

Association between comorbid conditions and BADL/IADL disability in hypertension patients over age 45

Based on the China health and retirement longitudinal study (CHARLS)

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Abstract

Hypertension usually coexists with other chronic conditions and can cause disability in relation to activities of daily living. We examined the association between the number and categories of comorbid conditions and disability affecting activities of daily living in hypertension patients.

The data were collected from the 2013 follow-up survey of the China Health and Retirement Longitudinal Study (CHARLS), which contains information about chronic conditions and disability. Additionally, socio-demographic characteristics of 3754 hypertension patients aged 45 and older were included in this study. Comorbid conditions included dyslipidemia, stroke, and 12 other chronic conditions. Disability in relation to activities of daily living was assessed using the basic activities of daily living (BADL) and the instrumental activities of daily living (IADL) instruments. Differences in BADL/IADL disability among patients with different comorbid conditions were compared using the chi-square test, and the influence of chronic conditions and socio-demographic characteristics on BADL/IADL disability was analyzed using logistic models.

Without considering the influence of specific chronic conditions on BADL/IADL, hypertension patients with additional comorbid conditions were more likely to suffer from BADL/IADL disability. When considering the effect of specific chronic conditions, the number of comorbid conditions did not significantly influence BADL/IADL disability. Dyslipidemia, chronic lung disease, stroke, memory-related diseases, and arthritis/rheumatism were associated with BADL disability. Chronic lung diseases, heart diseases, stroke, stomach/digestive system diseases, emotional/nervous/psychiatric problems, memory-related diseases, arthritis/rheumatism, and asthma were associated with IADL disability. Additionally, female, people with lower education level, people living in village, and people living in middle and western China were more likely suffer from BADL/IADL disability.

Comorbid conditions were associated with disability in activities of daily living in hypertension patients aged 45 and older. The specific comorbid conditions had a stronger effect on disability in activities of daily living than the number of comorbid conditions. In addition, we should pay attention to socioeconomic factors related to disability.

Abbreviations: BADL = basic activities of daily living, CHARLS = China Health and Retirement Longitudinal Study, CI = confidence interval, COPD = chronic obstructive pulmonary disease, CVD = cardiovascular disease, IADL = instrumental activities of daily living, NCDs = noncommunicable diseases, OR = odds ratio, QOL = quality of life, SES = socioeconomic status, SF-36 = the 36-Item Short Form Health Survey.

Keywords: BADL, comorbid conditions, hypertension, IADL

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1. Introduction

Many developing countries have experienced rapid epidemiological transitions from infectious to chronic conditions.^[1] From a global perspective, the combined burden of chronic conditions, such as cardiovascular diseases, cancers, diabetes, and chronic lung diseases, is increasing the fastest among lower-income countries. Although popular belief presumes that noncommunicable diseases (NCDs) afflict mostly high-income populations, nearly 80% of NCD deaths occur in low- and middle-income countries.^[2]

Diseases tend to co-occur at a higher rate than would be expected by chance alone.^[3] Comorbid conditions may aggravate the influence of chronic conditions on physical activity or cognitive ability. Wijnhoven et al^[4] demonstrated that comorbidity was an important determinant of a poor quality of life in asthma and COPD (chronic obstructive pulmonary disease)

patients. However, this type of association is not necessarily true. *Angelo Scuteri* found that the co-occurrence of hypertension and depression did not further increase the odds for disability, although depression and hypertension were associated with a higher level of disability and cognitive impairment, respectively.^[5] Therefore, it is necessary to explore the influence of specific comorbid conditions when measuring the disability in activities of daily living.

