Potential associated factors of functional disability in Chinese older inpatients: A multicenter cross-sectional study

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Abstract

Background: Older adults are vulnerable to a decline in physical functioning, including basic activities of daily living (ADL) and higher-level instrumental activities of daily living (IADL). The causes of functional disability in older adults are multifactorial. A comprehensive understanding of these factors will contribute toward future health service planning. However, studies of ADL and IADL in Chinese older adults are insufficient. The aim of this study is to describe the level of ADL and IADL in different age groups and explore the factors associated with functional disability in Chinese older inpatients. Methods: We conducted a cross-sectional study consisted of 9,996 Chinese older inpatients aged 65 years and older. Participants were recruited from six provinces or municipality city in southwest (Sichuan province), northeast (Heilongjiang), south central (Hubei province), northern (Beijing municipality city), northwest (Qinghai province), and eastern China (Zhejiang province) from October 2018 to February 2019. The levels of ADL and IADL were measured by scores of the Barthel index and Instrumental Activities of Daily Living Scale in consecutive intervals from 65 years of age. After controlling for the cluster effect of hospital wards, a mixed-effect generalized linear model was used to examine the association between functional disability and covariates. Results: The average ADL score was 27.68±4.59 and the mean IADL score 6.76±2.01 for all participants. A negative correlation between scores and age was observed, and there was a significant difference in ADL and IADL scores among different age groups. The top negatively influential factor in ADL and IADL was stair climbing and shopping, respectively. After controlling for the cluster effect of hospital wards, aging, emaciation, frailty, depression, falling accidents in past 12 months, hearing dysfunction, cognitive dysfunction, urinary dysfunction, and defecation dysfunction were associated with ADL and IADL. Patients transitioned from the emergency department and other hospitals were also affected by ADL disability. Former smoking was associated with lower IADL scores. Higher level of education, living in a building without elevators, and current alcohol consumption were correlated with better IADL performance. Conclusion: Decreased functional ability was associated with the increasing age. Sociodemographic characteristics (such as age), physical health variables (frailty, emaciation, hearing dysfunction, urinary dysfunction, defecation dysfunction, falling accidents in past 12 months), and mental health variables (cognitive dysfunction, depression) were associated with functional disability. These findings potentially have major importance for the planning of hospital services, discharge planning, and post-discharge care.

1. Introduction

The aging population is increasing at an unprecedented rate worldwide (1). The proportion of people aged 60 years and older is expected to double from about 11% in 2000 to 22% in 2050, with 80% living in low- to middle-income countries (2). In China, 38% of older adults (aged 60 and older) were reported as having difficulty with daily living (1). In 2018, the number of Chinese older adults approached 241 million, accounting for 17.2% of the total population, and this figure is expected to approach 480 million by 2050 (3).

Older adults are likely to suffer from poor quality of life and irreversible decline in functional ability (4), as they are vulnerable to a decline in physical functioning and find themselves unable to undertake the basic activities of daily living (ADL) and higher-level tasks that they used to (3). Functional disability is defined in terms of higher-level instrumental activities of daily living (IADL) and basic ADL, including ability to use a telephone and personal items, feeding, bathing, grooming, and using public transport by oneself, which tend to deteriorate with the aging process (5–7). With the advent of the increasingly aging society, functional disability of older adults is a pressing concern for China and the world.

Results from previous studies have varied with respect to the association between functional disability and potential associated factors, such as alcohol consumption, smoking, and body mass index (BMI). In addition, most previous estimates of functional disability in Chinese older inpatients used data from only a single hospital or smaller, unrepresentative sample sizes. To address this issue, we designed and conducted a study to explore the possible correlation between functional disability and age, and to examine the potential associated risk factors of functional disability in Chinese older inpatients based on a large-scale, cross-sectional national survey.

2. Methods

2.1. Study design and participants

Participants were derived from a large-scale cohort study in a representative sample of Chinese older inpatients, which is an ongoing survey of physiological and psychological conditions in older inpatients nationwide. The baseline data collected from the period October 2018 to February 2019 represent the baseline survey data used in this study. The study sample was drawn from five provinces and one municipality in China (southwest: Sichuan province; northeast: Heilongjiang province; south central: Hubei province; northern: Beijing municipality/city; northwest: Qinghai province; eastern: Zhejiang province). One tertiary hospital was sampled in each province or municipality. All eligible older inpatients from medical or surgical departments of the selected hospitals were continuously enrolled. Inclusion criteria were as follows: aged 65 and older; signed the consent form; understood the aims of the study; and with sufficient mental ability to answer the interview questionnaire.

