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## Utilization Willingness of Institutional Care by the Elderly: A Comparative Study between Empty-nesters and Non-empty-nesters in Shandong, China

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3 **Utilization Willingness of Institutional Care by the Elderly: A**  
4 **Comparative Study between Empty-nesters and Non-empty-nesters**  
5 **in Shandong, China**  
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## Abstract

**Introduction:** Institutional care has been strongly promoted in China to meet the seniors' long-term care needs. Empty-nest elderly, in comparison with their counterparts, have less social support and caring networks. This study aims to compare the utilization willingness of institutional care and its predictors between empty-nest and non-empty-nest seniors.

**Methods:** A total of 3923 seniors were included in the analysis. Binary logistic regression models were used to understand the association between living arrangements of the elderly households and willingness for institutional care, and also to identify the predictors of the utilization willingness for institutional care among empty-nesters and non-empty-nesters.

**Results:** Our study found that about 8.5% of the seniors had willingness for institutional care in Shandong, China. Empty-nest singles (OR=6.046; 95CI 3.337-10.917) and empty-nest couples (OR=1.382; 95CI 1.019-1.875) were found to be more willing for institutional care. Our results also showed that residence was a key determinant for institutionalization willingness in empty-nest and non-empty-nest elderly. Among empty-nest singles, psychological stress was a positive determinant for institutional care. Factors including education level, relationship with adult children, household income and per capita living space were determinants for empty-nest couples' willingness for institutionalization. Age, number of children self-reported health status were found to be associated] factors for willingness among non-empty nester.

**Conclusions:** Government should pay more attention to institutional care in rural areas where elder care is still a gap compared with the urban areas. Targeted policies should be made for different types of seniors to offer appropriate institutional care.

**Keywords:** Institutional care, Willingness, Elderly, Empty-nest, Determinants

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## Strengths and limitations of this study

- A large sample of 3,923 participants based on a community survey provided a real profile of willingness for institutional care in Chinese seniors .
- Living arrangements of the households with seniors was found to be associated with the willingness for institutional care in the elderly in China, and the empty-nesters were more willing for institutional care than their counterparts.
- There might be a possible recall bias as for most questionnaire data, which is a limitation of this study.
- The cross-sectional study design precludes any causal interpretation.

## Introduction

Since China entered the aging society in 1999, the amount of aging population in China has ranked the first in the world (Aging, 2006). The number of Chinese people aged 60 years and above had reached 212.4 million by 2014, which accounted for 15.5% of the total population (China, 2015). It's estimated that China, with an amount of 98.3 million old people aged 80 or over in 2050, will still be one of those countries which have the greatest numbers of oldest-old (Nations, 2011). With the rapid aging of the Chinese population, the number of empty-nesters is on the rise as well (Liu and Guo, 2008). Empty-nest seniors refer to those seniors who are childless or whose children have already left home (Zhou et al., 2015). With the increasing amount of the elderly empty-nesters, long-term care for the elderly has been emerging as a social problem.

Traditionally, taking care of the elderly by adult children in the family was a basic norm in the Confucian doctrine (Liu and Sun, 2015). In recent years, increased geographic mobility and reduced family size due to one-child policy have made more adult children unavailable for elder care (Zhan et al., 2006b). More women in urban China are gaining higher education and becoming more work-oriented which indicate that gender roles in elder care are changing and the availability of elder care by adult children has become questionable (Zhan and Montgomery, 2003). On the other hand, with Chinese baby boomers approaching retirement age, informal care such as familial care is unlikely to meet the needs of all seniors (Zhan et al., 2006a). One study indicated that nearly half of seniors, who needed some level of assistance in their activities of daily living or instrumental activities of daily living, actually lived alone instead of living with their adult children (Zhan and Montgomery, 2003). Another study found that many seniors expressed preference to live alone or with their spouse, if housing and health status permit (Xu, 1994). Consequently, institutional care has been strongly promoted to meet older adults' long-term care needs (Chou, 2010).

After the welfare reform in 1990s, former government-sponsored nursing homes have become decentralized, and a great amount of private nursing homes is on the rise, mostly emerging in large cities (Zhan et al., 2006b). Previous studies have identified the empty-nest elderly's attitudes towards institutional care and its predictors. One



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3 study found that the seniors' living arrangements prior to elder home placement and  
4 their assessment of the cost involved for such care were related to seniors' willingness  
5 to stay in elder homes (Guan et al., 2007). Some other studies found that factors  
6 including gender, educational attainment, occupation, health insurance, number of  
7 children were associated with willing for institutional care among the empty-nest  
8 seniors(Chen 2015; Xie et al., 2010; Zhu et al., 2017). However, few of such studies  
9 were published in international journals. Moreover, the studies described earlier have  
10 some systematic weaknesses. First, almost all of the empirical studies were based on  
11 small sample sizes (e.g.,n=523 in the case of Xie et al.; n=570 in the case of Chen et  
12 al.; n=1000 in the case of Zhu et al.)(Chen 2015; Xie et al., 2010; Zhu et al., 2017).  
13 Second, in many studies it is not clear who is serving as the reference group. In other  
14 words, the associated factors were only explored in the empty-nest seniors(Chen 2015;  
15 Xie et al., 2010; Zhu et al., 2017).

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18 To remedy this situation, the present study aims to compare utilization  
19 willingness of institutional care between empty-nest and non-empty-nest seniors in  
20 China. To do so, we have following specific objectives. First, we will compare the  
21 willingness for institutional care between empty-nest and non-empty nest elderly.  
22 Second, we will identify the associated factors for institutional care among the  
23 empty-nest and non-empty-nest elderly.

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## Methods

### Settings and participants

This study was conducted in Shandong, a province where the elderly aged 65 or over accounted for 11.6% of its total population (Statistics, 2015).In this study, a 3-stage cluster sampling was used to select participants. Firstly, all districts and counties in Shandong province were stratified into three groups on the ground of GDP per capita (2011) separately. Secondly, we chose one district and one county from each group. Thus, three urban districts (Huaiyin, Dongchangfu and Zhangdian) and three rural counties (Qufu, Chiping and Leling) were chosen as the study sites. Similarly, we then chose three sub-districts and three townships in each sampling district or county on the basis of GDP per capita. Lastly, three communities and three villages were selected from each chosen sub-district and township. Therefore, we

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3 selected 27 urban communities and 27 rural villages in total. A total of 3923 older  
4 people were included in the analysis.  
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### 6 7 **Data collection**

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9 Data were collected from November 2011 to January 2012 by using a  
10 house-to-house interview. Face-to-face interviews were conducted among the elderly  
11 using a structured questionnaire by trained master students from Shandong University  
12 School of Public Health. To ensure quality, completed questionnaires were carefully  
13 checked by quality supervisors at the end of each day. The questionnaire included  
14 demographic characteristics, living arrangements of the households, relationship with  
15 children, marital status, economic status, mental health condition and willingness for  
16 institutional care.  
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### 23 **Variables and measures**

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25 The independent variable was seniors' willingness for institutionalization which  
26 was evaluated on the ground of interviewees' answers to 'which endowment way are  
27 you willing for?' If the response was 'institutional care', the willingness for  
28 institutional care could be coded as 'yes'. On the contrary, if the answer was  
29 'home-based care', 'community endowment' and 'others', willingness for institutional  
30 care could be coded as 'no'.  
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36 Socio-demographic and psychological characteristics such as gender, age,  
37 education, past occupation (pre-retirement occupation), marital status, number of  
38 children, relationship with children, residence, self-reported health status,  
39 psychological stress, ADL (activities of daily living), NCDs (non-communicable  
40 diseases) and household income were included in this study.  
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45 The age of the participants was categorized as follows: 60-, 70- and 80+ years.  
46 Other demographic characteristics were classified as follows: gender (male vs.  
47 female), education (illiteracy, primary school and junior school or above), past  
48 occupation (farmer vs. others), marital status (single vs. couple), number of children  
49 (0-3 vs. >3), relationship with children (good vs. bad), residence (urban vs. rural),  
50 self-reported health status (good vs. normal or poor), ADL ( I , II and III), NCDs in  
51 the past six months (yes vs. no), and household income (Q1, Q2, Q3 and Q4).  
52 Quartile 1 (Q1) is the poorest and Quartile 4 (Q4) is the richest.  
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3 Living arrangement of elderly households could be classified into non-empty  
4 nester, empty-nest single and empty-nest couple. Non-empty-nester refers to those  
5 seniors who live with their children while empty-nest single and empty-nest couple  
6 refers to those seniors who live alone with a spouse and without a spouse respectively  
7 more than six months(Zhou et al., 2012). Per-capita living space is a measure that  
8 takes total living space (square meter) and divides it by the number of constant  
9 people(who live in the house more than half a year) in a house.  
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15 Psychological stress was evaluated on the ground of 10-item Kessler Scale (K10).  
16 K10 is an effective tool to assess people's psychological status designed by scholars  
17 such as Kessler, Mroczek and so on (Kessler et al., 2002). The Chinese-language  
18 version of K10 has been verified to be of good reliability and validity (Zhou et al.,  
19 2008).  
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24 ADL instrument was consisted of Physical Self-maintenance Scale and  
25 Instrumental Activities of Daily Living Scale designed by Lawton and Brody (Lawton  
26 and Brody, 1969). ADL Scale was used to evaluate people's simple and basic ability  
27 to practice one's normal life independently. The reliability and validity of ADL  
28 instrument in Chinese-language version was demonstrated to be good (Feng, 2013).  
29 Scores of ADL can be divided into 3 levels, the higher level represents more severe  
30 dysfunction. Level 1, 2 and 3 means mild dysfunction, moderate dysfunction and  
31 severe dysfunction respectively (Mahoney and Barthel, 1965).  
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### 38 **Statistical Analysis**

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40 The data was double entered and checked using EpiData 6.04. Statistical  
41 analyses were performed using SPSS 21.0. For continuous variables, p value was  
42 calculated using Student's t test or F-test; for categorical variables, p value was  
43 calculated using chi-square test. Two binary logistic regression models were  
44 employed to assess the association between living arrangements of elderly households  
45 and willingness of institutional care. All reported CIs were calculated at the 95% level.  
46 Statistical significance was set at the 5% level.  
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### 52 **Patient and Public Involvement statement**

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54 Ethical approval was obtained from The Ethical Committee of Shandong  
55 University School of Public Health. The investigation was performed after the  
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3 acquisition of written informed consents of all participants.  
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## 5 **Results**

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8 Table 1 showed basic information of the 3923 seniors. About 8.5% seniors had  
9 willingness for institutional care. Non-empty-nesters accounted for 40.7% of the  
10 participants, empty-nest singles accounted for 10.0%, and empty-nest couples  
11 accounted for 49.3%. Generally speaking, the majority of the elderly were female  
12 (53.6%), at the ages of 60 and 69 (65.5%), illiterate or semiliterate (44.5%), farmers  
13 (64.2%), couple (79.1%), having 0 to 3 children (67.4%), having good or normal  
14 relationship with children (92.8%), rural (54.9%), having good self-reported health  
15 status (52.1%), having mild dysfunction (72.7%), and having NCDs (65.9%). The  
16 elderly's K10 score was  $15.8 \pm 6.0$  and their per-capita living space was  $33.9 \pm 23.1$   
17 square meters.  
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25 We presented our results in two models to understand the association between  
26 living arrangements of elderly households and willingness for institutional care.  
27 Model 1 showed that institutionalization willingness was higher in empty-nest singles  
28 (OR=2.759; 95CI 1.974-3.857) and empty-nest couples (OR=1.340; 95CI 1.038-1.729)  
29 than in non-empty-nesters. When other variables were controlled, willingness for  
30 institutionalization was still higher among empty-nest singles (OR=6.046; 95CI  
31 3.337-10.917) and empty-nest couples (OR=1.382; 95CI 1.019-1.875) than in  
32 non-empty-nesters (Table 2). Figure 1 showed that in each of the three subgroups with  
33 different household living arrangements, 'urban seniors' willingness to use  
34 institutional care was statistically higher than rural seniors'.  
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42 Table 3 showed the factors associated with willingness for institutional care  
43 among empty-nest singles. Univariate analysis indicated that empty-nest singles who  
44 were from rural areas ( $p=0.000$ ) had lower willingness for institutional care.  
45 Empty-nest singles who had greater psychological stress ( $p=0.050$ ) had higher  
46 willingness for institutional care. Multi-logistic analysis also showed that the two  
47 factors were associated with willingness for institutional care.  
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52 As shown in Table 4, univariate analysis showed that those empty-nest couples  
53 who had higher education level, who were not farmers ( $p=0.000$ ), who had normal  
54 relationship with children ( $p=0.013$ ), who had higher household income were more  
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3 willing for institutional care. Those empty-nest couples who had more than 3 children  
4 (p=0.040), who lived in rural areas (p=0.000), who had severe dysfunction (p=0.003),  
5 who had more per-capita living space (p=0.019) were less willing for institutional care.  
6 Multi-logistic regression indicated that factors including education level ,relationship  
7 with children, household income, residence were associated with willingness for  
8 institutional care.  
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13 Likewise, for those non-empty-nest seniors, multi-logistic regression model  
14 found that those with younger age, those who had less children, those who were from  
15 urban areas, and those who had normal or poor self-rated health status preferred to use  
16 institution (See Table 5).  
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## 21 **Discussion**

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23 Our study found that 8.5% of the seniors had willingness for institutional care.  
24 This was lower than the that found among Korean American elders (45%) with a  
25 similar age (Jang et al., 2008). This was lower than the reported rates of 20% in urban  
26 area, 17% in rural area in the elderly in China (Chou, 2010), and 16.7% in a study of  
27 the seniors aged 65 or above in Taiwan, China (Chung et al., 2008). It was also lower  
28 than the 9.69% found in older population in Zhejiang, China (Jiang and Si, 2006), and  
29 44.8% found in a study in the elderly with a similar age in Chengdu, China (Deng et  
30 al., 2003). Compared with above mentioned sites, Shandong is rather a conservative  
31 province which is deeply affected by Confucianism. The culture of filial piety is  
32 profoundly rooted in Shandong residents' mind. This might be primary cause of the  
33 variation between our study and the previous studies quoted above.  
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42 Our results showed that living arrangement of the households was associated  
43 with the elderly's willingness for institutional care. The analysis made it clear that  
44 empty-nest singles and empty-nest couples were more willing for institutional care  
45 than non-empty-nesters. This finding was consistent with another study which found  
46 that older adults who had no spouse or children were more likely to move into nursing  
47 homes than their counterparts (Grundy and Jitlal, 2007; Zhan et al., 2006b). Due to  
48 lack of care from adult children, empty-nest seniors are facing more endowment risks.  
49 Empty-nest elderly had poorer self-rated health, higher prevalence of two-week illness  
50 and NCDs, which indicated that they had poorer health status than non-empty-nest  
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3 elderly (Zhou et al., 2015). It's also found that empty-nest seniors, in comparison with  
4 non-empty nest seniors, had higher level of loneliness (Liu and Guo, 2007). The high  
5 physical and mental health service needs might be the reason why empty-nest seniors  
6 are more willing for institutional care which can provide professional health care.  
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10 Consistent with previous studies, our results also showed that residence was a  
11 key predictor for institutionalization willingness in all three types of elderly  
12 households (Nie et al., 2015). Urban seniors had statistically higher willingness for  
13 institutional care than rural seniors across all three types of elderly household.  
14 Compared with rural seniors, urban seniors were less conservative. Rural seniors had  
15 lower income, poorer social welfare condition than urban seniors. Further, the supply  
16 of institutional care was relatively deficient in rural areas. These differences between  
17 rural and urban areas might explain why rural seniors were less willing for  
18 institutional care. This finding was helpful for the policy-makers to allocate  
19 differentially the institutional care resources in urban and rural China.  
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27 Among empty-nest singles, psychological stress was a positive determinant for  
28 institutional care which was in accordance with previous studies (Branch and Jette,  
29 1982). To avoid excessive reliance on family members which may result in tensions in  
30 family, when seniors had psychological stress, they would rather choose institutional  
31 care (Tao and Cong, 2014). This might be associated with empty-nest singles'  
32 attitudes of self-reliance.  
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38 Similar with previous studies, empty-nest seniors who had normal relationship  
39 with children were more willing for institutional care (Chou, 2010). Having good  
40 relationship with children represents more financial assistance and spiritual comfort  
41 from children. When seniors were in poor relationship with children, they usually  
42 relied less on their adult children which may lead to more willingness for institutional  
43 care. Empty-nest couples with higher household income were more likely to prefer  
44 institutional care which is inconsistent with previous studies in Finland (Einiö, 2010).  
45 In Finland, most long-term institutional care is publicly provided in nursing homes  
46 and health centers, and user charges are related to disposable income, up to maximum  
47 of 80 percent (Nihtilä and Martikainen, 2007). The high-income elderly and their  
48 families may therefore have an economic incentive to avoid long-term institutional  
49 care if the absolute level of charges would be very high. In China, most institutional  
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3 care was provided by private institutions and the charges for different services are  
4 fixed so that higher income seniors in China won't have that financial concerns  
5 compared with Finland seniors. It was vital to develop pro-poor institutional care  
6 policies for those lower-income empty-nest seniors with high willingness for  
7 institutional care. We also found that empty-nest couples with more per capita living  
8 space were less willing for institutional care. Per capita living space actually could be  
9 a representative of wealth. Seniors with higher per capita living space might be richer,  
10 given the circumstance of China's rapidly growing housing prices. This might explain  
11 why empty-nest couples with more per capita living space were more willing for  
12 institutional care. Further, empty-nest couples with education level of junior school or  
13 above were more willing for institutional care which was consistent with previous  
14 studies (Nie et al., 2015).  
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23 It's found that aged 70 and 79, having more than 3 children and normal  
24 self-reported health status were risk factors for non-empty nester. Those who aged 70  
25 and 79 had less preference for institutionalization which was inconsistent with one  
26 study in Hong Kong (Woo et al., 1994) and other capitalist countries (Wingard et al.,  
27 1987) where the likelihood of elderly living in institutional care increased with age.  
28 Hong Kong and other capitalist countries are more developed and open than  
29 Shandong which makes those seniors more open-minded about institutional care.  
30 Different value concepts about institutional care might explain why those seniors were  
31 more willing for institutional care compared with Shandong seniors. Those non-empty  
32 seniors who had more than 3 children were less willing for institutionalization. More  
33 children usually means more financial and physical assistance (Zhan and Montgomery,  
34 2003), so it might reduce elders' needs for institutional care.  
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43 This study has a large size of the sample (nearly 4000), which is much larger  
44 than that used in most of the similar studies. This give the study a high degree of  
45 statistical power. This study has some limitations. Firstly, our study has a  
46 cross-sectional design and the result could not be interpreted as cause and effect.  
47 Secondly, all data were based on self-reported measures which could lead to recall  
48 biases. Thirdly, even those we have included some variables of social support in this  
49 study (e.g., living arrangements of the elderly households, number of the children and  
50 relationship with children) , we have not yet used a scale to measure social support of  
51 the seniors, which would be remedied in the future study.  
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## Conclusion

