for dignity and self-respect; it gives opportunities for learning, health and employment. According to Bratt[3], housing affects the wellbeing in three ways: (i) physical attributes, which ensures everyday functioning and therefore safety, (ii) relations with other occupants (space sufficiency, sharing of resources, opportunities to create positive sense of self and empowerment, stable and secure), and (iii) neighbourliness (quality and safety of the neighbourhood, accessibility to employment, education and other services).

HOUSING AND AGEING

For older persons, their house is "a central hub in their life because the very old individuals spend most of their time at home"[4] and staying at home is a "preferred strategy by the elderly"[5]. In old

age, intrinsic capacities of the person are declining and this leads to limitations in activities of daily living. Therefore, a place where older persons spend the most of the time should help deal with these limitations[1].

The housing choices are shaped by a combination of life-course circumstances and external barriers[6]. Housing dynamics are observed also in old age, (e.g. moving to or from urban area, changing to smaller or more convenient place, or for proximity of children or grandchildren), in dealing with reduced mobility, and changing living arrangement, either by living with carers or pursuit to maintain independent living, and some of these changes are determined by the income and wealth status of older persons[7].

Housing as a shelter is a basic human need. Satisfaction of needs connected with housing (e.g. security, personal space, temperature and noise comfort) enhance mental wellbeing[8]. There were several studies showing how housing influence wellbeing of a person, especially in old age[8-11].

Home-related attributes (such as comfort, size of the apartment, degree of light, insulation) have a high influence on residential satisfaction: The higher number of necessary amenities and the more space for persons in the dwelling, the higher residential satisfaction[12]. Older people living in more accessible housing perceived their homes as more useful and meaningful[13]. Therefore, the perception of one's own house can vary depending upon the function it serves. However, dwelling conditions can also act as a stressor and become a contributing factor for psychological wellbeing. Environmental factors, such as dwelling conditions, can adversely affect wellbeing of older persons[8]. The mechanism behind it is the failure to meet preferred living conditions which is the proof of "inability to alter the unwanted circumstances of their lives"[14].

The other important attribute of housing are ownership rights, but its influence is rather vague. Tenure type may have significant influence on wellbeing by affecting freedom, privacy and a sense of self-worth. Some research show that tenants experience abuse by their landlords (verbal, financial, neglect of repairs, illegal evictions)[6]. On the other hand, there is evidence that tenants are more satisfied than owners[15], which could be the result of a lesser burden (less problems with maintenance, no need for difficult choices such as selling the house). Tenure type as a predictor of wellbeing is highly dependent on environmental circumstances, including the presence of affordable and secure housing for rent.

The relationship between housing conditions and wellbeing could be, however, a result of material wellbeing of the person and household. It is difficult to disentangle housing conditions from income and wealth of a person[3]. Hence it is important to include material wellbeing factors to the analysis of housing conditions and wellbeing.

Health and subjective wellbeing
Research on the relationship between health and housing are well developed. In old age this relationship is becoming more significant as older persons are more vulnerable to environmental challenges[16]. A general link between housing and health is manifested by the situation that older persons who are able to remain active, live in their own house, while dependent people stay in nursing homes[7,8]. It is also manifested by limitations in everyday functioning, which result in difficulties using home[4].

There is evidence on more meaningful effects of housing on health. Housing problems, as defined also by overcrowding and not owner-occupied, are responsible for ill health[17]. People living in deprived housing poverty area have a higher risk of depression and poor health[18,19]. Living in a poverty area increases mortality rate and the higher risk of death is independent of individual behaviours[20]. Housing deprivation -not only current, but also past- has substantial impact on the risk of severe ill-health[21].

Internal hazardous conditions of the house have impact on health of older persons, especially incidents of falls[4,22,23] and an improvement in housing conditions may decrease number of falls in old age[24].

In social sciences, self-rated health is the most often used single indicator of general health. It is connected with morbidity[25], and poor self-rated health predict higher mortality[26,27]. Some studies showed better self-rated health is associated with better housing quality[28]. Improved self-rated health was most strongly associated with improved satisfaction with apartment or building (condition and comfort of the apartment, condition of the building) and apartment related social components (relationship with neighbours, rent and mortgage)[10].

The other important factor, which is shaped by housing, is subjective wellbeing. The origin of subjective wellbeing has roots in an American approach to wellbeing studies, which underlines consumer perception of needs satisfaction. They can be expressed by subjective evaluation using satisfaction with life and happiness[29].

Subjective wellbeing has usually two dimensions – cognitive and affective[30]. Most often used measure of the cognitive aspect is life satisfaction[30,31]. For the purpose of this study we applied this measure to be consistent with another indicator –self-rated health– which is also rather cognitive than affect driven. Life satisfaction, as one of the aspects of psychological wellbeing, could be influenced by housing condition[8].

