Preplanned Studies

Hearing Loss and Depressive Symptoms Among Community-Dwelling Older Adults — Liaoning, Henan, and Guangdong Provinces, China, 2019–2020

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Summary

What is already known about this topic?

More than half of Chinese older adults over 60 are suffering from hearing loss (HL), which might increase the risk of depressive symptoms.

What is added by this report?

The results indicated a significant association between severe or profound HL and depressive symptoms, characterized by notable age and gender disparities, particularly among women aged 60–74 years old.

What are the implications for public health practice?

Timely intervention and treatment for elderly individuals with HL, particularly younger female elders suffering from severe or profound HL, are pivotal in reducing depressive symptom rates and are key policy considerations.

Hearing loss (HL), a highly prevalent and undertreated disorder in older adults, affects over 60% of the elderly population in China (*1*). A national survey in China revealed that older adults have a higher prevalence of depression compared to other age groups (*2*). HL significantly impacts communication and participation in social activities, potentially leading to social isolation and negatively affecting physical and mental health. Furthermore, research suggests that HL increases the risk of depression (*3*). Scinicariello's study demonstrated age and gender disparities in the association between moderate to severe HL and depressive symptoms among older adults in the United States (*4*). However, there is limited research on this association in older Chinese adults. This study aims to explore the relationship between severe or profound HL and depressive symptoms in the general population, focusing on age and gender differences. Data were obtained from the Prevention and Intervention on Neurodegenerative Disease for Elderly in China (PINDEC) project, which focuses on building capacity for the prevention and intervention of Alzheimer's disease (AD) and Parkinson's disease (PD), as well as other health conditions. This study included 9,865 community-dwelling older adults aged 60 years and older from three provinces in China. The results indicate that younger elderly individuals aged 60–74 are a high-risk group for the association between severe or profound HL and depressive symptoms. Additionally, there is a significant correlation between severe or profound HL and depressive symptoms among elderly women aged 60–74. This study shows that elderly people with severe or profound HL have a significantly increased risk of depressive symptoms. Therefore, developing a national strategy for preventing and managing HL in the elderly population is crucial to reducing the risk of depressive symptoms.

The PINDEC project considered both the degree of aging and balanced geographical distribution when initiating its 2019–2020 survey of community-based residents aged 60 and above in three regions: Liaoning, Henan, and Guangdong provinces. The stratified multi-stage cluster sampling process involved several steps. First, two or three cities were randomly selected from each province. Second, one county and one district were randomly selected from each city. Third, one subdistrict in urban areas and one township in rural areas were selected from each county/district using probability proportionate to size sampling. Finally, 4–8 administrative villages or neighborhood communities were randomly selected from each subdistrict/township using cluster sampling until the desired sample size (1,000 participants) was reached. A total of 12,369 older adults aged 60 and above were initially included (*5*). After excluding participants with missing key variables or who refused to participate in psychological questionnaires and hearing tests, 9,865 respondents remained in the study (Supplementary Figure S1, available at https://weekly.chinacdc.cn/). The study was approved by the Ethnics Committee of

the National Center for Chronic and Non-Communicable Disease Control and Prevention, China CDC (Ref. no.: 201902). All participants were assigned informed consent forms.

HL was measured using the four-frequency air conduction pure-tone average (PTA) in the better ear at 500, 1,000, 2,000, and 4,000 Hz and reported continuously in decibels (dB). Lower hearing thresholds indicated better hearing, while higher thresholds indicated worse hearing. HL severity was defined using the following categories: normal HL (0 to 25 dB), mild HL (26 to 40 dB), moderate HL (41 to 60 dB), and severe or profound HL (61 dB or worse) (*6*). The Patient Health Questionnaire-9 (PHQ-9) was used to screen for depressive symptoms. PHQ-9 scores range from 0 to 27, and participants with scores of 5 or above were identified as having depressive symptoms (*7*).

Categorical variables were described using frequencies and proportions. Differences between subgroups were analyzed using the chi-square test. Multivariable logistic regression models were used to assess the association between depressive symptoms and HL, adjusting for covariates (demographic variables, behavioral factors, and cardiovascular disease). Statistical significance was set at $P<0.05$. All statistical analyses were performed using R software (Version 4.0.5; R Foundation for Statistical Computing, Vienna, Austria).