Our study suggested that living arrangements of the households with seniors was associated with the willingness for institutional care of the elderly in China, and the empty-nesters were more willing for institutional care than their counterparts. Our results also showed that residence was a key associated factor for institutionalization willingness in all three types of elderly households. Government should pay more attention to institutional care in rural areas where elder care is still a gap compared with urban areas. Furthermore, we also identified some other associated factors for institutional care willingness among each type of the elderly households. Targeting policies should be developed to offer appropriate institutional care for different types of the seniors.

## Competing interests

The authors declare that they have no competing interests.

## Authors' contributions

Chengchao Zhou, Yangyang Qian, and Wen Qin conceived the idea, Chengchao Zhou implemented the field study. Chengchao Zhou, Yangyang Qian, Dandan Ge, Li Zhang participated in the statistical analysis and interpretation of the results. Yangyang Qian drafted the manuscript. Chengchao Zhou, Wen Qin, and Long Sun gave many valuable comments on the draft and also polished it. All authors read and approved the final manuscript.

## Data sharing

No additional data available.

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Table 1 Socio-demographic characteristics of the elderly in Shandong, China (n=3923)

Characteristics	Total n (%)	Empty-nest single n (%)	Empty-nest couple n (%)	Non-empty-nest n (%)	$\chi^2/F$	p
<b>N</b>	3923(100.0)	391(10.0)	1934(49.3)	1598(40.7)		
<b>Gender</b>					43.525	<b>0.000</b>
Male	1821(46.4)	132(33.8)	983(50.8)	706(44.2)		
Female	2102(53.6)	259(66.2)	951(49.2)	892(55.8)		
<b>Age</b>					145.042	<b>0.000</b>
60-	2568(65.5)	162(41.4)	1257(65.0)	1149(71.9)		
70-	1122(28.6)	183(46.8)	588(30.4)	351(22.0)		
80-	233(5.9)	46(11.8)	89(4.6)	98(6.1)		
<b>Education</b>					84.222	<b>0.000</b>
Illiteracy or semiliterate	1744(44.5)	240(61.4)	744(38.5)	760(47.6)		
Primary school	1171(29.8)	96(24.6)	633(32.7)	442(27.7)		
Junior school or above	1008(25.7)	55(14.1)	557(28.8)	396(24.8)		
<b>Past occupation</b>					34.103	<b>0.000</b>

6	Farmer	2519(64.2)	278(71.1)	1156(59.8)	1085(67.9)		
7							
8	Others	1404(35.8)	113(28.9)	778(40.2)	513(32.1)		
9							
10	<b>Marital Status</b>					2024.826	<b>0.000</b>
11							
12	Single <sup>a</sup>	820(20.9)	391(100.0)	0(0.0)	429(26.8)		
13							
14	Couple	3103(79.1)	0(0.0)	1934(100.0)	1169(73.2)		
15							
16	<b>Number of children</b>					42.968	<b>0.000</b>
17							
18	0-3	2643(67.4)	212(54.2)	1290(66.7)	1141(71.4)		
19							
20	>3	1280(32.6)	179(45.8)	644(33.3)	457(28.6)		
21							
22	<b>Relationship with children</b>					44.656	<b>0.000</b>
23							
24	Good or normal	3639(92.8)	332(84.9)	1794(92.8)	1513(94.7)		
25							
26	Poor	284(7.2)	59(15.1)	140(7.2)	85(5.3)		
27							
28	<b>Residence</b>					150.403	<b>0.000</b>
29							
30	Urban	1768(45.1)	155(39.6)	912(47.2)	701(43.9)		
31							
32	Rural	2155(54.9)	236(60.4)	1022(52.8)	897(56.1)		
33							
34	<b>Self-reported health status</b>					28.629	<b>0.000</b>
35							
36	Good	2044(52.1)	173(44.2)	962(49.7)	909(56.9)		
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Normal or poor	1879(47.9)	218(55.8)	972(50.3)	689(43.1)		
<b>Psychological stress</b>	15.8±6.0	17.3±7.2	15.6±5.7	15.6±5.9	1.743	<b>0.004</b>
<b>ADL</b>					75.403	<b>0.000</b>
I	2853(72.7)	217(55.5)	1403(72.5)	1233(77.2)		
II	631(16.1)	98(25.1)	313(16.2)	220(13.8)		
III	439(11.2)	76(19.4)	218(11.3)	145(9.1)		
<b>NCD</b>					26.274	<b>0.000</b>
Yes	2586(65.9)	296(75.7)	1293(66.9)	997(62.4)		
No	1337(34.1)	95(24.3)	641(33.1)	601(37.6)		
<b>Household income</b>					371.563	<b>0.000</b>
Q1 <sup>b</sup>	996(25.4)	221(56.5)	537(27.8)	238(14.9)		
Q2	1001(25.5)	81(20.7)	551(28.5)	369(23.1)		
Q3	965(24.6)	69(17.6)	414(21.4)	482(30.2)		
Q4	961(24.5)	20(5.1)	432(22.3)	509(31.9)		
<b>Per-capita living space</b>	33.9±23.1	53.0±42.6	36.9±20.0	25.4±14.6	7.255	<b>0.000</b>

<sup>a</sup> Single includes those who are unmarried(1.7%), divorced(0.3%), widowed(18.6%), separated(0.3%).

<sup>b</sup> Quartile 1 (Q1) is the poorest and Quartile 4 (Q4) is the richest.

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Table 2 Association of institutionalization and household composition in Shandong, China

Characteristics	Model 1 (No covariates)		Model 2 (Covariates)	
	OR (95%CI)	p	OR (95%CI)	p
<b>Household composition</b>				
Non-empty-nest	1.0	<b>0.000</b>	1.0	<b>0.000</b>
Empty-nest single	2.759(1.974-3.857)	<b>0.000</b>	6.036(3.337-10.917)	<b>0.000</b>
Empty-nest couple	1.340(1.038-1.729)	<b>0.024</b>	1.382(1.019-1.875)	<b>0.038</b>
<b>Gender</b>				
Male			1.0	
Female			1.014(0.783-1.312)	0.919
<b>Age</b>				
60-			1.0	0.663
70-			0.881(0.657-1.183)	0.400
80-			1.022(0.561-1.864)	0.942
<b>Education</b>				
Illiteracy or semiliterate			1.0	0.047

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6	Primary school	1.065(0.771-1.470)	0.702
7			
8	Junior school or above	1.481(1.045-2.097)	0.027
9			
10	<b>Past occupation</b>		
11			
12	Farmer	1.0	
13			
14	Others	0.915(0.659-1.269)	0.594
15			
16	<b>Marital Status</b>		
17			
18	Single <sup>a</sup>	1.0	
19			
20	Couple	1.336(0.773-2.308)	0.300
21			
22	<b>Number of children</b>		
23			
24	0-3	1.0	
25			
26	>3	0.679(0.503-0.916)	0.011
27			
28	<b>Relationship with children</b>		
29			
30	Good or normal	1.0	
31			
32	Poor	2.418(1.649-3.546)	0.000
33			
34	<b>Residence</b>		
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36	Urban	1.0	
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Rural	0.236(0.170-0.329)	0.000
<b>Self-reported health status</b>		
Good	1.0	
Normal or poor	1.115(0.857-1.452)	0.418
<b>Psychological stress</b>		
	1.005(0.984-1.027)	0.635
<b>ADL</b>		
I	1.0	0.349
II	1.028(0.731-1.447)	0.872
III	0.707(0.431-1.162)	0.172
<b>NCD</b>		
Yes	1.0	
No	1.002(0.755-1.330)	0.991
<b>Household income</b>		
Q1 <sup>b</sup>	1.0	0.327
Q2	1.136(0.760-1.699)	0.534
Q3	1.197(0.791-1.810)	0.396

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Q4			1.475(0.949-2.292)	0.084
<b>Per-capita living space</b>			0.992(0.986-0.999)	0.024
Constant	0.070	0.000	0.078	0.000
R squared		0.019		0.141
Observations	3923			

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<sup>a</sup> Single includes those who are unmarried(1.7%), divorced(0.3%), widowed(18.6%), separated(0.3%).

<sup>b</sup> Quartile 1 (Q1) is the poorest and Quartile 4 (Q4) is the richest.

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Table 3 Factors associated with willingness of institutional care among old empty-nest single in Shandong, China (n=391)

Characteristics	Willingness for institutionalization		OR <sub>c</sub> (95%CI)	p	OR <sub>a</sub> (95%CI)	p
	Yes (%)	No (%)				
<b>n=391</b>	63(16.1)	328(83.9)				
<b>Gender</b>						NA
Male	21(15.9)	111(84.1)	1.0			
Female	42(16.2)	217(83.8)	1.023(0.578-1.812)	0.938		
<b>Age</b>						NA
60-	27(16.7)	135(83.3)	1.0	0.708		
70-	27(14.8)	156(85.2)	0.865(0.484-1.547)	0.626		
80-	9(19.6)	37(80.4)	1.216(0.526-2.810)	0.647		
<b>Education</b>						NA
Illiteracy or semiliterate	38(15.8)	202(84.2)	1.0			
Primary school	17(17.7)	79(82.3)	1.144(0.610-2.144)	0.675		
Junior school or above	8(14.5)	47(85.5)	0.905(0.396-2.066)	0.812		
<b>Past occupation</b>						NA

Farmer	40(14.4)	238(85.6)	1.0			
Others	23(20.4)	90(79.6)	1.521(0.862-2.682)	0.148		
<b>Number of children</b>						NA
0-3	38(17.9)	174(82.1)	1.0			
>3	25(14.0)	154(86.0)	0.743(0.429-1.288)	0.290		
<b>Relationship with children</b>						NA
Good or normal	49(14.8)	283(85.2)	1.0			
Poor	14(23.7)	45(76.3)	1.797(0.918-3.519)	0.087		
<b>Residence</b>						
Urban	38(24.5)	117(75.5)	1.0		1.0	
Rural	25(10.6)	211(89.4)	0.365(0.210-0.634)	<b>0.000</b>	0.304(0.161-0.572)	<b>0.000</b>
<b>Self-reported health status</b>						NA
Good	24(13.9)	149(86.1)	1.0			
Normal or poor	39(17.9)	179(82.1)	1.353(0.778-2.352)	0.284		
<b>Psychological stress</b>	63(16.1)	328(83.9)	1.036(1.000-1.073)	<b>0.050</b>	1.045(1.007-1.085)	<b>0.019</b>
<b>ADL</b>						NA



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I	32(14.7)	185(85.3)	1.0			
II	18(18.4)	80(81.6)	1.301(0.690-2.453)	0.416		
III	13(17.1)	63(82.9)	1.193(0.589-2.415)	0.624		
<b>NCD</b>						NA
Yes	50(16.9)	246(83.1)	1.0			
No	13(13.7)	82(86.3)	0.780(0.403-1.508)	0.460		
<b>Household income</b>						
Q1	29(13.1)	192(86.9)	1.0		1.0	
Q2	19(23.5)	62(76.5)	2.209(1.064-3.869)	<b>0.032</b>	1.434(0.721-2.851)	0.304
Q3	13(18.8)	56(81.2)	1.537(0.749-3.154)	0.241	0.832(0.373-1.858)	0.654
Q4	2(10.0)	18(90.0)	0.736(0.162-3.337)	0.691	0.401(0.084-1.917)	0.252
<b>Per-capita living space</b>	63(16.1)	328(83.9)	0.997(0.990-1.005)	0.504		NA

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<sup>a</sup>Quartile 1 (Q1) is the poorest and Quartile 4 (Q4) is the richest.

Table 4 Factors associated with willingness of institutional care among old empty-nest couple in Shandong, China (n=1934)

Characteristics	Willingness for institutionalization		OR <sub>c</sub> (95%CI)	p	OR <sub>a</sub> (95%CI)	p
	Yes (%)	No (%)				
<b>n=1934</b>	165(8.5)	1769(91.5)				
<b>Gender</b>						NA
Male	83(8.4)	900(91.6)	1.0			
Female	82(8.6)	869(91.4)	1.023(0.744-1.408)	0.888		
<b>Age</b>						NA
60-	100(8.0)	1157(92.0)	1.0	0.384		
70-	58(9.9)	530(90.1)	1.266(0.902-1.778)	0.173		
80-	7(7.9)	82(92.1)	0.988(0.445-2.195)	0.976		
<b>Education</b>						
Illiteracy or semiliterate	34(4.6)	710(95.4)	1.0		1.0	
Primary school	45(7.1)	588(92.9)	1.598(1.010-2.528)	<b>0.045</b>	1.115(0.686-1.814)	0.660
Junior school or above	86(15.4)	471(84.6)	3.813(2.521-5.767)	<b>0.000</b>	1.927(1.177-3.157)	<b>0.009</b>
<b>Past occupation</b>						

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Farmer	54(4.7)	1102(95.3)	1.0		1.0	
Others	111(14.3)	667(85.7)	3.396(2.419-4.767)	<b>0.000</b>	0.735(0.439-1.233)	0.244
<b>Number of children</b>						
0-3	122(9.5)	1168(90.5)	1.0		1.0	
>3	43(6.7)	601(93.3)	0.685(0.477-0.983)	<b>0.040</b>	0.872(0.592-1.286)	0.490
<b>Relationship with children</b>						
Good or normal	145(8.1)	1649(91.9)	1.0		1.0	
Poor	20(14.3)	120(85.7)	1.895(1.146-3.134)	<b>0.013</b>	2.921(1.680-5.077)	<b>0.000</b>
<b>Residence</b>						
Urban	136(14.9)	776(85.1)	1.0		1.0	
Rural	29(2.8)	993(97.2)	0.167(0.110-0.252)	<b>0.000</b>	0.258(0.152-0.438)	<b>0.000</b>
<b>Self-reported health status</b>						NA
Good	85(8.8)	877(91.2)	1.0			
Normal or poor	80(8.2)	892(91.8)	0.925(0.672-1.273)	0.634		
<b>Psychological stress</b>	165(8.5)	1769(91.5)	0.984(0.955-1.014)	0.289		
<b>ADL</b>						

I	134(9.6)	1269(90.4)	1.0		1.0	
II	24(7.7)	289(92.3)	0.786(0.500-1.237)	0.298	0.926(0.575-1.492)	0.753
III	7(3.2)	211(96.8)	0.314(0.145-0.681)	<b>0.003</b>	0.456(0.204-1.020)	0.056
<b>NCD</b>						NA
Yes	118(9.1)	1175(90.9)	1.0			
No	47(7.3)	594(92.7)	0.788(0.554-1.121)	0.185		
<b>Household income</b>						
Q1	11(2.0)	526(98.0)	1.0		1.0	
Q2	34(6.2)	517(93.8)	3.145(1.576-6.273)	<b>0.001</b>	2.300(1.127-4.691)	<b>0.022</b>
Q3	44(10.6)	370(89.4)	5.686(2.898-11.157)	<b>0.000</b>	2.503(1.164-5.380)	<b>0.019</b>
Q4	76(17.6)	356(82.4)	10.208(5.348-19.485)	<b>0.000</b>	3.758(1.695-8.335)	<b>0.001</b>
<b>Per-capita living space</b>	165(8.5)	1769(91.5)	0.989(0.980-0.998)	<b>0.019</b>	0.985(0.974-0.995)	<b>0.005</b>

<sup>a</sup> Quartile 1 (Q1) is the poorest and Quartile 4 (Q4) is the richest.