However, the relationship between housing conditions and life satisfaction is more complex and not clear. One of the outcomes of housing conditions can be satisfaction with current residence and the relationship between this indicator and life satisfaction may indicate how housing influences subjective wellbeing. Some research found this relationship to be an artefact. People with better health, higher income, and better mobility have higher psychological wellbeing, and thanks to high income, they can also ensure themselves higher quality residence. Such a residence improves safety, comfort and self-worth of the person, which result in a higher level of psychological wellbeing[11], therefore the initial reason is better material wellbeing, not housing itself.

Some studies showed also that not only living in better conditions, but also moving to a better living environment increases happiness and life satisfaction and this effect can last several years[32]. Certain attributes of the house –such as size measured by number of bedrooms– influence life satisfaction, but this is not a universal finding – it depends on the cultural and economic context of the person[28]. People with better-equipped houses living in the lower developed areas are more satisfied with life, whereas in the developed areas, satisfaction with home environment and duration of living within the same dwelling are good predictors of wellbeing, not the equipment of the house[15].

Subjective wellbeing is also correlated with housing accessibility, measured by detailed evaluation of outdoor environment, entrance and indoor environment of the house, but this dependence was not very high, confirming the complexity of the construct of subjective wellbeing[33].

National and cultural differences
The issue of cultural and national differences in perception of housing conditions is rarely analysed[34]. This relationship is rather vague. Cultural difference can play an important role in perception of different dimensions of housing quality[10,35]. Housing differences between countries are natural and due to differences in climate, religious background and economics; perception of housing and its attributes can be different[36].

However, the relationship between national origin and perception of housing is unclear yet. There might be cross-national differences in aspects of housing satisfaction, e.g. overall size of housing, location of rooms and overall layout of the house, pre-installed lights and air conditioning[37]. However, other research, conducted in the context of five European countries, showed universalities – very old people who live in better accessible homes and who perceive their homes as meaningful and useful are more independent in daily living and have higher subjective wellbeing and this finding is independent of country of origin[38].

In China rural residents have a long history of owning a house, whereas in urban areas residents had no right to own a house. Since early 1980s, the Chinese government started to sell dwellings to private owners and now the rate of home ownership in cities increased significantly[7,9]. A majority of older persons (85%) own their housing property, higher ownership is observed in rural areas (despite housing reform). Special needs housing facilities for the elderly are inadequate in all areas, especially those serving the disabled. But most of the older persons have access to basic facilities: 98% live in houses with electricity, 79% have tap water and 79% a kitchen[7,9]. Studies on housing conditions of elderly in India are very rare, and one of them from mid 1990s was focused on living arrangement and access to care homes for older persons[39]. Our research has ambition to fill this gap with an additional comparative aspect.

It should be noted, though, that the situation of older people in China and India is different. The internationally recognised composite measure of older people's wellbeing –Global Age Watch Index– ranks China on 52nd position worldwide and India on 71st position. China scores better on health, capability and enabling environment dimensions, whereas income security of elderly is on a similar level. Older people in China enjoy higher life expectancy, have higher employment rate and better absolute welfare, but risk of poverty is lower among Indian's elderly. More details of the results for the Global AgeWatch Index are discussed in its methodology paper[40].

The first aim of this study was to describe housing conditions in the two most populous developing countries, namely China and India[41], with strong emphasis on comparative analysis. This was done not just by descriptive analysis, but also by building of a composite index of housing conditions and looking at differences in housing conditions between groups of older persons. The second aim was to examine the relationship between housing conditions (in general as the composite index and analysis of specific ameni-

ties separately) and two measures of subjective wellbeing: self-rated health and satisfaction with life. The expected outcome of the study was not only showing what are the housing conditions of older persons in those two countries, but also to assess the hypothesis that housing conditions do influence subjective wellbeing and that this relationship is different in different housing circumstances (lower developed country – higher influence of housing conditions on wellbeing)

The WHO's SAGE survey
The WHO Study on Global AGEing and Adult Health (SAGE) is a longitudinal study collecting data on adults aged 50 years and older, with a smaller sample of persons aged 18-49 years old for comparative purposes. It has been conducted in six countries: China, Ghana, India, Mexico, Russian Federation and South Africa. First wave was conducted between years 2007 and 2010. SAGE is supported by the WHO and the U.S. National Institute of Aging (NIA) through an Interagency Agreement.

SAGE uses two questionnaires: household and individual. The household questionnaire covers household roster, housing information, household family support networks and transfers, assets, household income and expenditure data. The individual questionnaire consists of 11 sections: Socio-demographic characteristics; Work history and benefits; Health state descriptions; Anthropometrics, Performance tests and biomarkers; Risk factors and preventive health behaviours; Chronic conditions and health services coverage; Health care utilisation; Social cohesion; Subjective wellbeing and quality of life; Impact of caregiving; and Interviewer assessment.

The housing section consists of 15 questions covering the following issues: dwelling ownership, approximate value of the dwelling, number of rooms in the dwelling, type of floor in the dwelling, type of walls, main source of drinking water, main source of non-drinking water (for those who use bottled water for drinking), time needed to get the water (for those who don't have water in the dwelling), person responsible for fetching the water, type of toilet facility, is toilet shared, type of fuel used for cooking, and for those who don't have gas or electricity for cooking – is food cooked in open fire, whether the stove has a chimney and whether the cooking is done in a separate room in the house. Since for some of the questions the number of observations was very low, we used only some of the above-mentioned variables of the full list.

