

Factors associated with older adults' ADL in urban area of Hangzhou, China – a cross-sectional study

Chao Rong (✉ 155189273@qq.com)

Zhejiang Chinese Medical University <https://orcid.org/0000-0001-5516-6102>

Xiao-Lan Wang

Zhejiang Chinese Medical University

Xiao Ye

Zhejiang Chinese Medical University

Yan-Chun Sun

Kunming Medical University

Shu-Han Jiang

Zhejiang Chinese Medical University

Shu-Han Shen

Zhejiang Hospital of Traditional Chinese Medicine

Wei-Ming Cao

Zhejiang Chinese Medical University

Cai-Ming Xu

Zhejiang Chinese Medical University

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Abstract

Background : To explore socioeconomic associated factors of activities of daily living (ADL) among the elderly in an urban setting, and to provide evidence for designing appropriate long-term care system.

Methods : Participants were selected using the method of combining stratified sampling with judgment sampling. 500 older adults were effectively surveyed. Rank sum test was used to compare the ADL of the elderly with different socio-demographic characteristics. The multiple generalized linear model and ordinal logistic regression model were conducted to analyze factors correlated with ADL.

Results : Rank sum test showed that the ADL total scores of the elderly with different gender, age, marital status and living situation were statistically different ($P < 0.05$). The generalized linear model showed that age, self-rated health status and living situation were significantly associated with ADL total scores ($P < 0.05$). The ordinal logistic regression showed that gender, age, self-rated health status, the number of chronic diseases and living situation were significantly associated with ADL level ($P < 0.05$).

Conclusion : Future interventions to improve elderly care service for urban elderly in eastern China should focus on instrumental functions, rather than on basic ADL. Further strengthen medical service functions in nursing homes. Community health service center should provide high quality health services for the elderly living in communities and homes. Build more nursing homes in China. The elderly who are not in marriage should be the focus population of long-term care.

Introduction

A rapid aging trend, with declines in fertility and mortality, was observed in China during recent decades. The population aged 60 and above reached 222 million, accounting for 16.15% of the total population in 2015. It is estimated that the elderly population will reach 248 million by 2020, and the aging level will reach 17.17%, including 30.67 million people aged 80 and above. The number of people over the age of 60 will reach 300 million and 400 million by 2025 and 2035 respectively, making China a super aged country.^[1] The enormous increase in this population sector will have serious impacts for long-term care system and healthcare system, which have already been in difficulty to cater for increased long-term care service and healthcare utilization.

Assessment of the functional status of the elderly in activities of daily living (ADL) is widely used in social surveys and clinical studies. Disabilities in ADL are not only predictors of hospitalization and mortality, but also important indicators of the need for institution, community and home care.^[2] Hence, a comprehensive understanding of the factors that correlated with ADL will contribute towards future long-term care and healthcare service planning. On an individual level, it is of great importance to maintain independence in ADL for the elderly. Dependence in ADL leads to poorer quality of life and greater mortality, and also increased long-term care and healthcare costs. Hence, it is important to identify the risk factors of dependency among the elderly in order to promote healthy aging and active aging.^[3]

Agnieszka Beata Ćwirlej-Sozańska (2018) studied rural areas of south-eastern Poland, and found that age, educational level, pain, low assessment of quality of life, using assistive devices, falls, household not fully adapted for one's needs and lack of satisfaction with life had a significant impact on the disabilities of ADL and/or instrumental activities of daily living (IADL) in the elderly.^[4] Deirdre Connolly (2016) studied community dwelling older adults in the Irish, and found that the top four factors associated with disabilities in ADL/IADL, including age, pain, taking five or more medications and depression.^[3] Le V Hoi(2011) studied rural areas in Vietnam, and found that age, sex, educational level, marital status, working status, income, household size, household membership, living arrangement, residential area and chronic illnesses were determinants of daily care needs in old age.^[2] A systematic review investigated risk factors for functional decline in ADL for community-dwelling elderly. This review identified chronic diseases, cognitive impairment, upper and lower extremity dysfunction, high and low body mass index (BMI), lack of physical activity, self-rated health, poor self-reported vision, medications, smoking, heavy alcohol consumption, low level of social activity and few social contacts as risk factors of disability. In more recent studies, age, stroke, falling, the presence of comorbidities, poor cognitive functioning, self-rated health, joint complaints, medication, stiffness and waist circumference have also been identified as factors associated with disability.^[3]