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Table 5 Factors associated with willingness of institutional care among old non-empty-nesters in Shandong, China (n=1598)

Characteristics	Willingness for institutionalization		OR <sub>c</sub> (95%CI)	p	OR <sub>a</sub> (95%CI)	p
	Yes (%)	No (%)				
<b>n=1598</b>	104(6.5)	1494(93.5)				
<b>Gender</b>						NA
Male	48(6.8)	658(93.2)	1.0		1.0	
Female	56(6.3)	836(93.7)	0.918(0.616-1.368)	0.675		
<b>Age</b>						
60-	93(8.1)	1056(91.9)	1.0	<b>0.001</b>	1.0	
70-	10(2.8)	341(97.2)	0.333(0.171-0.647)	<b>0.001</b>	0.405(0.210-0.814)	<b>0.011</b>
80-	1(1.0)	97(99.0)	0.117(0.016-0.849)	<b>0.034</b>	0.209(0.027-1.591)	0.131
<b>Education</b>						
Illiteracy or semiliterate	34(4.5)	726(95.5)	1.0		1.0	
Primary school	30(6.8)	412(93.2)	1.555(0.938-2.578)	0.087	0.962(0.561-1.649)	0.887
Junior school or above	40(10.1)	356(89.9)	2.399(1.493-3.856)	<b>0.000</b>	1.099(0.630-1.916)	0.739
<b>Past occupation</b>						

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Farmer	48(4.4)	1037(95.6)	1.0		1.0	
Others	56(10.9)	457(89.1)	2.647(1.773-.953)	<b>0.000</b>	1.103(0.669-1.818)	0.702
<b>Marital Status</b>						
Single	18(4.2)	411(95.8)	1.0		1.0	
Couple	86(7.4)	1083(92.6)	1.813(1.077-3.051)	<b>0.025</b>	1.216(0.697-2.122)	0.492
<b>Number of children</b>						
0-3	91(8.0)	1050(92.0)	1.0		1.0	
>3	13(2.8)	444(97.2)	0.338(0.187-0.610)	<b>0.000</b>	0.506(0.271-0.948)	<b>0.033</b>
<b>Relationship with children</b>						NA
Good or normal	95(6.3)	1418(93.7)	1.0			
Poor	9(10.6)	76(89.4)	1.768(0.859-3.637)	0.122		
<b>Residence</b>						
Urban	82(11.7)	619(88.3)	1.0		1.0	
Rural	22(2.5)	875(97.5)	0.19(0.117-0.307)	<b>0.000</b>	0.210(0.122-0.363)	<b>0.000</b>
<b>Self-reported health status</b>						
Good	48(5.3)	861(94.7)	1.0		1.0	

Normal or poor	56(8.1)	633(91.9)	1.587(1.065-2.365)	<b>0.023</b>	1.854(1.225-2.805)	<b>0.003</b>
<b>Psychological stress</b>	104(6.5)	1494(93.5)	0.990(0.956-1.026)	0.595		NA
<b>ADL</b>						NA
I	89(7.2)	1144(92.8)	1.0			
II	11(5.0)	209(95.0)	0.677(0.355-1.288)	0.234		
III	4(2.8)	141(97.2)	0.365(0.132-1.008)	0.052		
<b>NCD</b>						
Yes	65(6.5)	932(93.5)	1.0			NA
No	39(6.5)	562(93.5)	0.995(0.660-1.500)	0.981		
<b>Household income</b>						
Q1	15(6.3)	223(93.7)	1.0			NA
Q2	12(3.3)	357(96.7)	0.500(0.230-1.087)	0.080		
Q3	30(6.2)	452(93.8)	0.987(0.520-1.872)	0.967		
Q4	47(9.2)	462(90.8)	1.512(0.828-2.764)	0.179		
<b>Per-capita living space</b>	104(6.5)	1494(93.5)	0.985(0.969-1.001)	0.073		NA

OR<sub>c</sub>: crude odds ratio; OR<sub>a</sub>: adjusted odds ratio

<sup>a</sup> Single includes those who are unmarried(0.9%), divorced(0.3%), widowed(25.3%), separated(0.3%).



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<sup>b</sup>Quartile 1 (Q1) is the poorest and Quartile 4 (Q4) is the richest.

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8 Figure 1 Prevalence of seniors' willingness for institutionalization among empty-nest single,  
9 empty-nest couple and non-empty-nest in Shandong, China (n=3923)

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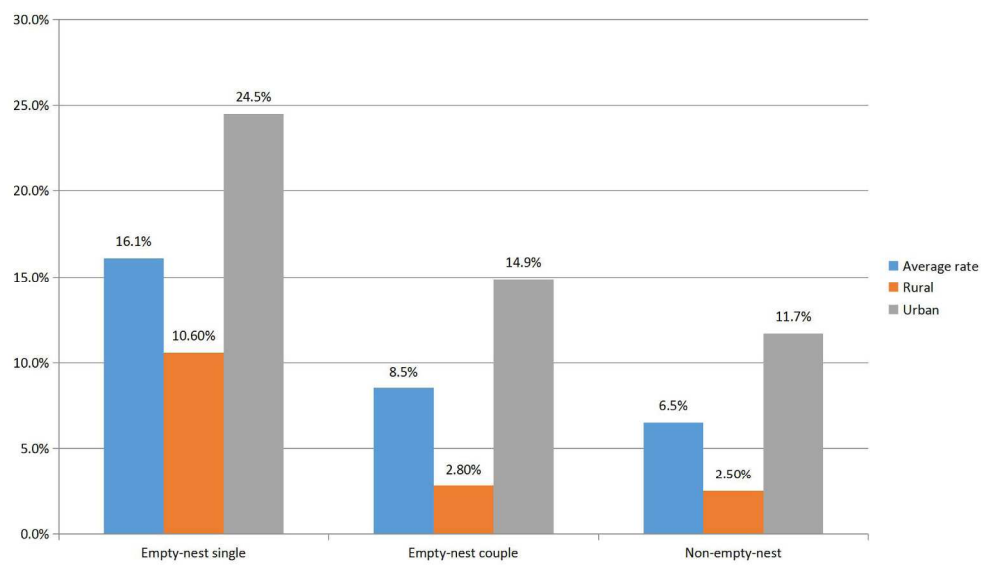


Figure 1

244x141mm (300 x 300 DPI)

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STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation	Reported on page #
<b>Title and abstract</b>	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1,
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	1
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	2,3
Objectives	3	State specific objectives, including any prespecified hypotheses	3
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	3,4,5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	3,4,5
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	3,4,5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	3,4,5
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	3,4,5
Bias	9	Describe any efforts to address potential sources of bias	9
Study size	10	Explain how the study size was arrived at	3,4,5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	3,4,5
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	3,4,5
		(b) Describe any methods used to examine subgroups and interactions	3,4,5
		(c) Explain how missing data were addressed	
		(d) If applicable, describe analytical methods taking account of sampling strategy	
		(e) Describe any sensitivity analyses	
<b>Results</b>			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5,6
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	5,6
		(b) Indicate number of participants with missing data for each variable of interest	
Outcome data	15*	Report numbers of outcome events or summary measures	5,6

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2	Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-
3			adjusted estimates and their precision (eg, 95% confidence interval).
4			Make clear which confounders were adjusted for and why they were
5			included
6			
7			(b) Report category boundaries when continuous variables were
8			categorized
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10			(c) If relevant, consider translating estimates of relative risk into
11			absolute risk for a meaningful time period
12	Other analyses	17	Report other analyses done—eg analyses of subgroups and
13			interactions, and sensitivity analyses
14	<b>Discussion</b>		
15	Key results	18	Summarise key results with reference to study objectives
16	Limitations	19	Discuss limitations of the study, taking into account sources of
17			potential bias or imprecision. Discuss both direction and magnitude
18			of any potential bias
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20	Interpretation	20	Give a cautious overall interpretation of results considering
21			objectives, limitations, multiplicity of analyses, results from similar
22			studies, and other relevant evidence
23			
24	Generalisability	21	Discuss the generalisability (external validity) of the study results
25	<b>Other information</b>		
26	Funding	22	Give the source of funding and the role of the funders for the
27			present study and, if applicable, for the original study on which the
28			present article is based
29			

\*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).

# BMJ Open

## Difference in Utilization Willingness of Institutional Care between Empty-nest and Non-empty-nest Elderly: A Cross-sectional Study in Shandong, China

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Keywords:	Institutional care, Willingness, Elderly, Empty-nest, Determinants

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Manuscripts

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3 **Difference in Utilization Willingness of Institutional Care between**  
4 **Empty-nest and Non-empty-nest Elderly: A Cross-sectional Study in**  
5 **Shandong, China**  
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## Abstract

**Introduction:** Institutional care has been strongly promoted in China to meet the seniors' long-term care needs. Empty-nest elderly, in comparison with their counterparts, have less social support and caring networks. This study aims to compare the utilization willingness of institutional care and its predictors between empty-nest and non-empty-nest seniors.

**Methods:** A total of 3923 seniors (60+) were included in the analysis. Face-to-face interviews were conducted among the elderly using a structured questionnaire to collect data. Two binary logistic regression models were employed to assess the association between living arrangements of elderly households and willingness of institutional care. Multivariate logistic regression models were used to identify the predictors of the utilization willingness for institutional care among empty-nesters and non-empty-nesters.

**Results:** Our study found that about 8.5% of the seniors had willingness for institutional care in Shandong, China. Empty-nest singles (OR=5.301; 95CI 2.838-9.904) and empty-nest couples (OR=1.547; 95CI 1.135-2.107) were found to be more willing for institutional care. Our results also showed that residence was a key determinant for institutionalization willingness in empty-nest and non-empty-nest elderly. Among empty-nest singles, psychological stress was a positive determinant for institutional care. Factors including education attainment, relationship with adult children, household income and per capita living space were determinants for empty-nest couples' willingness for institutionalization. Age, number of children, self-reported health status were found to be associated factors for willingness among non-empty nesters.

**Conclusions:** Government should pay more attention to institutional care in rural areas where elder care is still a gap compared with the urban areas. Targeted policies should be made for different types of seniors to offer appropriate institutional care.

**Keywords:** Willingness for insitutional care, Elderly, Empty-nest, Determinants



## Strengths and limitations of this study

- A large sample of 3,923 participants based on a community survey provided a real profile of willingness for institutional care in Chinese seniors .
- This study focuses on the association between living arrangements of the households with seniors and the willingness for institutional care in the elderly in China.
- There might be a possible recall bias as for most questionnaire data, which is a limitation of this study.
- The cross-sectional study design precludes any causal interpretation.

## Introduction

Since 1999, the proportion of the seniors aged 60 and above among the general population in China has reached more than 10%, the number of aging population in China has ranked the first in the world.[1] The number of Chinese people aged 60 years and above had reached 212.4 million by 2014, which accounted for 15.5% of the total population.[2] It's estimated that China, with an amount of 98.3 million old people aged 80 or over in 2050, will still be one of those countries which have the greatest numbers of oldest-old.[3] With the rapid aging of the Chinese population, the number of empty-nesters is on the rise as well.[4] Empty-nest seniors refer to those seniors who are childless or whose children have already left home.[5] With the increasing number of the elderly empty-nesters, long-term care for the elderly has been emerging as a social problem.

Traditionally, taking care of the elderly by adult children in the family was a basic norm in the Confucian doctrine.[6] In recent years, increased geographic mobility and reduced family size due to one-child policy have made more adult children unavailable for elder care.[7] Actually, inter-generational relations are also changing, thus elderly support is no longer considered to be an absolute obligation by adult children.[8-9] More women in urban China are gaining higher education and becoming more work-oriented which indicates that gender roles in elder care are changing and the availability of elder care by adult children has become questionable.[10] On the other hand, with Chinese baby boomers approaching retirement age, informal care such as familial care is unlikely to meet the needs of all seniors.[11] One study indicated that nearly half of seniors, who needed some level of assistance in their activities of daily living or instrumental activities of daily living, actually lived alone instead of living with their adult children.[10] Another study found that many seniors expressed preference to live alone or with their spouse, if housing and health status permit.[12] Consequently, institutional care has been strongly promoted to meet older adults' long-term care needs (Chou, 2010).[13]

After the welfare reform in 1990s, former government-sponsored nursing homes have become decentralized, and a great amount of private nursing homes is on the rise, mostly emerging in large cities.[7] Previous studies have identified the empty-nest elderly's attitudes towards institutional care and its predictors. Some studies found that the rate of institutional care of Chinese elderly was on the rise rapidly, which

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3 might be due to elderly's increasing need for that.[14-15] A study found that the  
4 seniors' living arrangements prior to elder home placement and their assessment of  
5 the cost involved for such care were related to seniors' willingness to stay in elder  
6 homes.[16] Some other studies found that factors including gender, educational  
7 attainment, occupation, health insurance, number of children were associated with  
8 willing for institutional care among the empty-nest seniors.[17-19] However, few of  
9 such studies were published in international journals. Moreover, the studies described  
10 earlier have some systematic weaknesses. First, almost all of the empirical studies  
11 were based on small sample sizes (e.g.,n=523 in the case of Xie et al.; n=570 in the  
12 case of Chen et al.; n=1000 in the case of Zhu et al.).[17-19] Second, in many studies  
13 it is not clear who is serving as the reference group. In other words, the associated  
14 factors were only explored in the empty-nest seniors. [17-19]

15  
16 To remedy this situation, the present study aims to compare utilization  
17 willingness of institutional care between empty-nest and non-empty-nest seniors in  
18 China. To do so, we have following specific objectives. First, we will compare the  
19 willingness for institutional care between empty-nest and non-empty nest elderly.  
20 Second, we will identify the associated factors for institutional care among the  
21 empty-nest and non-empty-nest elderly. Our study is an empirical study and it's not  
22 guided by theory.

## 23 24 **Methods**

### 25 26 **Settings and participants**

27  
28 This study was conducted in Shandong, a province where the elderly aged 65 or  
29 over accounted for 11.6% of its total population.[20] In this study, a 3-stage cluster  
30 sampling was used to select participants. Firstly, all districts and counties in Shandong  
31 province were stratified into three groups (high, middle and low GDP per capita) on  
32 the ground of GDP per capita (2011) separately. Secondly, we chose one district and  
33 one county from each group. Thus, three urban districts (Huaiyin, Dongchangfu and  
34 Zhangdian) and three rural counties (Qufu, Chiping and Leling) were chosen as the  
35 study sites. Similarly, we then chose three sub-districts and three townships in each  
36 sampling district or county on the basis of GDP per capita. Lastly, three communities  
37 and three villages were selected from each chosen sub-district and township.  
38 Therefore, we selected 27 urban communities and 27 rural villages in total. A total of  
39 3923 older people were included in the analysis.

### Data collection

Data were collected from November 2011 to January 2012 by using a house-to-house interview. Face-to-face interviews were conducted among the elderly using a structured questionnaire by trained master students from Shandong University School of Public Health. To ensure quality, completed questionnaires were carefully checked by quality supervisors at the end of each day. The questionnaire included demographic characteristics, living arrangements of the households, relationship with children, marital status, economic status, mental health condition and willingness for institutional care.

### Variables and measures

The dependent variable was seniors' willingness for institutional care which was evaluated on the ground of interviewees' answers to 'which endowment way are you willing for?' If the response was 'institutional care', the willingness for institutional care would be coded as 'yes'. On the contrary, if the answer was 'home-based care', 'community endowment' or 'others', willingness for institutional care would be coded as 'no'.