Both subjective wellbeing questions we used in the study come from the individual questionnaire.

Self-rated health (*"In general, how would you rate your health today?"*) is evaluated on a 5-point scale from 'very good' to 'very bad'. The other indicator - life satisfaction (*"Taking all things together, how satisfied are you with your life as a whole these days?"*) was also measured on a 5-point scale from 'very satisfied' to 'very dissatisfied'.

The SAGE study uses multistage clustered design samples. Each household and individual is assigned a known nonzero probability of being selected and household and individual weights were used to weight up to the entire population[42]. This paper focuses on the population aged 60 years and over (*Table 1*). Total sample of this population amounted to 7,560 in China (50.2% of total SAGE sample) and 3,971 in India (32.6% of SAGE sample).

RESULTS
Dwelling ownership
Without analysing property rights, we can say that the basic requirement for housing security in old age is fulfilled in both countries. Moreover, 93% of older persons in India and 87% in China live in owned houses, which are fully paid, hence without the burden of repaying a mortgage. Only 10% of people in China and 5% in India occupy rented or other (free of charge) houses.

The distribution of full ownership is not equally distributed among different groups of respondents, though. This is especially visible in China, where we observed the lowest share of full ownership (owned and paid) among older persons who are:
-divorced or never married: 78%;
-living in urban areas: 80%;
-from the oldest group (80 years and older): 81%;
-from top income quartile: 82% (10% rented);
-not working currently: 83%.

The highest share of fully owned houses was in rural areas (94%), among people currently working (93%) and in 1st income quartile (92%). There were no differences between man and women and between education groups in home ownership.

The distribution of full ownership in India is more flat. There were no differences between age groups, man and women, married and widowed, education and income groups. However, there is a difference regarding place of living: 95% of older persons in rural areas had full ownership and 88% of those living in urban areas. People living is big households (7 and more persons) had also a higher share (95%) of full ownership.

The analysis suggests that place of residence is an important factor influencing dwelling own-

Older adults' housing in China and India

Table 1. Characteristics of samples taken from the population aged 60 years and older in China and India in the SAGE study

Characteristic		China		India	
		n	%	n	%
Total sample		7,560	100,0	3,971	100.0
Gender	Male	3,586	47.4	2,094	52.7
	Female	3,974	52.6	1,877	47.3
Age groups	60-69 years old	3,968	52.5	2,456	61.9
	70-79 years old	2,802	37.1	1,148	28.9
	80 years and older	790	10.5	367	9.2
Place of residence	Urban	3,960	52.4	1,021	25.7
	Rural	3,600	47.6	2,950	74.3
Education level	Never in education	2,588	34.2	2,362	59.5
	Primary incomplete	1,323	17.5	448	11.3
	Completed primary	1,447	19.1	497	12.5
	Secondary and higher	2,202	29.1	664	16.7
Employment status	Never worked	931	12.3	1,019	25.7
	Not working currently	4,454	58.9	1,514	38.1
	Currently working	1,901	25.2	1,087	27.4
	No answer	274	3.6	351	8.8

to the dwelling). In India only 16% of older persons live in dwellings with water piped directly to their apartment. For the majority (55%) drinking water source is tube well or dug well, whereas in China slightly more than 15% use tube well or dug well. In China a flush toilet is used by 64% and 32% used a pit latrine. In India almost 50% of older persons lived in dwellings without any toilet facility; almost 39% have a flush toilet and 10% other types of toilet. A significant majority (81%) of toilets are not shared in both countries.

ership in both India and China. Additionally, in China income and employment status play important roles.

Housing quality
Whereas India and China share similarities with regard to home ownership types, housing quality is very different in those countries. The older population in China live in much better condition than in India.

In China older persons have definitely more space in their apartment. This is mainly due to much smaller number of persons in household in China as compared to India. Almost 41% of older persons in China live in a dwelling with at least 2 rooms per person, and only 17% of older persons live in high density houses (less than 1 room per person). In India only 24% have at least 1 room per person. More than 40% of older persons in India live in dwellings with 1 (or even less) room per 2 persons.

Space is one of the factors of housing quality with others being type of dwelling and the housing facilities. In case of all of the facilities, China dwellings are better equipped than those in India. In China 93% of older persons lived in houses with a hard floor (the other type was earth floor) and 88% in houses with durable walls (cement or brick). In India both indicators were much lower - 60% of elderly live in buildings with a hard floor and 66% with durable walls. Another important facility is connected with water supply and sewerage. The differences between China and India show that the conditions in which older persons live vary significantly.