Among chronic conditions, hypertension is prevalent and poses a significant threat to mankind's physical and mental health.^[6] Hypertension can increase the risk of concurrent impairments in mobility, cognition, and mood, which subsequently increases basic activities of daily living (BADL) and instrumental activities of daily living (IADL) disability.^[7] Hypertension is also a risk factor for many health problems and death in a long run.^[8] The worldwide prevalence of hypertension among adults was 26.4% in 2000, and the proportion is expected to increase to 29% by the year 2025.^[9] In 2010, the prevalence of hypertension among Chinese adults was 33.5%, which accounts for ~330 million patients.^[10] Participants with hypertension were at greater risk of disability compared to normotensives.^[11,12]

Other chronic conditions often occur with hypertension concurrently, and hypertension is closely linked to some of these conditions. Hypertension is one of the most significant risk factors for stroke and cardiovascular diseases.^[13,14] Untreated hypertension is the strongest predictor for an increased risk of dementia and cognitive decline.^[15] In addition, diabetes and hypertension, which are the most common cardiovascular disease (CVD) risk factors, often appear concurrently.^[16] Related studies have also shown that an inner link may exist between hypertension and arthritis.^[17]

Previous studies have suggested that heart disease, stroke, diabetes, and difficulty in breathing were associated with physical activity limitations,^[18] but it remains unclear how these chronic conditions will affect the ability of hypertension patients to engage in activities of daily living. Exploring the association between comorbid conditions and BADL/IADL disability will help to assess the activities of daily living in hypertension patients more accurately. The aim of this study was to describe the relationship between comorbid conditions and BADL/IADL disability in hypertension patients aged 45 and older and to explore the influence of the number and categories of comorbid conditions on activities of daily living. Additionally, the differences in activities of daily living among hypertension patients with different socioeconomic status were examined.

2. Materials and methods

2.1. Subjects

Data for this study came from the 2013 follow-up survey of the China Health and Retirement Longitudinal Study (CHARLS),^[19] conducted by the National School for Development (China Center for Economic Research). Samples of households with members aged 45 and older were chosen through multistage probability sampling. A total of 450 villages and urban communities from 30 provinces were selected, which included a mix of urban and rural settings and a wide variety of levels of economic development. The original CHARLS was approved by the Ethical Review Committee of Peking University, and all participants signed informed consent at the time of participation.

The prevalence of hypertension showed a younger trend related to working strength and life pressures. *Tian's* study

reported that the greatest increase in the hypertension prevalence rate was in the 40- to 59-year-old age group among all adults over age 20 during 1991–2009.^[20] In this study, we limited our samples to the respondents aged 45 and above who had hypertension. Respondents with hypertension must have been diagnosed by a doctor and completed the questions about activities of daily life. With the selection criteria, a total of 3754 samples were included.

2.2. Measurements

Respondents replied to survey items on BADL/IADL disability, comorbid conditions, and socio-demographic factors. The components of the questionnaire relevant to this study are detailed below.

2.3. BADL/IADL disability

This study referred to the BADL scale and the Lawton functional scale.^[21,22] The abilities to take a bath, eat, get in and out of bed, dress, use the toilet, and defecate were used to assess the BADL, whereas the abilities to do housework, cook, make phone calls, take medicine, shop, and take care of finances were used to assess the IADL. Each answer was divided into 4 responses as follows: (1) No, I do not have any difficulty; (2) I have difficulty but still can do it; (3) Yes, I have difficulty and need help; (4) I cannot do it. In this study, people who completed all items without difficulty were classified as BADL- or IADL-independent; people who reported any difficulty in any item were classified as having BADL or IADL disability.

2.4. Comorbid conditions

The patients were asked "Have you been diagnosed with following conditions (each condition was read one-by-one by the trained interviewers) by a doctor?" The conditions were as follows: (1) dyslipidemia (elevation of low-density lipoprotein, triglycerides, and total cholesterol, or a low high-density lipoprotein level); (2) diabetes or high blood sugar; (3) cancer or malignant tumor (excluding minor skin cancers); (4) chronic lung diseases, such as chronic bronchitis or emphysema (excluding tumors or cancer); (5) liver disease (except fatty liver, tumors, or cancer); (6) heart attack, coronary heart disease, angina, congestive heart failure, or other heart problems; (7) stroke; (8) kidney disease (except for tumor or cancer); (9) stomach or other digestive diseases (except for tumor or cancer); (10) emotional, nervous, or psychiatric problems; (11) memory-related disease; (12) arthritis or rheumatism; and (13) asthma.