2.2. Measurement instruments

The Barthel Index (BI) is a 10-item instrument measuring disability in terms of a person's level of functional independence in personal ADL (8). BI comprises 10 ADL, each of which is graded as 0, 5, or 10 with a maximum total score of 100 (9). A higher score means better capacity to perform daily living activities (8, 9).

IADL were measured by employing the Instrumental Activities of Daily Living Scale (IADL) (5), which includes a range of higher-level activities that are considered to address the older adult's capacity to interact with his or her community (10). The scores of this scale range from 0 to 8, with 0 being the least independent and 8 being the most independent in the eight-item scale (5, 11, 12).

2.3. Data collection and quality control

Nursing staff were trained according to the training manual. Before the data collection, nurses were trained regarding the application of the functional disability assessment, frailty assessment, and other health assessment scales. Baseline data such as demographic factors and physiological and psychological conditions were collected by pretrained and certified registered nurses through interviews and physical examinations. All case report forms were carefully reviewed by the head nurse in each ward to ensure the authenticity and accuracy of the raw data. A database was built using an electronic data collection system and was corrected to guarantee the accuracy and integration of the data.

2.4. Definition of covariates

Potential associated factors of functional disability in the model included age, BMI, sex, ethnicity, education level, marital status, frailty, depression, admission to hospital, living conditions, smoking, alcohol consumption, falling accidents in the past 12 months, vision, hearing, sleeping, cognitive function, urinary function, and defecation function. BMI was measured in kg/m^2 (13, 14). Frailty was assessed by the Frailty Scale (15), with a larger total score meaning more a severely frail condition. Assessment of cognitive function was based on the Mini-Mental State Examination Scale (16), which was dichotomized as normal cognitive function and cognitive dysfunction. The depression assessment scale was based on the Geriatric Depression Scale 15 (GDS15) (17), with a larger GDS score denoting more severe depression.

2.5. Statistical analysis

Continuous variables were described as mean and standard deviation (SD). Categorical variables were described as number and percentage. ANOVA was used to examine the statistical differences of variables among different age groups. Considering that the participants in the same ward or hospital were more likely to be assessed as having similar ADL or IADL scores, a mixed-effect generalized linear model was used to examine the relationship between functional disability and covariates in order to control the cluster effect of hospital wards. The regression coefficient and its 95% confidence interval (CI) were used to assess the strength of relationships. All statistical analyses were conducted using SAS 9.4 software (SAS Institute, Cary, NC, USA). A P value of less than 0.05 was considered statistically significant.

3. Results

3.1. Baseline demographic and clinical characteristics

Descriptive statistics and frequencies of demographics are shown in Supplementary File 1. Among a total of 9,996 participants, 57.64% of participants were older than 70 years and 12.19% older than 80 years. Normal BMI was measured in 48.54% of participants, and overweight patients accounted for the second biggest proportion in this regard (34.31%). More than 80% of participants were not in a frail condition although, notably, 82.28% of inpatients had symptoms of depression. An estimated two-thirds of

participants had a smoking history and nearly one-quarter a history of drinking alcohol. At least one falling accident in the previous 12 months was recorded in 14.23% of participants. In addition, vision dysfunction (22.03%), hearing dysfunction (22.03%), cognitive dysfunction (19.40%), sleeping dysfunction (20.57%), urinary dysfunction (14.11%), and defecation dysfunction (12.53%) were present. With regard to living conditions, 16.95% of participants lived in a bungalow and the remainder lived in a building with (36.09%) or without (46.96%) an elevator.

3.2. The level of ADL and IADL in different age groups

The levels of ADL and IADL among different age groups are presented in Table 1. The average ADL score was 27.68 ± 4.59 for all participants. The most affected ADL were walking up and down stairs, mobility (on level surfaces), bathing, transfers (bed to chair and back), and toilet use (see Fig. 1). In addition, there was a trend of decreasing scores along with aging, and significant differences between age groups were also observed ($P < 0.05$).