In China almost 80% of older persons have access to piped water (70% - to water piped directly

The next analysed equipment was the fuel used for cooking. Fuels were divided into two basic types: gas and electricity as more convenient, and open-fire cooking using coal or wood. We again observed significant differences between countries. Gas or electricity for cooking is used by 57% of older persons in China and only 25% in India (mainly gas).

To assess the distribution of indicators of housing quality among certain groups of older persons and identify the most vulnerable groups, we propose a composite index of Quality of Housing (QoH). It is using 7 (described above) indicators from the SAGE survey. Each indicator was transformed into a dichotomous variable, with code 1 indicating the possession of high quality facility and code 0 for other circumstances.

Table 2 shows the list of variables with their coding method. All variables had the same weight. Therefore, QoH can have values: From 0 (household does not have any facility indicating quality housing to 7 (household has all facilities of quality housing).

The distribution of the index QoH, not surprisingly knowing descriptive analysis, is completely different in both countries. In China more than 35% of older persons lived in dwellings having all necessary facilities to lead a dignified and comfortable life and only 7% live in poor quality dwellings with no more than 2 facilities of high quality. The situation of Indian older persons is opposite – only 4% have access to all analysed facilities and almost 55% of them lived in low quality dwellings, including 16% who haven't access to any of the modern facilities (Figure 1).

Table 2. Variables used to build the composite Quality of Housing (QoH) index for older adults; 1=high quality; 0=low quality

Variable		Question posed	Indicator value of housing quality	
#	Name		1	0
1	No of rooms per capita	How many rooms does this dwelling have in total, without counting the bathrooms/ toilets or hallways/ passage ways? (Number of persons in the household as also asked)	≥1 room / person	<1 room / person
2	Type of floor	What type of floor does your dwelling have?	Hard floor	Earth floor
3	Type of walls	What type of walls does your dwelling have?	Cement, brick, stone or wood	Other = non-durable walls
4	Source of drinking water	What is the main source of drinking water for members of this household?	Piped water into dwelling	Water not piped to the dwelling, tube well or dug well
5	Type of toilet	What type of toilet facility do members of your household usually use?	Any type of flush toilet	Latrine or no facilities
6	Shared toilet	Do you share toilet facility with other households?	Not shared	Shared
7	Fuel used for cooking	What type of fuel does your household mainly use for cooking?	Gas, electricity or kerosene	Wood, coal or other open fire

For further analysis the QoH index was categorized into poor and good quality housing, with good quality defined as the dwelling which access to at least 4 (more than half) of the facilities (*Table 3*).

The distribution of the QoH index by demographic and economic attributes of the population 60+ showed a clear relationship between some of the attributes. There is a positive relationship between education level and income. Both in China and India we observed that the higher education level and the higher income, the higher the share of good quality housing. In both countries, the share of good quality housing is higher among people living in urban areas. Additionally in India this difference is enormous – 81% of people in rural areas had poor quality housing, whereas in urban areas – 21%.

Due to a different distribution of number of persons in households, values for this variable were categorized differently, e.g. the top value for China was four and more persons and in India – 10 and more persons. But this didn't change the main conclusion, that in both countries small and populous households has lower share of good quality housing than average households (2-3 persons in China, 3-6 persons in India).

Age groups and gender have a very limited influence on housing quality. There are no differences between men and women and between age groups, except the oldest (80 years and over) in India, where the share of good quality housing is the lowest. High housing inequality between age groups can be explained as a result of income and occupation before retirement, which was also noted in other studies[7,9].

Housing and subjective wellbeing
Housing quality and wellbeing of older persons are clearly linked. However, we should be aware that it couldn't indicate a causal relationship as housing quality is an effect of income and social status (and place of living). Despite that, housing quality is an important objective factor indicating wellbeing. We used two variables to assess
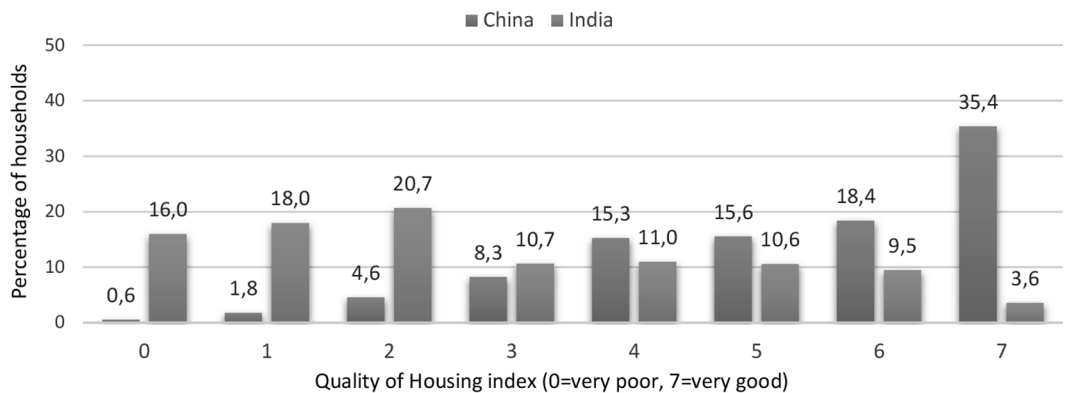

