

The Impact of Age-Friendly Home Modifications on the Well-Being of Urban Older Adults: Evidence from the China Health and Retirement Longitudinal Study

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Abstract: With the acceleration of the aging process and the change of people's ideas, it has become the key point of social construction in China in the new era to provide a good living environment for the elderly and focus on improving their sense of acquisition and happiness. However, the improvement of the quality of life and happiness of the elderly by the aging renovation of urban housing remains to be further verified. In this paper, based on the data of China Health and Pension Tracking Survey in 2020, an Ordered Logit model is constructed to demonstrate the influence of aging renovation of urban housing on the happiness of elderly residents, and to clarify the differentiated influence of aging renovation of urban housing on the happiness of elderly residents with different individual characteristics. The results show that the aging renovation of urban housing can significantly improve the happiness of elderly residents; Some urban residential aging projects have a more significant impact on the happiness of elderly residents; The individual characteristics of elderly residents should be fully considered in the aging transformation of urban housing.

Keywords: Age-friendly Home Modifications; Urban Older Adults; Subjective Well-being; Ordered Logit Model.

1. Introduction

According to the data of the seventh census, the population aged 60 and over in China accounts for 18.7% of the total population, among which the population aged 65 and over accounts for 13.5% of the total population. The aging process is obviously accelerated, and the elderly are becoming an important part of China society. At the same time, with the sustained development of China's economy and the change of people's ideas, happiness has gradually replaced simple material needs and become a higher pursuit of people's lives. In this context, efforts to provide a good living environment for the elderly and strive to improve their sense of acquisition and happiness have become the key focus of social construction in China in the new era[1-2].

Residential aging renovation is a way to update the interior and exterior space of the residential suite with the goal of ensuring the elderly residents to live safely and independently in the original home environment[3]. Different from the practice of creating increment by building new facilities for the aged, the aging renovation of housing is considered to be the most common and economical way to meet the needs of the elderly and improve their quality of life and happiness. The World Health Organization has incorporated environmental factors into the construction of a healthy aging policy system, emphasizing that the friendly environment for the elderly, including the living environment, plays an important role in the development of individual functions[4]. It has become an important measure for the government of China to enhance the sense of acquisition and happiness of the elderly residents and promote the construction of an elderly-friendly society by aging-adapted residential renovation to provide convenience and improve their quality of life[5].

Compared with the eager demand of the elderly residents for the aging renovation of housing and the government's

focus on promoting the aging renovation of housing, there is still much room for improvement in the aging renovation of urban housing in China[6]. However, due to the late start and imperfect governance system, the aging renovation of urban housing in China also faces many problems, such as inconsistent implementation and chaotic management. Therefore, it is necessary to know the different needs of the elderly residents with different individual characteristics for the aging renovation projects of urban housing by clarifying the influence of different aging renovation projects on the happiness of the elderly residents. Further, on the basis of clear demand and influence, it should provide a basis for the further refinement and personalization of China urban housing aging renovation, and provide reference for the government to formulate relevant boosting systems.

2. Theoretical Framework

Self-Determination theory (SDT) was put forward by American psychologist by Deci and Ryan in 1985. As a macro theory to study human motivation and personality, Self-Determination theory is constructed on the following assumptions: firstly, human beings are active organisms, and have a positive tendency of self-integration, self-improvement and continuous learning. Secondly, the above-mentioned tendency of human beings needs the support and influence of various external social factors, rather than natural formation. Finally, by influencing and changing social factors, it can effectively promote or block the formation and development of individual positive behavior and healthy psychology. This theory emphasizes the role and influence of social environment and social factors on people's behavior and psychology, clarifies the importance of organic interaction between individuals and society, and based on this, constructs an explanation and prediction framework for individual behavior and psychological changes, which is its most remarkable feature compared with other motivation

theories[7].