The existing studies had the following defects: First, ADL was rarely used as a continuous variable or an ordered classification variable for regression analysis. In addition, few studies had included both home-based and institution-based older adults. Finally, studies focusing on ADL of older adults in urban areas of eastern China were rare. Therefore, in order to provide evidence for designing appropriate long-term care system, this study took the elderly living at home and in institution in eastern China as samples, and continuous variable and ordered classification variable of ADL were used as dependent variables, to explore socioeconomic risk factors of ADL among the elderly in an urban setting.

Materials And Methods

2.1. Sampling

Field investigation was conducted from July to August 2015 in Hangzhou city, which is an economically developed city in eastern China. Participants were selected using the method of combining stratified sampling with judgment sampling. The specific sampling process was performed in four steps: (a) According to the per capital GDP, the eight districts—Xiacheng, Shangcheng, Jianggan, Binjiang, Gongshu, Xihu, Yuhang, and Xiaoshan—of Hangzhou were divided into three levels: high, moderate, and low. (b) One district from each level was randomly selected, and they were Shangcheng, Xihu, Gongshu, respectively. (c) According to the method of judgment sampling, judged by the research team, four ageing communities (two in Shangcheng, one in Xihu, and one in Gongshu) and four larger scale nursing homes (one in Shangcheng, one in Xihu, and two in Gongshu) which have more older adults from the districts were selected. (d) Older adults in these communities and nursing homes were surveyed. The inclusion criteria were: a) Being older than 60, b) Having normal cognitive functions, judged according to whether

they can communicate normally. One leading teacher and five undergraduate students were recruited and trained as interviewers. All participants were clearly informed of the purpose of this study, and asked to sign in the consent form. All participants were assured of their right to refuse to participate or to withdraw from this study at any time. Anonymity and confidentiality of the participants were assured. Every single interview lasted for about 30 minutes. After verification, there is no missing information and no contradictory questionnaire, and it was considered as an effective questionnaire. 560 participants were interviewed. A total of 500 valid questionnaires were collected, and the effective response rate was 89.3%.

2.2. Measurements

2.2.1. The Activity of Daily Living Scale (ADL)

The Activity of Daily Living Scale (ADL), developed by Lawton and Brody in the United States in 1969. It is composed of Physical Self-Maintenance Scale (PSMS) and Instrumental Activities of Daily Living Scale (IADL). There are 6 items in PSMS: eating, dressing, washing, walking, going to the toilet, and bathing; There are 8 items in IADL: meal preparation, housework, laundry, shopping, transportation, phone call, medication and self-care economy. When evaluating, the investigators ask older adults item by item according to the table list. The evaluation results can be analyzed according to the total score, subscale score and single item score. The total score is between 14 and 56. If the total score is lower than 16, it is completely normal. If it is more than 16, it means that there are varying degrees of obstacles. Single item score 1 is normal, and 2–4 is functional decline. When a single item score is 2 or more than 2 items are more than or equal to 3, or the total score is more than or equal to 22, it indicates a significant dysfunction. In this study, in addition to calculating the total score of ADL, ADL is divided into three categories according to the above rules: normal, obstacles with certain degree, and serious obstacles. The above ADL total score (continuous variable) and ADL level (categorical variable) were used as the dependent variables in this study.

2.2.2. Independent variables

The independent variables included: gender (1 = male, 2 = female), age (1 = 60–64, 2 = 65–69, 3 = 70–74, 4 = 75–79, 5 = 80+), educational level (1 = junior high school and below, 2 = senior high school, 3 = college and above), marital status (1 = married, means the older adult with a spouse, 2 = not married, means the older adult without a spouse, including widowed, divorced, and separated), monthly income (1 = 1000-, 2 = 1001–3000, 3 = 3001–5000, 4 = 5001+), the number of chronic diseases (1 = 0, 2 = 1, 3 = 2, 4 = 3+), self-rated health status (1 = good, 2 = moderate, 3 = bad), the number of children (1 = 0, 2 = 1, 3 = 2, 4 = 3, 5 = 4+).