Comorbidity was defined as follows: (1) the number of comorbidities (0, 1, or ≥ 2); (2) the presence of specific comorbid conditions.^[5]

2.5. Socioeconomic status (SES)

Socioeconomic status was added as a control variable and included gender, education level, community type, and geographic location. The education level was indicated as follows: illiterate, primary school and below, junior middle school or high school, and above. Community type was divided into rural and urban areas. According to the China health statistics yearbook, geographical location was divided into eastern, central, and western regions.^[23] China was geographically grouped into urban or rural areas according to the governmental administration system and eastern

Table 1
Characteristics of the study populations.

	Full sample (N = 3754)		No comorbid condition (N = 815)		One comorbid condition (N = 1073)		At least 2 comorbid conditions (N = 1866)	
	n	%	n	%	n	%	n	%
Sex								
Male	1781	47.7	415	50.9	529	49.3	837	44.9
Female	1973	52.6	400	49.1	544	50.7	1029	52.2
Age								
45–59	1538	41.0	372	45.6	446	41.6	720	38.6
60–74	1859	49.5	373	45.8	518	48.3	968	51.9
75 and above	357	9.5	70	8.6	109	10	178	9.5
Marital status								
Married or cohabited	3246	86.5	729	89.4	933	87.0	1584	84.9
Never Married/divorce/separated	54	1.4	6	0.7	14	1.3	34	1.8
Widowed	454	12.1	80	9.8	126	11.7	248	13.3
Education								
No formal education	915	24.4	194	23.8	282	26.3	439	23.5
Primary education	1541	41.0	314	38.5	408	38.0	819	43.9
Secondary education	772	20.6	188	23.1	239	22.3	345	18.5
High school and above	526	14.0	119	14.6	144	13.4	263	14.1
Community type								
Village	2674	71.2	614	75.3	781	72.8	1279	68.5
City	1080	28.8	201	24.7	292	27.0	587	31.5
Geographic location								
East	1453	38.7	391	48.0	455	42.5	608	32.5
Middle	1518	40.4	296	36.3	397	37.0	825	44.2
West	783	20.9	128	15.7	221	20.6	434	23.3

China, middle China, and western China based on economic development status. Urban areas are more developed, and eastern China is the most developed region; middle China is less developed, and western China is the least developed region.^[24] We used community type and geographical location to assess general economic conditions.

2.6. Socio-demographic factors

Other socio-demographic factors included age and marital status. Age was divided into 3 groups as follows: ages 45 to 59, ages 60 to 74, and older than 75. Marital status was divided as follows: married or cohabiting, unmarried or divorced/separated, and widowed.

2.7. Statistics analysis

The analyses were performed using the statistical package SPSS 19.0. First, we examined the prevalence of chronic conditions in our population. Then, we sought to describe the disability in each BADL/IADL items when the number of comorbid conditions was different. Third, we examined the associations between the number of comorbid conditions and each chronic condition with disability. The chi-square test was used to compare BADL/IADL disability in hypertension patients with different comorbid conditions. The association between comorbid conditions and BADL/IADL disability in hypertension patients was examined using logistic regression analyses. The dependent variables in Models I/II for BADL disability were as follows: 1=BADL disability, 0=BADL independent). The dependent variables in Models II/III for IADL disability were as follows: 1=IADL disability, 0=IADL independent. Models I/III included the number of comorbid conditions as independent variables, whereas Models II/IV included both the number of comorbid

conditions and specific chronic conditions. Age, gender, education level, marital status, community type, and geographic location were adjusted in all of the models. The level of significance was set at 0.05.

3. Results

3.1. Study population

The characteristics of the cohort sample are displayed in Table 1. A total of 3754 hypertension patients were included in this study. Of the 3754 respondents, 1781 (47.4%) were male. The mean age was 61.8 ± 9.1 years; 28.6% of the individuals had 1 comorbid condition, and 49.7% of the respondents had at least 2 comorbid conditions.

3.2. Prevalence of specific chronic conditions

Table 2 shows the prevalence of specific chronic conditions in individuals with comorbidity. The main chronic conditions of the hypertension patients with 1 comorbid condition were rheumatism/arthritis (33.6%), dyslipidemia (17.1%), stomach/other digestive disease (13.3%), and heart disease (12.7%). The conditions that occurred in individuals who had at least 2 comorbid conditions were rheumatism/arthritis (59.4%), heart disease (46.8%), dyslipidemia (43.6%), and stomach/other digestive disease (42.3%).