Socio-demographic and psychological characteristics such as gender, age, education, past occupation (pre-retirement occupation), marital status, number of children, relationship with children, residence, self-reported health status, psychological stress, ADL (activities of daily living), NCDs (non-communicable diseases), and household income were included in this study.

The age of the participants was categorized as follows: 60-, 70- and 80+ years. Other demographic characteristics were classified as follows: gender (male vs. female), education (illiteracy or semiliterate, primary school and junior school or above), past occupation (farmer vs. others), marital status (single vs. couple), number of children (0-3 vs. >3), relationship with children (good vs. bad), residence (urban vs. rural), self-reported health status (good vs. normal or poor), ADL ( I , II and III), NCDs in the past six months (yes vs. no), and household income (Q1, Q2, Q3 and Q4). Quartile 1 (Q1) is the poorest and Quartile 4 (Q4) is the richest.

Living arrangement of elderly households could be classified into non-empty nester, empty-nest single and empty-nest couple. Non-empty-nester refers to those seniors who live with their children while empty-nest single and empty-nest couple refers to those seniors who live alone with a spouse and without a spouse respectively

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3 more than six months.[21] Per-capita living space is a measure that takes total living  
4 space (square meter) and divides it by the number of permanent people(who live in  
5 the house more than half a year) in a house.  
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8 Psychological stress was evaluated on the ground of 10-item Kessler Scale (K10).  
9 K10 is an effective tool to assess people's psychological status designed by scholars  
10 such as Kessler, Mroczek and so on (Kessler et al., 2002).[22] The Chinese-language  
11 version of K10 has been verified to be of good reliability and validity.[23]  
12  
13

14 ADL instrument was consisted of Physical Self-maintenance Scale and  
15 Instrumental Activities of Daily Living Scale designed by Lawton and Brody.[24]  
16 ADL Scale was used to evaluate people's simple and basic ability to practice one's  
17 normal life independently. The reliability and validity of ADL instrument in  
18 Chinese-language version was demonstrated to be good.[25] Scores of ADL can be  
19 divided into three levels, the higher level represents more severe dysfunction. Level 1,  
20 2 and 3 means mild dysfunction, moderate dysfunction, and severe dysfunction  
21 respectively.[26]  
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27 We also presented the variables and assignments in the Appendix Table1.  
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### 29 **Statistical Analysis**

30 The data was double entered and checked using EpiData 6.04. Statistical  
31 analyses were performed using SPSS 21.0. For continuous variables, p value was  
32 calculated using Student's t test or F-test; for categorical variables, p value was  
33 calculated using chi-square test. Two binary logistic regression models were  
34 employed to assess the association between living arrangements of elderly households  
35 and willingness of institutional care. We used univariate logistic regression model and  
36 mutli-variate logistic regression model to explore the factors associated with  
37 willingness of institutional care. All reported CIs were calculated at the 95% level.  
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43 Statistical significance was set at the 5% level.  
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### 45 **Patient and Public Involvement statement**

46 Ethical approval was obtained from The Ethical Committee of Shandong  
47 University School of Public Health. The investigation was performed after the  
48 acquisition of written informed consents of all participants.  
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### 51 **Results**

52  
53 Table 1 showed basic information of the 3923 seniors. About 8.5% seniors had  
54 willingness for institutional care. Non-empty-nesters accounted for 40.7% of the  
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3 participants, empty-nest singles accounted for 10.0%, and empty-nest couples  
4 accounted for 49.3%. Generally speaking, the majority of the elderly were female  
5 (53.6%), between the ages of 60 and 69 (65.5%), illiterate or semiliterate (44.5%),  
6 farmers (64.2%), couple (79.1%), having 0 to 3 children (67.4%), having good or  
7 normal relationship with children (91.3%), rural (54.9%), having good self-reported  
8 health status (52.1%), having mild dysfunction (72.7%), and having NCDs (65.9%).  
9 The elderly's K10 score was  $15.8 \pm 6.0$  (M $\pm$ SD) and their per-capita living space was  
10  $33.9 \pm 23.1$  (M $\pm$ SD) square meters.  
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16 We presented our results in two models to understand the association between  
17 living arrangements of elderly households and willingness for institutional care.  
18 Model 1 showed that willingness for institutional care was higher in empty-nest  
19 singles (OR=2.759; 95CI 1.974-3.857) and empty-nest couples (OR=1.340; 95CI  
20 1.038-1.729) than in non-empty-nesters. When other variables were controlled,  
21 willingness for institutional care was still higher among empty-nest singles  
22 (OR=5.301; 95CI 2.838-9.904) and empty-nest couples (OR=1.547; 95CI 1.135-2.107)  
23 than in non-empty-nesters (Table 2). Figure 1 showed that in each of the three  
24 subgroups with different household living arrangements, urban seniors' willingness to  
25 use institutional care was statistically higher than rural seniors'.  
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32 Table 3 showed the factors associated with willingness for institutional care  
33 among empty-nest singles. Univariate analysis indicated that empty-nest singles who  
34 were from rural areas ( $p=0.000$ ) had lower willingness for institutional care.  
35 Empty-nest singles who had greater psychological stress ( $p=0.050$ ) had higher  
36 willingness for institutional care. Multivariate logistic analysis also showed that the  
37 two factors were associated with willingness for institutional care.  
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42 As shown in Table 4, univariate analysis showed that those empty-nest couples  
43 who had higher education level, who were non-farmers ( $p=0.000$ ), who had poor  
44 relationship with children ( $p=0.014$ ), who had higher household income were more  
45 willing for institutional care. Those empty-nest couples who had more than 3 children  
46 ( $p=0.040$ ), who lived in rural areas ( $p=0.000$ ), who had severe dysfunction ( $p=0.003$ ),  
47 who had more per-capita living space ( $p=0.019$ ) were less willing for institutional care.  
48 Multi-logistic regression indicated that factors including education level, relationship  
49 with children, household income, residence were associated with willingness for  
50 institutional care.  
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56 Likewise, for those non-empty-nest seniors, multi-logistic regression model  
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3 found that those with younger age, those who had less children, those who were from  
4 urban areas, and those who had normal or poor self-rated health status preferred to use  
5 institutional care (See Table 5).  
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## 7 **Discussion**

8  
9 Our study found that 8.5% of the seniors had willingness for institutional care.  
10 This was lower than the that found among Korean American elders (45%) with a  
11 similar age. [27] This was lower than the reported rates of 20% in urban area, 17% in  
12 rural area in the elderly in China, and 16.7% in a study of the seniors aged 65 or  
13 above in Taiwan, China. It was also lower than the 9.69% found in older population in  
14 Zhejiang, China, and 44.8% found in a study in the elderly with a similar age in  
15 Chengdu, China.[13,28-30] Compared with above mentioned sites, Shandong is rather  
16 a conservative province which is deeply affected by Confucianism. The culture of  
17 filial piety is profoundly rooted in Shandong residents' mind. This might be primary  
18 cause of the variation between our study and the previous studies mentioned above.  
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20  
21 Our results showed that living arrangement of the households was associated  
22 with the elderly's willingness for institutional care. The analysis made it clear that  
23 empty-nest singles and empty-nest couples were more willing for institutional care  
24 than non-empty-nesters. This finding was consistent with another study which found  
25 that older adults who had no spouse or children were more likely to move into nursing  
26 homes than their counterparts.[7,31] Due to lack of care from adult children,  
27 empty-nest seniors are facing more endowment risks. Empty-nest elderly had poorer  
28 self-rated health, higher prevalence of two-week illness and NCDs, which indicated  
29 that they had poorer health status than non-empty-nest elderly.[5] It's also found that  
30 empty-nest seniors, in comparison with non-empty nest seniors, had higher level of  
31 loneliness.[32] The high physical and mental health service needs might be the reason  
32 why empty-nest seniors are more willing for institutional care which can provide  
33 professional health care.  
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36 Consistent with previous studies, our results also showed that residence was a  
37 key predictor of willingness for institutional care in all three types of elderly  
38 households.[33] Urban seniors had statistically higher willingness for institutional  
39 care than rural seniors across all three types of elderly household. Compared with  
40 rural seniors, urban seniors were less conservative. Rural seniors had lower income,  
41 poorer social welfare condition than urban seniors. Further, the supply of institutional  
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3 care was relatively deficient in rural areas. These differences between rural and urban  
4 areas might explain why rural seniors were less willing for institutional care. This  
5 finding was helpful for the policy-makers to allocate differentially the institutional  
6 care resources in urban and rural China.  
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9 Among empty-nest singles, psychological stress was a positive determinant for  
10 institutional care which was in accordance with previous studies.[34] To avoid  
11 excessive reliance on family members which may result in tensions in family, when  
12 seniors had psychological stress, they would rather choose institutional care.[35] This  
13 might be associated with empty-nest singles' attitudes of self-reliance.  
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16 Similar with previous studies, empty-nest seniors who had normal relationship  
17 with children were more willing for institutional care.[13] Having good relationship  
18 with children represents more financial assistance and spiritual comfort from children.  
19 When seniors were in poor relationship with children, they usually relied less on their  
20 adult children which may lead to more willingness for institutional care. Empty-nest  
21 couples with higher household income were more likely to prefer institutional care  
22 which is inconsistent with previous studies in Finland.[36] In Finland, most long-term  
23 institutional care is publicly provided in nursing homes and health centers, and user  
24 charges are related to disposable income, up to maximum of 80 percent.[37] The  
25 high-income elderly and their families may therefore have an economic incentive to  
26 avoid long-term institutional care if the absolute level of charges would be very high.  
27 In China, most institutional care was provided by private institutions and the charges  
28 for different services are fixed so that higher income seniors in China will not have  
29 that financial concerns compared with Finland seniors. It was vital to develop  
30 pro-poor institutional care policies for those lower-income empty-nest seniors with  
31 high willingness for institutional care. We also found that empty-nest couples with  
32 more per capita living space were less willing for institutional care. Per capita living  
33 space actually could be a representative of wealth. Seniors with higher per capita  
34 living space might be richer, given the circumstance of China's rapidly growing  
35 housing prices. This might explain why empty-nest couples with more per capita  
36 living space were more willing for institutional care. Further, empty-nest couples with  
37 education level of junior school or above were more willing for institutional care,  
38 which was consistent with previous studies.[33]  
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54 It's found that aged 70 and 79, having more than 3 children and normal  
55 self-reported health status were risk factors for non-empty nesters. Those who aged 70  
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3 and 79 had less preference for institutional care which was inconsistent with one study  
4 in Hong Kong (Woo et al., 1994) and other developed countries (Wingard et al., 1987)  
5 where the likelihood of elderly living in institutional care increased with age.[38-39]  
6  
7 Hong Kong and other developed countries are more developed and open than  
8 Shandong, which makes those seniors more open-minded about institutional care.  
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10 Different value concepts about institutional care might explain why those seniors were  
11 more willing for institutional care compared with Shandong seniors. Those non-empty  
12 seniors who had more than 3 children were less willing for institutional care. More  
13 children usually means more financial and physical assistance, so it might reduce  
14 elders' needs for institutional care. More  
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19 This study has a large size of the sample (nearly 4000), which is much larger  
20 than that used in most of the similar studies. This gives the study a high degree of  
21 statistical power. This study has some limitations. Firstly, our study has a  
22 cross-sectional design and the result could not be interpreted as cause and effect.  
23  
24 Secondly, all data were based on self-reported measures which could lead to recall  
25 biases. Thirdly, even though we have included some variables of social support in this  
26 study (e.g., living arrangements of the elderly households, number of the children and  
27 relationship with children), we have not yet used a scale to measure social support of  
28 the seniors, which would be remedied in the future study. Finally, our investigation is  
29 conducted in Shandong province, which is rather a conservative region, thus the results  
30 of our study may not be generalized to other parts of China.  
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## 38 **Conclusion**

39  
40 Our study suggested that living arrangements of the households with seniors  
41 was associated with the willingness for institutional care of the elderly in China, and  
42 the empty-nesters were more willing for institutional care than their counterparts. Our  
43 results also showed that residence was a key associated factor for willingness for  
44 institutional care in all three types of elderly households. Government should pay  
45 more attention to institutional care in rural areas where elder care is still a gap  
46 compared with urban areas. Furthermore, we also identified some other associated  
47 factors for institutional care willingness among each type of the elderly households.  
48 Targeting policies should be developed to offer appropriate institutional care for  
49 different types of the seniors.  
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### **Competing interests**

The authors declare that they have no competing interests.

### **Authors' contributions**

Chengchao Zhou, Yangyang Qian, and Wen Qin conceived the idea, Chengchao Zhou implemented the field study. Chengchao Zhou, Yangyang Qian, Dandan Ge, Li Zhang participated in the statistical analysis and interpretation of the results. Yangyang Qian drafted the manuscript. Chengchao Zhou, Wen Qin, and Long Sun gave many valuable comments on the draft and also polished it. All authors read and approved the final manuscript.

### **Data sharing**

No additional data available.

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Table 1 Socio-demographic characteristics of the elderly in Shandong, China (n=3923)

Characteristics	Total n (%)	Empty-nest single n (%)	Empty-nest couple n (%)	Non-empty-nest n (%)	$\chi^2/F$	p
<b>N</b>	3923(100.0)	391(10.0)	1934(49.3)	1598(40.7)		
<b>Gender</b>					43.525	<b>0.000</b>
Male	1821(46.4)	132(33.8)	983(50.8)	706(44.2)		
Female	2102(53.6)	259(66.2)	951(49.2)	892(55.8)		
<b>Age</b>					145.042	<b>0.000</b>
60-	2568(65.5)	162(41.4)	1257(65.0)	1149(71.9)		
70-	1122(28.6)	183(46.8)	588(30.4)	351(22.0)		
80-	233(5.9)	46(11.8)	89(4.6)	98(6.1)		
<b>Education</b>					84.222	<b>0.000</b>
Illiteracy or semiliterate	1744(44.5)	240(61.4)	744(38.5)	760(47.6)		
Primary school	1171(29.8)	96(24.6)	633(32.7)	442(27.7)		
Junior school or above	1008(25.7)	55(14.1)	557(28.8)	396(24.8)		
<b>Past occupation</b>					34.103	<b>0.000</b>
Farmer	2519(64.2)	278(71.1)	1156(59.8)	1085(67.9)		
Others	1404(35.8)	113(28.9)	778(40.2)	513(32.1)		
<b>Marital Status</b>					2024.826	<b>0.000</b>
Single <sup>a</sup>	820(20.9)	391(100.0)	0(0.0)	429(26.8)		
Couple	3103(79.1)	0(0.0)	1934(100.0)	1169(73.2)		
<b>Number of children</b>					42.968	<b>0.000</b>
0-3	2643(67.4)	212(54.2)	1290(66.7)	1141(71.4)		
>3	1280(32.6)	179(45.8)	644(33.3)	457(28.6)		
<b>Relationship with children <sup>b</sup></b>					35.101	<b>0.000</b>
Good or normal	3581(92.9)	298(85.6)	1782(92.7)	1501(94.6)		
Poor	275(7.1)	50(14.4)	140(7.3)	85(5.4)		
<b>Residence</b>					150.403	<b>0.000</b>
Urban	1768(45.1)	155(39.6)	912(47.2)	701(43.9)		
Rural	2155(54.9)	236(60.4)	1022(52.8)	897(56.1)		

<b>Self-reported health status</b>					28.629	<b>0.000</b>
Good	2044(52.1)	173(44.2)	962(49.7)	909(56.9)		
Normal or poor	1879(47.9)	218(55.8)	972(50.3)	689(43.1)		
<b>Psychological stress</b>	15.8±6.0	17.3±7.2	15.6±5.7	15.6±5.9	1.743	<b>0.004</b>
<b>ADL</b>					75.403	<b>0.000</b>
I	2853(72.7)	217(55.5)	1403(72.5)	1233(77.2)		
II	631(16.1)	98(25.1)	313(16.2)	220(13.8)		
III	439(11.2)	76(19.4)	218(11.3)	145(9.1)		
<b>NCD</b>					26.274	<b>0.000</b>
Yes	2586(65.9)	296(75.7)	1293(66.9)	997(62.4)		
No	1337(34.1)	95(24.3)	641(33.1)	601(37.6)		
<b>Household income<sup>c</sup></b>					371.563	<b>0.000</b>
Q1	996(25.4)	221(56.5)	537(27.8)	238(14.9)		
Q2	1001(25.5)	81(20.7)	551(28.5)	369(23.1)		
Q3	965(24.6)	69(17.6)	414(21.4)	482(30.2)		
Q4	961(24.5)	20(5.1)	432(22.3)	509(31.9)		
<b>Per-capita living space</b>	33.9±23.1	53.0±42.6	36.9±20.0	25.4±14.6	7.255	<b>0.000</b>

<sup>a</sup> Single includes those who are unmarried(1.7%), divorced(0.3%), widowed(18.6%), separated(0.3%).