Table 1
One-way ANOVA of ADL and IADL scores among different age groups

Age-group (year)	ADL (mean ± SD)	IADL (mean ± SD)
65–69	28.35 ± 3.88	7.10 ± 1.77
70–74	27.88 ± 4.28	6.88 ± 1.88
75–79	27.19 ± 4.90	6.50 ± 2.16
80–84	26.05 ± 5.70	6.02 ± 2.31
85 and above	24.54 ± 7.08	4.96 ± 2.57
Total	27.68 ± 4.59	6.76 ± 2.01
P value	< 0.001	< 0.001

With regard to IADL, the mean IADL score was 6.76 ± 2.01. Shopping, food preparation, mode of transportation, and doing the laundry were limited for most inpatients in terms of IADL. A similar trend of decreasing scores alongside aging in the older population was also apparent in IADL. Likewise, there were significant differences among the IADL scores of each age group ($P < 0.05$).

3.3. Associated factors of functional disability

As shown in Table 2, after controlling for the cluster effect of hospital wards, age was significantly associated with ADL. Compared with the 65–69 age group, the 70–74 age group (regression coefficient −0.0120; 95% CI: −0.0174, − 0.0066), 75–79 age group (− 0.0205; −0.0266, − 0.0144), 80–84 age group (−0.0484; −0.0601, − 0.0367), and 85 and older age group (− 0.0636; −0.0841, − 0.0431) were susceptible to ADL disability. Compared with participants of normal weight, emaciated participants were susceptible to

poor ADL (− 0.0220; −0.0347, − 0.0094). Aligning with univariate analysis results, frailty in participants (− 0.1031; −0.1160, − 0.0901) and depression in participants (− 0.0342; −0.0438, − 0.0246) were more likely to increase the risk of ADL in the multivariate model. Compared with outpatient department participants, those from emergency departments (− 0.0994; −0.1275, − 0.0714) and transferred from other hospitals (− 0.0208; −0.0385, − 0.0032) were susceptible to ADL disability. In addition, falling accidents in the past 12 months (− 0.0301; −0.0424, − 0.0178), hearing dysfunction (− 0.0068; −0.0136, − 0.0000), cognitive dysfunction (− 0.0229; −0.0310, − 0.0148), urinary dysfunction (− 0.0343; −0.0467, − 0.0219), and defecation dysfunction (− 0.0272; −0.0365, − 0.0179) increased the risk of ADL disability. On the contrary, sex, ethnicity, educational level, smoking, living conditions, alcohol consumption, vision dysfunction, sleeping dysfunction, and marital status were not statistically associated with ADL.

Table 2
Factors associated with ADL from regression model

Characteristics	Univariate		Multivariate	
	Regression coefficient	95% CI	Regression coefficient	95% CI
Age				
65–69 (ref.)	-	-	-	-
70–74	-0.0149	-0.0215, -0.0084	-0.0120	-0.0174, -0.0066
75–79	-0.0339	-0.0418, -0.0260	-0.0205	-0.0266, -0.0144
80–84	-0.0705	-0.0850, -0.0561	-0.0484	-0.0601, -0.0367
85 and above	-0.1014	-0.1280, -0.0748	-0.0636	-0.0841, -0.0431
BMI				
Obesity	0.0052	-0.0035, 0.0138	-0.0020	-0.0092, 0.0052
Overweight	0.0108	0.0052, 0.0164	0.0014	-0.0033, 0.0060
Emaciation	-0.0458	-0.0598, -0.0318	-0.0220	-0.0347, -0.0094
Normal (ref.)	-	-	-	-
Sex				
Male (ref.)	-	-	-	-
Female	-0.0059	-0.0116, -0.0002	-0.0040	-0.0098, 0.0017
Ethnicity				
Han (ref.)	-	-	-	-
Others	-0.0088	-0.0205, 0.0029	0.0035	-0.0052, 0.0122
Educational level				

Abbreviations, CI, confidence interval; BMI, body mass index.