A total of 9,865 adults (mean age: 68.92±6.46 years) were included in this study (Table 1). Of these, 1,640 (16.62%) met the criteria for depressive symptoms. The prevalence of depressive symptoms was 15.12%, 16.47%, 18.22%, and 23.00% for participants with normal HL, mild HL, moderate HL, and severe or profound HL, respectively ($P<0.001$).

As HL severity increased, a statistically significant trend toward higher levels of depressive symptoms emerged in both male and female older adults ($P<0.001$). However, when stratified by age and gender, a progressively higher rate of depressive symptoms with increasing HL was observed only among women aged 60–74 years (Table 2).

Multivariable logistic regression analyses revealed a significant association between severe or profound HL and depressive symptoms after adjusting for multiple variables [odds ratio (*OR*): 1.52, 95% confidence interval (*CI*): 1.15, 2.01]. This association was also observed among participants aged 60–74 years (*OR*: 1.50, 95% *CI*: 1.04, 2.16). Stratified by gender, the *OR* for severe or profound HL was 1.56 (95% *CI*: 1.00, 2.43) for males in the whole population and 1.60 (95% *CI*: 1.01, 2.56) for females in the 60–74 age group (Table 3).

DISCUSSION

This study analyzed the relationship between HL and depressive symptoms among community-dwelling older people aged 60 years and over in three regions of China (Liaoning, Henan, and Guangdong provinces). The results showed that severe or profound HL was a risk factor for depressive symptoms and that gender was a potential moderator of this association. After stratifying by age group, a positive correlation was observed between HL and depressive symptoms among females aged 60 to 74 years. This suggests that early intervention and treatment of HL in older adults, especially women over 60, to prevent further deterioration may promote psychological well-being and improve quality of life in later life.

Numerous studies have established a correlation between HL and depressive symptoms (*8*). In this study, after accounting for a wide variety of confounders, including demographics, behavioral variables, and cardiovascular risk factors, a positive association between severe or profound HL and depressive symptoms was found (*OR*: 1.52, 95% *CI*: 1.15, 2.01). Behavioral factors may explain this association in older populations (*9*). Hearing is crucial for spoken language communication, so HL is closely linked to social problems. People with HL are more likely to isolate themselves from society, experience social isolation, and have smaller social circles, factors that have been independently associated with depressive symptoms.

This study further explored age differences and found a positive association between severe or profound HL and depressive symptoms among elderly individuals aged 60–74. However, no significant association was observed in those aged 75 and above. One possible explanation is that individuals aged 60–74 are still actively engaged in work and social activities, and HL significantly impacts these aspects of their lives, thereby increasing the risk of depressive symptoms. Conversely, older adults may have adapted to HL over time and developed more effective coping strategies. They may be more proficient in utilizing visual cues or using hearing aids compared to those aged 60–74.

This study also indicated that within the 60–74 age group, women are more prone to depressive symptoms

TABLE 1. Prevalence of depressive symptoms for older adults by characteristics in three provinces in China.

