Prevalence and related factors for physical function and cognitive impairment among older adults in southern China: A population-based regional cross-sectional study

Yi Zhang
Guangdong Provincial People's Hospital
Hong Cui
Guangdong Provincial People's Hospital
Ling Chen
Guangdong Provincial People's Hospital
Xiaoxia Wang
Guangdong Provincial People's Hospital
Lixia Lin
Guangdong Provincial People's Hospital
Qiao Huang
Guangdong Provincial People's Hospital
Jinhua Guo
Guangdong Provincial People's Hospital
Bei Gong
Guangdong Provincial People's Hospital
Tiemei Shen
zhangyi4509@gdph.org.cn

Guangdong Provincial People's Hospital

Article

Keywords:

Posted Date: September 8th, 2023

DOI: https://doi.org/10.21203/rs.3.rs-3314297/v1

Additional Declarations: No competing interests reported.

Abstract

As the country with the largest and fastest-aging older population worldwide, China has hosted an increasing number of regional investigations of disability in older adults. However, the disability prevalence related to physical function and cognition in southern China is unknown. This study aimed to determine the prevalence of and associated factors for cognitive and physical-function impairment in persons 60 years or older. For this population-based cross-sectional study design, a total of 5603 participants were recruited between June 2021 to December 2022, using multistage, stratified, cluster-sampling procedure. Instruments including general questionnaire, basic and instrumental activities of daily life, Chinese version of mini-mental state examination, patient health questionnaire-9 and generalized anxiety disorder-7 were used to collect data in the form of WetChat mini program. Binary and multivariate logistic regression analysis were applied to explore the influencing factors. The prevalence of physical function and cognitive impairment in older adults was 37.3% and 31.0%, respectively. Multivariate regression analyses revealed that age, family income, education level, place of residence, medication type, annual physical examination, weekly social activities, care from family or friends, hearing disorder, walking disorder and depression were all associated with physical function and cognitive impairment. Moreover, an increased risk of physical function impairment was associated with BMI, region, income source, smoking and weekly exercise, and cognitive impairment was associated with the number of children, insurance type, coronary heart disease and anxiety. Physical function (*OR*: 1.79, 95%*CI*: 1.49, 2.16) and cognitive impairment (*OR*: 1.83, 95%*CI*: 1.51, 2.21) were mutually influenced in our study. This study showed a high prevalence of and several related factors for physical function and cognitive impairment in Guangdong Province. The results revealed that comprehensive and systematic prevention and control programs for disability should be established to improve the quality of life of older adults.

Introduction

With the increasing trend in the aging population, China has gradually come to be regarded as having the largest elderly population worldwide, which results in substantial treatment-related economic burden for families and the medical health service system[1−2]. According to the 7th national census in 2020, there were 26402 million people aged 60 years or older in China, representing 18.7% of the whole population, which was 5.44% higher than in 2010[3]. As a populous country with the most large-scale, fastest and most obvious development trend of the aging process, the health status of elderly people is concerning[4−5]. Older people have several bodily or mental diseases and a lengthy duration of illness, leading to a significant increase in older people with disabilities. Wang et al.[6] reported that the proportion estimates of disabled older people in the total population are increasing year by year and are expected to reach 13.68% by 2050. Disability status not only directly affects the overall quality of life among older people but also contributes to more long-term care demand and costs, which ultimately bring a substantial challenge to social care and medical security[7−9]. Thus, exploration of the relationship between disability status and chronic diseases, the formation mechanism and risk factors for disability status, and the establishment of prevention and treatment systems for disabilities have gradually become important research topics in gerontology.

Disability status is a core standard to measure and evaluate the functional status and health level of older individuals[6]. The World Health Organization (WHO) and Chinese disability classification standard defined disability as physical, visual, hearing, phonological and cognitive disability[10]. Body functional state or daily self-care ability in older people is generally expressed by basic activities of daily living (BADL) and instrumental activities of daily life (IADL). BADLs are considered original self-care functions such as eating and dressing, which can maintain physiological requirements, while IADLs include more difficult and complex items, which appear later and last for less time compared to BADLs[11−12]. Cognitive impairment leading to dementia is also a serious global public health problem that is affected by the growing number of older people and is regarded as a vital indicator to assess disability[13]. Mild cognitive impairment (MCI) is a middle stage between normal cognition and dementia, and increasing studies related to risk management or interventions have focused on these individuals to prevent dementia[14–15]. In the last three years, several studies have been conducted on the current situation of older people with MCI or dementia, and the estimated prevalence ranges from 1.2–23.2%[16−19], which is nearly 15% in China[20−21]. However, there are still some controversies regarding the influencing factors for MCI because of subjective characteristics or measuring approaches. Moreover, these factors are consistently changing with social development, lifestyle and regional environment.

Although an increasing number of regional surveys targeting the prevalence of and influencing factors for older people with disabilities have been conducted nationwide in recent years, little is known about the prevalence of disability in the southern region. The definition of disability in most studies has been based on only a single aspect. In view of the abovementioned variable factors for disability and to develop a more complete disability concept, we conducted a large cross-sectional study in a sample of adults aged 60 years or older from approximately 6 cities from Guangdong Province, China, to explore the prevalence, association and influencing factors for disability related to physical function and cognitive impairment in older people.

Methods

Study design and participants

We conducted a population-based observational cross-sectional study using a multistage, stratified, cluster-sampling procedure from June 2021 to December 2022. The selection of study sites was divided into three stages. First, we randomly selected 1–2 representative cities from the northern, southern, western and eastern regions of Guangdong Province. Second, we randomly selected 2–3 tertiary hospitals and 1 secondary hospital that is well-known or representative in the geriatric field. Third, we also randomly chose 1 community healthcare center and 60–70 families from community resident health files. Finally, we included 5603 adults aged over 60 years or older from 15 tertiary hospitals, 6 secondary hospitals, 6 community healthcare centers and 350 families in 6 cities (Gunangzhou, Shenzhen, Zhuhai, Foshan, Maoming, Qingyuan). The inclusion criteria of participants were as follows: ≥60 years or older, normal communication without barriers, and informed consent and volunteering for this study. The exclusion criteria were as follows: mental diseases or history of mental diseases, serious organ dysfunction, any acute disease, and an inability to cooperate with a physical examination.

Measurements

General questionnaire This questionnaire was designed by researchers based on related previous studies and research contents and reviewed by two experts before the pilot study. Evaluation of general information consisted of four main domains: demographic characteristics, behavioral habits, family or social support and disease-related characteristics. Demographic characteristics included age, sex, BMI, number of children, etc. Behavioral habits included smoking, drinking, annual physical examination, weekly social activities and weekly exercise. Family or social support was assessed around support from family or care from family or friends. Disease-related characteristics were investigated, such as cardiovascular or cerebrovascular diseases, hypertension, coronary heart disease, diabetes, type of medication, hearing disorder, vision disorder and walking impairment. Participants were asked to respond whether hearing, vision or walking affected the daily life of older adults, which included three items: no effect, less effect and obvious effect. The answer “less effect” or “obvious effect” was regarded as functional impairment in hearing, vision or walking.

Physical function impairment measurement Physical function impairment was evaluated using an assessment of activities of daily life (ADLs). ADLs are defined as the necessary activities for daily life, which reflect the basic activities of individuals in medical institutions, communities and families[22–23]. The assessment of ADLs is divided into basic activities of daily life (BADLs) and instrumental activities of daily life (IADLs). BADLs refer to the basic movements and self-care activities performed in hospitals or families, which include 8 items: eating, bathing, combing, dressing, controlling urine, controlling excrement, walking and walking up and down stairs[22]. IADLs refer to more elaborate activities than BADLs, such as those necessitating advanced skills with the assistance of instruments that are performed in communities, including 7 items: shopping, cycling/riding, cooking, doing housework, washing clothes, phoning and taking medicine[23–24]. Each item is evaluated by three levels: without help, partial help and total help. Answers of the levels other than “without help” in each item indicated functional impairment, which was considered disability.

Cognitive impairment measurement Cognitive impairment was evaluated via the Chinese version of the Mini-Mental State Examination (MMSE) with 30 items, which consisted of orientation, memory, attention and calculation, recall and language. The sensitivity of this assessment for cognitive impairment screening was up to 92.5%[25], and it was the most common and widely used assessment worldwide and was designed by Folstein[26] in 1975. A correct answer means one score, and an incorrect or unclear response means no score. The maximum of the scale is 30 points, and higher scores indicate more serious cognitive impairment. The cutoff points of cognitive impairment were calculated according to education level: ≤19 points for illiterate people, ≤ 22 points for primary school and ≤ 26 points for secondary school or above.

Depressive symptoms Depressive symptoms were measured with the Patient Health Questionnaire-9 (PHQ-9). This questionnaire was used to assess the frequency of nine conditions in the last two weeks: displeasure, appetite change, fatigue, worthlessness, guilt, decreased concentration, slow movement, restlessness and suicidal tendency[27]. Each question is evaluated by four levels on a 4-point Likert scale with total scores ranging from 0 to 27. Depressive symptoms are divided into four levels: mild (5–9), moderate (10–14), moderate-severe (15–19), and severe (20–27).

Anxiety Anxiety was measured with the generalized anxiety disorder-7 (GAD-7). This questionnaire was used to assess the frequency of seven conditions in the last two weeks: tension, uncontrollable worries, excessive worries, inability to relax, akathisia, irritability and foreboding[28]. Each question is evaluated by four levels on a 4-point Likert scale with total scores ranging from 0 to 21. Depressive symptoms are divided into four levels: mild (5–9), moderate (10–13), moderate-severe (14–18), and severe (19–21).

Data collection procedures

Data collection was conducted using the WeChat mini program called "Jingyice platform on the functional assessment of older adults". First, we contacted the relevant leaders of selected hospitals and communities to acquire permission for the investigation. Specialized interviewers formed for each hospital and community were responsible for collecting information in every specific research area. A door-to-door survey in families was conducted by interviewers from corresponding communities. To ensure the homogenization of the investigation process, online training on questionnaire interpretation and methods was organized, and a preliminary survey was conducted before the formal survey. Interviewers adopted unified instructions to introduce the study objectives and contents and used one-on-one, face-to-face dialog to obtain information after informed consent. Inquiries on family members or caregivers were allowed if participants could not directly communicate with interviewers because of speech or hearing disorders. We eliminated questionnaires with > 15% missing data in the general questionnaire, data missing in every scale and logical mistakes. Every data point was preserved on a secured file that only allowed authorized personnel access.

