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Epidemiological characteristics of dementia and its correlation with multimorbidity among people aged 65 and above☆

Sijing Zhou[a], Bangan Luo[b], Hui Cao[b], Xi Zhang[c], Dongxin Wang[b,*]

[a] College of Medicine, Hunan University of Traditional Chinese Medicine, Changsha, China
[b] Hunan Provincial Brain Hospital/The Second People's Hospital of Hunan Province, Changsha, China
[c] Hunan University of Traditional Chinese Medicine, Changsha, China

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ABSTRACT

Background: With population aging, the prevalence of dementia is rising annually, alongside a rise in multimorbidity. However, comprehensive surveys on the prevalence of dementia in older population in Hunan Province are limited, and the comorbid relationships between diseases remain unclear.

Objective: To comprehensively understand the prevalence of dementia among older people aged 65 years and above in Hunan Province and analyze its comorbidity relationships with 11 common chronic diseases.

Methods: From April to May 2021, using stratified multistage sampling, residents aged 65 years and above were randomly surveyed across 30 districts/counties, 60 streets/townships, and 180 community/village committees in Hunan Province. Dementia diagnosis was conducted by neurologists or psychiatrists using the Community Screening Interview for Dementia (CSI-D) or the 8-item dementia questionnaire (AD8), along with the Mini-Mental State Examination (MMSE) and the Montreal Cognitive Assessment (MoCA). Additionally, the prevalence of hypertension, cerebrovascular disease, ischemic heart disease, rheumatoid arthritis, intervertebral disc disease, diabetes, gastroenteritis, chronic obstructive pulmonary disease, cholecystitis cholelithiasis, peptic ulcer, and cancer was investigated.

Results: Out of the 5,979 individuals sampled, 5,616 completed the survey, with 785 cases (13.98 %) identified with dementia. Comparisons of dementia prevalence among different regions, genders, ages, smoking histories, and chronic disease conditions showed statistically significant differences ($P < 0.05$). A total of 5,606 sets of chronic disease prevalence data were collected, with hypertension [2,205 (39.33 %)], intervertebral disc disease [553 (9.86 %)], diabetes [526 (9.38 %)], cerebrovascular disease [492 (8.78 %)], and ischemic heart disease [467 (8.33 %)] being the most common. In the dementia group, the most prevalent conditions were hypertension [325 (41.40 %)], cerebrovascular disease [111 (14.14 %)], ischemic heart disease [91 (11.59 %)], rheumatoid arthritis [89 (11.33 %)], and intervertebral disc disease [81 (10.31 %)]. The prevalence rates of dementia among groups with varying numbers of chronic diseases ranged from 11.46 % to 18.26 %, increasing with the number of conditions. Significant differences in dementia prevalence were found in individuals with gastroenteritis, rheumatoid arthritis, cerebrovascular disease, chronic obstructive pulmonary disease, and ischemic heart disease ($P < 0.05$). Binary logistic regression analysis showed that living in rural areas [OR = 2.048, 95 %CI (1.655, 2.536)], being female [OR = 1.388, 95 %CI (1.163, 1.655)], advanced age [OR = 1.348, 95 %CI (1.270, 1.431)], and suffering from chronic diseases [OR = 1.195, 95 %CI (1.101, 1.297)] were risk factors for dementia in residents aged ≥ 65 ($P < 0.05$). Regarding medication adherence, 12.79 % (99/774) dementia patients reported difficulties, 6.59 % (51/774) needed assistance, and 2.97 % (23/774) were unable to manage independently.

Conclusion: The prevalence of dementia among residents aged ≥ 65 in Hunan Province is influenced by the number of chronic diseases and varies with different conditions. The self-care abilities and family care burdens of dementia patients with comorbidities should attract widespread attention from all of the society. These findings aim to provide recommendations for the development of prevention and control policies for dementia and related comorbidities in Hunan Province.

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* Corresponding author.
E-mail address: 46677076@qq.com (D. Wang).