Characteristics	Univariate		Multivariate	
	Regression coefficient	95% CI	Regression coefficient	95% CI
University	0.0211	0.0091, 0.0331	0.0049	-0.0057, 0.0156
Middle school	0.0212	0.0116, 0.0309	0.0009	-0.0076, 0.0095
Primary school	0.0148	0.0052, 0.0245	0.0029	-0.0048, 0.0106
Illiterate (ref.)	-	-	-	-
Marriage				
Divorced or widowed	-0.0156	-0.0256, -0.0055	0.0070	-0.0010, 0.0151
Married (ref.)	-	-	-	-
Frail				
Yes	-0.1340	-0.1482, -0.1198	-0.1031	-0.1160, -0.0901
No (ref.)	-	-	-	-
Depression				
Yes	-0.0760	-0.0878 -0.0642	-0.0342	-0.0438, -0.0246
No (ref.)	-	-	-	-
Admission to hospital				
Emergency department	-0.1175	-0.1473, -0.0877	-0.0994	-0.1275, -0.0714
Outpatient department (ref.)	-	-	-	-
Transit from other hospitals	-0.0334	-0.0545, -0.0124	-0.0208	-0.0385, -0.0032
Others	-0.0041	-0.0252, 0.0169	0.0046	-0.0082, 0.0174
Living conditions				
Building with elevators (ref.)	-	-	-	-

Abbreviations, CI, confidence interval; BMI, body mass index.

Characteristics	Univariate		Multivariate	
	Regression coefficient	95% CI	Regression coefficient	95% CI
Building without elevators	0.0027	-0.0043, 0.0098	0.0038	-0.0020, 0.0097
Bungalow	-0.0126	-0.0220, -0.0032	-0.0026	-0.0112, 0.0059
Smoking				
Non-smoker (ref.)	-	-	-	-
Current smoker	0.0009	-0.0069, 0.0087	-0.0066	-0.0139, 0.0007
Former smoker	-0.0051	-0.0117, 0.0015	-0.0036	-0.0097, 0.0026
Alcohol drinking				
Non-drinker (ref.)	-	-	-	-
Current drinker	0.0104	0.0034, 0.0175	-0.0002	-0.0068, 0.0064
Former drinker	-0.0075	-0.0175, 0.0024	-0.0084	-0.0170, 0.0002
Falling accidents in past 12 months				
Yes	-0.0507	-0.0649, -0.0364	-0.0301	-0.0424, -0.0178
No (ref.)	-	-	-	-
Vision				
Normal (ref.)	-	-	-	-
Dysfunction	-0.0222	-0.0304 -0.0140	-0.0022	-0.0096, 0.0053
Hearing				
Normal (ref.)	-	-	-	-
Dysfunction	-0.0243	-0.0324, -0.0162	-0.0068	-0.0136, -0.0000
Cognitive function				

Abbreviations, CI, confidence interval; BMI, body mass index.

Characteristics	Univariate		Multivariate	
	Regression coefficient	95% CI	Regression coefficient	95% CI
Normal (ref.)	-	-	-	-
Dysfunction	-0.0478	-0.0582, -0.0375	-0.0229	-0.0310, -0.0148
Sleeping				
Normal (ref.)	-	-	-	-
Dysfunction	-0.0202	-0.0261, -0.0143	0.0002	-0.0048, 0.0051
Urinary function				
Normal (ref.)	-	-	-	-
Dysfunction	-0.0617	-0.0783, -0.0451	-0.0343	-0.0467, -0.0219
Defecation function				
Normal (ref.)	-	-	-	-
Dysfunction	-0.0589	-0.0703, -0.0475	-0.0272	-0.0365, -0.0179
Abbreviations, CI, confidence interval; BMI, body mass index.				