Statistical analysis

SPSS software version 26.0 was used to analyze the data. The distribution of the included factors was identified by descriptive statistics. We used means and standard deviations to describe continuous variables and absolute values and percentages to express categorical variables. Independent-samples *t* tests or chi-square tests were used to compare the sex differences on each continuous or categorical variable, respectively. Univariate analysis was used via bivariate logistic regression analysis to demonstrate whether independent variables of demographic characteristics, behavioral habits, family or social support and disease-related characteristics were associated with physical-function impairment and cognitive impairment with estimated odds ratios and 95% confidence intervals. Multivariate logistic regression analysis was used to confirm the influencing factors, taking the above variables as independent variables and physical-function impairment or cognitive impairment as dependent variables. A two-sided p value < .05 was considered to indicate statistical significance.

Ethics approval and consent

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The study was approved by the ethics committee of Guangdong Province People's Hospital (KY-Z-2021-690-01). Informed consent was obtained from all individual participants included in the study.

Results

General characteristics A total of 5603 adults aged over 60 years or older were enrolled in this survey, of whom 2675 (47.4%) were male and 2946 (52.6%) were female. The average age of the included participants was 71.38 ± 7.65 years old. Most of the older people lived in Guangdong Province during the survey process, including 3356 (59.9%) subjects living in Guangzhou or Shenzhen and 2100 (37.5%) participants living in other cities in Guangdong. The largest quantity of participants from this survey was the rural population, accounting for 41.5% of the total. Different levels of anxiety and depression symptoms were found in 28.2% and 20.5% of subjects, respectively. A total of 2089 participants aged 60 years or older had physical function decline measured via BADLs and IADLs, with a prevalence of 37.3%. Cognitive impairment evaluated by the MMSE was found in 1378 participants aged 60 years or older, with a prevalence of 31.0%. There was a significant difference between sexes, including variables such as age, quantity of children, religion, living with children, family income per month, source of income, education level, marital status, type of insurance, hypertension, coronary heart disease, drinking, smoking, care from family or friends, vision, walking, physical-function impairment and cognitive impairment. The general characteristics of the included participants and prevalence of disability are shown in Table 1.

Table 1
General characteristics of the included participants

Variables and subgroups	**Total participants (n = 5603)**	**Male (n = 2657)**	**Female (n = 2946)**	***P* value**
Sex distribution, %		47.4	52.6	
Age, years old [Mean (Std)]	71.38(7.65)	71.24(7.43)	71.51(7.83)	**.012***
BMI, kg/m^2 [Mean (Std)]	23.01(3.59)	23.10(3.67)	22.93(3.51)	.849
Quantity of children [Mean (Std)]	2.97(1.43)	2.87(1.38)	3.05(1.47)	**.001****
Region				
Other cities in Guangdong	3356(59.9)	1616(60.8)	1740(59.1)	.245
Guangzhou or Shenzhen	2100(37.5)	967(36.4)	1133(38.5)	
Other provinces or cities	147(2.6)	74(2.8)	73(2.4)	
Religion				
Yes	448(8.0)	167(6.3)	281(9.5)	**< .001****
No	5155(92.0)	2490(93.7)	2665(90.5)	
Living with children				
Yes	4091(73.0)	1867(70.3)	2224(75.5)	**< .001****
No	1512(27.0)	790(29.7)	722(24.5)	
Family income per month,				
2000	1108(19.8)	499(18.8)	609(20.7)	**< .001****
2000–4000	2005(35.8)	973(36.6)	1032(35.0)	
4000–6000	1166(20.8)	564(21.2)	602(20.4)	
6000	1324(23.6)	621(23.4)	703(23.9)	
Source of income				
Acquiring from children	3895(69.5)	1723(64.8)	2172(73.7)	**< .001****
Retirement income	1312(23.4)	746(28.1)	566(19.2)	
Labor income	396(7.1)	188(7.1)	208(7.1)	
Education level				
Illiteracy	1115(19.9)	351(13.2)	764(25.9)	**< .001****
Primary school and below	2356(42.0)	1025(38.6)	1331(45.2)	
Junior high school	1125(20.1)	654(24.6)	471(16.0)	
Senior high school	811(14.5)	497(18.7)	314(10.7)	
College and above	196(3.5)	130(4.9)	66(2.2)	

Data are shown by n and % except for age, BMI and number of children.

BMI = body mass index

***P* .01

Variables and subgroups	Total participants (n = 5603)	Male (n = 2657)	Female (n = 2946)	*P* value
Marital status				
With partner	4577(81.7)	2346(88.3)	2231(75.7)	**<.001****
No partner	1026(18.3)	311(11.7)	715(24.3)	
Place of residence				
Villages	2326(41.5)	1123(42.3)	1203(40.8)	.383
Counties or towns	855(15.3)	407(15.3)	448(15.2)	
Small or middle-sized cities	777(13.9)	376(14.2)	401(13.6)	
Large-sized cities	1645(29.4)	751(28.3)	894(30.3)	
Type of insurance				
Rural medical service	3452(61.6)	1587(59.7)	1865(63.3)	**.001****
Urban medical service	1780(31.8)	906(34.1)	874(29.7)	
Free medical service	371(6.6)	164(6.2)	207(7.0)	
Cardiovascular or cerebrovascular diseases				
Yes	3270(58.4)	1556(58.6)	1714(58.2)	.772
No	2333(41.6)	1101(41.4)	1232(41.8)	
Hypertension				
Yes	2323(41.5)	1052(39.6)	1771(43.1)	**.007****
No	3280(58.5)	1605(60.4)	1675(56.9)	
Coronary heart disease				
Yes	962(17.2)	533(20.1)	429(14.6)	**< .001****
No	4641(82.8)	2124(79.9)	2517(85.4)	
Diabetes				
Yes	1060(18.9)	505(19.0)	555(18.8)	.873
No	4543(81.1)	2152(81.0)	2391(81.2)	
Type of medication				
None	2155(38.5)	1023(38.5)	1132(38.4)	.066
1	1077(19.2)	482(18.1)	595(20.2)	
2	1093(19.5)	515(19.4)	578(19.6)	
3	585(10.4)	277(10.4)	308(10.5)	
4	693(12.4)	360(13.6)	333(11.3)	

Data are shown by n and % except for age, BMI and number of children.

BMI = body mass index

***P* .01

Variables and subgroups	Total participants (n = 5603)	Male (n = 2657)	Female (n = 2946)	*P* value
Drinking				
Never	4450(79.4)	1733(65.2)	2717(92.2)	**< .001****
Occasional	547(9.8)	454(17.1)	93(3.2)	
Always	606(10.8)	470(17.7)	136(4.6)	
Smoking				
Never	3980(71.0)	1254(47.2)	2726(92.5)	**< .001****
Occasional	760(13.6)	632(23.8)	128(4.3)	
Always	863(15.4)	771(29.0)	92(3.2)	
Annual physical examination for the last 10 years				
Yes	3126(55.8)	1506(56.7)	1326(45.0)	.203
No	2477(44.2)	1151(43.3)	1620(55.0)	
Weekly social activities, days				
Never	2313(41.3)	1097(41.3)	1216(41.3)	.607
1–3	1531(27.3)	708(26.6)	823(27.9)	
4–6	228(4.1)	114(4.3)	114(3.9)	
Every day	1531(27.3)	738(27.8)	793(26.9)	
Weekly exercise, days				
Never	1942(34.7)	921(34.7)	1021(34.7)	.427
1–3	1350(24.1)	634(23.9)	716(24.3)	
4–6	243(4.3)	104(3.9)	139(4.7)	
Every day	2068(36.9)	998(37.6)	1070(36.3)	
Support from family				
Yes	3042(54.3)	1386(52.2)	1656(56.2)	.607
No	2561(45.7)	1271(47.8)	1290(43.8)	
Care from family or friends				
Yes	4570(81.6)	2126(80.0)	2444(83.0)	**.005****
No	1033(18.4)	531(20.0)	502(17.0)	
Anxiety				
None	4058(72.4)	1970(74.1)	2088(70.9)	.056
Mild	1245(22.2)	562(21.2)	683(23.2)	

Data are shown by n and % except for age, BMI and number of children.

BMI = body mass index

***P* .01

Variables and subgroups	Total participants (n = 5603)	Male (n = 2657)	Female (n = 2946)	*P* value
Moderate	162(2.9)	67(2.5)	95(3.2)	
Moderate-severe	100(1.8)	44(1.7)	26(1.9)	
Severe	38(0.7)	14(0.5)	24(0.8)	
Depression				
None	4025(75.0)	1995(75.1)	2210(75.0)	.279
Mild	1010(18.0)	497(18.7)	513(17.4)	
Moderate	218(3.9)	92(3.5)	126(4.3)	
Moderate-severe	115(2.1)	50(1.9)	65(2.2)	
Severe	55(1.0)	23(0.8)	32(1.1)	
Hearing				
Normal	1705(30.4)	815(30.7)	890(30.2)	.707
Abnormal	3898(69.6)	1842(69.3)	2056(69.8)	
Vision				
Normal	3618(64.6)	1775(66.8)	1843(62.6)	**.001****
Abnormal	1985(35.4)	882(33.2)	1103(37.4)	
Walking				
Normal	3790(67.6)	1845(69.4)	1945(66.0)	**.006****
Abnormal	1813(32.4)	812(30.6)	1001(34.0)	
Physical function impairment				
Yes	2089(37.3)	929(35.0)	1160(39.4)	**.001****
No	3514(62.7)	1728(65.0)	1786(60.6)	
Cognitive impairment				
Yes	1378(24.6)	702(26.4)	676(22.9)	**.003****
No	4225(75.4)	1955(73.6)	2270(77.1)	
Data are shown by n and % except for age, BMI and number of children.				
BMI = body mass index				
***P* .01				

Influencing factors associated with physical function impairment As shown in Table 2, variables extracted through univariate analysis with statistical significance were included to establish multivariate logistic regression, and the results indicated that older age (*OR*: 1.06, 95%*CI*: 1.05, 1.07) and higher BMI (*OR*: 1.03, 95%*CI*: 1.01, 1.05) were associated with a higher risk of physical function impairment. Older people who lived in other cities in Guangdong, acquired income from children, were illiterate, lived in large-seized cities, never smoked, never received annual physical examination for the last 10 years and were not cared for by family or friends were at a higher risk of physical function impairment. Family income per month between 2000 and 4000 (*OR*: 1.40, 95%*CI*: 1.13, 1.72) or between 4000 and 6000 (*OR*: 1.51, 95%*CI*: 1.18, 1.92) increased the risk of physical-function impairment. Older people who did not participate in social activities weekly were more likely to face physical function impairment than those who participated in social activities 1–3 days per week or every day. More types of medication, hearing disorders (*OR*: 1.24, 95%*CI*: 1.09, 1.43), and impaired walking ability (*OR*: 6.35, 95%*CI*: 5.39, 7.45) were also correlated with a higher risk of physical functional impairment. Older people who had mild (*OR*: 1.58, 95%*CI*: 1.52, 2.00), moderate (*OR*: 3.46, 95%*CI*: 2.13, 5.61) or moderate-severe (*OR*: 3.94, 95%*CI*: 1.70, 9.12) depression showed an increasing risk of physical function impairment. Multivariate logistic regression analysis of risk factors for physical impairment among adults aged 60 years or older is presented in Table S3 and Fig. 1.