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Introduction

Dementia is a progressive central nervous system degenerative condition, primarily characterized by a decline in memory, cognitive function, and behavioral abilities. In recent years, the prevalence of dementia has been increasing annually, with national cross-sectional studies indicating that over 15.07 million individuals over the age of 60 are suffering from dementia in China.[1] Approximately 25.5 % of dementia patients worldwide are located in China.[2] A 2019 survey identified dementia as the fifth leading cause of death among urban and rural residents in China.[3] The care burden associated with dementia has emerged as a significant public health concern. Primary prevention of dementia has substantial potential, as one-third of dementia cases can be attributed to modifiable risk factors.[4] Thus, investigating the factors influencing dementia is crucial for reducing prevalence rates and alleviating the social burden.

Over the years, numerous studies have analyzed the association between dementia and chronic diseases,[1,5] yet the nature of these relationships—whether causal or comorbid—remains to be further clarified. Comorbidity is increasingly common in an aging society,[6] as highlighted by a 2020 study from China showing that the prevalence of multimorbidity among adults over 60 ranged from 44 % to 76 %.[7] The complicated relationships between an individual's various diseases have been increasingly understood by researchers, leading to a growing focus on multimorbidity in recent years.[8] Consequently, the care for individuals with multiple chronic diseases necessitates well-founded scientific theories.

Currently, there is a lack of research on the comorbidity of dementia and chronic diseases in Hunan Province. Local surveys focusing on dementia have been conducted in Xiangxi,[9] Changsha,[10] and Yueyang,[11] but the findings differ significantly due to regional variations and differences in measurement tools. Thus, this study aims to examine the prevalence of dementia in residents aged≥65 in Hunan Province and to assess the incidence of 11 diseases, including hypertension, cerebrovascular disease, ischemic heart disease, rheumatoid arthritis, disc disease, diabetes, gastroenteritis, chronic obstructive pulmonary disease, gallstones, cholecystitis, peptic ulcer, and cancer. The goal is to objectively and comprehensively understand the epidemiological status and care burden associated with the comorbidity of dementia and chronic diseases in Hunan Province, providing valuable recommendations for the prevention and treatment of dementia and research on chronic disease comorbidity.

Methods

Study subjects

From April to May 2021, a stratified multistage sampling methods was employed to select survey households from districts/counties, streets/townships, and community/village committees based on the demographic data of Hunan Province. One individual from each household was selected for the survey. Initially, 30 districts/counties from 122 in the province were selected, then 2 streets/townships were identified in each district/county, resulting in a total of 60 streets /townships across the province. Subsequently, three community/village committees from each chosen street/township were selected, resulting in a total sample size of 180 committees. In each committee, 56 households were selected for dementia questionnaire survey of individuals aged ≥ 65 years through systematic sampling. A total of 5,979 individuals were initially sampled, with 5,616 individuals included in the final analysis. The inclusion criteria were as follows: (1) registered locally and residing for more than >6 months; (2) living in the community for over 6 months regardless of local household registration; (3) aged≥65 years. Individuals not found after at least three visits at different times were excluded. All study subjects participated in the survey voluntarily and provided informed consent.

The sample size for the cross-sectional study was calculated using the formula $N = [\mu \times p \times (1\text{-}p)] / \delta^2 \times deff$, with an allowable error(δ) of 10 %, where the significance level(α) = 0.05, and $\mu\alpha$ = 1.96. Based on an 8 % prevalence rate of dementia in the elderly (≥65 years old) in China, p was set at 8 %, resulting in N = 4,417. Considering response rates and other factors, the sample size was increased by 20 %, and the final sample was determined to be 5,300.