<sup>b</sup> 67 of the participants are childless elders, and were regared as missing data here.

<sup>c</sup>Quartile 1 (Q1) is the poorest and Quartile 4 (Q4) is the richest.

Table 2 Association of willingness for institutional care and household composition in Shandong, China

Characteristics	Model 1 (No covariates)		Model 2 (Covariates)	
	OR (95%CI)	p	OR (95%CI)	p
<b>Household composition</b>				
Non-empty-nest	1.0		1.0	
Empty-nest single	2.759(1.974-3.857)	<b>0.000</b>	5.301(2.838-9.904)	<b>0.000</b>
Empty-nest couple	1.340(1.038-1.729)	<b>0.024</b>	1.547(1.135-2.107)	<b>0.006</b>
<b>Gender</b>				
Male			1.0	
Female			1.223(0.938-1.595)	0.137
<b>Age</b>				
60-			1.0	
70-			1.017(0.754-1.371)	0.912
80-			1.144(0.612-2.139)	0.674
<b>Education</b>				
Illiteracy or semiliterate			1.0	
Primary school			1.166(0.835-1.627)	0.368
Junior school or above			1.617(1.128-2.136)	0.009
<b>Past occupation</b>				
Farmer			1.0	
Others			1.283(0.899-1.830)	0.169
<b>Marital Status</b>				
Single <sup>a</sup>			1.0	
Couple			1.190(0.680-2.085)	0.542
<b>Number of children</b>				
0-3			1.0	
>3			0.755(0.559-1.021)	0.068

**Relationship with children**

Good or normal	1.0		
Poor	2.504(1.685-3.720)	0.000	

**Residence**

Urban	1.0		
Rural	0.546(0.383-0.778)	0.000	

**Self-reported health status**

Good	1.0		
Normal or poor	1.019(0.778-1.334)	0.891	

**Psychological stress**

	0.998(0.975-1.020)	0.833	
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**ADL**

I	1.0		
II	0.910(0.637-1.299)	0.603	
III	0.577(0.334-0.997)	0.049	

**NCD**

Yes	1.0		
No	0.957(0.717-1.277)	0.764	

**Household income<sup>b</sup>**

Q1	1.0		
Q2	1.514(0.995-2.304)	0.053	
Q3	1.612(1.017-2.554)	0.042	
Q4	2.065(1.271-3.354)	0.003	

**Per-capita living space**

Constant	0.070	0.000	0.044	0.000
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R squared		0.019	0.112
Observations	3923		

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<sup>a</sup> Single includes those who are unmarried(1.7%), divorced(0.3%), widowed(18.6%), separated(0.3%).

<sup>b</sup> Quartile 1 (Q1) is the poorest and Quartile 4 (Q4) is the richest.

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Table 3 Factors associated with willingness of institutional care among old empty-nest single in Shandong, China (n=391)

Characteristics	Willingness for institutionalization		OR <sub>c</sub> (95%CI)	p	OR <sub>a</sub> (95%CI)	p
	Yes (%)	No (%)				
<b>n=391</b>	63(16.1)	328(83.9)				
<b>Gender</b>						NA
Male	21(15.9)	111(84.1)	1.0			
Female	42(16.2)	217(83.8)	1.023(0.578-1.812)	0.938		
<b>Age</b>						NA
60-	27(16.7)	135(83.3)	1.0	0.708		
70-	27(14.8)	156(85.2)	0.865(0.484-1.547)	0.626		
80-	9(19.6)	37(80.4)	1.216(0.526-2.810)	0.647		
<b>Education</b>						NA
Illiteracy or semiliterate	38(15.8)	202(84.2)	1.0			
Primary school	17(17.7)	79(82.3)	1.144(0.610-2.144)	0.675		
Junior school or above	8(14.5)	47(85.5)	0.905(0.396-2.066)	0.812		
<b>Past occupation</b>						NA
Farmer	40(14.4)	238(85.6)	1.0			
Others	23(20.4)	90(79.6)	1.521(0.862-2.682)	0.148		
<b>Number of children</b>						NA
0-3	38(17.9)	174(82.1)	1.0			
>3	25(14.0)	154(86.0)	0.743(0.429-1.288)	0.290		
<b>Relationship with children<sup>a</sup></b>						NA
Good or normal	39(13.1)	259(86.9)	1.0			
Poor	11(22.0)	39(78.0)	1.873(0.886-3.962)	0.101		
<b>Residence</b>						
Urban	38(24.5)	117(75.5)	1.0		1.0	
Rural	25(10.6)	211(89.4)	0.365(0.210-0.634)	<b>0.000</b>	0.304(0.161-0.572)	<b>0.000</b>

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<b>Self-reported health status</b>							NA
Good	24(13.9)	149(86.1)	1.0				
Normal or poor	39(17.9)	179(82.1)	1.353(0.778-2.352)	0.284			
<b>Psychological stress<sup>b</sup></b>	63(16.1)	328(83.9)	1.036(1.000-1.073)	<b>0.050</b>	1.045(1.007-1.085)		<b>0.019</b>
<b>ADL</b>							NA
I	32(14.7)	185(85.3)	1.0				
II	18(18.4)	80(81.6)	1.301(0.690-2.453)	0.416			
III	13(17.1)	63(82.9)	1.193(0.589-2.415)	0.624			
<b>NCD</b>							NA
Yes	50(16.9)	246(83.1)	1.0				
No	13(13.7)	82(86.3)	0.780(0.403-1.508)	0.460			
<b>Household income<sup>c</sup></b>							
Q1	29(13.1)	192(86.9)	1.0		1.0		
Q2	19(23.5)	62(76.5)	2.209(1.064-3.869)	<b>0.032</b>	1.434(0.721-2.851)		0.304
Q3	13(18.8)	56(81.2)	1.537(0.749-3.154)	0.241	0.832(0.373-1.858)		0.654
Q4	2(10.0)	18(90.0)	0.736(0.162-3.337)	0.691	0.401(0.084-1.917)		0.252
<b>Per-capita living space</b>	63(16.1)	328(83.9)	0.997(0.990-1.005)	0.504			NA

OR<sub>c</sub>: crude odds ratio; OR<sub>a</sub>: adjusted odds ratio  
<sup>a</sup> 43 of the participants are childless elders, and were regared as missing data here.  
<sup>b</sup> We also included “Psychological stress” into multi-variate logistice regression model.  
<sup>c</sup> Quartile 1 (Q1) is the poorest and Quartile 4 (Q4) is the richest.

Table 4 Factors associated with willingness of institutional care among old empty-nest couple in Shandong, China (n=1934)

Characteristics	Willingness for institutionalization		OR <sub>c</sub> (95%CI)	p	OR <sub>a</sub> (95%CI)	p
	Yes (%)	No (%)				
<b>n=1934</b>	165(8.5)	1769(91.5)				
<b>Gender</b>						NA
Male	83(8.4)	900(91.6)	1.0			
Female	82(8.6)	869(91.4)	1.023(0.744-1.408)	0.888		
<b>Age</b>						NA
60-	100(8.0)	1157(92.0)	1.0	0.384		
70-	58(9.9)	530(90.1)	1.266(0.902-1.778)	0.173		
80-	7(7.9)	82(92.1)	0.988(0.445-2.195)	0.976		
<b>Education</b>						
Illiteracy or semiliterate	34(4.6)	710(95.4)	1.0		1.0	
Primary school	45(7.1)	588(92.9)	1.598(1.010-2.528)	<b>0.045</b>	1.139(0.703-1.845)	0.660
Junior school or above	86(15.4)	471(84.6)	3.813(2.521-5.767)	<b>0.000</b>	1.918(1.173-3.135)	<b>0.009</b>
<b>Past occupation</b>						
Farmer	54(4.7)	1102(95.3)	1.0		1.0	
Others	111(14.3)	667(85.7)	3.396(2.419-4.767)	<b>0.000</b>	0.909(0.535-1.544)	0.724
<b>Number of children</b>						
0-3	122(9.5)	1168(90.5)	1.0		1.0	
>3	43(6.7)	601(93.3)	0.685(0.477-0.983)	<b>0.040</b>	0.878(0.598-1.288)	0.506
<b>Relationship with children<sup>a</sup></b>						
Good or normal	145(8.1)	1637(91.9)	1.0		1.0	
Poor	20(14.3)	120(85.7)	1.882(1.138-3.111)	<b>0.014</b>	2.677(1.553-4.615)	<b>0.000</b>
<b>Residence</b>						
Urban	136(14.9)	776(85.1)	1.0		1.0	
Rural	29(2.8)	993(97.2)	0.167(0.110-0.252)	<b>0.000</b>	0.167(0.110-0.252)	<b>0.000</b>

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<b>Self-reported health status</b>							NA
Good	85(8.8)	877(91.2)	1.0				
Normal or poor	80(8.2)	892(91.8)	0.925(0.672-1.273)	0.634			
<b>Psychological stress</b>	165(8.5)	1769(91.5)	0.984(0.955-1.014)	0.289			
<b>ADL</b>							
I	134(9.6)	1269(90.4)	1.0		1.0		
II	24(7.7)	289(92.3)	0.786(0.500-1.237)	0.298	0.905(0.563-1.453)		0.678
III	7(3.2)	211(96.8)	0.314(0.145-0.681)	<b>0.003</b>	0.436(0.196-1.018)		0.052
<b>NCD</b>							NA
Yes	118(9.1)	1175(90.9)	1.0				
No	47(7.3)	594(92.7)	0.788(0.554-1.121)	0.185			
<b>Household income<sup>b</sup></b>							
Q1	11(2.0)	526(98.0)	1.0		1.0		
Q2	34(6.2)	517(93.8)	3.145(1.576-6.273)	<b>0.001</b>	2.676(1.326-5.400)		<b>0.006</b>
Q3	44(10.6)	370(89.4)	5.686(2.898-11.157)	<b>0.000</b>	3.117(1.430-6.798)		<b>0.004</b>
Q4	76(17.6)	356(82.4)	10.208(5.348-19.485)	<b>0.000</b>	4.674(2.057-10.621)		<b>0.000</b>
<b>Per-capita living space</b>	165(8.5)	1769(91.5)	0.989(0.980-0.998)	<b>0.019</b>	0.984(0.974-0.995)		<b>0.003</b>

OR<sub>c</sub>: crude odds ratio; OR<sub>a</sub>: adjusted odds ratio  
<sup>a</sup> 12 of the participants are childless elders, and were regared as missing data here.  
<sup>B</sup> Quartile 1 (Q1) is the poorest and Quartile 4 (Q4) is the richest.

Table 5 Factors associated with willingness of institutional care among old non-empty-nesters in Shandong, China (n=1598)

Characteristics	Willingness for institutionalization		OR <sub>c</sub> (95%CI)	p	OR <sub>a</sub> (95%CI)	p
	Yes (%)	No (%)				
<b>n=1598</b>	104(6.5)	1494(93.5)				
<b>Gender</b>						NA
Male	48(6.8)	658(93.2)	1.0		1.0	
Female	56(6.3)	836(93.7)	0.918(0.616-1.368)	0.675		
<b>Age</b>						
60-	93(8.1)	1056(91.9)	1.0	<b>0.001</b>	1.0	
70-	10(2.8)	341(97.2)	0.333(0.171-0.647)	<b>0.001</b>	0.405(0.210-0.814)	<b>0.011</b>
80-	1(1.0)	97(99.0)	0.117(0.016-0.849)	<b>0.034</b>	0.209(0.027-1.591)	0.131
<b>Education</b>						
Illiteracy or semiliterate	34(4.5)	726(95.5)	1.0		1.0	
Primary school	30(6.8)	412(93.2)	1.555(0.938-2.578)	0.087	0.962(0.561-1.649)	0.887
Junior school or above	40(10.1)	356(89.9)	2.399(1.493-3.856)	<b>0.000</b>	1.099(0.630-1.916)	0.739
<b>Past occupation</b>						
Farmer	48(4.4)	1037(95.6)	1.0		1.0	
Others	56(10.9)	457(89.1)	2.647(1.773-.953)	<b>0.000</b>	1.103(0.669-1.818)	0.702
<b>Marital Status<sup>a</sup></b>						
Single	18(4.2)	411(95.8)	1.0		1.0	
Couple	86(7.4)	1083(92.6)	1.813(1.077-3.051)	<b>0.025</b>	1.216(0.697-2.122)	0.492
<b>Number of children</b>						
0-3	91(8.0)	1050(92.0)	1.0		1.0	
>3	13(2.8)	444(97.2)	0.338(0.187-0.610)	<b>0.000</b>	0.506(0.271-0.948)	<b>0.033</b>
<b>Relationship with children<sup>b</sup></b>						NA
Good or normal	92(6.1)	1409(93.9)	1.0			
Poor	9(10.6)	76(89.4)	1.814(0.881-3.735)	0.106		

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<b>Residence</b>						
Urban	82(11.7)	619(88.3)	1.0		1.0	
Rural	22(2.5)	875(97.5)	0.19(0.117-0.307)	<b>0.000</b>	0.210(0.122-0.363)	<b>0.000</b>
<b>Self-reported health status</b>						
Good	48(5.3)	861(94.7)	1.0		1.0	
Normal or poor	56(8.1)	633(91.9)	1.587(1.065-2.365)	<b>0.023</b>	1.854(1.225-2.805)	<b>0.003</b>
<b>Psychological stress</b>	104(6.5)	1494(93.5)	0.990(0.956-1.026)	0.595		NA
<b>ADL</b>						
I	89(7.2)	1144(92.8)	1.0			NA
II	11(5.0)	209(95.0)	0.677(0.355-1.288)	0.234		
III	4(2.8)	141(97.2)	0.365(0.132-1.008)	0.052		
<b>NCD</b>						
Yes	65(6.5)	932(93.5)	1.0			NA
No	39(6.5)	562(93.5)	0.995(0.660-1.500)	0.981		
<b>Household income<sup>c</sup></b>						
Q1	15(6.3)	223(93.7)	1.0			NA
Q2	12(3.3)	357(96.7)	0.500(0.230-1.087)	0.080		
Q3	30(6.2)	452(93.8)	0.987(0.520-1.872)	0.967		
Q4	47(9.2)	462(90.8)	1.512(0.828-2.764)	0.179		
<b>Per-capita living space</b>	104(6.5)	1494(93.5)	0.985(0.969-1.001)	0.073		NA

OR<sub>c</sub>: crude odds ratio; OR<sub>a</sub>: adjusted odds ratio  
<sup>a</sup> Single includes those who are unmarried(0.9%), divorced(0.3%), widowed(25.3%), separated(0.3%).  
<sup>b</sup> 12 of the participants are childless elders, and were regared as missing data here.  
<sup>c</sup>Quartile 1 (Q1) is the poorest and Quartile 4 (Q4) is the richest.