3.3. BADL/IADL disability in hypertension patients

The prevalences of BADL and IADL disability in Chinese hypertension patients were 20.9 and 27.0%, respectively. As shown in Table 3, the prevalence of BADL disability in hypertension patients with 1 comorbid condition was 16.1%, and the prevalence of BADL in hypertension patients with at least

Table 2**The prevalence of specific chronic conditions.**

Specific comorbid condition	One comorbid condition (N = 1073)		At least 2 comorbid conditions (N = 1866)	
	n	%	n	%
Dyslipidemia	184	17.1	813	43.6
Diabetes/ high blood sugar	67	6.2	508	27.2
Cancer /malignant tumor	8	0.7	44	2.4
Chronic lung diseases	54	5.0	423	22.7
Liver disease	22	2.1	229	12.3
Heart diseases	136	12.7	874	46.8
Stroke	32	3.0	173	9.3
Kidney disease	43	4.0	330	17.7
Stomach/other digestive diseases	143	13.3	790	42.3
Emotional/nervous/psychiatric problems	3	0.3	48	2.6
Memory-related diseases	11	1.0	91	4.9
Arthritis /rheumatism	360	33.6	1109	59.4
Asthma	10	0.9	145	7.8

2 comorbid conditions was 28.7%; in both cases, the results were significantly higher compared to hypertension patients without comorbid conditions (9.4%). Using the toilet, getting in and out of bed, bathing, and dressing were the most frequent seriously impaired functions. The prevalence of IADL disability in hypertension patients with 1 comorbid condition was 23.0%, and the prevalence of IADL in hypertension patients with at least 2 comorbid conditions was 32.6%, which were both significantly higher compared to hypertension patients without comorbid condition (19.3%). Making phone calls, financing, and doing housework were the most seriously impaired functions.

3.4. Relationship between comorbidity and BADL /IADL disability

As shown in Table 4, compared to hypertension patients without comorbid condition, the risk of BADL disability was higher in hypertension patients with 1 comorbid condition (OR = 1.768, 95% CI: 1.321–2.367) and at least 2 comorbid conditions (OR =

3.664, 95% CI: 2.819–4.763); the risk of IADL disability was higher in hypertension patients with at least 2 comorbid conditions (OR = 1.596, 95% CI: 1.078–2.363). Models II/IV added specific chronic conditions into the analysis based on Models I/III. The results showed that the association between the number of comorbid conditions and BADL/IADL disability was reduced after considering specific chronic conditions. Only hypertension patients with at least 2 comorbid conditions had a higher possibility of BADL disability (OR = 1.596). The presence of dyslipidemia, chronic lung disease, stroke, memory-related diseases, and rheumatism/arthritis was associated with BADL disability. The risk of BADL disability in hypertension patients with a history of stroke was 3.288 times higher than in patients without a history of stroke. The presence of chronic lung disease, heart diseases, stroke, stomach/other digestive diseases, emotional/nervous/psychiatric problems, memory-related diseases, rheumatism/arthritis or asthma led to IADL disability. A history of stroke was the most important risk factor for IADL disability (OR = 3.524, 95% CI: 2.538–4.893). Memory-related diseases

Table 3**BADL/IADL disability in hypertension patients.**

	Full sample (N = 3754)		No comorbid condition (N = 815)		One comorbid condition (N = 1073)		At least 2 comorbid conditions (N = 1866)		χ^2
	n	%	n	%	n	%	n	%	
BADL disability									
Dressing	194	5.2	17	2.1	45	4.2	132	7.1	31.707***
Bathing	271	7.2	20	2.5	63	5.9	188	10.1	53.262***
Eating	77	2.1	9	1.1	20	1.9	48	2.6	6.347*
Getting in and out of bed	226	6.0	21	2.6	39	3.6	166	8.9	55.150***
Using toilet	563	15.0	52	6.4	117	10.9	394	21.1	116.349***
Defecating	160	4.3	13	1.6	34	3.2	113	6.1	32.063***
IADL disability									
Doing housework	424	11.3	41	5.0	106	9.9	277	14.8	57.536***
Cooking	340	9.1	37	4.5	81	7.5	222	11.9	41.426***
Shopping	296	7.9	37	4.5	68	6.3	191	10.2	30.292***
Making phone calls	477	12.7	82	10.1	127	11.8	268	14.4	10.486**
Taking medicine	162	4.3	20	2.5	41	3.8	101	5.4	12.915**
Financing	379	10.1	53	6.5	89	8.3	237	12.7	29.378***

BADL = basic activities of daily living, IADL = instrumental activities of daily living.