The number of chronic diseases was surveyed by the multiple-choice questions, “How many chronic diseases do you have?” Sixteen chronic diseases were listed for selection, including hypertension, diabetes, chronic obstructive pulmonary disease, the tumor, cerebral haemorrhage/cerebral ischemia, coronary heart disease (CHD), senile dementia, Parkinson’s disease, hypothyroidism, chronic kidney failure, cirrhosis of the liver, other digestive disorders, epilepsy, cataract, fracture, rheumatoid arthritis. A higher score means that the participant has more chronic diseases. However, in the multiple generalized linear regression model and ordinal logistic regression model, the number of children and the number of chronic diseases were measured by continuous variables. Age, education level, and monthly income were regarded as continuous variables.

2.3. Quality control

Ages of the elderly were confirmed using the household registration system. During the face-to-face field survey, a trained teacher and five undergraduate students explained how to fill in the questionnaires and helped the elderly complete them in their homes or the nursing homes. The database was established by EpiData3.1, and double input by two students was conducted to ensure accuracy. The Medical Ethics Committee of Zhejiang Chinese Medical University granted ethical approval. Each respondent signed the informed consent form for this study.

2.4. Data analysis

Data was analyzed using the SAS version 9.1 software. Participants’ socio-demographic characteristics were expressed as frequencies and percentages and medians. Rank sum test was used to compare the ADL of the elderly with different socio-demographic characteristics. The correlation analysis method was conducted to analyze the correlation of the elderly’s socio-demographic characteristics and ADL total score. The multiple generalized linear model and ordinal logistic regression model were conducted to analyze factors influencing the elderly’s ADL.

Results

3.1. Comparison of social demographic characteristics

Table 1 presented the characteristics of the study sample. The highest proportion of the elderly was over 80 (29.8%). There were slightly more women (57.0%) than men (43.0%). The proportion of those with education level at junior high school and below 42.7% was the largest. Those with monthly income between 3,000 and 5,000 yuan (60.6%) were the most numerous. The majority of the elderly was married (70.8%). Rank sum test results showed that the ADL total score of older men was higher than that of women ($P = 0.011$). The ADL total score for those 80 and older was higher than those under 80

($P < 0.001$). The elderly who were not married had higher ADL scores than those who were married ($P = 0.001$). The elderly with two diseases and three or more diseases had higher ADL scores than those who with one disease and no disease. The elderly with one disease had higher ADL scores than those who with no disease. The elderly with bad self-rated health status had higher ADL scores than those who with good and moderate self-rated health status. The elderly had no child and two children and four or more children had higher ADL scores than those who had one children. The elderly who live in nursing homes had higher ADL scores than those who live at homes ($P < 0.001$).

3.2. ADL single item score of older adults

Table 2 described functional assessment of ADL single item score. The disabilities of IADL were more serious than those of PSMS. The two highest levels of disability were walking and bathing in PSMS, and they were 22.0% and 14.8%, respectively. The five highest levels of disability in IADL were transportation, housework, meal preparation, laundry and shopping, and they were 27.2%, 26.0%, 25.0%, 24.4% and 23.0%, respectively.

3.3. Correlation analysis between social demographic characteristics and ADL total scores of older adults

Table 3 showed correlation analysis between ADL and social demographic characteristics. Spearman correlation analysis results showed: Age, the number of children, self-rated health status and the number of chronic diseases were correlated with ADL scores ($P < 0.05$). Among them, self-rated health status had a relatively strong correlation ($r = 0.237$). The older they were, the more children they had, the worse the self-rated health status, the more kinds of chronic diseases, and the worse their ability to take care of themselves. Pearson correlation analysis results showed: Marital status and living situation were correlated with ADL scores ($P < 0.05$). Among them, living situation had a relatively strong correlation ($r = 0.272$). The elderly who were not married were less able to take care of themselves. The elderly who lived in nursing homes were less able to take care of themselves than those who lived at homes.