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7 Figure 1 Prevalence of seniors' willingness for institutionalization among empty-nest single,  
8 empty-nest couple and non-empty-nest in Shandong, China (n=3923)  
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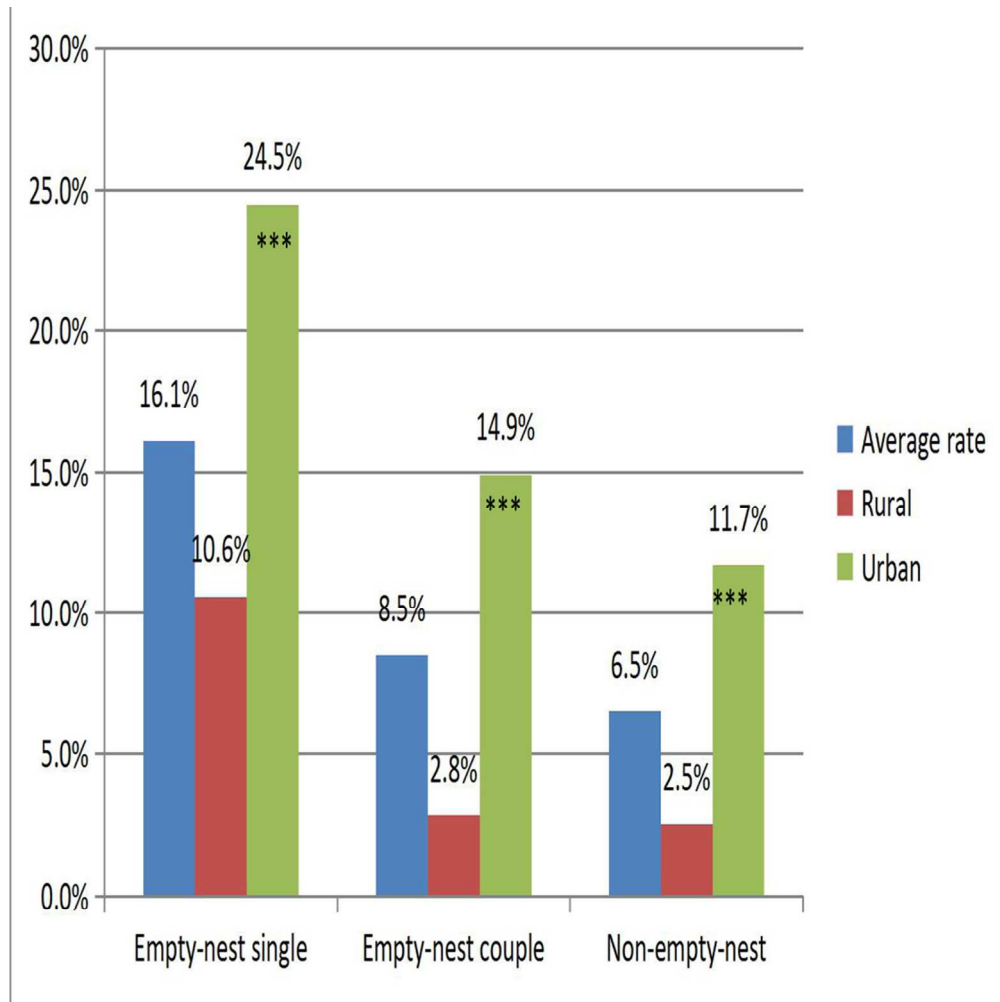


Figure 1 Prevalence of seniors' willingness for institutionalization among empty-nest single, empty-nest couple and non-empty-nest in Shandong, China (n=3923)

90x90mm (300 x 300 DPI)

Appendix Table 1: Variables and assignments

<b>Variables</b>	<b>Code</b>
<b>Gender</b>	
Male	0
Female	1
<b>Age</b>	
60-	1
70-	2
80-	3
<b>Education</b>	
Illiteracy or semiliterate	1
Primary school	2
Junior school or above	3
<b>Past occupation</b>	
Farmer	1
Others	2
<b>Marital Status</b>	
Single <sup>a</sup>	1
Couple	2
<b>Number of children</b>	
0-3	1
>3	2
<b>Relationship with children</b>	
Good or normal	1
Poor	2
<b>Residence</b>	
Urban	1
Rural	2
<b>Self-reported health status</b>	
Good	1
Normal	2
<b>Psychological stress</b>	
	-
<b>ADL</b>	
I	1
II	2
III	3
<b>NCD</b>	
Yes	1
No	2
<b>Household income</b>	
Q1 <sup>b</sup>	1
Q2	2
Q3	3
Q4	4

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation	Reported on page #
<b>Title and abstract</b>	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1,
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	1
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	2,3
Objectives	3	State specific objectives, including any prespecified hypotheses	3
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	3,4,5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	3,4,5
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	3,4,5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	3,4,5
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	3,4,5
Bias	9	Describe any efforts to address potential sources of bias	9
Study size	10	Explain how the study size was arrived at	3,4,5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	3,4,5
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	3,4,5
		(b) Describe any methods used to examine subgroups and interactions	3,4,5
		(c) Explain how missing data were addressed	
		(d) If applicable, describe analytical methods taking account of sampling strategy	
		(e) Describe any sensitivity analyses	
<b>Results</b>			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5,6
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	5,6
		(b) Indicate number of participants with missing data for each variable of interest	
Outcome data	15*	Report numbers of outcome events or summary measures	5,6

1			
2	Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-
3			adjusted estimates and their precision (eg, 95% confidence interval).
4			Make clear which confounders were adjusted for and why they were
5			included
6			(b) Report category boundaries when continuous variables were
7			categorized
8			(c) If relevant, consider translating estimates of relative risk into
9			absolute risk for a meaningful time period
10			
11	Other analyses	17	Report other analyses done—eg analyses of subgroups and
12			interactions, and sensitivity analyses
13			
14	<b>Discussion</b>		
15	Key results	18	Summarise key results with reference to study objectives
16	Limitations	19	Discuss limitations of the study, taking into account sources of
17			potential bias or imprecision. Discuss both direction and magnitude
18			of any potential bias
19			
20	Interpretation	20	Give a cautious overall interpretation of results considering
21			objectives, limitations, multiplicity of analyses, results from similar
22			studies, and other relevant evidence
23			
24	Generalisability	21	Discuss the generalisability (external validity) of the study results
25			
26	<b>Other information</b>		
27	Funding	22	Give the source of funding and the role of the funders for the
28			present study and, if applicable, for the original study on which the
29			present article is based
30			

\*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).

# BMJ Open

## Utilization Willingness for Institutional Care by the Elderly: A Comparative Study of Empty Nesters and Non-empty Nesters in Shandong, China

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3 **Utilization Willingness for Institutional Care by the Elderly: A**  
4 **Comparative Study of Empty Nesters and Non-empty Nesters in**  
5 **Shandong, China**  
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## Abstract

**Introduction:** Institutional care has been strongly promoted in China to meet seniors' long-term care needs. Empty-nest elderly, in comparison with their counterparts, have less social support and fewer caring networks. This study aimed to compare the utilization willingness for institutional care and its predictors between empty-nest and non-empty-nest seniors.

**Methods:** A total of 3923 seniors were included in the analysis. Binary logistic regression models were used to understand the association between the living arrangements of the elderly households and willingness for institutional care and to identify the predictors of the utilization willingness for institutional care among empty nesters and non-empty nesters.

**Results:** Our study found that approximately 8.5% of the seniors had a willingness for institutional care in Shandong, China. Empty-nest singles (OR=5.301; 95CI 2.838-9.904) and empty-nest couples (OR=1.547; 95CI 1.135-2.107) were found to be more willing to receive institutional care. Our results also showed that residence was a key determinant for institutionalization willingness in empty-nest and non-empty-nest elderly. Among empty-nest singles, psychological stress was a positive determinant for institutional care. Factors including education attainment, relationship with adult children, household income and per capita living space were determinants for empty-nest couple willingness for institutionalization. Age, number of children, and self-reported health status were found to be associated factors for willingness among non-empty nesters.

**Conclusions:** The government should pay more attention to institutional care in rural areas where there is still a gap in elder care compared with that in urban areas. Targeted policies should be made for different types of seniors to offer appropriate institutional care.

**Keywords:** Willingness for institutional care, Elderly, Empty nest, Determinants

## Strengths and limitations of this study

- A large sample of 3,923 participants based on a community survey provided a real profile of willingness for institutional care in Chinese seniors.
- There might be a possible recall bias for most questionnaire data, which is a limitation of this study.
- The cross-sectional study design precludes any causal interpretation.



## Introduction

Since 1999, the proportion of seniors aged 60 and above among the general population in China has reached more than 10%, and the number of people in the ageing population in China has ranked the first in the world.[1] The number of Chinese people aged 60 years and above reached 212.4 million by 2014, which accounted for 15.5% of the total population.[2] It has been estimated that China, with 98.3 million old people aged 80 or over in 2050, will still be one of the countries that has the greatest numbers of oldest-to-old people.[3] With the rapid ageing of the Chinese population, the number of empty nesters is on the rise as well.[4] Empty-nest seniors are those seniors who are childless or whose children have already left home.[5] With the increasing number of elderly empty nesters, long-term care for the elderly has been emerging as a social problem.

Traditionally, taking care of the elderly by adult children in the family was a basic norm within Confucian doctrine.[6] In recent years, increased geographic mobility and reduced family size due to the one-child policy have made more adult children unavailable for elder care.[7] Inter-generational relations are also changing; thus, elderly support is no longer considered an absolute obligation by adult children.[8-9] More women in urban China are obtaining a higher education and becoming more work oriented, which indicates that gender roles in elder care are changing, and the availability of elder care by adult children has become questionable.[10] On the other hand, with Chinese “baby boomers” approaching retirement age, informal care, such as familial care, is unlikely to meet the needs of all seniors.[11] One study indicated that nearly half of the seniors who needed some level of assistance in their activities of daily living or instrumental activities of daily living actually lived alone instead of living with their adult children.[10] Another study found that many seniors expressed preference to live alone or with their spouse, if housing and health status permitted.[12] Consequently, institutional care has been strongly promoted to meet older adults’ long-term care needs.[13]

After the welfare reform in 1990s, former government-sponsored nursing homes have become decentralized, and the amount of private nursing homes is on the rise, mostly emerging in large cities.[7] Previous studies have identified the attitudes of empty-nest elderly towards institutional care and its predictors. Some studies found

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3 that the rate of institutional care of the Chinese elderly was rapidly on the rise, which  
4 might be due to the elderly's increasing need.[14-15] A study found that seniors'  
5 living arrangements prior to elder home placement and their assessment of the cost  
6 involved for such care were related to seniors' willingness to stay in elder homes.[16]  
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8 Some other studies found that factors including gender, educational attainment,  
9 occupation, health insurance, and number of children were associated with  
10 willingness for institutional care among the empty-nest seniors.[17-19] However, only  
11 a few of these studies were published in international journals. Moreover, the studies  
12 described earlier had some systematic weaknesses. First, almost all of the empirical  
13 studies were based on small sample sizes (e.g., n=523 in the case of Xie et al.; n=570  
14 in the case of Chen et al.; n=1000 in the case of Zhu et al.).[17-19] Second, in many  
15 studies, it was not clear who served as the reference group. In other words, the  
16 associated factors were only explored in empty-nest seniors.[17-19]  
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24 To remedy this situation, the present study aimed to compare the willingness to  
25 utilize institutional care between empty-nest and non-empty-nest seniors in China. To  
26 do so, we had the following specific objectives. First, we compared the willingness  
27 for institutional care between empty-nest and non-empty-nest elderly. Second, we  
28 identified the associated factors for institutional care among the empty-nest and  
29 non-empty-nest elderly. Our study was an empirical study and was not guided by  
30 theory.  
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## 36 **Methods**

### 37 **Data**

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41 This study was conducted in Shandong, a province where the elderly aged 65 or  
42 over accounted for 11.6% of the total population.[20] In this study, a 3-stage cluster  
43 sampling was used to select participants, as described in detail previously.[21] A total  
44 of 3923 older people was included in the analysis. We used a face-to-face interviews to  
45 collect data from November 2011 to January 2012. The interviews were conducted  
46 by trained master students from Shandong University School of Public Health. To  
47 ensure quality, completed questionnaires were carefully checked by quality  
48 supervisors at the end of each day. The questionnaire included demographic  
49 characteristics, living arrangements of the households, relationship with children,  
50 marital status, economic status, mental health condition and willingness for  
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3 institutional care.

#### 4 5 **Variables and measures**

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7 The dependent variable was seniors' willingness for institutional care, which was  
8 evaluated on the grounds of participant answers to 'which endowment way are you  
9 willing for?' If the response was 'institutional care', the willingness for institutional  
10 care was coded as 'yes'. In contrast, if the answer was 'home-based care',  
11 'community endowment' or 'others', willingness for institutional care was coded as  
12 'no'.  
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18 Socio-demographic and psychological characteristics such as gender, age,  
19 education, past occupation (pre-retirement occupation), marital status, number of  
20 children, relationship with children, residence, self-reported health status,  
21 psychological stress, activities of daily living (ADL), non-communicable diseases  
22 (NCDs), and household income were included in this study.  
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27 The age of the participants was categorized as follows: 60-, 70- and 80+ years.  
28 Other demographic characteristics were classified as follows: gender (male vs.  
29 female), education (illiteracy or semiliterate, primary school and junior school or  
30 above), past occupation (farmer vs. others), marital status (single vs. couple), number  
31 of children (0-3 vs. >3), relationship with children (good vs. bad), residence (urban vs.  
32 rural), self-reported health status (good vs. normal or poor), ADL (,  and ),  
33 NCDs in the past six months (yes vs. no), and household income (Q1, Q2, Q3 and  
34 Q4). Quartile 1 (Q1) is the poorest and Quartile 4 (Q4) is the richest.  
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41 The living arrangements of elderly households were classified into non-empty  
42 nester, empty-nest single and empty-nest couple. Non-empty nester refers to those  
43 seniors who live with their children, while empty-nest single and empty-nest couple  
44 refers to those seniors who live alone without a spouse and with a spouse,  
45 respectively, for more than six months.[22] Per-capita living space is a measure that  
46 takes total living space (square metre) and divides it by the number of permanent  
47 people (who live in the house more than half a year) in a house.  
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53 Psychological stress was evaluated on the grounds of the 10-item Kessler Scale  
54 (K10). K10 is an effective tool to assess people's psychological status and was  
55 designed by scholars such as Kessler and Mroczek.[23] The Chinese-language version  
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3 of the K10 has been verified to have good reliability and validity.[24]  
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5 The ADL instrument consisted of the Physical Self-maintenance Scale and  
6 Instrumental Activities of Daily Living Scale designed by Lawton and Brody.[25] The  
7 ADL Scale was used to evaluate people's simple and basic ability to practise one's  
8 normal life independently. The reliability and validity of the ADL instrument in the  
9 Chinese-language version was demonstrated to be good.[26] Scores for ADL can be  
10 divided into three levels, with the higher level representing more severe dysfunction.  
11 Levels 1, 2 and 3 means mild dysfunction, moderate dysfunction, and severe  
12 dysfunction, respectively.[27]  
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15 We also present the variables and assignments in Appendix Table 1.  
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### 18 **Statistical Analysis**

19 The data were double entered and checked using EpiData 6.04. Statistical  
20 analyses were performed using SPSS 21.0. For continuous variables, p values were  
21 calculated using a Student's t test or F-test; for categorical variables, p values were  
22 calculated using a chi-square test. Two binary logistic regression models were  
23 employed to assess the association between living arrangements of elderly households  
24 and willingness for institutional care. We used a univariate logistic regression model  
25 and multi-variate logistic regression model to explore the factors associated with  
26 willingness for institutional care. All reported CIs were calculated at the 95% level.  
27 Statistical significance was set at the 5% level.  
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### 30 **Patient and Public Involvement statement**

31 Neither patients nor the public were involved in the development of the research  
32 question, in the analysis and in drawing conclusions from the results. The results in  
33 this study will provide evidence for policy-makers and will not be disseminated to the  
34 study participants.  
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### 37 **Results**

38 Table 1 shows basic information on the 3923 seniors. Approximately 8.5%  
39 seniors indicated willingness for institutional care. Non-empty nesters accounted for  
40 40.7% of the participants, empty-nest singles accounted for 10.0%, and empty-nest  
41 couples accounted for 49.3%. Generally, the majority of the elderly were female  
42 (53.6%), between the ages of 60 and 69 (65.5%), illiterate or semiliterate (44.5%),  
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3 farmers (64.2%), couples (79.1%), having 0 to 3 children (67.4%), having a good or  
4 normal relationship with their children (91.3%), rural (54.9%), having good  
5 self-reported health status (52.1%), having mild dysfunction (72.7%), and having  
6 NCDs (65.9%). The elderly's K10 score was  $15.8 \pm 6.0$  (M $\pm$ SD), and their per-capita  
7 living space was  $33.9 \pm 23.1$  (M $\pm$ SD) square metres.  
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11 We presented our results in two models to understand the association between  
12 living arrangements of elderly households and willingness for institutional care.  
13 Model 1 showed that willingness for institutional care was higher in empty-nest  
14 singles (OR=2.759; 95CI 1.974-3.857) and empty-nest couples (OR=1.340; 95CI  
15 1.038-1.729) than that in non-empty nesters. When other variables were controlled,  
16 willingness for institutional care was still higher among empty-nest singles  
17 (OR=5.301; 95CI 2.838-9.904) and empty-nest couples (OR=1.547; 95CI 1.135-2.107)  
18 than that in non-empty nesters (Table 2). Figure 1 shows that in each of the three  
19 subgroups with different household living arrangements, urban seniors' willingness to  
20 use institutional care was statistically higher than that of rural seniors.  
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28 Table 3 shows the factors associated with willingness for institutional care  
29 among empty-nest singles. Univariate analysis indicated that empty-nest singles who  
30 were from rural areas ( $p < 0.001$ ) had lower willingness for institutional care.  
31 Empty-nest singles who had greater psychological stress ( $p = 0.050$ ) had higher  
32 willingness for institutional care. Multivariate logistic analysis also showed that the  
33 two factors were associated with willingness for institutional care.  
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39 As shown in Table 4, univariate analysis showed that those empty-nest couples  
40 who had a higher education level, who were non-farmers ( $p < 0.001$ ), who had a poor  
41 relationship with their children ( $p = 0.014$ ), and who had higher household incomes  
42 were more willing for institutional care. Those empty-nest couples who had more than  
43 3 children ( $p = 0.040$ ), who lived in rural areas ( $p < 0.001$ ), who had severe dysfunction  
44 ( $p = 0.003$ ), and who had more per-capita living space ( $p = 0.019$ ) were less willing for  
45 institutional care. Multi-logistic regression indicated that factors including education  
46 level, relationship with children, household income, and residence were associated  
47 with willingness for institutional care.  
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54 Likewise, for those non-empty-nest seniors, the multi-logistic regression model  
55 found that those with younger age, those who had fewer children, those who were  
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3 from urban areas, and those who had a normal or poor self-rated health status  
4 preferred to use institutional care (See Table 5).  
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## 6 7 **Discussion**