The environment-behavior perspective is a science that studies the relationship between people and the surrounding material environment. It mainly focuses on the study of environmental factors and human factors, aiming to explore the factors that determine the nature of the material environment and its influence on behavior, and apply the results to the regulation of human behavior through environmental policies, planning, design and education, which is widely used in the study of the relationship between human behavior, architecture, space and their interaction[8-9]. The environment-behavior perspective emphasizes the influence of external physical environment and its spatial elements on individual behavior, focusing on the role of environmental factors on individual behavior[10], so it can be used as a theoretical basis to explain and analyze the aging transformation of urban housing and the role of its sub-projects. It is clear that the aging transformation of urban housing can improve the living space and home environment of urban elderly residents by improving facilities and system optimization, change the behavior and activities of urban elderly residents, and then improve the happiness of elderly residents. Therefore, from the perspective of environmental behavior theory, this paper will explore the role and influence of the aging renovation of urban housing on the happiness of elderly residents.

3. Research Design

3.1. Research Hypotheses

The theoretical framework outlined above shows that the residential reconstruction suitable for the elderly can improve the living environment of the elderly by making the living space safer, more convenient and easier to use. When these obstacles arise in the family, the elderly may find it easier to manage their daily lives, live independently and continue their daily activities, which in turn can improve their subjective well-being. From the perspective of environmental behavior, the change of physical environment shapes the behavior and participation mode in daily activities. Self-determination theory emphasizes autonomy and daily function, indicating that a supportive living environment is also conducive to mental health. In this sense, the old-friendly housing renovation can be regarded as a direct environmental intervention. Therefore, they are expected to improve the subjective well-being of the elderly.

Empirical research also supports this expectation. It has been found that elderly-friendly environmental measures, including recreational facilities, elderly-friendly health care infrastructure and barrier-free environment, are related to better quality of life and higher subjective well-being of the elderly[11-12]. To sum up, theoretical discussion and existing evidence support the following assumptions:

H1: Old-age-friendly housing renovation has a significant positive impact on the subjective well-being of the urban elderly.

However, family reform friendly to the elderly does not constitute a single intervention measure; On the contrary, they include various modification measures. Different renovation projects improve the living environment through different mechanisms, so they may have different effects on the behavior and life experience of the elderly. From the perspective of environment-behavior, different environmental attributes provide different forms of environmental support,

which may have different degrees of influence on individual behavior and psychological results. Previous studies show that the improvement of housing facilities, intelligent technology suitable for the elderly, barrier-free design intervention and residential space optimization have different effects in promoting the health and improving the quality of life of the elderly. Therefore, it can be expected that different revision measures may lead to different degrees of improvement of subjective well-being. Accordingly, the following assumptions are put forward:

H2: Different types of housing renovation suitable for the elderly have different effects on the subjective well-being of the urban elderly.

In addition, the effectiveness of the elderly-friendly housing renovation may depend not only on the characteristics of the renovation measures themselves, but also on the characteristics of the individuals who accept the renovation measures. According to the theory of self-determination, individuals differ in their ability to perceive, utilize and benefit from environmental support. Similarly, the viewpoint of environmental behavior emphasizes that the influence of environmental conditions is determined by individual's ability, resources and needs. The existing research records the huge differences of the elderly with different demographic, socio-economic and health characteristics in the demand for housing renovation suitable for the elderly[13]. Empirical evidence also shows that the benefits of similar environmental interventions may vary from population to population. Therefore, the influence of family reform friendly to the elderly on subjective well-being may be different for the elderly with different individual characteristics. Accordingly, the following assumptions are put forward:

H3: The influence of housing renovation suitable for the elderly on the subjective well-being of the urban elderly varies with individual characteristics.

3.2. Data Source

This study uses data from the 2020 wave of the China Health and Retirement Longitudinal Study (CHARLS), which is a national representative survey of middle-aged and elderly people in China. CHARLS records the demographic characteristics, health status, family environment, socio-economic status and housing environment of the respondents in considerable detail, so it is very suitable for studying how the housing renovation suitable for the elderly is related to the subjective well-being of the urban elderly.