3.4. Results of generalized linear model analysis

Table 4 displayed the results of multiple generalized linear model analysis for ADL total scores of older adults. Age ($P < 0.001$), self-rated health status ($P < 0.001$) and living situation ($P < 0.001$) were significantly associated with ADL total scores. The older the age, the worse the self-rated health status, the higher the ADL total scores. The elderly who were living in institution had higher ADL scores than those who were living at home.

3.5. Results of ordinal logistic regression analysis

The functional status of older adults was divided into three levels according to the standard. There were 348 totally normal participants, accounting for 69.6%; 61 participants with certain functional impairment,

accounting for 12.2%; and 91 participants with obvious functional impairment, accounting for 18.2%. Table 5 depicted the results of ordinal logistic regression analysis for ADL total scores of the elderly. Gender ($P = 0.011$), age ($P < 0.001$), self-rated health status ($P = 0.001$), the number of chronic diseases ($P = 0.001$) and living situation ($P < 0.001$) were significantly associated with ADL level.

Discussion

This study investigated the situation of functional status of older adults and its associated factors of 500 elderly adults in Hangzhou urban area, and used multiple generalized linear model and ordinal logistic regression analysis methods to explore its associated factors. This study results showed that the disabilities of IADL were more serious than those of PSMS. The older the age, the worse the self-rated health status, the more kinds of chronic diseases, the higher the ADL total scores. The elderly who were living in nursing homes had higher ADL total scores than those who were living at homes. Older men had higher ADL total scores than older women.

This study assessed ADL single item score, and the results showed that the disabilities of IADL were more serious than those of PSMS. The five highest levels of disability were transportation, housework, meal preparation, laundry and shopping, which all belong to IADL. The results of this study are consistent with those of Le V Hoi. He also found that dependence in instrumental ADLs was more common than for basic ADLs.[2] It was suggested that future interventions to improve long-term care service for urban elderly in eastern China should focus on instrumental functions, rather than on basic ADL.

The results of both the multiple generalized linear model and ordinal logistic model showed that the worse the self-rated health status, the higher the ADL total scores. This study is consistent with Agnieszka Beata Ćwirlej-Sozańska's and Siri Høvik Storeng's findings.[4–7] Poor subjective health perception or lower health-related quality of life or lower quality-adjusted life years indicate poor health status, which can cause a decline in physical function, and will affect the elderly's ability to take care of themselves. The result of ordinal logistic regression showed that the more kinds of chronic diseases, the higher the ADL total scores. This study is consistent with previous studies.[2, 8] The elderly having more than one chronic disease tend to be more of dependency. Further strengthen medical functions in nursing homes, and provide the elderly with appropriate disease prevention, treatment and rehabilitation services. The community health service center should provide high quality health services for the elderly living in communities and homes.

The results of both the multiple generalized linear model and ordinal logistic model showed that the older the age, the higher the ADL total scores. This study is consistent with previous studies.[2–4, 9–11] With the increase of age, physical function gradually decreases, and the cumulative effect of many years of health risks is increasingly prominent. Therefore, the diseases will be more and the severity will increase, and the self-care ability will go from bad to worse. The result of ordinal logistic regression showed that older men had higher ADL total scores than older women. This study is inconsistent with José C's and Juan Manuel Carmona-Torres's findings.[9, 12] This may be because the men in this study are older than

women, while gender in the above two studies is not the case. The results of both the multiple generalized linear model and ordinal logistic model showed that the elderly who were living in nursing homes had higher ADL scores than those who were living at homes. Perhaps because no one at home can take care of the elderly with poor self-care ability, they can only come to live in a nursing home. [8, 13] With the increasingly serious aging of China, the demand for institution based care will increase day by day, and China needs to build more nursing homes.[14]

The results of both the correlation analysis and rank sum test showed that the elderly who were not married had higher ADL scores than those who were married. This study is consistent with previous studies. [2, 10] This may suggest that life care and emotional exchange within a married couple is very important in maintaining physical functions at old ages. Le V Hoi found that the elderly living under the national poverty line had higher ADL total scores.[2, 10, 15] Some studies found that education had a significant impact on the prevalence of ADL and/or IADL disabilities in the rural elderly.[4, 10] However, this study found no association between economic income, education and ADL. It may be because our survey objects were the elderly in the eastern cities of China, whose economic status was better, and there were very few people who were particularly poor or very poorly educated. The elderly who are not married should be the focus population of long-term care service.