Figure 1. Value distribution of the Quality of Housing (QoH) index for China and India

Table 3. Distribution in China and India of quality of housing of older persons when using 2 categories only

Quality	High quality facilities	Frequency, %	
		China	India
Poor	0 – 3	15.3	65.4
Good	4 – 7	84.7	34.7

Table 4. Frequency distribution of self-rated health and life satisfaction among people aged 60 years and older; n=7,560 (China) and 3,971 (India)

Value	Frequency, %	
	China	India
SELF-RATED HEALTH		
Very good	2.0	1.1
Good	24.8	19.4
Moderate	46.1	47.0
Bad	21.0	21.4
Very bad	2.7	2.2
No answer	3.5	8.8
LIFE SATISFACTION		
Very satisfied	5.4	8.9
Satisfied	54.1	48.0
Neutral	30.1	26.8
Dissatisfied	5.2	6.6
Very dissatisfied	0.2	0.8
No answer	5.0	8.9

subjective wellbeing of older persons: self-rated health and satisfaction with life. Motivation for using those variables was presented earlier. There are slight differences in distribution of both variables in China and India. In China the share of people reporting good and very good health is 6 percentage points higher than in India, but the share of people with bad health is almost the same. Similarly, in case of life satisfaction, in China the share of satisfied is slightly higher than in India and the share of dissatisfied – slightly lower (*Table 4*).

Table 5. Ordered probit regression of life satisfaction, self-rated health, Quality of Housing (QoH) index and dwelling ownership of older adults in China and India; *=p<0.05; **=p<0.01

Independent variable	Dependent variable			
	Self-rated Health		Life Satisfaction	
	China	India	China	India
QoH index (ref. poor): Good	-0.238**	-0.331**	-0.508**	-0.374**
Dwelling Ownership (ref. owned in full): Other	0.059	-0.020	0.098*	0.257**
cut 1	-2.239	-2.388	-2.028	-1.427
cut 2	-0.788	-0.875	-0.093	0.212
cut 3	0.498	0.544	1.192	1.312
cut 4	1.725	1.887	2.436	2.318
Pseudo R-squared	0.003	0.009	0.013	0.012
LR Chi^2	45.53	75.82	188.93	100.68
Probit > Chi^2	0.000	0.000	0.000	0.000

Descriptive analysis suggests a positive relationship between all wellbeing indicators and the QoH index. We had a higher share of good health scores among persons living in good quality housing conditions. The percentage of satisfied with life is also higher among those who live in good quality housing conditions.

Assessment of the relationship between wellbeing and housing quality was performed using ordered probit regression. Dependent variables were: self-rated health and life satisfaction, and the independent variables were: housing quality and dwelling ownership. Additionally we examine which dimensions of housing quality had an influence on wellbeing. We also used dummies for gender, age groups, education level, living arrangement, place of residence and equalised income quartiles to control for the influence of housing attributes alone. Finally, we included interaction terms between housing quality and age and housing quality and income to exclude reciprocal effects of those variables (as in [43]). The results of the regression analysis are presented in *Tables 5 to 8*.

We have estimated four models. In the first, we assessed the relationship between QoH and dwelling ownership and subjective wellbeing (self-rated health and life satisfaction, separately). In the 2nd model, we added dummies for socioeconomic variables. Third model examined which attributes of housing quality (such as number of rooms per person or type of fuel used for cooking) have an influence on subjective wellbeing, as we suspected not all have the same input. These were the same attributes, which were used to create the QoH index. Finally, the fourth model consisted of the third model enhanced with socioeconomic features of respondents.

The simplified model confirmed that housing quality has significant influence (p<0.01) on subjective wellbeing. The findings were valid both for life satisfaction and self-rated health and for China and India. Dwelling ownership had only a moderate influence, and this was observed only for life satisfaction (India: p<0.01; China: p<0.05). Therefore, both in China and India older persons living in better-equipped houses are more satisfied with life and report better health in general (*Table 5*).

In the second model, we included 6 socio-economic variables in order to check whether the relationship between housing condition and subjective wellbeing will be still valid. The influence of housing quality on life satisfaction was significant in China and India and on self-rated health – only in India (*Table 6*).