3.3. Variables

The dependent variable is subjective well-being, which is measured by the respondents' self-reported life satisfaction. In the survey, respondents were asked: "Overall, are you satisfied with your life?" Their answers were recorded on a five-point scale, from "completely dissatisfied" to "completely satisfied". Then, I recoded these answers into a sequential variable from 1 to 5. The higher the value, the higher the subjective well-being. In the study of the elderly, life satisfaction is usually used as an indicator of subjective well-being. Because the CHARLS questionnaire does not provide a direct measure of subjective well-being, this study uses life satisfaction as its substitute.

The main explanatory variables describe the elderly-friendly characteristics of the respondents' housing environment. Based on the CHARLS questionnaire in 2020

and the measures proposed in the Guiding Opinions on Accelerating the Implementation of Home Care for the Elderly, this study selected nine indicators: accessibility, living age, home broadband access, water heater or centralized hot water facilities, bathroom type, pipeline gas or natural gas access, residential floors, balcony number and elevator availability. Group differences can be important. In order to test whether the effect of residential renovation suitable for the elderly is different among different groups of the elderly, this study includes three interactive terms: elevator usability physical disability, elevator usability gender and barrier-free access physical disability. In order to limit the potential missing variables, the analysis also controls a series of personal characteristics, which were associated with the subjective well-being of the elderly in earlier studies, including age, gender, education level, marital status and physical disability.

3.4. Model Specification

Considering the orderliness of dependent variables, an orderly logit model is used to test the relationship between the housing renovation suitable for the elderly and the subjective well-being of the urban elderly.

In order to test the hypothesis, three nested models are estimated. As a baseline specification, Model 1 does not include explanatory variables. Model 2 introduces housing renovation indicators and control variables suitable for the elderly to test the overall relationship between housing renovation suitable for the elderly and subjective well-being. The estimation of this model is also used to evaluate whether different housing characteristics have different effects on subjective well-being. Model 3 further includes the interaction between the selected housing indicators and personal characteristics to investigate whether the effect of housing renovation suitable for the elderly is different among different groups of the elderly.

All models are estimated by Stata 17.

4. Empirical Results

4.1. Main Results

Table 1. Ordered Logit Regression Results for Subjective Well-Being

Variables	Model 2	Model 3
Barrier-free access	-0.101 (0.078)	-0.225 (0.269)
Dwelling age	-0.042 (0.079)	-0.037 (0.079)
Broadband access	-0.077 (0.084)	-0.078 (0.084)
Hot-water facilities	0.029 (0.117)	0.035 (0.118)
Toilet type	0.207** (0.081)	0.206** (0.081)
Gas access	0.014 (0.083)	0.012 (0.083)
Floor level	-0.048 (0.062)	-0.049 (0.062)
Number of balconies	0.013 (0.054)	0.012 (0.054)
Elevator availability	-0.151* (0.083)	1.007*** (0.364)
Elevator × Physical disability	—	-0.427*** (0.160)
Elevator × Gender	—	-0.304** (0.145)
Barrier-free access × Physical disability	—	0.079 (0.159)
N	3,049	3,049
χ^2	134.29***	145.20***
Pseudo R ²	0.021	0.022

Table 1 shows the ordered logit estimation of subjective

well-being of the urban elderly. Overall, both Model 2 and Model 3 are statistically significant. Chi-square statistics are 134.29 and 145.20, respectively, and both models are significant at 1% level. Pseudo-R-squared increased from 0.021 in model 2 to 0.022 in model 3, indicating that the model fitting has been improved moderately after including the interaction term.

The results show that the housing renovation suitable for the elderly is related to the subjective well-being of the urban elderly, but this influence is different in different housing characteristics. Among the nine housing indicators included in the analysis, only the toilet type and elevator availability have statistically significant influence. It is reported that the subjective well-being of the elderly living in sitting toilets is significantly higher than that of the elderly using squatting toilets. Elevator usability is also closely related to subjective well-being. Other indicators, including barrier-free access, years of residence, broadband access, hot water facilities, gas access, the number of floors and balconies, did not reach statistical significance.