This study had several advantages. First, the study not only investigated the elderly living at homes, but also the elderly living in nursing homes, which can better reflect the ADL situation of the elderly in Hangzhou. Second, A combination of the multiple generalized linear model and ordinal logistic regression method was used to more accurately explore the associated factors of ADL in the elderly. Third, the eastern urban area of China has relatively developed economy, and aging is more severe, and the demand for long-term care service is more exuberant. The elderly in this area was selected as the research object. Some limitations of the study should be acknowledged. First, the independent variables considered may not be comprehensive, such as mental health status, cognitive status, depression, expressive suppression, hearing, etc.[16–20] Second, it was a cross-sectional study, and there is no longitudinal follow-up to clearly explore the causal relationship between ADL and its associated factors. Third, most people surveyed were in a good self-care status, which may have some bias.

The study relatively systematically discussed the associated factors of ADL for the elderly in Hangzhou, and provided some theoretical references for better realization of healthy aging and active aging in the time of increasingly serious aging. China is actively developing institutional, community and home-based care for the aged, providing a theoretical basis for rational planning and allocation of long-term care resources, and for finding key objects of concern and intervention for service providers of these different long-term care modes. Feasible strategies should be explored to prevent ADL disorders in the future research.

Abbreviations: Activities of daily living (ADL); Instrumental activities of daily living (IADL); Physical Self-Maintenance Scale (PSMS)

Declarations

- Ethics approval and consent to participate

Dr. Chao Rong presided over the following three research projects: The China Ministry of Education's Humanities and Social Sciences Research Youth Program(Number:15YJC840024), and China NHC Key Laboratory of Health Economics and Policy Research Program (Number: NHC-HEPR2018004). Dr. Rong's research team needs to conduct a questionnaire survey on the sociodemographic characteristics, social support, mental health, quality of life, diseases and service utilization, and elderly care preference of the parents who lost their only child in China. According to The Medical Ethics Committee of Zhejiang Chinese Medical University, since these studies do not involve human intervention, do not pose a health risk to the human body. And the research team promised to keep all the investigation materials confidential and never leak. The committee has decided that a full review is not necessary, and decided to grant ethical approval waiver.

The written Informed consent was obtained from all individual participants included in the study.

- Consent for publication

All authors have approved the final manuscript and consent for publication

- Availability of data and material

Researchers interested in this topic can contact the corresponding author of this article. We share data with everyone following basic ethical principles such as privacy and confidentiality.

- Competing interests

The authors declare that they have no conflict of interest. The funding sources had no role in the design of this study and will not have any role during its execution, analyses, interpretation of the data, or decision to submit results.

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- Authors' contributions

Xiao-Lan Wang and Shu-Hua Shen designed the present study. Xiao Ye and Yan-Chun Sun assisted in the acquisition of subjects and data. Analysis and interpretation of data were conducted by Shu-Han Jiang

and Cai-Ming Xu. The preparation of the manuscript was conducted by Chao Rong and Wei-Ming Cao. All authors contributed to and have approved the final manuscript.

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Tables

Table 1 Comparison of ADL total scores among the elderly with different socio-demographic characteristics

Characteristic	Group	Frequency	Percentage	M(QR)	Z	P
Gender	Male	215	43.0	14(6)	-2.532	0.011
	Female	285	57.0	14(3)		
Age	60-64	63	12.6	14(0)	76.770	<0.001
	65-69	80	16.0	14(0)		
	70-74	103	20.6	14(3)		
	75-79	105	21.0	14(3)		
	80+	149	29.8	14(12)		
Marital status	married	354	70.8	14(3)	-3.455	0.001
	not married	146	29.2	14(8)		
Monthly Income	1000-	13	2.6	14(10)	1.351	0.717
	1001-3000	109	21.8	14(3)		
	3001-5000	303	60.6	14(4)		
	5001+	75	15.0	14(7)		
Educational level	Junior high school and below	213	42.6	14(3)	0.246	0.884
	Senior high school	116	23.2	14(4)		
	College and above	171	34.2	14(6)		
Living Situation	Living at home	246	49.2	14(0)	-8.426	<0.001
	Living in institution	254	50.8	14(9)		

Note: Married: with a spouse; Not married: without a spouse, including widowed, divorced, and separated.