Table 2
Univariate analysis of influencing factors for physical function or cognitive impairment

Variables and subgroups	**No disability (n = 3514)**	**Disability (n = 2089)**	***OR* (95%*CI*)**	**No cognitive Impairment (n = 4225)**	**Cognitive Impairment (n = 1378)**	***OR* (95%*CI*)**
Sex						
Male	1728(49.2)	929(44.5)	**1.21(1.08,1.35)****	1955(46.3)	702(50.9)	**0.83((0.73,0.94)****
Female	1786(50.8)	1160(55.5)		2270(53.7)	676(49.1)	
Age, years old [Mean (Std)]	69.20(6.10)	75.05(8.53)	**1.12(1.11,1.13)****	70.97(7.25)	72.64(8.64)	**1.03(1.02,1.04)****
BMI, kg/m^2 [Mean (Std)]	22.92(3.50)	23.25(3.75)	**1.02(1.00,1.03)***	22.99(3.63)	23.03(3.47)	1.00(0.99,1.02)
Quantity of children [Mean (Std)]	2.80(1.31)	3.24(1.57)	**1.24(1.19,1.29)****	2.99(1.42)	2.91(1.48)	0.96(0.92,1.01)
Region						
Other cities in Guangdong	1935(55.1)	1421(68.0)	**0.64(0.57,0.70)****	2552(60.4)	804(58.4)	1.03(0.93,1.16)
Guangzhou or Shenzhen	1486(42.3)	614(29.4)		1551(36.7)	549(39.8)	
Other provinces or cities	93(2.6)	54(2.6)		122(2.9)	25(1.8)	
Religion						
Yes	273(7.8)	175(8.4)	1.09(0.89,1.32)	344(8.1)	104(7.6)	0.92(0.73,1.16)
No	3241(92.2)	1914(91.6)		3881(91.9)	1274(92.4)	
Living with children						
Yes	2609(74.3)	1482(70.9)	**0.85(0.75,0.96)****	3129(74.1)	962(69.8)	**0.81(0.71,0.93)****
No	905(25.7)	607(29.1)		1096(25.9)	416(30.2)	
Family income per month,						
2000	672(19.1)	436(20.9)	**0.88(0.84,0.93)****	815(19.3)	293(21.3)	**0.91(0.86,0.96)****
2000–4000	1203(34.2)	802(38.4)		1481(35.1)	524(38.0)	
4000–6000	721(20.5)	445(21.3)		893(21.1)	273(19.8)	
6000	918(26.2)	406(19.4)		1036(24.5)	288(20.9)	

Data are shown by n and % except for age, BMI and quantities of children.
OR = odds ratio, 95% CI = 95% confidence interval
BMI = body mass index
**P* < .05, ***P* < .01

Variables and subgroups	No disability (n = 3514)	Disability (n = 2089)	*OR* (95% *CI*)	No cognitive Impairment (n = 4225)	Cognitive Impairment (n = 1378)	*OR* (95% *CI*)
Source of income						
Acquiring from children	2327(66.2)	1568(75.1)	**0.82(0.75,0.89)****	2990(70.8)	905(65.7)	**1.18(1.07,1.30)****
Retirement income	957(27.2)	355(16.9)		950(22.5)	362(26.3)	
Labor income	230(6.6)	166(8.00)		285(6.7)	111(8.0)	
Education level						
Illiteracy	534(15.2)	581(27.8)	**0.72(0.68,0.75)****	955(22.6)	160(11.6)	**1.59(1.50,1.68)****
Primary school and below	1440(40.9)	916(43.9)		1981(46.9)	375(27.2)	
Junior high school	807(22.9)	318(15.2)		637(15.1)	488(35.4)	
Senior high school	604(17.2)	207(9.9)		524(12.4)	287(20.9)	
College and above	129(3.8)	67(3.2)		128(3.0)	68(4.9)	
Marital status						
With partner	3043(86.6)	1534(73.4)	**2.34(2.04,2.68)****	3443(81.5)	1134(82.3)	0.95(0.81,1.11)
No partner	471(13.4)	555(26.6)		782(18.5)	244(17.7)	
Place of residence						
Villages	1390(39.6)	936(44.8)	**0.86(0.82,0.89)****	1827(43.2)	499(36.2)	**1.13(1.07,1.18)****
Counties or towns	489(13.9)	366(17.5)		658(15.6)	197(14.3)	
Small or middle-sized cities	459(13.1)	318(15.2)		542(12.8)	235(17.1)	
Large-sized cities	1176(33.5)	469(22.5)		1198(28.4)	447(32.4)	
Type of insurance						
Rural medical service	2164(61.6)	1288(61.7)	0.99(0.91,1.09)	2691(63.7)	761(55.2)	**1.28(1.16,1.41)****

Data are shown by n and % except for age, BMI and quantities of children.
OR = odds ratio, 95% CI = 95% confidence interval
BMI = body mass index
**P* < .05, ***P* < .01

Variables and subgroups	No disability (n = 3514)	Disability (n = 2089)	*OR* (95%*CI*)	No cognitive Impairment (n = 4225)	Cognitive Impairment (n = 1378)	*OR* (95%*CI*)
Urban medical service	1115(31.7)	665(31.8)		1266(29.9)	514(37.3)	
Free medical service	235(6.7)	136(6.5)		268(6.4)	103(7.5)	
Cardiovascular or cerebrovascular diseases						
Yes	1786(50.8)	1484(71.0)	**2.37(2.12,2.66)****	2363(55.9)	907(65.8)	**1.52(1.34,1.72)****
No	1728(49.2)	605(29.00)		1862(44.1)	471(34.2)	
Hypertension						
Yes	1222(34.8)	1101(52.7)	**2.09(1.87,2.33)****	1686(39.9)	637(46.2)	**1.30(1.15,1.46)****
No	2292(65.2)	988(47.3)		2539(60.1)	741(53.8)	
Coronary heart disease						
Yes	447(12.7)	515(24.7)	**2.25(1.95,2.58)****	660(15.6)	302(21.9)	**1.52(1.30,1.77)****
No	3067(87.3)	1574(75.3)		3565(84.4)	1076(78.1)	
Diabetes						
Yes	552(15.7)	508(24.3)	**1.72(1.51,1,97)****	757(17.9)	303(22.0)	**1.29(1.11,1.50)****
No	2962(84.3)	1581(75.7)		3468(82.1)	1075(78.0)	
Type of medication						
None	1677(47.7)	478(22.9)	**1.54(1.47,1.60)****	1709(40.4)	446(32.4)	**1.13(1.08,1.18)****
1	688(19.6)	389(18.6)		782(18.5)	295(21.4)	
2	599(17.1)	494(23.7)		836(19.80)	257(18.7)	
3	282(8.0)	303(14.5)		420(9.9)	165(11.9)	
4	268(7.6)	425(20.3)		478(11.2)	215(15.6)	
Drinking						
Never	2774(78.9)	1676(80.2)	**0.85(0.78,0.93)****	3346(79.2)	1104(80.1)	0.94(0.86,1.04)
Occasional	288(8.2)	259(12.4)		406(9.6)	141(10.2)	
Always	452(12.9)	154(7.4)		473(11.2)	133(9.7)	

Data are shown by n and % except for age, BMI and quantities of children.
OR = odds ratio, 95% CI = 95% confidence interval
BMI = body mass index
**P* < .05, ***P* < .01

Variables and subgroups	No disability (n = 3514)	Disability (n = 2089)	*OR* (95% *CI*)	No cognitive Impairment (n = 4225)	Cognitive Impairment (n = 1378)	*OR* (95% *CI*)
Smoking						
Never	2475(70.4)	1505(72.0)	**0.84(0.78,0.91)****	2992(70.8)	988(71.7)	0.95(0.87,1.03)
Occasional	398(11.3)	362(17.3)		561(13.3)	199(14.4)	
Always	641(18.2)	222(10.7)		672(15.9)	191(13.9)	
Annual physical examination for the last 10 years						
Yes	1734(49.4)	743(35.6)	**0.57(0.51,0.63)****	1832(43.4)	645(46.8)	**1.15(1.02,1.30)***
No	1780(50.6)	1346(64.4)		2393(56.6)	733(53.2)	
Weekly social activities, days						
Never	1143(32.5)	1170(56.1)	**0.64(0.61,0.67)****	1626(38.5)	687(49.9)	**0.81(0.77,0.86)****
1–3	1006(28.6)	525(25.1)		1179(27.9)	352(25.5)	
4–6	146(4.2)	82(3.9)		168(4.0)	60(4.4)	
Every day	1219(34.7)	312(14.9)		1252(29.6)	279(20.2)	
Weekly exercise, days						
Never	870(24.8)	1072(51.3)	**0.61(0.59,0.64)****	1421(33.6)	521(37.8)	**0.93(0.88,0.97)****
1–3	861(24.5)	489(23.4)		1019(24.1)	331(24.0)	
4–6	159(4.5)	84(4.0)		176(4.2)	67(4.9)	
Every day	1624(46.2)	444(21.3)		1609(38.1)	459(33.3)	
Support from family						
Yes	1933(55.0)	1109(53.1)	0.93(0.83,1.03)	2364(55.9)	678(49.2)	**0.76(0.68,0.86)****
No	1581(45.00)	980(46.9)		1861(44.1)	700(50.8)	
Care from family or friends						
Yes	3035(86.4)	1535(73.5)	**0.44(0.38,0.50)****	3529(83.5)	1041(75.5)	**0.61(0.53,0.71)****
No	479(13.6)	554(26.5)		696(16.5)	337(24.5)	

Data are shown by n and % except for age, BMI and quantities of children.
OR = odds ratio, 95% CI = 95% confidence interval
BMI = body mass index
**P* < .05, ***P* < .01