As Table 3 shows, age was statistically associated with IADL. Compared with the 65–69 age group, the 70–74 age group (regression coefficient − 0.0235; 95% CI: −0.0330, − 0.0141), 75–79 age group (− 0.0434; −0.0565, − 0.0302), 80–84 age group (− 0.1040; −0.1233, − 0.0848), and 85 and older age group (− 0.2166; −0.2591, − 0.1740) were susceptible to IADL disability. Compared with participants of normal weight, emaciated participants were susceptible to poor IADL (− 0.0437; −0.0678, − 0.0195). A higher level of education (0.0588; 0.0364, 0.0811) was statistically associated with a decline in the risk of IADL disability compared with illiterate participants. Frailty (− 0.2835; −0.3159, − 0.2510) and depression (− 0.1491; −0.1715, − 0.1268) in participants were more prone to increased risk of IADL disability in the multivariate model. Living in a building without elevators suggested a lower risk of IADL disability (0.0099; 0.0004, 0.0194) in the multivariate model, whereas there was no significant difference for participants living in a bungalow or a building with elevators. Moreover, compared with nonsmokers, former smokers were prone to poor IADL (− 0.0142; −0.0262, − 0.0022) whereas there was no significance among current smokers. Current alcohol drinkers (0.0176; 0.0062, 0.0290) had a reduced risk of IADL disability compared with nondrinkers. Falling accidents in the past 12 months (− 0.0484; −0.0641, − 0.0327), hearing dysfunction (− 0.0252; −0.0413, − 0.0091), cognitive dysfunction (− 0.0742; −0.0895, −

0.0588), urinary dysfunction (− 0.0365; −0.0533, − 0.0197), and defecation dysfunction (− 0.0394; −0.0559, − 0.0228) increased the risk of IADL disability. Sex, ethnicity, marital status, admission to hospital, former alcohol drinking, vision dysfunction, and sleeping dysfunction were not statistically associated with IADL.

Characteristics	Univariate		Multivariate	
	Regression coefficient	95% CI	Regression coefficient	95% CI
Age				
65-69 (ref.)	-	-	-	-
70-74	-0.0312	-0.0441, -0.0183	-0.0235	-0.0330, -0.0141
75-79	-0.0740	-0.0908, -0.0571	-0.0434	-0.0565, -0.0302
80-84	-0.1562	-0.1821, -0.1303	-0.1040	-0.1233, -0.0848
85 and above	-0.3014	-0.3572, -0.2457	-0.2166	-0.2591, -0.1740
BMI				
Obesity	0.0135	-0.0079, 0.0350	-0.0026	-0.0192, 0.0139
Overweight	0.0275	0.0162 0.0388	0.0022	-0.0059, 0.0104
Emaciation	-0.1123	-0.1460, -0.0787	-0.0437	-0.0678, -0.0195
Normal (ref.)	-	-	-	-
Sex				
Male (ref.)	-	-	-	-
Female	-0.0233	-0.0345, -0.0122	-0.0021	-0.0130, 0.0087
Ethnicity				
Han (ref.)	-	-	-	-
Others	-0.0504	-0.0832, -0.0175	-0.0093	-0.0316, 0.0130
Educational level				
University	0.1113	0.0847, 0.1380	0.0588	0.0364, 0.0811
Middle school	0.0993	0.0764, 0.1221	0.0395	0.0213, 0.0576
Primary school	0.0668	0.0424, 0.0913	0.0317	0.0130, 0.0503

Illiterate (ref.)	-	-	-	-
Marriage				
Divorced or widowed	-0.0583	-0.0816, -0.0350	-0.0013	-0.0185, 0.0159
Married (ref.)	-	-	-	-
Frail				
Yes	-0.3713	-0.4060, -0.3365	-0.2835	-0.3159, -0.2510
No (ref.)	-	-	-	-
Depression				
Yes	-0.2575	-0.2867, -0.2284	-0.1491	-0.1715, -0.1268
No (ref.)	-	-	-	-
Admission to hospital				
Emergency department	-0.0591	-0.0859, -0.0323	-0.0142	-0.0348, 0.0064
Outpatient department (ref.)	-	-	-	-
Transit from other hospitals	-0.0085	-0.0452, 0.0283	0.0240	-0.0015, 0.0495
Others	-0.0150	-0.0888, 0.0588	-0.0026	-0.0500, 0.0447
Living conditions				
Building with elevators (ref.)	-	-	-	-
Building without elevators	0.0092	-0.0036, 0.0220	0.0099	0.0004, 0.0194
Bungalow	-0.0487	-0.0680, -0.0295	-0.0137	-0.0298, 0.0025
Smoking				
Non-smoker (ref.)	-	-	-	-
Current smoker	0.0245	0.0080, 0.0410	-0.0054	-0.0192, 0.0085
Former smoker	-0.0120	-0.0276, 0.0035	-0.0142	-0.0262, -0.0022
Alcohol drinking				