Characteristics	*N* (%)	Depressive symptoms		
		Cases	Prevalence [% (95% *CI*)]	*P*
Total	9,865 (100.00)	1,640	16.62 (15.89, 17.36)	
Age groups, years				<0.001
60–64	2,925 (29.65)	426	14.56 (13.29, 15.84)	
65–69	3,024 (30.65)	473	15.64 (14.35, 16.94)	
70–74	2,015 (20.43)	336	16.67 (15.05, 18.30)	
75–79	1,098 (11.13)	239	21.77 (19.33, 24.21)	
≥80	803 (8.14)	166	20.67 (17.87, 23.47)	
Sex				<0.001
Male	4,184 (42.41)	496	11.85 (10.88, 12.83)	
Female	5,681 (57.59)	1,144	20.14 (19.09, 21.18)	
Area type				<0.001
Urban	4,094 (41.50)	593	14.48 (13.41, 15.56)	
Rural	5,771 (58.50)	1,047	18.14 (17.15, 19.14)	
Education				<0.001
Illiteracy	2,545 (25.80)	576	22.63 (21.01, 24.26)	
Primary school	3,752 (38.03)	582	15.51 (14.35, 16.67)	
Junior high school	2,459 (24.93)	341	13.87 (12.50, 15.23)	
Senior high school and above	1,109 (11.24)	141	12.71 (10.75, 14.67)	
Marital status				<0.001
Non-widowed	7,876 (79.84)	1,231	15.63 (14.83, 16.43)	
Widowed	1,989 (20.16)	409	20.56 (18.79, 22.34)	
Provinces				<0.001
Liaoning	3,262 (33.07)	610	18.70 (17.36, 20.04)	
Guangdong	3,336 (33.12)	364	11.14 (10.06, 12.22)	
Henan	3,267 (33.82)	666	19.96 (18.61, 21.32)	
Neighborhood communication				<0.001
Almost never	1,811 (18.36)	369	20.38 (18.52, 22.23)	
Regular communicate	8,054 (81.64)	1,271	15.78 (14.98, 16.58)	
Social activities				<0.001
Almost never	6,847 (69.41)	1,311	19.15 (18.22, 20.08)	
Regular join activities	3,018 (30.59)	329	10.90 (9.79, 12.01)	
Daily exercise				<0.001
No regular exercise	2,290 (23.21)	502	21.92 (20.23, 23.62)	
Regular exercise	7,575 (76.79)	1,138	15.02 (14.22, 15.83)	
Hypertension				<0.001
No	6,173 (62.57)	920	14.90 (14.02, 15.79)	
Yes	3,692 (37.43)	720	19.50 (18.22, 20.78)	
Diabetes				<0.001
No	8,607 (87.25)	1,367	15.88 (15.11, 16.65)	
Yes	1,258 (12.75)	273	21.70 (19.42, 23.98)	
Dyslipidemia				<0.001
No	8,333 (84.47)	1,245	14.94 (14.18, 15.71)	

Continued

Characteristics	*N* (%)	Depressive symptoms		
		Cases	Prevalence [% (95% *CI*)]	*P*
Yes	1,532 (15.53)	395	25.78 (23.59, 27.97)	
Hearing Loss				<0.001
Normal	3,029 (30.71)	458	15.12 (13.84, 16.40)	
Mild	4,687 (47.51)	772	16.47 (15.41, 17.53)	
Moderate	1,762 (17.86)	321	18.22 (16.42, 20.02)	
Severe or profound	387 (3.92)	89	23.00 (18.80, 27.19)	

Abbreviation: *CI*=confidence interval.

TABLE 2. Prevalence of depressive symptoms among Chinese older adults with different HL levels, by age group and sex.

Grades of hearing loss	Depressive symptoms					
	ALL		60–74 Years		≥75 Years	
	Male	Female	Male	Female	Male	Female
Normal HL	111 (10.28)	347 (17.80)	95 (9.58)	311 (17.25)	16 (18.18)	36 (24.66)
Mild HL	229 (11.31)	543 (20.40)	95 (9.58)	418 (19.14)	47 (12.74)	125 (26.15)
Moderate HL	119 (13.51)	202 (22.93)	73 (12.29)	113 (20.89)	46 (16.03)	89 (26.18)
Severe or profound HL	37 (18.69)	52 (27.51)	15 (16.30)	28 (27.45)	22 (20.75)	24 (27.59)
P	0.003	<0.001	0.126	0.023	0.176	0.968

Abbreviation: HL= hearing loss.

TABLE 3. Multivariable logistic regression analyses between depressive symptoms and HL for older adults in three provinces in China, by age group and sex.

Item	*OR* (95% *CI*)		
	All	60–74 years	≥75 Years
Grades of hearing loss			
Normal HL		Ref.	
Mild HL	1.05 (0.92, 1.20)	1.05 (0.91, 1.20)	0.90 (0.62, 1.29)
Moderate HL	1.16 (0.98, 1.38)	1.06 (0.87, 1.29)	0.89 (0.61, 1.30)
Severe or profound HL	1.52 (1.15, 2.01)*	1.50 (1.04, 2.16)*	1.07 (0.67, 1.71)
Male			
Normal HL		Ref.	
Mild HL	0.98 (0.76, 1.25)	1.07 (0.82, 1.40)	0.65 (0.34, 1.24)
Moderate HL	1.07 (0.79, 1.44)	1.16 (0.83, 1.62)	0.76 (0.39, 1.48)
Severe or profound HL	1.56 (1.00, 2.43)*	1.64 (0.88, 3.04)	1.13 (0.53, 2.42)
Female			
Normal HL		Ref.	
Mild HL	1.11 (0.95, 1.29)	1.11 (0.94, 1.31)	1.11 (0.71, 1.73)
Moderate HL	1.16 (0.94, 1.43)	1.18 (0.92, 1.50)	1.06 (0.67, 1.70)
Severe or profound HL	1.41 (0.99, 2.02)	1.60 (1.01, 2.56)*	1.14 (0.61, 2.14)