Variables and subgroups	No disability (n = 3514)	Disability (n = 2089)	*OR* (95%*CI*)	No cognitive Impairment (n = 4225)	Cognitive Impairment (n = 1378)	*OR* (95%*CI*)
Anxiety						
None	2922(83.1)	1136(54.4)	**2.88(2.61,3.19)****	3216(76.2)	842(61.1)	**1.73(1.60,1.88)****
Mild	526(14.9)	719(34.4)		859(20.3)	386(28.0)	
Moderate	43(1.2)	119(5.7)		103(2.4)	59(4.3)	
Moderate-severe	21(0.6)	79(3.8)		39(0.9)	61(4.4)	
Severe	2(0.2)	36(1.7)		8(0.2)	30(2.2)	
Depression						
None	3066(87.3)	1139(54.5)	**3.51(3.16,3.90)****	3371(79.8)	834(60.5)	**1.86(1.72,2.01)****
Mild	387(11.0)	623(29.8)		674(15.9)	336(24.4)	
Moderate	43(1.2)	175(8.4)		120(2.8)	98(7.1)	
Moderate-severe	15(0.4)	100(4.8)		46(1.1)	69(5.0)	
Severe	3(0.1)	52(2.5)		14(0.4)	41(3.0)	
Hearing						
Normal	2816(80.1)	1082(51.8)	**3.76(3.33,4.23)****	3053(72.3)	845(61.3)	**1.64(1.45,1.87)****
Abnormal	698(19.9)	1007(48.2)		1172(27.7)	533(38.7)	
Vision						
Normal	2593(73.8)	1025(49.1)	**2.92(2.61,3.28)****	2855(67.6)	763(55.4)	**1.68(1.48,1.90)****
Abnormal	921(26.2)	1064(50.9)		1370(32.4)	615(44.6)	
Walking						
Normal	3109(88.5)	681(32.6)	**15.87(13.82,18.22)****	3071(72.7)	719(52.2)	**2.44(2.15,2.77)****
Abnormal	405(11.5)	1408(67.4)		1154(27.3)	659(47.8)	
Cognitive impairment						
Yes	654(18.6)	724(34.7)	**2.32(2.05,2.63)****			
No	2860(81.4)	1365(65.3)				
Physical function impairment						

Data are shown by n and % except for age, BMI and quantities of children.
OR = odds ratio, 95% CI = 95% confidence interval
BMI = body mass index
**P* < .05, ***P* < .01

Variables and subgroups	No disability (n = 3514)	Disability (n = 2089)	*OR* (95%*CI*)	No cognitive Impairment (n = 4225)	Cognitive Impairment (n = 1378)	*OR* (95%*CI*)
Yes				1365(32.3)	724(52.5)	**2.32(2.05,2.63)****
No				2860(67.7)	654(47.5)	
Data are shown by n and % except for age, BMI and quantities of children.						
OR = odds ratio, 95% CI = 95% confidence interval						
BMI = body mass index						
**P* < .05, ***P* < .01						

Influencing factors associated with cognitive impairment The results from multivariate logistic regression analysis of risk factors for cognitive impairment are shown in Table 4 and Fig. 2. Older people with older age (*OR*: 1.02 95%*CI*: 1.01, 1.03), and fewer children were associated with a higher risk of cognitive impairment. Education level influenced the risk of cognitive impairment, and this risk was higher among those with primary school (*OR*: 1.75, 95%*CI*: 1.40, 2.22), junior high school (*OR*: 11.59, 95%*CI*: 8.96, 15.00), senior high school (*OR*: 8.71, 95%*CI*: 6.57, 11.56) or college (*OR*: 7.14, 95%*CI*: 4.70, 10.86). The risk of cognitive impairment was higher among older people whose family income was < 2000 , having rural medical service, receiving annual physical examination (*OR*: 1.23, 95%*CI*: 1.05, 1.44) for the last 10 years, and without care from family or friends. Living in small or middle-sized cities (*OR*: 1.49, 95%*CI*: 1.19, 1.87) or large-sized cities (*OR*: 1.68, 95%*CI*: 1.38, 2.05) was related to a higher risk of cognitive impairment compared with that of living in villages. Older people who did not participate in social activities weekly had a higher risk of cognitive impairment than those participating in social activities 1–3 days per week or every day. Many disease-related factors were also found to be significantly associated with cognitive function, such as coronary heart disease (*OR*: 1.26, 95%*CI*: 1.03, 1.55), hearing disorders (*OR*: 1.24 95%*CI*: 1.05, 1.47) and impaired walking ability (*OR*: 1.67, 95%*CI*: 1.30, 2.02). Older people who did not take medication were more likely to experience cognitive impairment than people taking 2 types, 3 types or > 4 types of medication. The results revealed that risk factors significantly associated with cognitive impairment were severe anxiety (*OR*: 3.16, 95%*CI*: 1.02, 9.81) and depression. Moreover, as shown in Tables 3 and 4, we found that physical function impairment (*OR*: 1.79, 95%*CI*: 1.49, 2.16) and cognitive impairment (*OR*: 1.83, 95%*CI*: 1.51, 2.21) were independent risk factors for each other among older people.

Table 3
Multivariate logistic regression analysis of influencing factors for physical function impairment

Influencing factors	***β (SE)***	**Adjusted *OR* (*95%*CI)**	***P* value**
Age	**0.06(0.01)**	**1.06(1.05,1.07)**	**< .001****
BMI	**0.03(0.01)**	**1.03(1.01,1.05)**	**.015***
Quantity of children	0.01(0.03)	1.01(0.97,1.07)	.646
Sex	0.07(0.09)	1.08(0.90,1.29)	.408
Region			
Other cities in Guangdong	as ref		
Guangzhou or Shenzhen	**-0.31(0.12)**	**0.73(0.57,0.93)**	**.011***
Other provinces or cities	-0.39(0.24)	0.68(0.40,1.07)	.097
Living with children	0.06(0.09)	1.06(0.90,1.26)	.488
Family income per month,			
2000	as ref		
2000–4000	**0.32(0.11)**	**1.38(1.12,1.70)**	**.003****
4000–6000	**0.39(0.13)**	**1.48(1.16,1.90)**	**.002****
6000	0.09(0.13)	1.10(0.86,1.40)	.467
Source of income			
Acquiring from children	as ref		
Retirement income	**-0.41(0.10)**	**0.66(0.55,0.81)**	**< .001****
Labor income	0.03(0.15)	1.03(0.77,1.38)	.850
Education level			
Illiteracy	as ref		
Primary school and below	**-0.33(0.10)**	**0.72(0.59,0.88)**	**.001****
Junior high school	**-0.72(0.13)**	**0.49(0.37,0.63)**	**< .001****
Senior high school	**-0.76(0.15)**	**0.47(0.35,0.63)**	**< .001****
College and above	**-0.51(0.24)**	**0.60(0.38,0.97)**	**.036***
Marital status	0.04(0.10)	1.04(0.85,1.27)	.705
Place of residence			
Villages	as ref		
Counties or towns	0.10(0.12)	1.11(0.89,1.39)	.369
Small or middle-sized cities	0.23(0.12)	1.26(0.99,1.60)	.056

OR = odds ratio, 95% *CI* = 95% confidence interval

BMI = body mass index

$*P < .05$, $**P < .01$

Influencing factors	*β (SE)*	Adjusted *OR* (*95%*CI)	*P* value
Large-sized cities	**0.30(0.15)**	**1.36(1.01,1.81)**	**.040***
Cardiovascular or cerebrovascular diseases	-0.16(0.14)	0.85(0.64,1.13)	.275
Hypertension	0.21(0.11)	1.23(0.99,1.53)	.059
Coronary heart disease	0.09(0.11)	1.09(0.88,1.36)	.424
Diabetes	0.02(0.11)	1.02(0.82,1.26)	.872
Type of medication			
None	as ref		
1	**0.34(0.13)**	**1.41(1.10,1.81)**	**.008****
2	**0.60(0.14)**	**1.82(1.40,2.37)**	**< .001****
3	**0.66(0.16)**	**1.93(1.41,2.62)**	**< .001****
4	**0.96(0.16)**	**2.62(1.92,3.57)**	**< .001****
Drinking			
Never	as ref		
Occasional	0.21(0.14)	1.24(0.95,1.63)	.117
Always	-0.03(0.14)	0.97(0.74,1.26)	.809
Smoking			
Never	as ref		
Occasional	0.07(0.13)	1.07(0.84,1.37)	.585
Always	**-0.27(0.13)**	**0.76(0.60,0.98)**	**.033***
Annual physical examination for the last 10 years	**-0.27(0.08)**	**0.76(0.65,0.90)**	**.001****
Weekly social activities, days			
Never	as ref		
1–3	**-0.30(0.10)**	**0.74(0.62,0.90)**	**.002****
4–6	-0.01(0.20)	0.99(0.67,1.45)	.953
Every day	**-0.53(0.11)**	**0.59(0.48,0.73)**	**< .001****
Weekly exercise, days			
Never	as ref		
1–3	-0.19(0.10)	0.83(0.67,1.01)	.064
4–6	-0.12(0.19)	0.89(0.61,1.29)	.526
Every day	**-0.47(0.10)**	**0.62(0.51,0.76)**	**< .001****
Care from family or friends	**-0.34(0.10)**	**0.71(0.59,0.87)**	**.001****
OR = odds ratio, 95% *CI* = 95% confidence interval			
BMI = body mass index			
$*P < .05$, $**P < .01$			

Influencing factors	β (SE)	Adjusted OR (95%CI)	P value
Hearing	**0.23(0.08)**	**1.26(1.07,1.49)**	**.006****
Vision	0.11(0.08)	1.11(0.95,1.31)	.193
Walking	**1.84(0.08)**	**6.29(5.34,7.41)**	**< .001****
Anxiety			
None	as ref		
Mild	0.21(0.11)	1.23(0.99,1.54)	.059
Moderate	0.38(0.27)	1.46(0.86,2.50)	.166
Moderate-severe	-0.31(0.42)	0.74(0.32,1.68)	.466
Severe	0.91(1.27)	2.48(0.21,29.81)	.473
Depression			
None	as ref		
Mild	**0.47(0.12)**	**1.59(1.26,2.01)**	**< .001****
Moderate	**1.24(0.25)**	**3.46(2.13,5.62)**	**< .001****
Moderate-severe	**1.33(0.43)**	**3.79(1.64,8.74)**	**.002****
Severe	1.49(1.02)	4.46(0.60,33.01)	.144
Cognitive impairment	**0.61(0.10)**	**1.83(1.51,2.21)**	**< .001****
OR = odds ratio, 95% *CI* = 95% confidence interval			
BMI = body mass index			
**P* < .05, ***P* < .01			

Table 4
Multivariate logistic regression analysis of influencing factors for cognitive impairment