Table 6. Ordered probit regression of life satisfaction, self-rated health, socio-economic attributes, Quality of Housing (QoH) index and dwelling ownership of older adults in China and India; *=p<0.05; **=p<0.01

Independent variable		Dependent variable			
		Self-rated Health		Life Satisfaction	
		China	India	China	India
QoH index (ref. poor): good		-0.067	-0.172**	-0.333**	-0.217**
Dwelling Ownership (ref. owned in full): other		0.075	-0.036	0.081	0.172*
Gender (ref: male): female		0.129**	0.085*	0.045	0.057
Age, years (ref. 60-69)	70-79	0.209**	0.254**	0.022	0.116**
	≥80	0.220**	0.543**	0.112*	0.352**
Living arrangement (ref. with partner)	alone	-0.026	-0.032	-0.012	0.235
	with others	0.048	0.058	0.159**	0.064
Education level (ref. no education): completed at least primary		-0.068*	-0.190**	-0.100**	-0.147**
Place of living (ref. urban): rural		-0.079*	0.010	-0.263**	-0.121*
Income quartiles (ref. 4th)	1st (Top)	-0.536**	-0.188**	-0.696**	-0.374**
	2nd	-0.125**	-0.019	-0.070	-0.030
	3rd	-0.343**	0.010	-0.422**	-0.177**
cut 1		-2.302	-2.323	-2.336	-1.560
cut 2		-0.808	-0.764	-0.344	0.100
cut 3		0.526	0.699	0.983	1.230
cut 4		1.784	2.055	2.314	2.296
Pseudo R-squared		0.022	0.028	0.037	0.027
LR Chi^2		350.71	220.45	492.00	211.69
Probit > Chi^2		0.000	0.000	0.000	0.000

The inclusion of socioeconomic feature showed that education, income and age influence both self-rated health and life satisfaction and in both countries. Older people who have completed at least primary education have better self-rated health and higher life satisfaction than people who never attended formal education. People from the bottom income quartiles have worse self-rated health and lower life satisfaction than 3rd and top income quartiles in both countries. The youngest group (60-69 years old) also report better self-rated health and life satisfaction than older groups. Additionally, we observed a significant influence of gender on self-rated health and place of living on both dependent variables (except self-rated health in India). Surprisingly, living arrangement has no relationship with subjective wellbeing, with exception of living without a partner on life satisfaction in China.

After implementation of socio-economic features into the model, the relationship between dwelling ownership was significant only for life satisfaction in India (p<0.05). Hence, the ownership of the dwelling was found to be not important for subjective wellbeing of older persons. It should be noted, however, that private ownership of the dwelling dominated in India and China, so the sample size of not-owners is probably too small to perform reliable assessment of this relationship.

The introduction of interaction terms between Housing Quality and Age and Housing Quality and Income did not change the model outcome (*Table 7*). The impact of Housing Quality on Life Satisfaction still was significant and on Self-Rated Health in India kept the significance, but on a 0.05 level. All the interactions between Housing Quality and socio-economic features of respondents were insignificant, but introduction of interactions reduced the impact of some socio-economic features, e.g. only 3rd income quartile was significant for self-rated health in China and in other cases the significance level dropped from 0.01 to 0.05.

Next two models examined the influence of particular elements of housing quality, namely the seven variables used to build the QoH index, on self-rated health and life satisfaction (*Table 8*). The first general conclusion after analysing the models is that not all housing facilities had the same influence on subjective wellbeing. We have also found that housing has more influence on life satisfaction, but rather limited on self-rated health. There was only one variable having a significant influence (p<0.01) on subjective wellbeing variables in both India and China and this was type of the fuel used for cooking. Older people using gas or electricity at home have also better health and higher life satisfaction.

Another important element is type of floor in the apartment. People living in the apartment with a hard floor reported better self-rated heath in both countries and higher life satisfaction in Chi-

Table 7. Ordered probit regression of life satisfaction, self-rated health, socio-economic attributes, Quality of Housing (QoH) index and dwelling ownership of older adults in China and India, with interaction terms added; *=p<0.05; **=p<0.01

Independent variable		Dependent variable			
		Self-rated Health		Life Satisfaction	
		China	India	China	India
QoH index (ref. poor): good		-0.067	-0.264*	-0.314**	-0.369**
Dwelling Ownership (ref. owned in full): other		0.075	-0.042	0.081	0.169*
Gender (ref: male): female		0.129**	0.086*	0.045	0.058
Age, years (ref. 60-69)	70-79	0.156*	0.263**	0.005	0.074
	≥80	0.333*	0.590**	0.221	0.332**
Living arrangement (ref. with partner)	alone	-0.026	-0.034	-0.011	0.232
	with others	0.048	0.057	0.158**	0.062
Education level (ref. no education): completed at least primary		-0.068*	-0.193**	-0.100**	-0.149**
Place of living (ref. urban): rural		-0.079*	0.012	-0.265**	-0.120*
Income quartiles (ref. 1st (Top) 4th)	2nd	-0.595	-0.189*	-0.537	-0.382**
		-0.114	-0.029	-0.044	-0.050
	3rd	-0.379*	-0.039	-0.434*	-0.203**
Interaction terms: QoH	Age 70-79 yrs	0.061	-0.026	0.019	0.125
	Age ≥80 yrs	-0.128	-0.152	-0.126	0.071
	Income, 2nd quartile	-0.013	0.077	-0.034	0.159
	Income, 3rd quartile	0.036	0.204	0.008	0.144
	Income, 1st quartile	0.059	0.096	-0.165	0.098
cut 1		-2.310	-2.333	-2.325	-1.588
cut 2		-0.817	-0.771	-0.333	0.073
cut 3		0.518	0.693	0.995	1.204
cut 4		1.776	2.051	2.326	2.269
Pseudo R-squared		0.022	0.028	0.037	0.027
LR Chi^2		352.64	224.32	493.35	215.09
Probit > Chi^2		0.000	0.000	0.000	0.000

na (in India the relationship was not significant). In case of self-rated health we found only one more significant variables, which is type of toilet in China – people having access to flush toilet had better self-rated health than those who use a latrine.