Survey process and quality control

The survey was conducted in two phases: the screening phase and the diagnostic phase. In the screening phase, the Community Screening Instrument for Dementia (CSI-D) or the 8-item Ascertain Dementia (AD8) was used for the initial assessment. The CSI-D score was used to evaluate memory, cognitive ability, spatial skills, and more, with scores ranging from 0 to 9 points and 1 point awarded for each correct response. A CSI-D score of ≤4 suggests a high likelihood of dementia, 7-9 indicates normal cognitive function, and 5-6 necessitates further informant interviews for a comprehensive assessment.[12] The AD8 encompasses eight items: (1) problems with judgment, (2) less interest in hobbies/activities, (3) repeats the same things over and over, (4) trouble learning how to use a tool, appliance, or gadget, (5) forgets correct month or year, (6) trouble handling complicated financial affairs, (7) trouble remembering appointments (8) daily problems with thinking and/or memory. Each "yes" answer scores 1 point, with a total AD8 score ≥ 2 indicating a high suspicion of early-stage dementia and recommending further professional evaluation.[13] In the diagnostic phase, for individuals with an educational level of junior high school or below, the Mini-Mental State Examination (MMSE) was used to assess various cognitive domains including orientation, memory, attention and calculation, recall ability, naming ability, repetition ability, reading ability, three-stage command execution ability, writing ability, and structural ability, out of 30 points, with scores below 27 indicating cognitive impairment.[14]

For those with educational levels above junior high school, the Montreal Cognitive Assessment (MoCA) was used to test visuospatial and executive ability, naming ability, attention, backward reading ability, calculation, language ability, abstract thinking, delayed recall, and orientation, also out of a total of 30 points, with scores below 27 indicating cognitive impairment.[15] Additionally, medical history was collected through questionnaire survey, oral presentations and diagnostic records by medical institutions at all levels. This included the presence and specific names of chronic diseases, such as hypertension, cerebrovascular disease, ischemic heart disease, rheumatoid arthritis, disc disease, diabetes, gastroenteritis, chronic obstructive pulmonary disease, gallstones and cholecystitis, peptic ulcer, and cancer.

To analyze the comorbidity of dementia and chronic diseases, this study incorporated variables such as region, gender, age, chronic diseases, mental illnesses, alcohol consumption history, and smoking history into the analysis.

Prior to conducting the survey, researchers received relevant training and conducted on-site simulations and drills to ensure proficiency in the necessary survey skills and techniques. During the survey phase, the implementation plan was strictly followed to ensure full cooperation from the participants. Additionally, a provincial-level quality control team was established to conduct on-site quality control and supervision in 5 % of the selected regions. Neurologists reviewed 15 % of the participants who initially screened negative for dementia to confirm their status against the diagnostic criteria for dementia.

Statistical methods

Weight calculations were conducted using a multistage systematic cluster sampling method. Statistical analyses were performed using SPSS 25.0 software. The data were presented as ratios or proportions. Comparisons of one-way differences were conducted using the Chi-square

test. Trend tests were conducted using the trend Chi-square test. Binary Logistic regression was used to analyze the influencing factors of dementia. The level of significance was set at $\alpha = 0.05$.

Results

General Information of residents aged 65 and above

The survey was completed by 3,600 households, encompassing 5,979 older adults aged 65 years and above. Out of these, a total of 5,616 older adults (93.9 %) completed the survey. In the first stage, 4,568 individuals were initially screened using the CSI-D and 1,038 using AD8 (with 363 individuals refusing to participate or unable to complete the survey for various reasons). This initial screening identified 607 individuals (CSI-D ≤ 7 points) and 222 individuals (AD8 ≥ 2 points) as suspected patients. Out of these 829 suspected cases, 785 cases (13.98 %) were subsequently diagnosed as positive for dementia in the second stage by clinical neurologists or psychiatrists using MMSE (<27 points) or MoCA (<26 points). In addition to dementia screening, data on chronic diseases were collected from 5,606 individuals.

Comparisons of the prevalence of dementia by different regions, gender, age, smoking history, and the presence of chronic diseases all demonstrated statistically significant differences (P < 0.05); however, comparisons based on different alcohol consumption histories and the presence of mental illnesses did not show statistically significant differences in the prevalence of dementia (P > 0.05), as shown in Table 1.