Influencing factors	***β (SE)***	**Adjusted *OR* (*95%*CI)**	***P* value**
Age	**0.02(0.01)**	**1.02(1.01–1.03)**	**.001****
Sex	0.10(0.07)	1.11(0.96–1.28)	.159
Living with children	-0.06(0.08)	0.94(0.80–1.10)	.458
Family income per month,			
2000	as ref		
2000–4000	**-0.24(0.10)**	**0.78(0.64–0.96)**	**.016***
4000–6000	**-0.65(0.12)**	**0.52(0.41–0.67)**	**< .001****
6000	**-0.73(0.12)**	**0.48(0.38–0.61)**	**< .001****
Source of income			
Acquiring from children	as ref		
Retirement income	-0.08(0.09)	0.92(0.76–1.11)	.381
Labor income	-0.01(0.14)	1.00(0.76–1.30)	.975
Education level			
Illiteracy	as ref		
Primary school and below	**0.56(0.12)**	**1.75(1.39–2.20)**	**< .001****
Junior high school	**2.45(0.13)**	**11.61(8.97–15.03)**	**< .001****
Senior high school	**2.17(0.14)**	**8.72(6.57–11.57)**	**< .001****
College and above	**1.99(0.21)**	**7.33(4.82–11.14)**	**< .001****
Type of insurance			
Rural medical service	as ref		
Urban medical service	**-0.21(0.09)**	**0.81(0.68–0.97)**	**.023***
Other medical service	-0.14(0.15)	0.87(0.65–1.17)	.358
Place of residence			
Villages	as ref		
Counties or towns	0.09(0.11)	1.10(0.88–1.37)	.414
Small or middle-sized cities	**0.41(0.12)**	**1.50(1.20–1.89)**	**< .001****
Large-sized cities	**0.53(0.10)**	**1.71(1.40–2.08)**	**< .001****
Cardiovascular or cerebrovascular diseases	0.19(0.13)	1.21(0.93–1.57)	.156
Hypertension	0.06(0.10)	1.07(0.87–1.30)	.538
Coronary heart disease	**0.23(0.11)**	**1.26(1.02–1.55)**	**.029***

OR = odds ratio, 95% *CI* = 95% confidence interval

*P < .05, **P < .01

Influencing factors	*β (SE)*	Adjusted *OR* (*95%*CI)	*P* value
Diabetes	0.13(0.10)	1.14(0.93–1.39)	.200
Type of medication			
None	as ref		
1	0.01(0.12)	1.01(0.80–1.27)	.967
2	**-0.45(0.13)**	**0.64(0.49–0.82)**	**.001****
3	**-0.48(0.15)**	**0.62(0.46–0.83)**	**.002****
4	**-0.58(0.15)**	**0.56(0.42–0.76)**	**< .001****
Annual physical examination for the last 10 years	**0.21(0.08)**	**1.24(1.06–1.45)**	**.007****
Weekly social activities, days			
Never	as ref		
1–3	**-0.28(0.09)**	**0.76(0.63–0.91)**	**.003****
4–6	-0.27(0.19)	0.77(0.53–1.10)	.152
Every day	**-0.32(0.10)**	**0.73(0.60–0.89)**	**.002****
Weekly exercise, days			
Never	as ref		
1–3	0.12(0.10)	1.13(0.93–1.38)	.228
4–6	0.32(0.18)	1.38(0.96–1.98)	.078
Every day	0.14(0.10)	1.15(0.95–1.41)	.157
Support from family	-0.11(0.08)	0.90(0.77–1.05)	.166
Care from family or friends	**-0.36(0.10)**	**0.70(0.57–0.85)**	**< .001****
Hearing	**0.21(0.08)**	**1.24(1.05–1.46)**	**.011***
Vision	0.16(0.08)	1.17(0.99–1.36)	.052
Walking	**0.51(0.09)**	**1.67(1.38–2.02)**	**< .001****
Anxiety			
None	as ref		
Mild	-0.06(0.11)	0.94(0.76–1.17)	.573
Moderate	-0.24(0.23)	0.79(0.51–1.23)	.299
Moderate-severe	0.57(0.30)	1.76(0.98–3.17)	.058
Severe	**1.16(0.58)**	**3.17(1.02–9.83)**	**.045***
Depression			
None	as ref		
Mild	**0.56(0.12)**	**1.75(1.39–2.19)**	**< .001****

OR = odds ratio, 95% *CI* = 95% confidence interval

*P < .05, **P < .01

Influencing factors	β (SE)	Adjusted OR (95%CI)	P value
Moderate	**0.93(0.19)**	**2.54(1.75–3.68)**	**< .001****
Moderate-severe	**1.34(0.28)**	**3.80(2.18–6.64)**	**< .001****
Severe	**1.81(0.48)**	**6.08(2.38–15.57)**	**< .001****
Physical function impairment	**0.58(0.09)**	**1.79(1.49–2.16)**	**< .001****
OR = odds ratio, 95% *CI* = 95% confidence interval			
*P< .05, **P< .01			

Discussion

High prevalence and multidimensional risk factors for disability or cognitive decline among adults aged 60 years or older have been widely demonstrated by numerous studies from different national large-scale epidemiological investigations. However, to our knowledge, little is known about the regional current conditions of disability status in China, especially in the southern region. This large sample, cross-sectional study was conducted in urban or rural adults aged 60 years or older and living in Guangdong Province and confirmed the prevalence and related factors of disability from the two perspectives of physical function and cognition.

We found that physical function impairment existed in nearly one-third of subjects in the total population, with a prevalence of 37.28%. This result was similar to the data of Vásquez et al.[28] performed in 3050 older individuals from the Hispanic Established Populations for Epidemiologic Study and Farías-Antúnez et al.[29] performed in 1451 elderly individuals from Brazil. However, this disability rate was obviously lower than those from a nationwide population-based longitudinal survey of a healthy aging study, which was selected randomly in 22 provinces in China[30]. The prevalence of disability from the above study was more than half of the total individuals in both urban and rural areas. This is likely because the average age of the included older individuals in our survey was generally younger. Moreover, some native regional studies close to Guangdong Province also reached similar results. One population-based study[31], for example, conducted in Guangxi Province with 2300 adults aged 60 years or older, indicated that the disability rates measured with ADL and IADL were 43.4% and 42.4%, respectively. The same conclusion was drawn in another study in northeastern rural areas of India for a community-based population[32]. The most likely reason is that the urban and rural distribution in our study was nearly balanced, while a higher proportion of participants in the above studies resided in rural areas. The discrepancy in the evaluation criteria for BADL or IADL in the two studies may also lead to inconsistent results. Future multicenter, large-scale epidemiological investigations should focus on uniform distributions of age and region during sampling and consistency of measurement methods to make the results more accurate and representative.

The overall cognitive impairment rate in our study was 31%. This result supports the proportion of surveys conducted for representative older adults from Brazil (34%)[33]. However, many population-based cross-sectional studies carried out in different countries, such as Spain[34], Italy[35], Mexico[36], Japan[37] and Korea[38], all showed a lower cognitive impairment rate. Nationwide data in China conducted among 46011[21], 21732[39] and 3768[40] samples in 2018 also showed prevalence rates of 15.0%, 17.8% and 22.4%, respectively, which were significantly lower than those of our study. A similar result was presented in other epidemiological studies in eastern[41] and northern China[42–43]. Qin et al.[40] also analyzed prevalence across regions and found that the rate of cognitive impairment among older adults in the southwest region was 29.94%, which was the highest of all regions. These data nearly conformed with our results. The above differences by country or region may be related to comprehensive complicated factors such as race, lifestyle, economic level, and medical pattern. Unfortunately, the prevalence of cognitive impairment among older adults in western or middle China is still unknown and needs further exploration. All of the findings implied that the southern area in China should be considered a major region to prevent and control cognitive impairment or dementia. Further studies should pay more attention to the establishment of interventions and management systems combined with regional characteristics.

The results of multivariate logistic regression analysis in our study found that age, family income, education level, type of medication, physical examination, social activities, care from family or friends, hearing, walking and depression were associated with both physical function and cognitive impairment. There was a broad consensus between older age and disability, whether it was in the concept of body or cognition[31, 44–46]. We also confirmed this opinion in previous studies. The possible reason may be that older individuals usually face several irreversible organic function declines and degenerative changes, such as Alzheimer's disease, with increasing age, which can directly weaken self-care or daily living abilities. Moreover, the risk of frailty or geriatric syndromes is higher among adults with older age, and this status is also considered an intermediate condition between normal individuals and disability[47–48]. High family income per month was regarded as a significant protective factor for physical function or cognitive impairment in our study, which was consistent with the results of most published studies[49–50] that explored the relationship between socioeconomic position or economic income and the incidence of disability. The explanation related to this phenomenon may be that older adults with low family income may possess insufficient financial circumstances and social resources to respond to increased health care burdens and pressures, obtain less access to medical services for chronic disease management, and restrict the interaction and support from the social network, thereby leading to the occurrence of functional disorders[51–53].

There was a significant difference in the prevalence of physical and cognitive impairment between older adults with different education levels. A higher education level was associated with a lower risk of physical function impairment, while the contrary result was shown in cognitive impairment. Previous studies[45, 54] tended to support the viewpoint that education level was considered a protective factor because individuals with more education have more available resources and approaches for health-related services and knowledge to enhance their disease management ability. However, in our study, more educated older individuals had a higher risk of cognitive impairment, which was inconsistent with most studies[16, 18, 55] investigating the relationship between cultural features and disability. However, the findings of Godinho et al.[56] agreed with our findings, which may be explained by complicated neuropathologic theory and structural and functional changes by age in brain features, and further research about mechanistic exploration is needed to interpret the relationship. A positive association between medication use and physical function impairment was found in our study, which conformed to previous findings[31–32]. Unfortunately, the opposite result was also shown in the cognitive aspect. The possible reason may be that older adults taking more types of medicine may have various chronic diseases, making them obtain medical assistance frequently; thus, they may find and control the risk and prodromal stage of cognition-related problems early.

Although the habit of undergoing regular physical examinations is beneficial to health promotion, the results of our study indicated that having an annual physical examination for the last 10 years was associated with a higher risk of cognitive impairment. We clarified that this phenomenon differed from conventional results in that older adults who usually participate in physical examination may have more diseases, which can cause a higher risk of negative emotions or mental problems, thereby leading to accelerated progression of cognitive impairment[57–58]. Available evidence from both original studies[49, 54, 59–60] and a systematic review[53] demonstrated the positive effect of social activities and family care on functional disability. Our study also agreed with this opinion. It is essential for elderly individuals to spend time on active social activities and socializing with friends or family to maintain basic cooperation and interactivity with their surroundings[49], contribute to keeping bodily skills preserved[53], and help delay the decline in physical or mental function. More importantly, participation in social groups helps them obtain unrestricted access to abundant information on prevention and healthcare, improve satisfaction with life and confidence in self-care, and consequently decrease the incidence of disability to a great extent[61]. The findings in our study also indicated that the effect of spiritual level support on disability, whether physical or cognitive, was more significant than that of material support, which highlighted the potential value of disability interventions based on psychological theories.