We observed more variables, which were significant in case of life satisfaction. Available space seems to be of key importance. People living in most crowded apartments (in China less than 1 room per person, in India less than 0.3 per person) had lower life satisfaction than others. Additionally, type of walls was important in India and source of drinking water in China (tube well and other versus piped into dwelling). The only facility with no influence on life satisfaction is whether a toilet is shared or not.

Most of the housing facilities (except a shared toilet) had influence on life satisfaction, which could be explained by those facilities increasing comfort of living and thus – satisfaction with life. In case of self-rated health a relationship was observed for fuel type and type of floor in both countries as these facilities has a clear correlation with possible health problems and this connection could be observed by older people

themselves (such as problems with breathing due to using wood or coal for cooking).

The validation of housing facilities as subjective wellbeing predictors was performed by implementation of socio-economic features to the model (Table 9). Not surprisingly, there was a strong relationship between almost all socioeconomic attributes and both indicators of subjective wellbeing, with some differences between India and China. Inclusion of socioeconomic attributes weakened the influence of housing amenities, but still the selected variables kept their significance.

Type of toilet (latrine vs flush) and type of fuel used for cooking had a significant (p<0.01) relationship with self-rated health in China. In India none of the amenities achieved significance below 0.5 level, but type of floor, tube well as a source of drinking water and fuel type for cooking were on the border.

After controlling for socioeconomic attributes, the relationship between housing amenities and life satisfaction in China did not change. Still house space, type of floor, source of drinking water, type of toilet, type of fuel used for cook-

Table 8. Ordered probit regression of life satisfaction, self-rated health, and housing conditions for older adults in China and India; *=p<0.05; **=p<0.01

Independent variable		Dependent variable			
		Self-rated Health		Life Satisfaction	
		China	India	China	India
Rooms / person (ref. CH< 1; IN<0.3 room)	1.0-1.5 China, 0.3-0.5 India	0.021	0.058	-0.181**	-0.204*
	1.5-2.0 China, 0.5-1.0 India	0.006	-0.033	-0.286**	-0.221*
	≥2 (China), ≥1 (India)	-0.021	-0.071	-0.394**	-0.263**
Floor (ref. hard floor): earth floor		0.151*	0.208*	0.334**	0.169
Walls (ref. durable): non-durable		-0.075	0.151	-0.050	0.286**
Source of drinking water (ref. piped into dwelling)	piped to yard / public tap	-0.083	-0.106	-0.012	0.041
	tube well	0.014	0.123	0.428**	0.087
	other	-0.010	-0.151	0.140**	-0.078
Type of toilet (ref. flush)	pit latrine (China), pit and others (India)	0.164**	0.039	0.049	0.012
	bucket or similar (China), no facilities (India)	0.005	0.000	0.194**	0.000
Shared toilet (ref. yes): not shared		-0.070	-0.093	-0.044	-0.073
Fuel for cooking (ref. gas or electricity): wood, coal, other open fire		0.228**	0.190**	0.301**	0.206**
cut 1		-1.981	-2.063	-1.716	-1.314
cut 2		-0.519	-0.579	0.265	0.400
cut 3		0.788	0.787	1.592	1.535
cut 4		2.033	2.173	2.862	2.614
Pseudo R-squared		0.012	0.025	0.036	0.029
LR Chi^2		205.20	107.07	519.25	115.83
Probit > Chi^2		0.000	0.000	0.000	0.000

ing – all of them had influence on life satisfaction of older people. We observed, however, an important change in India. Personal space is not significant any more. Additionally, variables with 0.01 significance achieved only 0.05 level.

In summary, housing amenities had influence on life satisfaction, more extensive in China than in India. The influence on self-rated health is rather limited and could be observed only in China.

CONCLUDING REMARKS

A large majority of Indian and Chinese older persons own their homes, without the obligations of an outstanding mortgage. This phenomenon can be considered a pre-requisite for positive experiences of ageing and wellbeing. However, this study shows that rights to home ownership for older persons are the only aspect where both these countries are rather similar.

In contrast, housing quality is significantly different, and all analyses undertaken in this paper show that the average condition in which older persons live is relatively worse in India. The Indian older persons have far less available space and they live with a limited access to dwelling amenities. The share of housing with durable walls and hard floors is much lower in India, and the access to water and sanitation is even worse. The QoH index showed that only one-third of older persons have access to at least 4 (out of 7) amenities, whereas in China – the corresponding

percentage is almost 85%.