* $P < 0.05$.

** $P < 0.01$.

*** $P < 0.001$.

Table 4
Regressions for BADL/IADL disability (OR [95% CI]).

	BADL		IADL	
	Model I	Mode II	Mode III	Mode IV
Sex				
Male	1.000	1.000	1.000	1.000
Female	1.388 (1.157–1.664)***	1.414 (1.171–1.708)***	1.292 (1.090–1.530)**	1.328 (1.113–1.583)**
Age				
45–59	1.000	1.000	1.000	1.000
60–74	1.505 (1.244–1.820)***	1.417 (1.167–1.721)***	1.826 (1.529–2.181)***	1.706 (1.423–2.045)***
75 and above	2.935 (2.164–3.981)***	2.695 (1.973–3.682)***	4.083 (3.062–5.443)***	3.669 (2.732–4.927)***
Marital status				
Married or cohabited	1.000	1.000	1.000	1.000
Never married/divorced/separated	2.656 (1.461–4.830)**	2.684 (1.462–4.928)*	1.406 (0.738–2.679)	1.306 (0.708–2.614)
Widowed	1.201 (0.940–1.535)	1.213 (0.946–1.554)	1.146 (0.909–1.446)	1.139 (0.900–1.442)
Education				
No formal education	1.000	1.000	1.000	1.000
Primary education	0.863 (0.701–1.063)	0.857 (0.694–1.058)	0.493 (0.407–0.596)***	0.481 (0.397–0.584)***
Secondary education	0.746 (0.565–0.985)*	0.705 (0.531–0.936)*	0.395 (0.305–0.511)***	0.358 (0.275–0.467)***
High school	0.637 (0.440–0.921)*	0.601 (0.531–0.936)*	0.344 (0.242–0.490)***	0.313 (0.218–0.451)***
Junior college and above	0.31 (0.140–0.731)**	0.340 (0.147–0.786)*	0.387 (0.205–0.730)**	0.401 (0.209–0.768)**
Community type				
Village	1.000	1.000	1.000	1.000
City	0.639 (0.515–0.794)***	0.631 (0.504–0.790)***	0.547 (0.444–0.673)***	0.531 (0.428–0.659)***
Geographic location				
Eastern	1.000	1.000	1.000	1.000
Middle	1.783 (1.466–2.168)***	1.721 (1.409–2.102)***	1.685 (1.406–2.019)***	1.624 (1.350–1.995)***
Western	1.638 (1.304–2.057)***	1.512 (1.192–1.917)**	1.625 (1.316–2.005)***	1.572 (1.262–1.958)***
Number of comorbid conditions				
0	1.000	1.000	1.000	1.000
1	1.768 (1.321–2.367)***	1.245 (0.909–1.705)	1.189 (0.937–1.510)	0.899 (0.691–1.169)
≥2	3.664 (2.819–4.763)***	1.596 (1.078–2.363)*	1.997 (1.613–2.473)***	0.842 (0.587–1.208)
Specific chronic conditions				
Dyslipidemia		1.325 (1.073–1.636)**		1.229 (0.999–1.510)
Diabetes/high blood sugar		1.019 (0.799–1.300)		1.028 (0.808–1.307)
Cancer/malignant tumor		1.304 (0.680–2.398)		1.458 (0.771–2.758)
Chronic lung diseases		1.501 (1.173–1.922)**		1.510 (1.182–1.930)**
Liver disease		0.910 (0.658–1.259)		0.956 (0.695–1.317)
Heart diseases		1.055 (0.860–1.294)		1.300 (1.064–1.588)*
Stroke		3.288 (2.383–4.537)***		3.524 (2.538–4.893)***
Kidney disease		1.301 (1.000–1.692)		1.187 (0.911–1.546)
Stomach/other digestive diseases		1.080 (0.878–1.330)		1.362 (1.112–1.668)**
Emotional/nervous/psychiatric problems		1.233 (0.666–2.284)		2.537 (1.374–4.684)**
Memory-related diseases		1.774 (1.147–2.742)*		2.993 (1.922–4.662)***
Arthritis/rheumatism		1.718 (1.402–1.106)***		1.240 (1.019–1.510)*
Asthma		1.084 (0.733–1.603)		1.520 (1.040–2.223)*

BADL = basic activities of daily living, CI=confidence interval, IADL = instrumental activities of daily living, OR=odds ratio.