Over the last few years, some researchers have conducted large-scale population-based observational studies[62–63] and a longitudinal study[64] that explored the relationship between sensory disorders and cognitive impairment, which indicated that hearing disorders were an independent influencing factor for cognitive impairment. Our findings also agreed with this result. The reason behind the observed correlation between sensory function and cognitive impairment may be related to potential mechanisms based on several hypotheses on internal effects, such as sensory deprivation[65–66] and resource allocation[66], or external effects, such as social disengagement[62]. Unfortunately, there was no evidence to determine whether the relationship between sensory disorder and cognitive impairment is causal and the exact mechanisms, which need further longitudinal studies with large sample sizes or basic research to confirm. The results of our study did not show a significant association between vision disorders and cognitive impairment or sensory disorders and physical function impairment, which also needs to be further confirmed. However, it may be necessary to pay particular attention to elderly individuals with age-related sensory disorders, identify them and provide interventions during the early stage to mitigate the development of cognitive decline. Our study also suggested that elderly adults with walking disorders had a higher risk of physical and cognitive function impairments. One systematic review[67] included 49 studies that considered gait speed as a predictor of physical frailty and health indicator variables and showed a potential correlation between walking problems and disability, which is consistent with our study. This result can be interpreted as walking ability being one of the categories or measurement criterion of disability according to the World Health Organization (WHO) and Chinese disability classification standards[10]. Regarding the negative effect of walking disorder on cognitive impairment, we speculated that the possible cause is social isolation, weakening of information exchange or psychological problems caused by physical restriction, thus indirectly accelerating cognitive reduction.

The results of our study showed a significant association between psychological factors such as anxiety or depression and cognitive impairment. There is a broad consensus that psychological distress is deemed an independently important predictor of cognitive health[57–58]. Therefore, investigating coping strategies for stress and constructing intervention networks based on social psychological aspects of cognitive health among older people may gradually become directions for future studies. Interestingly, we found that depression was also an influencing factor for physical-function impairment. Although this result was in conformity with many previous studies[68–69], the connection between the two variables is still debatable[70], and it is worthy of further discussion.

In addition to the factors mentioned above, the results of multivariate logistic regression analysis suggested that BMI, region, source of income, smoking and weekly exercise were also influencing factors for physical function impairment. Older adults with higher BMI had an increased risk of physical function impairment, which was in accordance with the study conducted in Japan among 12666 individuals through a 10-year cohort[71]. It has already been confirmed that overweight is an independent risk factor for many chronic metabolic diseases, which can directly generate disability[71–72]. It was less common for older adults whose long-term residence was in Guangzhou or Shenzhen to have physical-function impairment than for those who lived in other cities in Guangdong. The likely reason was related to rich medical resources and a complete system of medical care and health management in cities with developed economic levels. The opposite result obtained in our study, which was that smoking was a protective factor for disability, was unusual compared with most studies related to the negative effects of unhealthy lifestyles on diseases[32, 46, 54]. This may be explained by the complex relationship between praxeology or psychology and diseases, but further studies are needed to investigate the legitimacy of this result. Moreover, older adults with fewer children, rural medical insurance, residence in a village and coronary heart disease were more likely to develop cognitive impairment. Older adults can receive more care and psychological support when they have more children, and those who live in cities or possess urban medical insurance have more opportunities to enjoy high-quality medical resources. The significant relationship between coronary heart disease and cognitive impairment has been demonstrated by previous studies[73–74], and our findings also confirmed this relationship.

Interestingly, the additional findings in our study showed that older adults with physical function impairment had an increased risk of cognitive impairment, and similarly, cognitive impairment also promoted the progression of physical disability. Most published studies[75–78] suggest the possibility of a strong link between physical and cognitive impairment, and the association seems to be bidirectional. Longitudinal studies[76–77] have already confirmed that physical-function impairment or frailty is a predictor of cognitive decline among people with mild cognitive impairment and is associated with a higher risk of dementia. Cognitive impairment is also a potentially modifiable risk factor for physical disability in aging with changes in self-care and movement ability. Physical function and cognition are different concepts used to define disability, and those two aspects have similar comorbidity relations in risk factors, pathogenesis and clinical outcome. Therefore, interventions to slow or control the progression of physical function impairment may play a crucial role in the prevention of cognitive impairment or dementia, and the opposite strategy is equally possible.

There were also some limitations in this study. First, this was a cross-sectional study, which cannot verify the causal association between the included factors and physical function or cognitive impairment. Second, the concept of disability can be classified by levels other than physical function or cognition, but we did not perform the investigation from other aspects due to the restriction of instruments or population base. Third, a positive relationship may also exist between physical function or cognitive impairment and other factors, such as nutrition, frailty or disease-related factors, with more detailed divisions, which was not covered in our study. Finally, some results of this study might be biased because older adults with hearing or vision loss cannot finish the survey by themselves and need the assistance of caregivers or other family members, which may result in subjective opinions from proxy respondents affecting the data. Participants' ability to recall past information may also lead to inaccurate results.

Conclusion

Disability has been regarded as a major public health problem in China and is associated with aging. The findings in this population-based cross-sectional study in Guangdong Province demonstrated that there was a high incidence rate of disability in terms of physical function impairment and cognitive impairment, which was at a higher level than those from other large regional surveys in China. Many influencing factors related to demographic characteristics, chronic diseases, behavioral habits and psychological factors were associated with physical function or cognitive impairment. Further studies should concentrate on the causality of the relationship and effectively track various factors and disability, development of the concept and connotation of disability, and construction of prevention or control strategies for disability, which can effectively reduce the negative influence of the aging process and extend the life span of elderly people in China.

Declarations

Data availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Author Contributions

T.M.S., L.C. and Y.Z. design the conceptualization and methodology. Q.H., X.X.W. and L.X. L. conducted the investigation and collected the data. Y.Z., J.H.G. and B.G. analyzed and interpreted the data. Y.Z. wrote the original draft. H.C. reviewed and edited the manuscript. H.C., L.C. and T.M.S. provided the resources supports. All authors have read and agreed to the published version of the manuscript.

Funding

This study was funded by National Key R&D Program of China (Grant number: 2020YFC2008500) and Program of Guangdong Province People's Hospital (Grant number: KY012019175).

Competing interests

The authors declare they have no competing interests.

Additional information

Correspondence and requests for materials should be addressed to Tiemei Shen.

References

1. Qian RJ, Jia SL, Zhan WY, et al. Prevalence and correlates of disability among urban-rural older adults in Southwest China: a large, population-based study[J]. BMC Geriatr, 2022, 22(1): 517.
2. Han Y, Zhang LW, Fang Y. Multidimensional Disability Evaluation and Confirmatory Analysis of Older Adults in a Home-Based Community in China[J]. Front Public Health, 2022, 21: 899303.
3. National Bureau of Statistic. Bulletin of the 7th National Population Census(No.5): Age composition of the population[EB/OL]. (2021-05-11)[2023-4-2]. http: / /www. stats. gov. cn /tjsj /zxfb /202105 /t20210510_1817181. html
4. Damluji AA, Chung SE, Xue QL et al. Physical Frailty Phenotype and the Development of Geriatric Syndromes in Older Adults with Coronary Heart Disease[J]. Am J Med, 2021, 134(5): 662-671.
5. Han G,Han J, Han K,et al.Relationships among visual acuity, risk of acute myocardial infarction, and stroke: a nationwide cohort study in south korea[J]. Ophthalmic Epidemiol, 2022, 29(1): 57-69.
6. Wang JY, Li TR. The age pattern of disability in China and Prediction of future disability population[J]. Population Journal, 2020, 42(5): 57-72.
7. Hsieh N, Waite L. Disability, Psychological Well-Being, and Social Interaction in Later Life in China[J]. Res Aging, 2019, 41(4): 362-398.
8. Liao J, Wang Q, Huang JL, et al. Urban-rural difference in the costs of disability and its effects on poverty among people with disabilities in China[J]. Front Public Health, 2022, 10: 989540.
9. Zhang M, Zhu WZ, He XR, et al. Correlation between functional disability and quality of life among rural elderly in Anhui province, China: a cross-sectional study[J]. BMC Public Health, 2022, 22(1): 397.
10. Abdi S, Spann A, Borilovic J, et al. Understanding the care and support needs of older people: a scoping review and categorisation using the WHO international classification of functioning, disability and health framework (ICF)[J]. BMC Geriatr, 2019, 19(1): 195.
11. Gold DA. An examination of instrumental activities of daily living assessment in older adults and mild cognitive impairment[J]. J Clin Exp Neuropsychol, 2012, 34(1): 11-34.
12. Cornelis E, Gorus E, Schelvergem NV, et al. The relationship between basic, instrumental, and advanced activities of daily living and executive functioning in geriatric patients with neurocognitive disorders[J]. Int J Geriatr Psychiatry, 2019, 34(6): 889-899.
13. Inocian E, Patalagsa JG. Cognitive impairment in older people living in the community[J]. Nurs Older People, 2016, 28(2): 25-30.
14. Tangalos EG, Petersen RC. Mild Cognitive Impairment in Geriatrics[J]. Clin Geriatr Med, 2018, 34(4): 563-589.
15. Campbell NL, Unverzagt F, LaMantia MA, et al. Risk factors for the progression of mild cognitive impairment to dementia[J]. Clin Geriatr Med, 2013, 29(4): 873-893.
16. Xue J, Jiao YY, Wang JY, et al. The Incidence and Burden of Risk Factors for Mild Cognitive Impairment in Older Rural Chinese Persons[J]. Gerontol Geriatr Med, 2022, 8: 23337214221114559.
17. Teh WL, Abdin E, Vaingankar JA, et al. Prevalence, Lifestyle Correlates, and Psychosocial Functioning Among Multi-Ethnic Older Adults with Mild Cognitive Impairment in Singapore: Preliminary Findings from a 10/66 Population Study[J]. Yale J