Non-drinker (ref.)	-	-	-	-
Current drinker	0.0563	0.0429, 0.0697	0.0176	0.0062, 0.0290
Former drinker	-0.0103	-0.0305, 0.0098	-0.0092	-0.0242, 0.0059
Falling accidents in past 12 months				
Yes	-0.0984	-0.1180, -0.0789	-0.0484	-0.0641, -0.0327
No (ref.)	-	-	-	-
Vision				
Normal (ref.)	-	-	-	-
Dysfunction	-0.0661	-0.0841, -0.0481	-0.0132	-0.0290, 0.0026
Hearing				
Normal (ref.)	-	-	-	-
Dysfunction	-0.0767	-0.0945, -0.0589	-0.0252	-0.0413, -0.0091
Cognitive function				
Normal (ref.)	-	-	-	-
Dysfunction	-0.1517	-0.1733, -0.1302	-0.0742	-0.0895, -0.0588
Sleeping				
Normal (ref.)	-	-	-	-
Dysfunction	-0.0529	-0.0634, -0.0425	-0.0011	-0.0094, 0.0073
Urinary function				
Normal (ref.)	-	-	-	-
Dysfunction	-0.0998	-0.1278, -0.0718	-0.0365	-0.0533, -0.0197
Defecation function				
Normal (ref.)	-	-	-	-
Dysfunction	-0.1195	-0.1442, -0.0948	-0.0394	-0.0559, -0.0228

Abbreviations, CI, confidence interval; BMI, body mass index.

Table 3
Factors associated with IADL from regression model

4. Discussion

To our knowledge, this is the first study to evaluate the level of ADL and IADL among different age groups as well as the potential factors associated with functional disability in a nationally representative sample of Chinese older inpatients. Application of a mixed-effect generalized linear model not only controlled the cluster effect of hospital wards but also examined the effect of potential associated factors, including indicators for sociodemographic characteristics, physical health variables, and mental health variables, on both the prevalence and extent of functional disability.

Our results suggested that with increasing age, the main activities that affected ADL as graded from high to low were walking up and down stairs, mobility, bathing, transfers (from bed to chair and back), and toilet use. However, in Spain, changes in the ADL were reported to occur mainly in dressing, toilet use, transfers, mobility, and stair climbing (9). These differences can be attributed to the physical limitations of wearing bandages around legs or arms in older Spanish patients who underwent dermatologic surgery. The activities most impactful on IADL in the present study as graded from high to low were shopping, food preparation, mode of transportation, and laundry. This finding is consistent with those of previous studies reporting that IADL rapidly declines with increasing age in terms of speed and executive function (18) with regard to, for example, household tasks, traveling, and shopping (19). Therefore, developing targeted nursing plans to help older inpatients to self-manage their daily activities is fundamental to the management of individuals' aging progress.

The levels of ADL and IADL decreased gradually with the increase in participants' age in this study, differing from certain studies conducted in welfare institutions and among ethnic minorities (Demura et al., 2001; Ran et al., 2017). These differences can be ascribed to the participants of these two studies not being representative of the general older population. However, the findings of our study were consistent with reports from the Netherlands and the Republic of Ireland that aimed to analyze factors associated with ADL and IADL disability among general community-dwelling older adults (6, 19). The differences in ADL and IADL that appear to exist between the general aging population and older adults from welfare institutions or ethnic minorities require further study. In addition, although aging cannot be controlled, our results suggest that older adults are at risk of a decline in functional independence. Therefore, evidence-based nursing intervention programs aimed at improving ADL and IADL independence among older adults are warranted.

Apart from age, emaciation, frailty, and depression bring about a series of negative effects on functional ability. It has been proved that BMI is effective in evaluating functional status in the aging population, with emaciation being related to poor physical function (20, 21). Meanwhile, older adults with frailty were more likely to experience disability in ADL and IADL (22, 23). Previous studies also reported that functional disability was associated with depressive moods in older adults (24–27). Therefore, to

ameliorate functional disability in older inpatients, it might become essential for nurses to formulate dietary strategies and implement physiological interventions or psychotherapy for older inpatients with emaciation, frailty, or depression (26, 28, 29).