* $P < 0.05$.

** $P < 0.01$.

*** $P < 0.001$.

(OR=2.993, 95% CI: 1.922–4.662) and emotional/nervous/psychiatric problems (OR=2.537, 95% CI: 1.374–4.684) were both considerable risk factors for IADL disability in hypertension patients.

3.5. Adjusted factors and BADL /IADL disability

Table 4 shows that the likelihood of BADL/IADL disability increased with age. Females, older individuals, people with a lower education level, people living in a village, and people living in middle and western China were more likely to suffer from BADL/IADL disability. Hypertension patients who were never married, divorced, or separated had a higher possibility of developing BADL disability.

4. Discussion

The prevalences of BADL and IADL disability in Chinese hypertension patients were 20.9 and 27.0%, respectively. Our research examined the association between comorbid conditions and BADL/IADL disability. The results showed that both BADL and IADL disability rates in hypertension patients increased concurrently with the number of comorbid conditions. BADL disability rates of hypertension patients without comorbidities, with 1 comorbid condition and with at least 2 comorbid conditions were 9.4, 16.1 and 28.7%, respectively, whereas IADL disability rates were 19.3, 23.0, and 32.6%, respectively. The ability to use the toilet was the most seriously impaired function of all the BADL abilities. A possible explanation for the

finding is that many Chinese families, particularly those who live in rural areas, still use the traditional squat toilets, and squatting and getting up require good physical coordination. The most seriously impaired function for IADL was making phone calls. Poor memory, eyesight, and hearing may limit the ability to make phone calls, and some of the elderly may not have access to a telephone or cell phone.

Without considering the influence of specific chronic conditions, hypertension patients with multiple comorbid conditions were more likely to suffer from BADL/IADL disability. However, the association between the number of comorbid conditions and BADL/IADL disability was weakened after adjusting for specific chronic conditions, which indicates that activities of daily living in hypertension patients were seriously affected by specific chronic conditions rather than by the number of comorbid conditions.

Stroke is one of the most important risk factors for BADL/IADL disability.^[25] Approximately 80% of stroke patients have different types and degrees of disability; limb disabilities, including hemiplegia and monoplegia, are the most common types. Stroke can even cause comprehensive disabilities including hemiplegia, aphasia, agnosia, dementia, difficulty in reading or writing, and difficulty in urination or defecation.^[26] In this study, a history of stroke seriously affected hypertension patients' activities of daily living. The possibility of BADL and IADL disability in hypertension patients with a history of stroke was 3.288 and 3.524 times higher, respectively, than patients without a history of stroke. Similarly, CVD is another major reason for the declining ability of daily living activities. A previous study showed that individuals with 2 or more cardiovascular diseases were 3 times more likely to have mobility difficulties;^[27] our study suggested that patients with heart disease were 1.300 times more likely to have IADL disability compared to patients without heart disease.

In addition, memory-related diseases and emotional/nervous/psychiatric problems can affect cognitive ability, which is closely related to IADL.^[28] For example, limitations in cognition and everyday practical capabilities are the main symptoms of degenerative dementias.^[29] A Japanese cross-sectional study reported that individuals with depression revealed significantly lower scores for BADL and quality of life (QOL) than individuals without depression.^[30] In our study, hypertension patients with memory-related diseases and emotional/nervous/psychiatric problems were 2.993 and 2.537 times more likely to develop IADL disability, respectively.