Biol Med, 2021, 94(1): 73-83.
18. Liu LY, Lu YX, Shen L, et al. Prevalence, risk and protective factors for mild cognitive impairment in a population-based study of Singaporean elderly[J]. J Psychiatr Res, 2021, 145: 111-117.
19. Vlachos GS, Kosmidis MH, Yannakoulia M, et al. Prevalence of Mild Cognitive Impairment in the Elderly Population in Greece: Results From the HELIAD Study[J]. Alzheimer Dis Assoc Disord, 2020, 34(2): 156-162.
20. Deng Y, Zhao SQ, Cheng GW, et al. The Prevalence of Mild Cognitive Impairment among Chinese People: A Meta-Analysis[J].Neuroepidemiology, 2021, 55(2): 79-91.
21. Jia LF, Du YF, Chu L, et al. Prevalence, risk factors, and management of dementia and mild cognitive impairment in adults aged 60 years or older in China: a cross-sectional study[J]. Lancet Public Health, 2020, 5(12): 661-671.
22. Cornelis E, Gorus E, Van Schelvergem N, et al. The relationship between basic, instrumental, and advanced activities of daily living and executive functioning in geriatric patients with neurocognitive disorders[J]. Int J Geriatr Psychiatry, 2019;34(6):889–99.
23. De Vriendt P, Cornelis E, Cools W, et al. The Usefulness of Evaluating Performance of Activities in Daily Living in the Diagnosis of Mild Cognitive Disorders[J]. Int J Environ Res Public Health, 2021, 18(21):11623.
24. Bruderer-Hofstetter M, Gorus E, Elise Cornelis E, et al. Influencing factors on instrumental activities of daily living functioning in people with mild cognitive disorder - a secondary investigation of cross-sectional data[J]. BMC Geriatr, 22(11): 791.
25. Bo ZY, Kuang WH, Wang Y, et al. Cognitive Impairment and Associated Factors in Community-dwelling Elderly in Chengdu, Sichuan[J]. J Sichuan Univ(Med Sci Edi), 2018, 49(5): 759-764.
26. Cockrell JR, Folstein MF. Mini-Mental State Examination (MMSE)[J]. Psychopharmacol Bull, 1988, 24(4): 689-692.
27. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure[J].J Gen Intern Med, 2001, 16(9): 606-613.
28. Löwe B, Decker O, Müller S, et al. Validation and standardization of the Generalized Anxiety Disorder Screener (GAD-7) in the general population[J]. Med Care, 2008, 46(3): 266-274.
29. Vásquez E, Gadgil MA, Zhang WH, et al. Diabetes, disability, and dementia risk: Results from the Hispanic Established Populations for the Epidemiologic Studies of the Elderly (H-EPESE)[J]. In J Soc Psychiatry, 2022, 68(7): 1462-1469.
30. Farías-Antúnez S, Lina NP, Bierhals IO, et al. Disability relating to basic and instrumental activities of daily living: a zopulation-based study with elderly in Pelotas, Rio Grande do Sul, Brazil, 2014[J]. Epidemiol Serv Saude, 2018, 27(2): e2017290.
31. Hou CB, Ma Y, Yang XH, et al. Disability Transitions and Health Expectancies among Elderly People Aged 65 Years and Over in China: A Nationwide Longitudinal Study[J]. Aging Dis, 2019, 10(6): 1246-1257.
32. Chen SY, Qin J, Li Y, et al. Disability and Its Influencing Factors among the Elderly in a County, Guangxi Province, China[J]. Int J Environ Res Public Health, 2018, 15(9): 1967.
33. Medhi GK, Visi V, Bora PJ, et al. A Community-Based Study on Functional Disability and Its Associated Factors Among Elderly Individuals in a Rural Setting in Northeastern India[J]. Cureus, 2021, 13(2): e13309.
34. Brigola AG, Ottaviani AC, Carvalho DH, et al. Association between cognitive impairment and criteria for frailty syndrome among older adults[J]. Arq Neuropsiquiatr, 2020, 78(1): 2-8.
35. Lara E, Koyanagi A, Olaya B, et al. Mild cognitive impairment in a Spanish representative sample: prevalence and associated factors[J]. Int J Geriatr Psychiatry, 2016, 31(8): 858-867.
36. Caffò AO, Spano G, Tinella L, et al. The Prevalence of Amnestic and Non-Amnestic Mild Cognitive Impairment and Its Association with Different Lifestyle Factors in a South Italian Elderly Population[J]. Int J Environ Res Public Health, 2022, 19(5): 3097.
37. Givan A, Downer B, Chou LN, et al. Cognitive impairment and low physical function among older Mexican Americans: findings from a 20-year follow-up[J]. Ann Epidemiol, 2022, 70: 9-15.

38. Saw YM, Saw TN, Than TM, et al. Cognitive impairment and its risk factors among Myanmar elderly using the Revised Hasegawa's Dementia Scale: A cross-sectional study in Nay Pyi Taw, Myanmar[J]. PLoS One, 2020, 15(7): e0236656.
39. Lee WT, Lim SS, Yoon JH, et al. Association between Changes in the Regularity of Working Hours and Cognitive Impairment in Middle-Aged and Older Korean Workers: The Korean Longitudinal Study of Aging, 2008-2018[J]. Int J Eniviron Res Public Health, 2022, 19(7): 4161.
40. Qi SG, Sun YY, Yin P, et al. Mobile Phone Use and Cognitive Impairment among Elderly Chinese: A National Cross-Sectional Survey Study[J]. Int J Eniviron Res Public Health, 2021, 18(11): 5695.
41. Qin F, Luo M, Xiong Y, et al. Prevalence and associated factors of cognitive impairment among the elderly population: A nationwide cross-sectional study in China[J]. Front Public Health, 2022, 10: 1032666.
42. Ding D, Zhao QH, Guo QH, et al. Prevalence of mild cognitive impairment in an urban community in China: a cross-sectional analysis of the Shanghai Aging Study[J]. Alzheimers Dement, 2015, 11(3): 300-309.
43. Jiang F, Kong FL, Li SX. The Association between Social Support and Cognitive Impairment among the Urban Elderly in Jinan, China[J]. Healthcare(BaseL), 2021, 9(11): 1443.
44. Zhang Y, Guan YL, Shi ZH, et al. Sex Differences in the Prevalence of and Risk Factors for Cognitive Impairment No Dementia among the Elderly in a Rural Area of Northern China: A Population-Based Cross-Sectional Study[J]. Neuroepidemiology, 2019, 52(1-2): 25-31.
45. Huang X, Zhang MQ, Fang JY. The Association between Frailty and Disability among the Elderly in Rural Areas of Korea[J]. Arch Gerontol Geriatr, 2022, 99: 104599.
46. Goswami AK, S R, Kalaivani M, et al. Disability and its association with sociodemographic factors among elderly persons residing in an urban resettlement colony, New Delhi, India[J]. PLoS One, 2019, 14(9): e20222992.
47. Ramadass S, Rai SK, Gupta SK, et al. Prevalence of disability and its association with sociodemographic factors and quality of life in a rural adult population of northern India[J]. Natl Med J India, 2018, 31(5): 268-273.
48. Choi YS, Kim MJ, Lee GY, et al. The Association between Frailty and Disability among the Elderly in Rural Areas of Korea[J]. Int J Environ Res Public Health, 2019, 16(14): 2481.
49. Tavares DMDS, Faria PM, Pegorari MS, et al. Frailty Syndrome in Association with Depressive Symptoms and Functional Disability among Hospitalized Elderly[J]. Issue Ment Health Nurs, 2018, 39(5): 433-438.
50. Danielewicz AL, d'Orsi E, Boing AF. Contextual income and incidence of disability: results of EpiFloripa Elderly Cohort[J].Rev Saude Publica, 2019, 53: 11.
51. Philibert MD, Pampalon R, Hamel D, et al. Interactions between neighborhood characteristics and individual functional status in relation to disability among Québec urbanites[J]. Disabil Health J, 2013, 6(4): 361-368.
52. Bowling A, Stafford M. How do objective and subjective assessments of neighbourhood influence social and physical functioning in older age? Findings from a British survey of ageing[J]. Soc Sci Med, 2007, 64(12): 2533-2549.
53. Zeng Y, Gu D, Purser J, et al. Associations of environmental factors with elderly health and mortality in China[J]. Am J Public Health, 2010, 100(2): 298-305.
54. Vaughan M, LaValley MP, AlHeresh R, et al. Which Features of the Environment Impact Community Participation of Older Adults? A Systematic Review and Meta-Analysis[J]. J Aging Health, 2016, 28(6): 957-978.
55. Ravi J, Kuzhali S, Ramamoorthy P. Prevalence of disability among the elderly people in an urban slum of Chennai - A cross-sectional study[J]. J Family Med Prim Care, 2022, 11(12): 7763-7768.
56. Wang J, Xiao LDX, Wang K, et al. Cognitive Impairment and Associated Factors in Rural Elderly in North China[J]. J Alzheimers Dis, 2020, 77(3): 1241-1253.
57. Gondinho F, Maruta C, Borbinha C, et al. Effect of education on cognitive performance in patients with mild cognitive impairment[J]. Appl Neuropsychol Adult, 2022, 29(6): 1440-1449.
58. Freire ACC, Pondé MP, Liu A, et al. Anxiety and Depression as Longitudinal Predictors of Mild Cognitive Impairment in Older Adults[J]. Can J Psychiatry, 2017, 62(5): 343-350.