In terms of prevalence, the top five chronic diseases among the surveyed subjects were hypertension, disc disease, diabetes, cerebrovascular disease, and ischemic heart disease. Meanwhile, among the dementia group, the most common conditions were hypertension, cerebrovascular disease, ischemic heart disease, rheumatoid arthritis, and disc disease, as detailed in Table 2.

One-way Analysis of the Prevalence of Dementia and Chronic Diseases in Hunan Province Residents Aged ≥65 years.

A total of 5,606 cases of chronic disease were documented. The prevalence rates of dementia for groups with 0, 1, 2, and ≥ 3 different chronic diseases were 11.46 % (214/1,867), 13.66 % (309/2,262), 17.50 % (176/1,006), and 18.26 % (86/471), respectively. As the number of chronic diseases increased, the prevalence rate of dementia correspondingly rose (χ^2trend = 26.912, P < 0.001). Comparisons of the prevalence rates of dementia among individuals with or without gastroenteritis, rheumatoid arthritis, cerebrovascular disease, chronic obstructive pulmonary disease, and ischemic heart disease all showed statistically significant differences (P < 0.05), as shown in Table 3.

Binary Logistic Regression Analysis of Influencing Factors of Dementia Prevalence in Residents Aged ≥ 65 in Hunan Province.

Table 1
Comparison of dementia prevalence among elderly population aged 65 years and above in different basic situations in Hunan Province.

Variable	Number	Dementia	X^2 value	*P* value
Region			45.340	<0.001
Urban	1 334	112 (8.40)		
Rural	4 282	673 (15.72)		
Gender			24.481	<0.001
Male	2 885	339 (11.75)		
Female	2 731	446 (16.33)		
Age			131.774	<0.001
65—70	2 034	210 (10.32)		
70—75	1 727	215 (12.45)		
75—80	1 036	153 (14.77)		
80—85	551	121 (21.96)		
85—90	209	63 (30.14)		
≥90	59	23 (38.98)		
Chronic Diseases[a]			15.004	<0.001
No	1 867	214 (11.46)		
Yes	3 739	571 (15.27)		
Mental Illness			0.015	0.902
No	5 600	782 (13.96)		
Yes	16	3 (18.75)		
Alcohol Consumption[a]			2.657	0.103
No	4 167	602 (14.45)		
Yes	1 439	183 (12.71)		
Smoking History[a]			6.865	0.009
No	4 331	635 (14.66)		
Yes	1 275	150 (11.76)		

Note: [a] reprents 5,606 sets of data were collected.

To explore the impact of chronic diseases on dementia, binary logistic regression analysis was conducted using the diagnosis of dementia as the dependent variable and the significantly associated factors from Table 1, along with the number of different chronic diseases, as independent variables (as detailed in Table 4). The results indicate that living in rural areas, being female, increasing age, and having chronic diseases are risk factors for dementia in elderly residents aged ≥ 65 in Hunan Province (Table 5).

Self-medication adherence of dementia patients aged ≥ 65 in hunan province

Statistics on the medication adherence of 774 dementia patients were collected, showing that 77.65 % (601/774) reported they could manage medication completely by themselves, 12.79 % (99/774) had difficulties, 6.59 % (51/774) needed assistance, and 2.97 % (23/774) were unable to manage medication independently.

Table 2
Prevalence of chronic diseases between the total population and dementia population aged 65 years and above in Hunan Province.

Order	Total population (N=5,606)		Dementia population (N=785)	
	Disease	Cases	Disease	Cases
1	Hypertension	2 205 (39.33)	Hypertension	325 (41.40)
2	Intervertebral Disc Disease	553 (9.86)	Cerebrovascular Disease	111 (14.14)
3	Diabetes	526 (9.38)	Ischemic Heart Disease	91 (11.59)
4	Cerebrovascular Disease	492 (8.78)	Rheumatoid Arthritis	89 (11.33)
5	Ischemic Heart Disease	467 (8.33)	Intervertebral Disc Disease	81 (10.31)
6	Rheumatoid Arthritis	461 (8.22)	Diabetes	69 (8.78)
7	Gastroenteritis	252 (4.49)	Gastroenteritis	49 (6.24)
8	Gallstones and Cholecystitis	186 (3.32)	Chronic Obstructive Pulmonary Disease	29 (3.69)
9	Chronic Obstructive Pulmonary Disease	148 (2.64)	Gallstones and Cholecystitis	24 (3.05)
10	Peptic Ulcer	121 (2.16)	Peptic Ulcer	16 (2.03)
11	Cancer	61 (1.09)	Cancer	5 (0.63)

Table 3
Comparison of dementia prevalence among different chronic disease patients.