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9 Our study found that 8.5% of the seniors had willingness for institutional care.  
10 This rate was lower than the that found among Korean American elders (45%) with a  
11 similar age.[28] This rate was lower than the reported rates of 20% in an urban area  
12 and 17% in a rural area in the elderly in China and 16.7% in a study of the seniors  
13 aged 65 or above in Taiwan, China. This rate was also lower than the 9.69% found in  
14 an older population in Zhejiang, China, and 44.8% found in a study in the elderly with  
15 a similar age in Chengdu, China.[13,29-31] Compared with the abovementioned sites,  
16 Shandong is a rather conservative province that is deeply affected by Confucianism.  
17 The culture of filial piety is profoundly rooted in Shandong residents' minds. This  
18 might be a primary cause of the variation between our study and the previous studies  
19 mentioned above.  
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28 Our results showed that living arrangements of the households were associated  
29 with the elderly's willingness for institutional care. The analysis made it clear that  
30 empty-nest singles and empty-nest couples were more willing for institutional care  
31 than non-empty nesters. This finding was consistent with another study that found that  
32 older adults who had no spouse or children were more likely to move into nursing  
33 homes than their counterparts.[7,32] Due to lack of care from adult children,  
34 empty-nest seniors are facing more endowment risks. Empty-nest elderly had poorer  
35 self-rated health, higher prevalence of two-week illness and NCDs, which indicated  
36 that they had poorer health status than non-empty-nest elderly.[5] In addition,  
37 empty-nest seniors, in comparison with non-empty-nest seniors, had higher levels of  
38 loneliness.[33] The high physical and mental health service needs might be the reason  
39 why empty-nest seniors are more willing for institutional care, which can provide  
40 professional health care.  
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50 Consistent with previous studies, our results also showed that residence was a  
51 key predictor of willingness for institutional care in all three types of elderly  
52 households.[34] Urban seniors had statistically higher willingness for institutional  
53 care than rural seniors across all three types of elderly households. Compared with  
54 rural seniors, urban seniors were less conservative. Rural seniors had lower incomes  
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3 and poorer social welfare conditions than urban seniors. Further, the supply of  
4 institutional care was relatively deficient in rural areas. These differences between  
5 rural and urban areas might explain why rural seniors were less willing for  
6 institutional care. This finding was helpful for policy-makers to differentially allocate  
7 the institutional care resources in urban and rural China.  
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11 Among empty-nest singles, psychological stress was a positive determinant for  
12 institutional care, which was in accordance with previous studies.[35] To avoid  
13 excessive reliance on family members, which may result in tensions in the family,  
14 when seniors had psychological stress, they would rather choose institutional care.[36]  
15 This might be associated with empty-nest singles' attitudes of self-reliance.  
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19 Similar to previous studies, empty-nest seniors who had a normal relationship  
20 with children were more willing for institutional care.[13] Having a good relationship  
21 with children represents more financial assistance and spiritual comfort from children.  
22 When seniors were in a poor relationship with children, they usually relied less on  
23 their adult children, which may lead to more willingness for institutional care.  
24 Empty-nest couples with higher household income were more likely to prefer  
25 institutional care which is inconsistent with previous studies in Finland.[37] Finland  
26 health system partially funds most long-term care provided at institutional facilities  
27 including health centers and nursing homes, with the maximum user fees not  
28 exceeding 80% of patients' disposable income.[38] Given this, extremely high  
29 expenditures in absolute value that would be imposed on affluent patients could  
30 economically discourage them from seeking long-term institutional care. In China,  
31 most institutional care was provided by private institutions, and the charges for  
32 different services were fixed so that, compared with Finland seniors, higher-income  
33 seniors in China will not have financial concerns. It was vital to develop pro-poor  
34 institutional care policies for those lower-income empty-nest seniors with high  
35 willingness for institutional care. We also found that empty-nest couples with more  
36 per capita living space were less willing for institutional care. Per capita living space  
37 actually could be a representative of wealth. Seniors with higher per capita living  
38 space might be richer, given the circumstance of China's rapidly growing housing  
39 prices. This might explain why empty-nest couples with more per capita living space  
40 were more willing for institutional care. Further, empty-nest couples with an  
41 education level of junior school or above were more willing for institutional care,  
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3 which was consistent with previous studies.[34]  
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5 It was found that age 70 and 79 years, having more than 3 children and normal  
6 self-reported health status were risk factors for non-empty nesters. Those who were  
7 age 70 and 79 had less preference for institutional care, which was inconsistent with  
8 one study in Hong Kong and other developed countries where the likelihood of  
9 elderly living in institutional care increased with age.[39-40] Hong Kong and other  
10 developed countries are more developed and open than Shandong, which makes those  
11 seniors more open-minded about institutional care. Different value concepts about  
12 institutional care might explain why those seniors were more willing for institutional  
13 care when compared with Shandong seniors. Non-empty-nest seniors who had more  
14 than 3 children were less willing for institutional care. More children usually means  
15 more financial and physical assistance, so it might reduce elderly needs for  
16 institutional care.[10]  
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25 This study had a large size sample (nearly 4000), which is much larger than that  
26 used in most of the similar studies. This gave the study a high degree of statistical  
27 power. This study had some limitations. First, our study had a cross-sectional design,  
28 and the results could not be interpreted as cause and effect. Second, all data were  
29 based on self-reported measures, which could lead to recall biases. Third, even though  
30 we have included some variables of social support in this study (e.g., living  
31 arrangements of the elderly households, number of the children and relationship with  
32 children), we did not use a scale to measure social support of the seniors, which will  
33 be remedied in a future study. Finally, our investigation was conducted in Shandong  
34 province, which is rather a conservative region, thus the results of our study may not  
35 be generalized to other parts of China.  
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## 46 **Conclusion**

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48 Our study suggested that the living arrangements of households with seniors  
49 were associated with the willingness for institutional care of the elderly in China, and  
50 empty nesters were more willing for institutional care than their counterparts. Our  
51 results also showed that residence was a key associated factor for willingness for  
52 institutional care in all three types of elderly households. The government should pay  
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3 more attention to institutional care in rural areas where there is still a gap in elder care  
4 when compared with that in urban areas. Furthermore, we also identified some other  
5 associated factors for institutional care willingness among each type of elderly  
6 household. Targeting policies should be developed to offer appropriate institutional  
7 care for different types of seniors.  
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### 11 **Competing interests**

12 The authors declare that they have no competing interests.  
13

### 14 **Ethics approval**

15 Ethical approval was obtained from The Ethical Committee of Shandong  
16 University School of Public Health.  
17

### 18 **Authors' contributions**

19 Chengchao Zhou, Yangyang Qian, and Wen Qin conceived the idea, Chengchao  
20 Zhou implemented the field study. Chengchao Zhou, Yangyang Qian, Dandan Ge, Li  
21 Zhang participated in the statistical analysis and interpretation of the results.  
22 Yangyang Qian drafted the manuscript. Chengchao Zhou, Wen Qin, and Long Sun  
23 gave many valuable comments on the draft and polished it. All authors read and  
24 approved the final manuscript.  
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### 33 **Data sharing**

34 No additional data available.  
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Table 1 Socio-demographic characteristics of the elderly in Shandong, China (n=3923)

Characteristics	Total n (%)	Empty-nest single n (%)	Empty-nest couple n (%)	Non-empty nester n (%)	$\chi^2/F$	p
<b>N</b>	3923(100.0)	391(10.0)	1934(49.3)	1598(40.7)		
<b>Gender</b>					43.525	<0.001
Male	1821(46.4)	132(33.8)	983(50.8)	706(44.2)		
Female	2102(53.6)	259(66.2)	951(49.2)	892(55.8)		
<b>Age</b>					145.042	<0.001
60-	2568(65.5)	162(41.4)	1257(65.0)	1149(71.9)		
70-	1122(28.6)	183(46.8)	588(30.4)	351(22.0)		
80-	233(5.9)	46(11.8)	89(4.6)	98(6.1)		
<b>Education</b>					84.222	<0.001
Illiteracy or semiliterate	1744(44.5)	240(61.4)	744(38.5)	760(47.6)		
Primary school	1171(29.8)	96(24.6)	633(32.7)	442(27.7)		
Junior school or above	1008(25.7)	55(14.1)	557(28.8)	396(24.8)		
<b>Past occupation</b>					34.103	<0.001
Farmer	2519(64.2)	278(71.1)	1156(59.8)	1085(67.9)		
Others	1404(35.8)	113(28.9)	778(40.2)	513(32.1)		

<b>Marital Status</b>					2024.826	<0.001
Single <sup>a</sup>	820(20.9)	391(100.0)	0(0.0)	429(26.8)		
Couple	3103(79.1)	0(0.0)	1934(100.0)	1169(73.2)		
<b>Number of children</b>					42.968	<0.001
0-3	2643(67.4)	212(54.2)	1290(66.7)	1141(71.4)		
>3	1280(32.6)	179(45.8)	644(33.3)	457(28.6)		
<b>Relationship with children<sup>b</sup></b>					35.101	<0.001
Good or normal	3581(92.9)	298(85.6)	1782(92.7)	1501(94.6)		
Poor	275(7.1)	50(14.4)	140(7.3)	85(5.4)		
<b>Residence</b>					150.403	<0.001
Urban	1768(45.1)	155(39.6)	912(47.2)	701(43.9)		
Rural	2155(54.9)	236(60.4)	1022(52.8)	897(56.1)		
<b>Self-reported health status</b>					28.629	<0.001
Good	2044(52.1)	173(44.2)	962(49.7)	909(56.9)		
Normal or poor	1879(47.9)	218(55.8)	972(50.3)	689(43.1)		
<b>Psychological stress</b>	15.8±6.0	17.3±7.2	15.6±5.7	15.6±5.9	1.743	0.004
<b>ADL</b>					75.403	<0.001
I	2853(72.7)	217(55.5)	1403(72.5)	1233(77.2)		
II	631(16.1)	98(25.1)	313(16.2)	220(13.8)		

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III	439(11.2)	76(19.4)	218(11.3)	145(9.1)		
<b>NCD</b>					26.274	<0.001
Yes	2586(65.9)	296(75.7)	1293(66.9)	997(62.4)		
No	1337(34.1)	95(24.3)	641(33.1)	601(37.6)		
<b>Household income<sup>c</sup></b>					371.563	<0.001
Q1	996(25.4)	221(56.5)	537(27.8)	238(14.9)		
Q2	1001(25.5)	81(20.7)	551(28.5)	369(23.1)		
Q3	965(24.6)	69(17.6)	414(21.4)	482(30.2)		
Q4	961(24.5)	20(5.1)	432(22.3)	509(31.9)		
<b>Per-capita living space</b>	33.9±23.1	53.0±42.6	36.9±20.0	25.4±14.6	7.255	<0.001

<sup>a</sup> Single includes those who were unmarried (1.7%), divorced (0.3%), widowed (18.6%), or separated (0.3%).

<sup>b</sup> 67 of the participants were childless elders and were regarded as missing data here.

<sup>c</sup> Quartile 1 (Q1) is the poorest, and Quartile 4 (Q4) is the richest.



Table 2 Association of willingness for institutional care and household composition in Shandong, China

Characteristics	Model 1 (No covariates)		Model 2 (Covariates)	
	OR (95%CI)	p	OR (95%CI)	p
<b>Household composition</b>				
Non-empty nester	1.0		1.0	
Empty-nest single	2.759(1.974-3.857)	<0.001	5.301(2.838-9.904)	<0.001
Empty-nest couple	1.340(1.038-1.729)	0.024	1.547(1.135-2.107)	0.006
<b>Gender</b>				
Male			1.0	
Female			1.223(0.938-1.595)	0.137
<b>Age</b>				
60-			1.0	
70-			1.017(0.754-1.371)	0.912
80-			1.144(0.612-2.139)	0.674
<b>Education</b>				
Illiteracy or semiliterate			1.0	
Primary school			1.166(0.835-1.627)	0.368
Junior school or above			1.617(1.128-2.136)	0.009
<b>Past occupation</b>				

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Farmer	1.0	
Others	1.283(0.899-1.830)	0.169
<b>Marital Status</b>		
Single <sup>a</sup>	1.0	
Couple	1.190(0.680-2.085)	0.542
<b>Number of children</b>		
0-3	1.0	
>3	0.755(0.559-1.021)	0.068
<b>Relationship with children</b>		
Good or normal	1.0	
Poor	2.504(1.685-3.720)	<0.001
<b>Residence</b>		
Urban	1.0	
Rural	0.546(0.383-0.778)	<0.001
<b>Self-reported health status</b>		
Good	1.0	
Normal or poor	1.019(0.778-1.334)	0.891
<b>Psychological stress</b>		
	0.998(0.975-1.020)	0.833
<b>ADL</b>		

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I			1.0	
II			0.910(0.637-1.299)	0.603
III			0.577(0.334-0.997)	<b>0.049</b>
<b>NCD</b>				
Yes			1.0	
No			0.957(0.717-1.277)	0.764
<b>Household income<sup>b</sup></b>				
Q1			1.0	
Q2			1.514(0.995-2.304)	0.053
Q3			1.612(1.017-2.554)	<b>0.042</b>
Q4			2.065(1.271-3.354)	<b>0.003</b>
<b>Per-capita living space</b>			0.989(0.983-0.996)	<b>0.003</b>
Constant	0.070	<b>&lt;0.001</b>	0.044	<b>&lt;0.001</b>
R squared		0.019		0.112
Observations	3923			

<sup>a</sup> Single includes those who were unmarried (1.7%), divorced (0.3%), widowed (18.6%), or separated (0.3%).

<sup>b</sup> Quartile 1 (Q1) is the poorest, and Quartile 4 (Q4) is the richest.

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Table 3 Factors associated with willingness for institutional care among older empty-nest singles in Shandong, China (n=391)

Characteristics	Willingness for institutionalization		OR <sub>c</sub> (95%CI)	p	OR <sub>a</sub> (95%CI)	p
	Yes (%)	No (%)				
<b>n=391</b>	63(16.1)	328(83.9)				
<b>Gender</b>						NA
Male	21(15.9)	111(84.1)	1.0			
Female	42(16.2)	217(83.8)	1.023(0.578-1.812)	0.938		
<b>Age</b>						NA
60-	27(16.7)	135(83.3)	1.0	0.708		
70-	27(14.8)	156(85.2)	0.865(0.484-1.547)	0.626		
80-	9(19.6)	37(80.4)	1.216(0.526-2.810)	0.647		
<b>Education</b>						NA
Illiteracy or semiliterate	38(15.8)	202(84.2)	1.0			
Primary school	17(17.7)	79(82.3)	1.144(0.610-2.144)	0.675		
Junior school or above	8(14.5)	47(85.5)	0.905(0.396-2.066)	0.812		
<b>Past occupation</b>						NA
Farmer	40(14.4)	238(85.6)	1.0			
Others	23(20.4)	90(79.6)	1.521(0.862-2.682)	0.148		
<b>Number of children</b>						NA

0-3	38(17.9)	174(82.1)	1.0			
>3	25(14.0)	154(86.0)	0.743(0.429-1.288)	0.290		
<b>Relationship with children<sup>a</sup></b>						NA
Good or normal	39(13.1)	259(86.9)	1.0			
Poor	11(22.0)	39(78.0)	1.873(0.886-3.962)	0.101		
<b>Residence</b>						
Urban	38(24.5)	117(75.5)	1.0		1.0	
Rural	25(10.6)	211(89.4)	0.365(0.210-0.634)	<0.001	0.304(0.161-0.572)	<0.001
<b>Self-reported health status</b>						NA
Good	24(13.9)	149(86.1)	1.0			
Normal or poor	39(17.9)	179(82.1)	1.353(0.778-2.352)	0.284		
<b>Psychological stress<sup>b</sup></b>	63(16.1)	328(83.9)	1.036(1.000-1.073)	<b>0.050</b>	1.045(1.007-1.085)	<b>0.019</b>
<b>ADL</b>						NA
I	32(14.7)	185(85.3)	1.0			
II	18(18.4)	80(81.6)	1.301(0.690-2.453)	0.416		
III	13(17.1)	63(82.9)	1.193(0.589-2.415)	0.624		
<b>NCD</b>						NA
Yes	50(16.9)	246(83.1)	1.0			

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No	13(13.7)	82(86.3)	0.780(0.403-1.508)	0.460		
<b>Household income<sup>c</sup></b>						
Q1	29(13.1)	192(86.9)	1.0		1.0	
Q2	19(23.5)	62(76.5)	2.209(1.064-3.869)	<b>0.032</b>	1.434(0.721-2.851)	0.304
Q3	13(18.8)	56(81.2)	1.537(0.749-3.154)	0.241	0.832(0.373-1.858)	0.654
Q4	2(10.0)	18(90.0)	0.736(0.162-3.337)	0.691	0.401(0.084-1.917)	0.252
<b>Per-capita living space</b>	63(16.1)	328(83.9)	0.997(0.990-1.005)	0.504		NA

OR<sub>c</sub>: crude odds ratio; OR<sub>a</sub>: adjusted odds ratio

<sup>a</sup> 43 of the participants are childless elders and were regarded as missing data here.