The factors differentiating housing quality within countries provide some interesting results, and they are similar in both countries. People living in rural areas, which in general are less educated and also have lower incomes, are more deprived of decent housing conditions in old age, and this pattern is the same in China and India. A notable feature is that the absolute level of housing quality in China is much higher, so it can be said that the most deprived groups in China has similar absolute level of housing quality as better-off groups in India. These housing conditions during old age also point to the cumulative life-course advantage or disadvantage in these two countries.

There is a positive relationship between housing conditions and self-rated health and life satisfaction. This relationship is stronger in the case of satisfaction with life and this result holds true even after controlling for varying socioeconomic groups. Home ownership has a weak relationship with life satisfaction only in India, but it has no significant association with self-rated health.

Not all housing amenities have the same influence on wellbeing and there are again important differences between the two countries. Housing conditions influence self-rated health only in China and only two of them are important (type of toilet and type of fuel used for cooking). They have, however, a stronger influence on satisfaction with life, and

Table 9. Ordered probit regression of life satisfaction, self-rated health, housing conditions, and socio-economic attributes of responding older adults in China and India; +=p=0.05; *=p<0.05; **=p<0.01

Independent variable		Dependent variable			
		Self-rated Health		Life Satisfaction	
		China	India	China	India
Rooms / person (ref. China< 1; India<0.3 room)	1.0-1.5 China, 0.3-0.5 India	0.032	0.062	-0.132**	-0.179
	1.5-2.0 China, 0.5-1.0 India	0.029	0.014	-0.210**	-0.153
	≥2 (China), ≥1 (India)	-0.010	0.062	-0.370**	-0.162
Floor (ref. hard floor): earth floor		0.120	0.176+	0.253**	0.170
Walls (ref. durable): non-durable		-0.061	0.143	0.003	0.223*
Source of drinking water (ref. piped into dwelling)	piped to yard / public tap	-0.064	-0.117	0.023	0.054
	tube well	0.053	0.157+	0.499**	0.189*
	other	-0.017	-0.141	0.166**	-0.019
Type of toilet (ref. flush)	pit latrine (China), pit and others (India)	0.184**	0.001	0.090	-0.023
	bucket or similar (China), no facilities (India)	0.033	0.000	0.243**	0.000
Shared toilet (ref. yes): not shared		0.002	-0.075	0.054	0.004
Fuel for cooking (ref. gas or electricity): wood, coal, other open fire		0.173**	0.144+	0.243**	0.182*
Gender (ref: male): female		0.137**	0.189**	0.061*	0.069
Age, years (ref. 60-69)	70-79	0.216**	0.244**	0.052	0.141*
	≥80	0.244**	0.520**	0.138**	0.278**
Living arrangement (ref. with partner)	alone	-0.008	-0.195	-0.148**	0.681**
	with others	0.038	-0.020	-0.085	0.153*
Education level (ref. no education): completed at least primary		-0.072*	-0.189**	-0.094**	-0.226**
Place of living (ref. urban): rural		-0.233**	-0.075	-0.429**	-0.273**
Income quartiles (ref. 4th)	1st (Top)	-0.399**	-0.120	-0.559**	-0.310**
	2nd	-0.083*	0.108	-0.035	0.027
	3rd	-0.226**	0.080	-0.306**	-0.122
cut 1		-2.116	-2.036	-2.019	-1.463
cut 2		-0.616	-0.504	-0.014	0.296
cut 3		0.729	0.905	1.372	1.485
cut 4		1.988	2.320	2.718	2.591
Pseudo R-squared		0.025	0.045	0.055	0.055
LR Chi^2		400.17	183.51	726.59	212.69
Probit > Chi^2		0.000	0.000	0.000	0.000

again – mainly in China. India has worse housing conditions, and the relationship between amenities and life satisfaction is very limited. In China this relationship is stronger and includes space (rooms per person), type of floor, source of drinking water, type of toilet and type of fuel used for cooking.

The housing conditions are therefore more important in the country where the average level of these conditions is high. Older persons deprived in terms of housing in China have lower satisfaction with life and some of the deficiencies can even result in worse self-rated health (such as open fire instead of gas for cooking). In India where the average level is low only substantive amenities, such as non-durable walls or wood / coal used for cooking could negatively affect life satisfaction. It is also striking that in India older persons live in more populated dwellings, they lack more often private space, but this has no influence on their life satisfaction, whereas in China people who have less than one

room per person are less satisfied with life.
Hence, the influence of housing conditions on wellbeing is dependent on the contextual environment. In areas, where the average conditions are poor, actual low conditions have limited influence on wellbeing, whereas when the absolute level in the environment is high, deprived people suffer lower subjective wellbeing.

For policy makers, the insights provided by this paper imply that housing is a significant determinant of wellbeing in old age. Therefore support for better housing conditions will significantly enhance older people's lives. Moreover, the analysis also point to specific policy directions of this housing support. Changing type of fuel used for cooking (for example, from wood or coal to gas or electricity) can have a strong positive effect in both countries. For new dwellings, hard floor in both countries and full water supply in China are major determinants of wellbeing among older persons.

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