Chronic disease	Number	Dementia	X^2 value	*P* value
Hypertension				
Yes	2 205	325 (14.74)	1.625	0.202
No	3 401	460 (13.52)		
Gastroenteritis				
Yes	252	49 (19.44)	6.488	0.011
No	5 354	736 (13.75)		
Diabetes				
Yes	526	69 (13.12)	0.378	0.539
No	5 080	716 (14.09)		
Rheumatoid Arthritis				
Yes	461	89 (19.30)	11.730	0.001
No	5 145	696 (13.53)		
Cerebrovascular Disease				
Yes	492	111 (22.56)	32.803	<0.001
No	5 114	674 (13.18)		
Intervertebral Disc Disease				
Yes	553	81 (14.65)	0.212	0.645
No	5 053	704 (13.93)		
Chronic Obstructive Pulmonary Disease				
Yes	148	29 (19.59)	3.947	0.047
No	5 458	756 (13.85)		
Ischemic Heart Disease				
Yes	467	91 (19.49)	12.719	<0.001
No	5 139	694 (13.50)		
Gallstones and Cholecystitis				
Yes	186	24 (12.90)	0.193	0.660
No	5 420	761 (14.04)		
Peptic Ulcer				
Yes	121	16 (13.22)	0.062	0.803
No	5 485	769 (14.02)		
Cancer				
Yes	61	5 (8.20)	1.726	0.189
No	5 545	780 (14.07)		

Table 4
Assignment table of binary Logistic regression analysis of influencing factors of prevalence of dementia among elderly individuals aged 65 or above in Hunan Province.

Variables	Variable contents	Variable assignment
X1	Region	Urban = 1, rural = 2
X2	Gender	Male = 1, Female = 2
X4	Age	65—70 = 1, 70—75 = 2, 75—80 = 3, 80—85 = 4, 85—90 = 5, ≥90 = 6
X4	Chronic disease	None = 0, 1 kind = 1, 2 kinds = 2, ≥ 3 kinds = 3
X5	Smoking history	No = 0, Yes = 1
Y	Dementia	No = 0, Yes = 1

Table 5
Binary Logistic regression analysis of influencing factors of prevalence of dementia among elderly individuals aged 65 or above in Hunan Province.

Variables	*B*	*SE*	Wald χ2 value	*P* value	*OR* (95 %*CI*)
Region	0.717	0.109	43.384	<0.001	2.048 (1.655, 2.536)
Gender	0.328	0.090	13.245	<0.001	1.388 (1.163, 1.655)
Age	0.299	0.030	97.025	<0.001	1.348 (1.270, 1.431)
Chronic disease	0.178	0.042	18.239	<0.001	1.195 (1.101, 1.297)
Smoking history	-0.063	0.113	0.308	0.579	0.939 (0.753, 1.171)

Discussion

The participants in this study were residents aged 65 and older from Hunan Province, diagnosed using the MMSE and MoCA scales, leading to a reported dementia prevalence of 13.98 %. The findings suggest that region, gender, age, and chronic diseases are influencing factors for dementia. The prevalence rate in this study is higher than the 6.0 % reported by JIA et al.[1] for the older people aged 60 and above in China, but lower than the prevalence observed in the population over 65 years old of Zunyi city by Shi,[16] and comparable to the 13.66 % prevalence rate found in Tianshui city.[17] The variation in results could be attributed to differences in the age range of the subjects, the scales employed, and regional variations.