<sup>b</sup> We also included “Psychological stress” in a multi-variate logistic regression model.

<sup>c</sup> Quartile 1 (Q1) is the poorest, and Quartile 4 (Q4) is the richest.



Table 4 Factors associated with willingness for institutional care among old empty-nest couples in Shandong, China (n=1934)

Characteristics	Willingness for institutionalization		OR <sub>c</sub> (95%CI)	p	OR <sub>a</sub> (95%CI)	p
	Yes (%)	No (%)				
<b>n=1934</b>	165(8.5)	1769(91.5)				
<b>Gender</b>						NA
Male	83(8.4)	900(91.6)	1.0			
Female	82(8.6)	869(91.4)	1.023(0.744-1.408)	0.888		
<b>Age</b>						NA
60-	100(8.0)	1157(92.0)	1.0	0.384		
70-	58(9.9)	530(90.1)	1.266(0.902-1.778)	0.173		
80-	7(7.9)	82(92.1)	0.988(0.445-2.195)	0.976		
<b>Education</b>						
Illiteracy or semiliterate	34(4.6)	710(95.4)	1.0		1.0	
Primary school	45(7.1)	588(92.9)	1.598(1.010-2.528)	<b>0.045</b>	1.139(0.703-1.845)	0.660
Junior school or above	86(15.4)	471(84.6)	3.813(2.521-5.767)	<b>&lt;0.001</b>	1.918(1.173-3.135)	<b>0.009</b>
<b>Past occupation</b>						
Farmer	54(4.7)	1102(95.3)	1.0		1.0	
Others	111(14.3)	667(85.7)	3.396(2.419-4.767)	<b>&lt;0.001</b>	0.909(0.535-1.544)	0.724
<b>Number of children</b>						

0-3	122(9.5)	1168(90.5)	1.0		1.0	
>3	43(6.7)	601(93.3)	0.685(0.477-0.983)	<b>0.040</b>	0.878(0.598-1.288)	0.506
<b>Relationship with children<sup>a</sup></b>						
Good or normal	145(8.1)	1637(91.9)	1.0		1.0	
Poor	20(14.3)	120(85.7)	1.882(1.138-3.111)	<b>0.014</b>	2.677(1.553-4.615)	<b>&lt;0.001</b>
<b>Residence</b>						
Urban	136(14.9)	776(85.1)	1.0		1.0	
Rural	29(2.8)	993(97.2)	0.167(0.110-0.252)	<b>&lt;0.001</b>	0.167(0.110-0.252)	<b>&lt;0.001</b>
<b>Self-reported health status</b>						NA
Good	85(8.8)	877(91.2)	1.0			
Normal or poor	80(8.2)	892(91.8)	0.925(0.672-1.273)	0.634		
<b>Psychological stress</b>						
	165(8.5)	1769(91.5)	0.984(0.955-1.014)	0.289		
<b>ADL</b>						
I	134(9.6)	1269(90.4)	1.0		1.0	
II	24(7.7)	289(92.3)	0.786(0.500-1.237)	0.298	0.905(0.563-1.453)	0.678
III	7(3.2)	211(96.8)	0.314(0.145-0.681)	<b>0.003</b>	0.436(0.196-1.018)	0.052
<b>NCD</b>						NA
Yes	118(9.1)	1175(90.9)	1.0			

No	47(7.3)	594(92.7)	0.788(0.554-1.121)	0.185		
<b>Household income<sup>b</sup></b>						
Q1	11(2.0)	526(98.0)	1.0		1.0	
Q2	34(6.2)	517(93.8)	3.145(1.576-6.273)	<b>0.001</b>	2.676(1.326-5.400)	<b>0.006</b>
Q3	44(10.6)	370(89.4)	5.686(2.898-11.157)	<b>&lt;0.001</b>	3.117(1.430-6.798)	<b>0.004</b>
Q4	76(17.6)	356(82.4)	10.208(5.348-19.485)	<b>&lt;0.001</b>	4.674(2.057-10.621)	<b>&lt;0.001</b>
<b>Per-capita living space</b>	165(8.5)	1769(91.5)	0.989(0.980-0.998)	<b>0.019</b>	0.984(0.974-0.995)	<b>0.003</b>

OR<sub>c</sub>: crude odds ratio; OR<sub>a</sub>: adjusted odds ratio

<sup>a</sup> 12 of the participants are childless elders and were regarded as missing data here.

<sup>B</sup> Quartile 1 (Q1) is the poorest, and Quartile 4 (Q4) is the richest.

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Table 5 Factors associated with willingness for institutional care among older non-empty nesters in Shandong, China (n=1598)

Characteristics	Willingness for institutionalization		OR <sub>c</sub> (95%CI)	p	OR <sub>a</sub> (95%CI)	p
	Yes (%)	No (%)				
<b>n=1598</b>	104(6.5)	1494(93.5)				
<b>Gender</b>						NA
Male	48(6.8)	658(93.2)	1.0		1.0	
Female	56(6.3)	836(93.7)	0.918(0.616-1.368)	0.675		
<b>Age</b>						
60-	93(8.1)	1056(91.9)	1.0	<b>0.001</b>	1.0	
70-	10(2.8)	341(97.2)	0.333(0.171-0.647)	<b>0.001</b>	0.405(0.210-0.814)	<b>0.011</b>
80-	1(1.0)	97(99.0)	0.117(0.016-0.849)	<b>0.034</b>	0.209(0.027-1.591)	0.131
<b>Education</b>						
Illiteracy or semiliterate	34(4.5)	726(95.5)	1.0		1.0	
Primary school	30(6.8)	412(93.2)	1.555(0.938-2.578)	0.087	0.962(0.561-1.649)	0.887
Junior school or above	40(10.1)	356(89.9)	2.399(1.493-3.856)	<b>&lt;0.001</b>	1.099(0.630-1.916)	0.739
<b>Past occupation</b>						
Farmer	48(4.4)	1037(95.6)	1.0		1.0	
Others	56(10.9)	457(89.1)	2.647(1.773-.953)	<b>&lt;0.001</b>	1.103(0.669-1.818)	0.702
<b>Marital status<sup>a</sup></b>						

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6	Single	18(4.2)	411(95.8)	1.0		1.0	
7	Couple	86(7.4)	1083(92.6)	1.813(1.077-3.051)	<b>0.025</b>	1.216(0.697-2.122)	0.492
8							
9	<b>Number of children</b>						
10							
11	0-3	91(8.0)	1050(92.0)	1.0		1.0	
12	>3	13(2.8)	444(97.2)	0.338(0.187-0.610)	<b>&lt;0.001</b>	0.506(0.271-0.948)	<b>0.033</b>
13							
14	<b>Relationship with children<sup>b</sup></b>						NA
15							
16	Good or normal	92(6.1)	1409(93.9)	1.0			
17	Poor	9(10.6)	76(89.4)	1.814(0.881-3.735)	0.106		
18							
19	<b>Residence</b>						
20							
21	Urban	82(11.7)	619(88.3)	1.0		1.0	
22	Rural	22(2.5)	875(97.5)	0.19(0.117-0.307)	<b>&lt;0.001</b>	0.210(0.122-0.363)	<b>&lt;0.001</b>
23							
24	<b>Self-reported health status</b>						
25							
26	Good	48(5.3)	861(94.7)	1.0		1.0	
27	Normal or poor	56(8.1)	633(91.9)	1.587(1.065-2.365)	<b>0.023</b>	1.854(1.225-2.805)	<b>0.003</b>
28							
29	<b>Psychological stress</b>	104(6.5)	1494(93.5)	0.990(0.956-1.026)	0.595		NA
30							
31	<b>ADL</b>						NA
32							
33	I	89(7.2)	1144(92.8)	1.0			
34	II	11(5.0)	209(95.0)	0.677(0.355-1.288)	0.234		
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III	4(2.8)	141(97.2)	0.365(0.132-1.008)	0.052	
<b>NCD</b>					
Yes	65(6.5)	932(93.5)	1.0		NA
No	39(6.5)	562(93.5)	0.995(0.660-1.500)	0.981	
<b>Household income<sup>c</sup></b>					
Q1	15(6.3)	223(93.7)	1.0		NA
Q2	12(3.3)	357(96.7)	0.500(0.230-1.087)	0.080	
Q3	30(6.2)	452(93.8)	0.987(0.520-1.872)	0.967	
Q4	47(9.2)	462(90.8)	1.512(0.828-2.764)	0.179	
<b>Per-capita living space</b>	104(6.5)	1494(93.5)	0.985(0.969-1.001)	0.073	NA

OR<sub>c</sub>: crude odds ratio; OR<sub>a</sub>: adjusted odds ratio

<sup>a</sup> Single includes those who are unmarried (0.9%), divorced (0.3%), widowed (25.3%), or separated (0.3%).

<sup>b</sup> 12 of the participants are childless elders and were regarded as missing data here.

<sup>c</sup> Quartile 1 (Q1) is the poorest, and Quartile 4 (Q4) is the richest.

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3 Legend for Figure 1  
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8 Figure 1 Prevalence of seniors' willingness for institutionalization among empty-nest singles,  
9 empty-nest couples and non-empty nesters in Shandong, China (n=3923)  
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11  $p < 0.001^{***}$ ,  $p < 0.01^{**}$ ,  $p < 0.05^{*}$   
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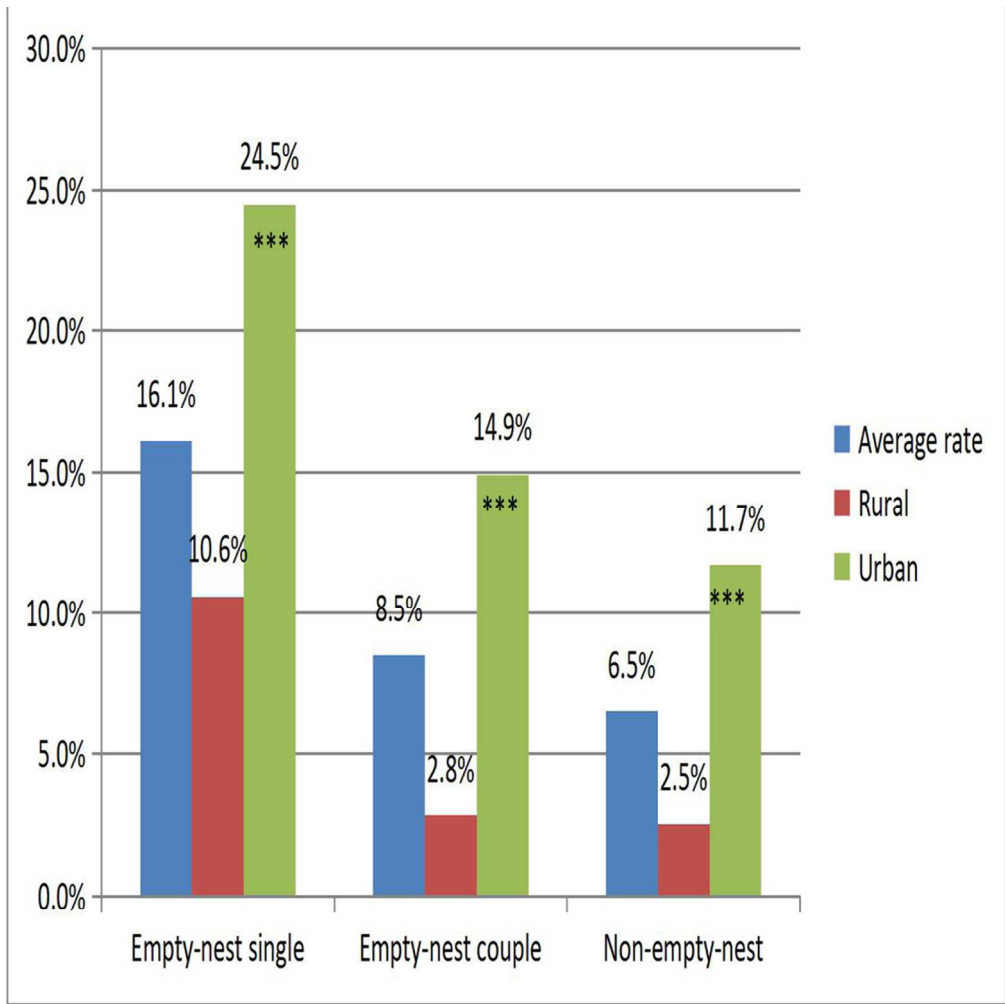


Figure 1 Prevalence of seniors' willingness for institutionalization among empty-nest single, empty-nest couple and non-empty-nest in Shandong, China (n=3923)

90x90mm (300 x 300 DPI)



Appendix Table 1: Variables and assignments

<b>Variables</b>	<b>Code</b>
<b>Gender</b>	
Male	0
Female	1
<b>Age</b>	
60-	1
70-	2
80-	3
<b>Education</b>	
Illiteracy or semiliterate	1
Primary school	2
Junior school or above	3
<b>Past occupation</b>	
Farmer	1
Others	2
<b>Marital Status</b>	
Single <sup>a</sup>	1
Couple	2
<b>Number of children</b>	
0-3	1
>3	2
<b>Relationship with children</b>	
Good or normal	1
Poor	2
<b>Residence</b>	
Urban	1
Rural	2
<b>Self-reported health status</b>	
Good	1
Normal	2
<b>Psychological stress</b>	
	-
<b>ADL</b>	
I	1
II	2
III	3
<b>NCD</b>	
Yes	1
No	2
<b>Household income</b>	
Q1 <sup>b</sup>	1
Q2	2
Q3	3
Q4	4

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation	Reported on page #
<b>Title and abstract</b>	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1,
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	1
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	2,3
Objectives	3	State specific objectives, including any prespecified hypotheses	3
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	3,4,5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	3,4,5
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	3,4,5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	3,4,5
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	3,4,5
Bias	9	Describe any efforts to address potential sources of bias	9
Study size	10	Explain how the study size was arrived at	3,4,5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	3,4,5
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	3,4,5
		(b) Describe any methods used to examine subgroups and interactions	3,4,5
		(c) Explain how missing data were addressed	
		(d) If applicable, describe analytical methods taking account of sampling strategy	
		(e) Describe any sensitivity analyses	
<b>Results</b>			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5,6
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	5,6
		(b) Indicate number of participants with missing data for each variable of interest	
Outcome data	15*	Report numbers of outcome events or summary measures	5,6

1			
2	Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-
3			adjusted estimates and their precision (eg, 95% confidence interval).
4			Make clear which confounders were adjusted for and why they were
5			included
6			(b) Report category boundaries when continuous variables were
7			categorized
8			(c) If relevant, consider translating estimates of relative risk into
9			absolute risk for a meaningful time period
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11	Other analyses	17	Report other analyses done—eg analyses of subgroups and
12			interactions, and sensitivity analyses
13			
14	<b>Discussion</b>		
15	Key results	18	Summarise key results with reference to study objectives
16	Limitations	19	Discuss limitations of the study, taking into account sources of
17			potential bias or imprecision. Discuss both direction and magnitude
18			of any potential bias
19			
20	Interpretation	20	Give a cautious overall interpretation of results considering
21			objectives, limitations, multiplicity of analyses, results from similar
22			studies, and other relevant evidence
23			
24	Generalisability	21	Discuss the generalisability (external validity) of the study results
25			
26	<b>Other information</b>		
27	Funding	22	Give the source of funding and the role of the funders for the
28			present study and, if applicable, for the original study on which the
29			present article is based
30			

\*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).