The results of our study showed that transferring patients from the emergency department or from other hospitals could increase the risk of ADL disability. First, the geriatric population in emergency departments are considered high-risk because they are susceptible to reduced immobility, impaired cognition, failure to eat and drink, incontinence, and functional decline (30). Consequently, they are at high risk of ADL disability (31, 32). A second explanation is that older patients who are transferred from district hospitals or community hospitals, which provide only basic inpatient services (33), may not receive systematic medical treatment and nursing care, thus leading to a higher incidence of poor ADL.

Previous studies provided strong evidence that former smoking is a risk factor for functional disability (34, 35). Our study indicated that former smokers had a higher risk of IADL disability, which further supported previous research findings. However, higher-level education and residing in a building without elevators were likely to maintain a better IADL performance, perhaps because well-educated participants could better comprehend the development of disease and maintain their physical function with a positive attitude (36). In addition, residence in apartment block-type buildings in China is associated with better economic conditions. There exists the possibility that the geriatric population living in such buildings have a better quality of life and health monitoring that help maintain IADL function.

Interestingly, current alcohol drinkers had a low risk of IADL disability. A previous study indicated that older adults who consumed small to moderate amounts of alcohol were more likely to maintain mobility than nondrinkers, which might be related to the fact that moderate alcohol consumption has been associated with a decreased risk of cardiovascular events (34). However, the detailed evaluation of alcohol consumption based on information about quantity and frequency of drinking alcoholic beverages requires further research.

In the present study, falling accidents in the previous 12 months, hearing dysfunction, cognitive dysfunction, urinary dysfunction, and defecation dysfunction were significantly associated with functional disability, which further supports previous research findings (11, 34, 37, 38). These dysfunctions of physical and mental health had a marked effect on functional ability of older inpatients and restrained them from taking part in social interaction, which made them more likely to experience a poorer quality of life. Therefore, regarding these factors, more advanced risk factor assessment scales and nursing care measures may be useful in managing functional disability among older patients in the future (39).

5. Limitations

There are limitations to this study that require discussion. First, owing to the nature of the cross-sectional study design, we could only explore the relationship between functional disability and potential associated factors. Second, although functional disability can be assessed by several different risk factor

scales, our use of a limited number of measurement tools restricted the comparison of results from different studies. Despite these limitations, an important strength of this study was the large sample size and the representativeness of participants. Moreover, the results were adjusted for a cluster effect.

6. Conclusions

This study suggests that poorer functional ability was associated with increasing age. Sociodemographic characteristics, physical health variables, and mental health variables were associated with functional disability. These findings could have major importance for the planning of hospital services, discharge planning, and post-discharge care. This research should help policy makers set priorities for future policies of the disablement process for older adults and develop more practical and cost-effective programs for preventing functional disability among older inpatients.

Declarations

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Conflict of interest

The authors declare that there are no conflicts of interest.

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Authors' contributions

XW[1*] conceived and designed this study, HL[1#] prepared and edited the manuscript and drafted the tables. JJ[1#] and TX[8]* performed statistical analyses and reviewed the manuscript. CZ[1], MZ[2], XW[3], JJ[4], HW[5], DL[6], and SZ[7] recruited participants, collected data, and edited the manuscript.

Ethical approval

This study was ethically approved by the ethics committee of Peking Union Medical College Hospital, Chinese Academy of Medical Sciences. Informed consent was given by participants who enrolled in this study. All participants' records and information were anonymized and de-identified prior to the analysis.

Declarations

Consent for publication

All the authors listed have approved the enclosed manuscript.

Availability of data and material

The data that support the findings of this study are available from the Ethics Committee of Peking Union Medical College Hospital, but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of the Ethics Committee of Peking Union Medical College Hospital (pumchkyc@126.com).