Table2 Functional assessment of ADL single item score of older adults n(%)

	Independent	Dependent
Physical self-maintenance Scale		
Eating	473(94.6%)	27(5.4%)
Dressing	470(94.0%)	30(6.0%)
Washing	463(92.6%)	37(7.4%)
Walking	390(78.0%)	110(22.0%)
Going to the toilet	455(91.0%)	45(9.0%)
Bathing	426(85.2%)	74(14.8%)
Instrumental Activities of Daily Living Scale		
Meal preparation	375(75.0%)	125(25.0%)
Housework	370(74.0%)	130(26.0%)
Laundry	378(75.6%)	122(24.4%)
Shopping	385(77.0%)	115(23.0%)
Transportation	364(72.8%)	136(27.2%)
Phone call	460(92.0%)	40(8.0%)
Medication	457(91.4%)	43(8.6%)
Self-care economy	437(87.4%)	63(12.6%)

Table3 The correlation of participants' socio-demographic characteristics and ADL total score

	Correlation coefficient	<i>P</i>
Gender	-0.026	0.563
Age	0.191	<0.001
Education level	-0.026	0.566
Marital status	0.157	<0.001
The number of children	0.108	0.016
Income	-0.008	0.864
self-rated health status	0.237	<0.001
The number of chronic diseases	0.155	0.001
Living situation	0.272	<0.001

Table4 The results of generalized linear model analysis of ADL total score

Independent variables	Reference group	β	SE	<i>P</i>	OR	95%CI
Gender						
Male	Female	0.412	0.683	0.547	1.509	(0.395-5.760)
Age		1.122	0.275	<0.001	3.070	(1.790-5.265)
Education level						
Junior high school and below	College and above	-0.479	0.846	0.571	0.619	(0.118-3.251)
Senior high school		0.154	0.897	0.864	1.167	(0.201-6.769)
Marital status						
Married	Not married	-1.089	0.763	0.153	0.336	(0.075-1.501)
Income		-0.413	0.322	0.199	0.662	(0.352-1.243)
Self-rated health status		1.378	0.307	<0.001	3.966	(2.172-7.241)
The number of chronic diseases		0.692	0.373	0.063	1.998	(0.962-4.148)
The number of children		0.149	0.306	0.625	1.161	(0.638-2.114)
Living situation						
Living at home	Living in Institution	-3.010	0.705	<0.001	0.049	(0.012-0.196)

Notes: Married: with a spouse; Not married: without a spouse, including widowed, divorced, and separated

Table5 The results of ordinal logistic regression analysis of ADL total score

Independent variables	Reference group	<i>B</i>	SE	<i>P</i>	OR	95%CI
Gender						
Male	Female	0.557	0.219	0.011	1.746	(1.137-2.681)
Age		0.517	0.099	<0.001		
Education level						
Junior high school and below	College and above	-0.297	0.268	0.268	0.743	(0.439-1.257)
Senior high school		-0.144	0.289	0.618	0.866	(0.491-1.526)
Marital status						
Married	Not married	-0.404	0.230	0.079	0.668	(0.425-1.048)
Income		0.004	0.103	0.971	1.004	(0.820-1.228)
Self-rated health status		0.322	0.098	0.001	1.380	(1.138-1.673)
The number of chronic diseases		0.386	0.120	0.001	1.470	(1.162-1.861)
The number of children		0.166	0.096	0.083	1.180	(0.979-1.423)
Living situation						
Living at home	Living in Institution	-0.837	0.230	<0.001	0.433	(0.276-0.679)

Notes: Married: with a spouse; Not married: without a spouse, including widowed, divorced, and separated.