59. Desai R, Whitfield T, Said G, et al. Affective symptoms and risk of progression to mild cognitive impairment or dementia in subjective cognitive decline: A systematic review and meta-analysis[J]. Aging Res Rev, 2021, 71: 101419.
60. Otsuka T, Tomata Y, Zhang S, et al. Association between social participation and incident risk of functional disability in elderly Japanese: The Ohsaki Cohort 2006[J]. J Psychosom Res, 2018, 111: 36-41.
61. Oliveira-Figueiredo DST, Felisbino-Mendes MS, Velasquez-Melendez G, et al. Association between social network and functional disability in brazilian elderly[J]. Rev Bras Enferm, 2021, 74(3): e20200770.
62. Tomioka K, Kurumatani N, Hosoi H. Association Between Social Participation and Instrumental Activities of Daily Living Among Community-Dwelling Older Adults[J]. J Epidemiol, 2016, 26(10): 553-561.
63. Fuller-Thomson E, Nowaczynski A, MacNeil A. The Association Between Hearing Impairment, Vision Impairment, Dual Sensory Impairment, and Serious Cognitive Impairment: Findings from a Population-Based Study of 5.4 million Older Adults[J]. J Alzheimers Dis Rep, 2022, 6(1): 211-222.
64. Borges KCS, Resende LM, Couto EAB. Hearing function, perception of disability (handicap) and cognition in the elderly: a relation to be elucidated[J]. Codas, 2021, 33(5): e20200150.
65. He Y, Song WT, Jiang X, et al. Longitudinal association between visual disability and cognitive function among middle-aged and older adults in China[J]. Br J Ophthalmol, 2022,
66. Lin FR, Ferrucci L, An Y, et al.Association of hearing impairment with brain volume changes in older adults[J]. Neuroimage, 2014, 90: 84-92.
67. Nixon GK, Sarant JZ, Tomlin D. Peripheral and central hearing impairment and their relationship with cognition: a review[J]. Int J Audiol, 2019, 58(9): 541-522.
68. Binotto MA, Lenardt MH, Rodríguez-Martínez MDC. Physical frailty and gait speed in community elderly: a systematic review[J]. Rev Esc Enferm USP, 2018, 52: e03392.
69. Kang HJ, Bae KY, Kim SW, et al. Impact of Anxiety and Depression on Physical Health Condition and Disability in an Elderly Korean Population[J]. Psychiatry Investig, 2017, 14(3): 240-248.
70. Taş U, Verhagen AP, Bierma-Zeinstra SMA, et al. Incidence and risk factors of disability in the elderly: the Rotterdam Study[J]. Prev Med, 2007, 44(3): 272-278.
71. Duba AS, Rajkumar AP, Prince M, et al. Determinants of disability among the elderly population in a rural south Indian community: the need to study local issues and contexts[J]. Int Psychogeriatr, 2012, 24(2): 333-341.
72. Zhang S, Tomata Y, Tanji F, et al. The relationship between body mass index and disability-free survival in elderly Japanese: the Ohsaki Cohort 2006 Study[J]. Int J Obes(Lond), 2019, 43(11): 2254-2263.
73. Jiang MJ, Zou YQ, Xin QH, et al. Dose-response relationship between body mass index and risks of all-cause mortality and disability among the elderly: A systematic review and meta-analysis[J]. Clin Nutr, 2019, 38(4): 1511-1523.
74. Deckers K, Schievink SHJ, Rodriquez MMF, et al.Coronary heart disease and risk for cognitive impairment or dementia: Systematic review and meta-analysis[J]. PLoS One, 2017, 12(9): e0184244.
75. Liang X, Huang YL, Han X. Associations between coronary heart disease and risk of cognitive impairment: A meta-analysis[J].Brain Behav, 2021, 11(5): e02108.
76. Borges MK, Oiring de Castro Cezar N, Silva Santos Siqueira A, et al. The Relationship between Physical Frailty and Mild Cognitive Impairment in the Elderly: A Systematic Review[J]. J Frailty Aging, 2019, 8(4): 192-197.
77. Chong MS, Tay L, Chan M, et al. Prospective longitudinal study of frailty transitions in a community-dwelling cohort of older adults with cognitive impairment[J]. BMC Geriatr, 2015, 15: 175.
78. Boyle PA, Buchman AS, Wilson RS, et al. Physical frailty is associated with incident mild cognitive impairment in community-based older persons[J]. J Am Geriatr Soc, 2010, 58(2): 248-255.
79. Shimada H, Makizako H, Doi T, et al. Combined prevalence of frailty and mild cognitive impairment in a population of elderly Japanese people[J]. J Am Dir Assoc, 2013, 14(7): 518-524

Figures

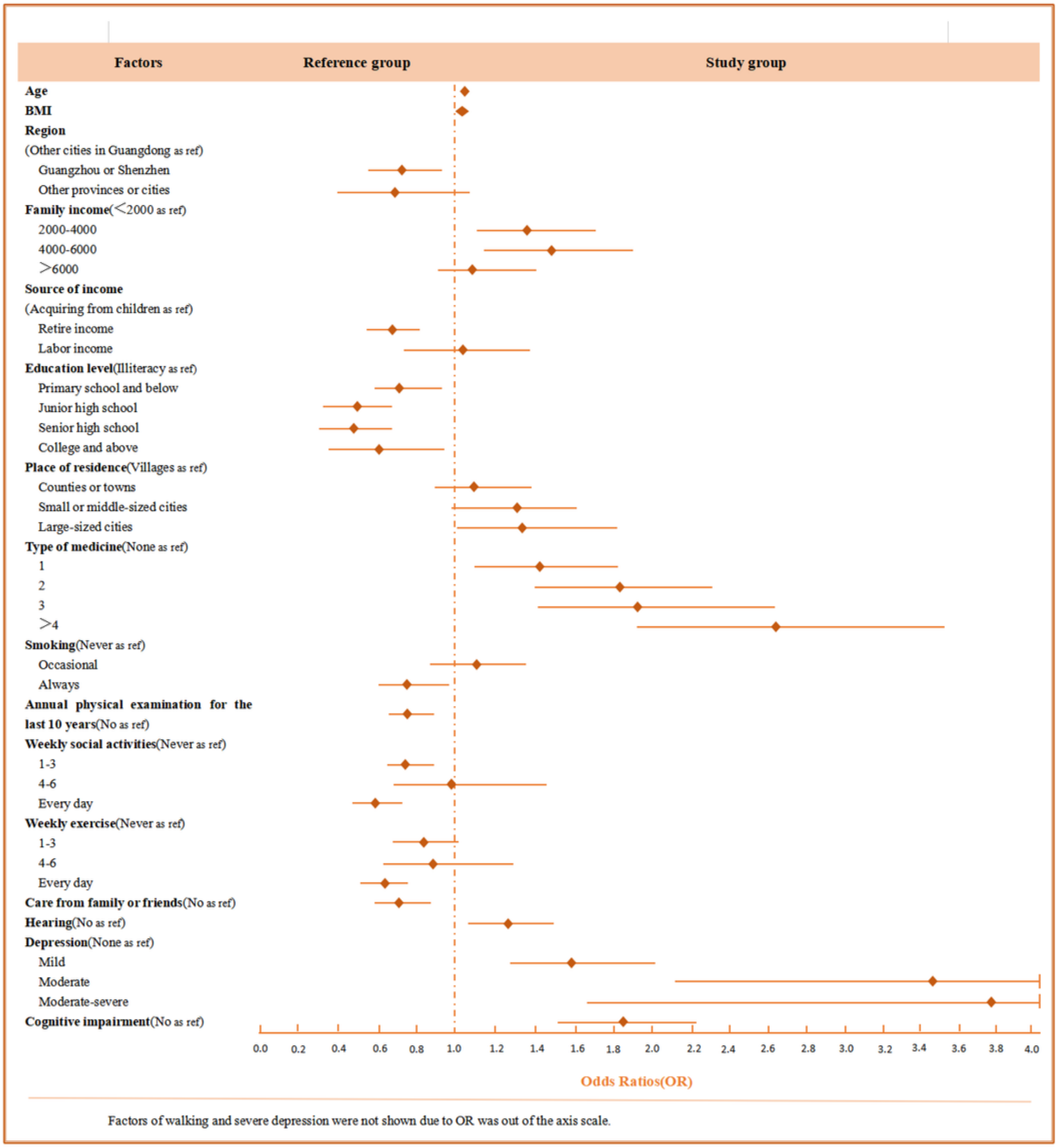

Figure 1

Odds ratios(*OR*) and 95% confidence intervals(95%*CI*) in factors with statistically significant for physical function impairment

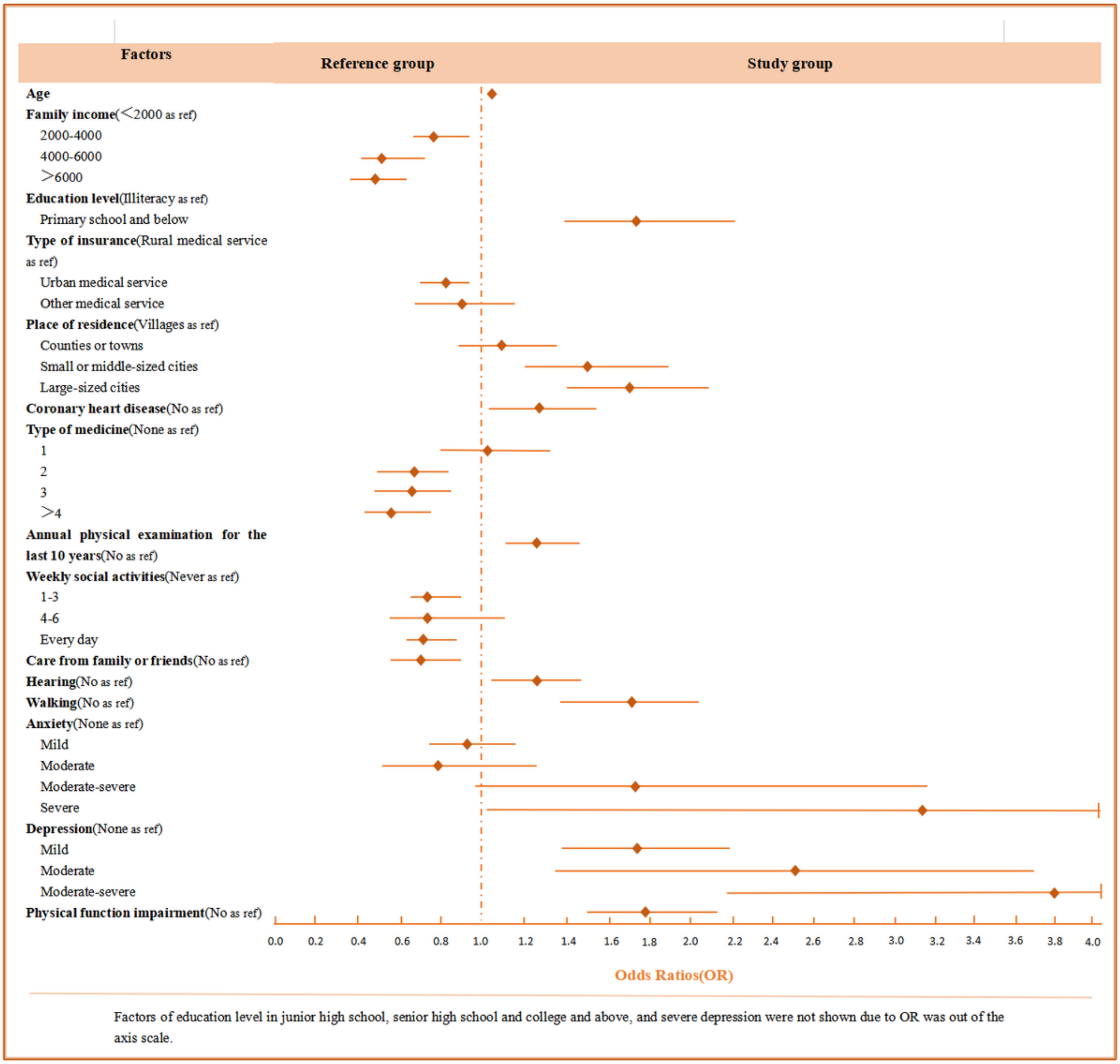

Figure 2

Odds ratios(*OR*) and 95% confidence intervals(95%*CI*) in factors with statistically significant for cognitive impairment