Multiple studies have confirmed a significant correlation between chronic diseases and the development of dementia,[1,5] with current research focusing on cardiovascular[18] and immune-related diseases.[19] This study conducted a comprehensive survey of 11 chronic diseases in the older population of Hunan province, aiming to provide more

data support for studies related to dementia-associated chronic diseases. The findings indicated correlations of cerebrovascular disease, ischemic heart disease, rheumatoid arthritis, gastroenteritis, chronic obstructive pulmonary disease, with dementia. It's noteworthy that hypertension,[20] a common topic recent research, did not show a correlation with dementia in this study. However, cerebrovascular and heart diseases were identified, consistent with other studies,[18] as risk factors for dementia. The role of physical exercise in mitigating dementia has been increasingly recognized.[21] Rheumatoid arthritis can impair the mobility of the older people, but unlike other movement-related conditions, disc disease did not demonstrate a significant correlation with dementia in this research, suggesting the immune aspects of rheumatoid arthritis may more significantly impact dementia. XU et al.[22] noted a link between the pathophysiology of dementia and rheumatoid arthritis, indicating shared changes in macrophages and cytokines in the immune systems of both conditions. Similar pathological factors and mechanisms across different diseases may have a synergistic effect on the onset and progression of these diseases. A similar mechanism is also present in chronic obstructive pulmonary disease, where oxidative stress plays a significant role in the pathogenesis of both chronic obstructive pulmonary disease and dementia.[23] Gastroenteritis also showed a correlation with dementia in this study, where the gut-brain axis, gut microbiota, autoimmunity, and complex gastrointestinal metabolites could all potentially affect the development of dementia.[24]

Research on chronic disease comorbidity is crucial not only for understanding disease relationships but also offers substantial prospects and potential in clinical disease management and geriatric care.[25] Currently, most care guidelines focus on one specific disease, failing to provide comprehensive nursing for patients with comorbid chronic diseases, with current scientific research being insufficient to address these needs.[26] Further exploration into chronic disease comorbidity is necessary to support the management and interdisciplinary care of these complex conditions.

This study also explored the self-medication adherence among the dementia group, revealing that 22.35 % of patients experience varying degrees of difficulty with medication adherence. Medication adherence significantly impacts disease control, including the management of chronic diseases and the progression of dementia. Additionally, medication adherence indirectly reflects the care needs of the dementia group. Comprehensive and meticulous care is not only a requirement for patients with dementia but also presents a current challenge for society and families. Therefore, new technologies and methods designed to ensure effective care for patients and alleviate the caregiving burden on family members deserve attention and research.

Conclusion

This study on the correlation between dementia and 11 common chronic diseases represents a provincial-wide random sample survey in Hunan Province of China, covering a broad scope and multiple types of diseases. It is essential to note that the actual detection rates of different diseases may influence the study outcomes. Cardiovascular and cerebrovascular diseases often present clear symptoms and definite diagnostic indicators, such as strokes, cerebral infarction, cerebral thrombosis, and ischemic heart disease. However, diseases not included in routine physical examinations or those manifesting clear symptoms only at advanced stages may lead to patients not fully understanding their condition or not receiving a timely and accurate diagnosis, thus potentially affecting the detection rates and correlation results. This study can provide a data foundation for research on Alzheimer's disease and chronic diseases in Hunan Province, but more accurate and detailed studies are needed for further exploration

Declarations

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Ethics approval and consent to participate

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Consent for publication

Not applicable.

Availability of data and materials

Not applicable.

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Authors' other information

Not applicable.

Declaration of competing interest

The authors declare that they have no competing interests.

Authors' contributions

Conceptualization, Z.S. and L.B.; Methodology, L.B. and Z.X.; Data curation, C.H.; Formal analysis, Z.S.; Funding acquisition, W.D.; Project administration, W.D.; Resources, W.D.; Supervision, W.D.; Writingoriginal draft, Z.S.; Writingreview and editing, W.D. All authors have read and agreed to the published version of the manuscript.

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