Rheumatoid conditions/arthritis were the most common comorbid conditions among hypertension patients in our study, and a previous study showed that rheumatism/arthritis occurred concurrently in asthma, malignant tumor, and diabetes patients.^[31] The prevalence of rheumatoid conditions/arthritis in hypertension patients with 1 comorbid condition and at least 2 comorbid conditions reached 33.6 and 59.4%, respectively. *Forjaz's* study showed that arthritis had a significant influence on both quality of life and disability rate.^[32] Our study supported this finding. Hypertension patients with rheumatoid conditions/arthritis were associated with both BADL and IADL disability. People with arthritis disability are likely to have pain performing BADL/IADL, and they may have more trouble getting or keeping jobs because of limitations in work category and workload.^[33]

Moreover, our study found that asthma, chronic lung diseases and stomach/digestive system diseases could increase the possibility of IADL to some extent. Asthma is one of the leading nonmusculoskeletal causes of work limitations, and it can

increase all-cause long-term work disability.^[34] A study by *Sveinn Magnusson* showed that one-third of individuals in Iceland with chronic bronchitis complained of dyspnea when walking on a horizontal level,^[35] which can affect the normal activities of daily living. Stomach/other digestive diseases can lead to IADL disability, most likely because of the symptoms of these diseases and side effects caused by treatments. *Wen*, who used the Chinese version of the 36-Item Short Form Health Survey (SF-36) to assess the quality of life, found that patients with both chronic gastritis and peptic ulcer disease had lower QOL (including physical function), compared to population norm scores.^[36]

Except for diseases that are direct causes of disability, it is worth noting that disability is influenced by many factors, including educational differences, wealth, and social status, and these factors can interact with other health-related factors such as behavior and medical care.^[37,38] In our research, we took socio-demographic factors into consideration and found that females, people with a lower education level, people living in a village, and people living in middle and western China were more likely to suffer from BADL/IADL disability. Previous studies have shown that women are more often affected by disabilities in all age groups.^[39,40] This finding can be partly explained by a greater prevalence of nonfatal disabling conditions in women, including fractures, osteoporosis, back problems, osteoarthritis, and depression, which contributes substantially to greater disability.^[41] Additionally, we found that people with a lower educational level had a greater possibility of disability, which may be attributed to the fact that higher education renders advantages in terms of knowledge, perceived control and social support.^[42] Moreover, a previous review analyzed 155 papers and found that a large majority (70%) of them described health as poorer in societies where income differences are larger,^[43] which was also demonstrated in our study. The prevalence of disability is lower in cities and eastern regions that are relatively developed, whereas the prevalence is higher in other areas that are rather underdeveloped. When allocating health resources, we should record not only the total number of people who have or do not have access but also socio-demographic details about them, such as sex, age, place of residence rural/urban, province or district.^[44] Even if the health resources are truly universal and everyone has access, partial coverage may benefit certain groups over others.

It is important to note that our study has some potential limitations. First, we only examined the influence of the number of comorbid conditions and the specific chronic conditions on BADL/IADL. The absence of the assessment of disease severity may have an effect on the results. Secondly, chronic conditions came from self-reports and did not include a health professional review. Patients may confuse different symptoms or forget to report important diagnoses that are current. However, a previous study showed that self-assessment was a valid and cost-efficient method to obtain data on the prevalence of chronic conditions.^[45]

5. Conclusion

Our research explored the relationship between comorbid conditions and socioeconomic status and BADL/IADL disability in hypertension patients. Hypertension patients with more comorbid conditions were more likely to have BADL/IADL disability, but the association between the number of comorbid conditions and BADL/IADL disability was weakened after taking specific chronic conditions into consideration. The presence of dyslipidemia, chronic lung disease, stroke, memory-related

diseases and rheumatism/arthritis led to BADL disability, whereas the presence of chronic lung disease, heart diseases, stroke, stomach/other digestive diseases, emotional/nervous/psychiatric problems, memory-related diseases, rheumatism/arthritis, and asthma were risk factors for IADL disability. Among these chronic conditions, stroke was the most important risk factor for both BADL and IADL disability in hypertension patients. Emotional/nervous/psychiatric problems and memory-related diseases were highly related to IADL disability. More attention should be given to hypertension patients with comorbid conditions, particularly those with stroke and arthritis/rheumatism. In addition, females, people with a lower education level, people living in a village, and people living in middle and western China were more likely to suffer from BADL/IADL disability; therefore, more focus should be placed on socioeconomic factors.

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