This model shows that housing renovation suitable for the elderly will not affect subjective well-being in the same way. The functions of shaping daily activities and physical convenience seem to be more important than those of improving living facilities. As a result, hypothesis 1 is partially supported and hypothesis 2 is supported.

Model 3 further tests whether the effect of housing reconstruction suitable for the elderly is different among the elderly by adding interactive items between the selected housing indicators and personal characteristics. The results show that the interaction between elevator availability and physical disability, and the interaction between elevator availability and gender are statistically significant. However, the interaction between accessibility and physical disability is not statistically significant.

Therefore, the relationship between elevator availability and subjective well-being seems to vary from crowd to crowd. More specifically, among the elderly with physical disabilities, the positive correlation between elevator availability and happiness is stronger than that among the elderly without physical disabilities. There are also gender differences in this relationship. In contrast, barrier-free environment does not show significant differences in disability status. To sum up, these results show that the welfare effect of the elderly-friendly housing renovation depends partly on individual characteristics, which supports hypothesis 3.

4.2. Diagnostic and Robustness Checks

In order to check the reliability of the estimation model, this study carried out diagnostic tests and robustness analysis.

Firstly, variance dilation factor (VIFs) is used to test multicollinearity. The VIF value of explanatory variables is between 1 and 2, and the average VIF is 1.19. Because these values are far below the commonly used thresholds, multicollinearity is unlikely to become a serious problem in the estimation model.

The second step is the robustness check. I randomly deleted 10% of the observations from the original sample and re-estimated Model 3 with the remaining 2744 observations. The results have changed little. The re-estimated model is still statistically significant, with chi-square statistics of 118.77 ($p < 0.01$) and pseudo-R square of 0.020. More importantly, the key coefficients keep the same sign, similar amplitude and the same significance level.

More specifically, toilet types and elevator availability still show a significant correlation with subjective well-being. The interaction between elevator availability and physical disability, and the interaction between elevator availability and gender are still statistically significant. In a word, these tests show that the main research results are insensitive to moderate changes in sample composition, and support the stability of empirical results.

5. Conclusion and Discussion

Based on the above empirical analysis results, this paper can draw the conclusion that the aging renovation of urban housing can significantly improve the happiness of elderly residents. The model based on the variables related to the aging renovation of various urban houses and the variables related to the individual characteristics of the elderly can explain the differences in happiness of the elderly residents to a greater extent. Some urban residential aging projects have a more significant impact on the happiness of elderly residents. Among the nine independent variables related to the aging renovation of urban housing selected in this paper, only "toilet type" and "elevator installation" have passed the verification, and the significant differences in the effects of different aging renovation projects of urban housing on the happiness of elderly residents have proved that different aging renovation projects of urban housing have differentiated effects on the happiness of elderly residents. The individual characteristics of elderly residents should be fully considered in the aging transformation of urban housing. As far as "elevator installation" is concerned, compared with elderly residents without physical disabilities, elevator installation has a more significant impact on the happiness of elderly residents with physical disabilities. Elevator installation also has a differentiated impact on the happiness of elderly residents because of their gender differences.

A series of studies, including this paper, have confirmed the outstanding role of the aging-adaptive transformation of urban housing in improving the living environment, improving the quality of life and enhancing the happiness of elderly residents. Therefore, the government needs to continue to invest resources in the aging renovation of urban housing, and strive to promote the aging level of urban housing to improve the happiness of elderly residents. If the elderly residents' happiness is the main concern to carry out the aging renovation of urban housing, the government should pay more attention to the change and optimization of toilet types in elderly residents' residences, and replace squatting toilets with sitting toilets. At the same time, we should also pay attention to the installation of supporting elevators for elderly residents' residences to improve their quality of life and subjective well-being. In the process of aging renovation of urban housing, elevator installation can be given priority

according to the number and proportion of elderly people with physical disabilities in the region, so that the results of aging renovation of urban housing can benefit the vulnerable groups facing the dual difficulties of old age and disability, and effectively improve the quality of life and subjective well-being of elderly residents with physical disabilities.

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