Note: Adjusting demographic variables including urban-rural status, educational level, province, and marital status; behavioral variables such as neighborhoods, social activities, and daily exercise; and cardiovascular risk factors such as hypertension, diabetes, and dyslipidemia. Ref. means the control group.
Abbreviation: HL=hearing loss; *OR*=odds ratio; *CI*=confidence interval.
* *P*<0.05.

associated with HL compared to men. Li (*10*) found that self-reported HL was linked to depressive symptoms in older women. Similarly, other research has shown that moderate to severe HL was associated with depressive symptoms among women aged 52–69 in the U.S. (*4*). This may be due to women generally being more expressive of their emotions and more sensitive to self-perception. These findings underscore the need for targeted public health interventions focusing on the mental health of older women. Comprehensive intervention strategies should account for gender differences and provide specialized psychological and social support services for older women, ultimately enhancing their social engagement and psychological resilience.

This study is subject to some limitations. As a cross-sectional study, it could not establish a causal relationship between depressive symptoms and HL. Although this study controlled for many confounding factors, certain variables (like the use of hearing aids) were not included due to data limitations, potentially affecting the results. Additionally, data from western and eastern provinces of China are missing, limiting the generalizability of the findings. Future research should include more regions.

In conclusion, this study demonstrates significant age and gender differences in the relationship between severe to profound HL and depressive symptoms. This relationship was particularly pronounced among women aged 60–74 years. Public health strategies should include more precise interventions tailored to different age and gender groups. For example, regular hearing screenings and mental health assessments should be conducted for women aged 60–74. Additionally, community health education programs can enhance awareness of HL and depressive symptoms among older adults and their families, promoting early detection and intervention to reduce the incidence of depressive symptoms. Furthermore, integrating regular auditory assessments and follow-up appointments ensures that hearing aids are properly adjusted and functioning optimally. Providing access to counseling services for both HL and depressive symptoms, as well as facilitating support groups, can offer emotional support and practical advice.

Conflicts of interest: No conflicts of interest.

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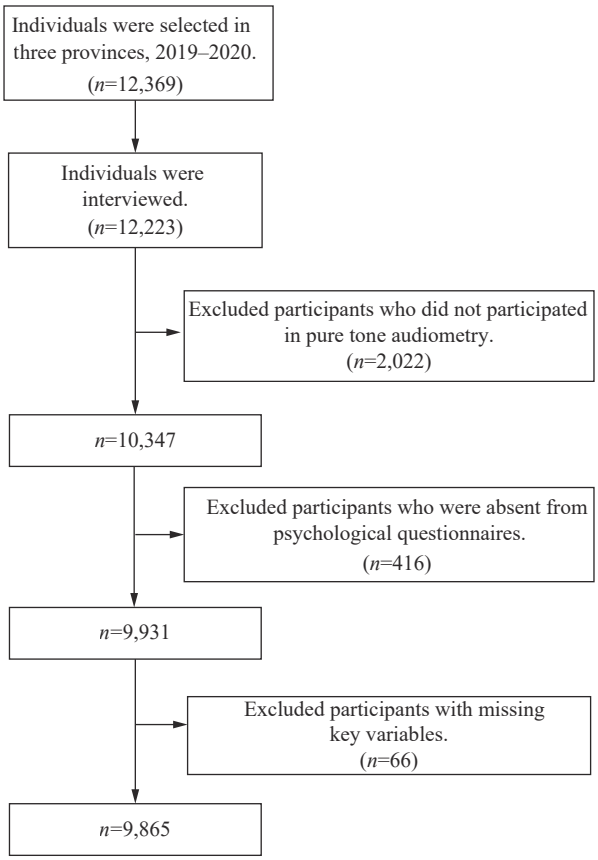
SUPPLEMENTARY MATERIAL



SUPPLEMENTARY FIGURE S1. The flowchart of the study sample.