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Figures

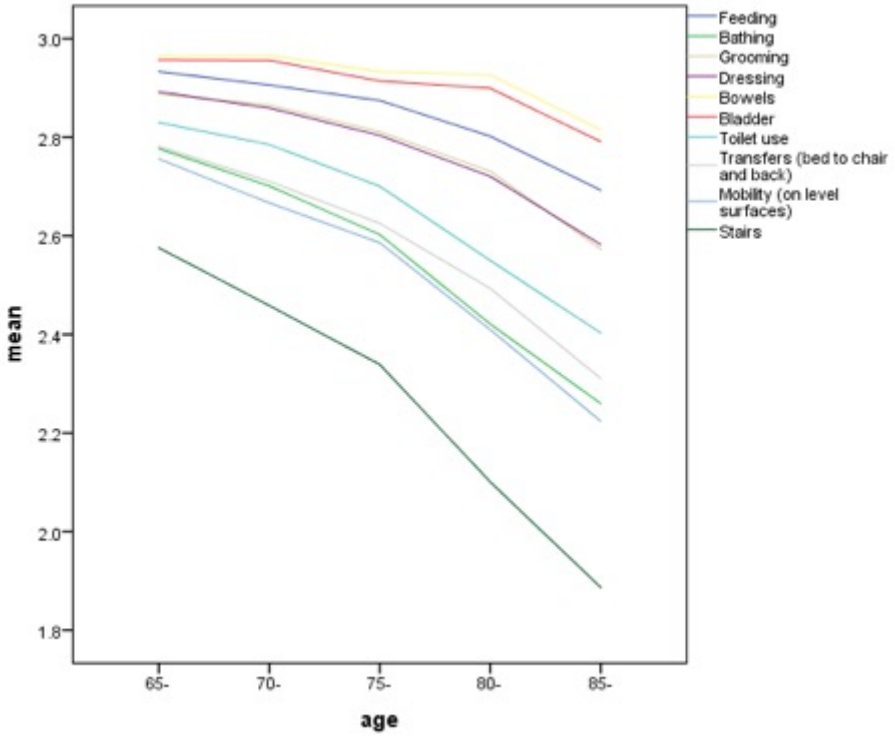

Figure 2

Risk of ADL by age.

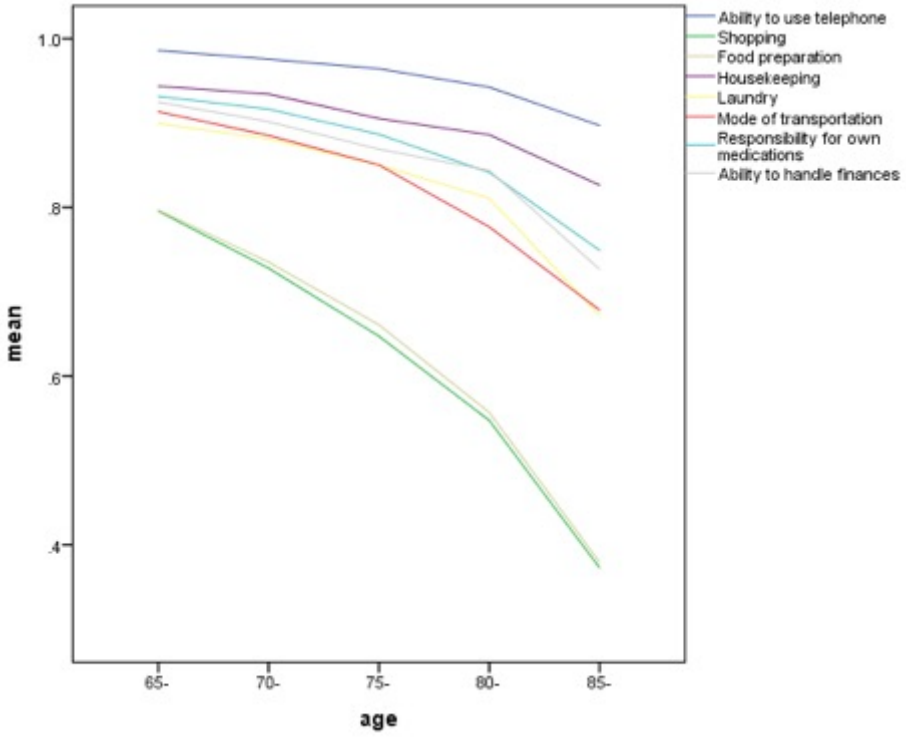

Figure 4

Risk of IADL by age.

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