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Prevalence of depression and its influencing factors in Chinese older population: A Meta-analysis☆

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ABSTRACT

Background: China has become an aged society so that the health status of older population is gaining increasing concern by the researchers overall. Depression especially attracted attention because it impairs the quality of life on one hand and imposes a significant economic burden on both society and families on the other hand. The early detection of depression and comprehensively understanding of factors influencing its prevalence, therefore is crucial. However, currently available research findings lack of consistency. Moreover, much solid evidence from systematic review is insufficient in China.

Objective: To understand the prevalence of depression and its influencing factors among the Chinese older population from 2018 to 2022, providing suggestions on preventing depression among the older population and promoting healthy aging.

Methods: A systematic review was conducted on available published papers on depression of Chinese older population in January 2023, searching multiple online databases including PubMed, EmBase, Web of Science, CNKI, Wanfang Data, and VIP, covering the period from 2018 to 2022. Two independent reviewers selected the papers, assessed the quality of the studies using the cross-sectional study quality assessment criteria recommended by the Agency for Healthcare Research and Quality(AHRQ), then extracted data needed. Meta-analysis was performed using Stata 15.0.

Results: A total of 23 papers were included, covering older population of 75,599, with 13,815 among them identified as depressed. The AHRQ quality assessment scores ranged from 5 to 7. Meta-analysis results indicated that the prevalence of depression among the Chinese older population was 20.6 % [95 % CI (16.6 %, 24.8 %)]. Significant risk factors include gender (female) [OR = 1.46, 95 % CI (1.30, 1.64)], older age [OR = 1.48, 95 % CI (1.13, 1.94)], lower educational level [OR = 1.52, 95 % CI (1.32, 1.75)], absence of a spouse [OR = 1.60, 95 % CI (1.35, 1.91)], rural residency [OR = 1.38, 95 % CI (1.14, 1.66)], having chronic disease [OR = 2.75, 95 % CI (2.07, 3.66)], comorbidities [two: OR = 1.84, 95 % CI (1.07, 3.14); three or more: OR = 3.86, 95 % CI (2.89, 5.15)], poor self-rated health [OR = 3.47, 95 % CI (1.14, 10.53)], insomnia [OR = 2.62, 95 % CI (1.88, 3.66)], living alone [OR = 1.86, 95 % CI (1.56, 2.21)], lack of exercise [OR = 1.88, 95 % CI (1.60, 2.20)], and requiring full or partial assistance for daily living [OR = 2.96, 95 % CI (1.12, 7.85)], all of which were statistically significant ($P<0.05$). Protective factors included alcohol consumption [OR = 0.67, 95 % CI (0.50, 0.88)] and having friends [OR = 0.52, 95 % CI (0.38, 0.71)].

Conclusion: The prevalence of depression among the older population in China is high. Those female, of older age, with a lower level of education, without a spouse, living in rural areas, with chronic diseases and comorbidities, self-rated poor health, suffering from insomnia, living alone, lack of physical exercise, and requiring full or partial assistance for daily living, are more likely to suffer from depression.

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Introduction

Seventh national census of China shows that the population aged 60 and above reached 264.02 million, representing for 18.70 % of the total population. In the context of an increasingly aging population, "healthy aging" is important and essential topic for development and research. "Providing psychological care for the older population" is also a primary objective of the "14th National Five-Year Plan" for healthy aging.[1] Depression is a widespread mood disorder among the older population, which can reduce social functioning[2] and may even lead directly to suicidal behaviors.[3] Numerous cross-sectional studies examined the factors influencing depression among the older population in China, but due to variations in sample size, survey regions, and study populations, the research conclusions show considerable difference, highlighting the need for further investigation. To comprehensively understand the current situation of depression among the older population in China, the current study compiles and reviews literatures published from 2018 to 2022 on factors affecting depression among the older population in China. Employing meta-analysis, this study examines the prevalence and influencing factors of depression, with the aim of offering suggestions for preventing depression among the older population and promoting healthy aging.

Methods

Strategies for literature search

In January 2023, a systematic literature review on factors influencing depression among the older population in China was conducted. This search scanned multiple online databases including PubMed, EmBase, Web of Science, CNKI, Wanfang Data, and VIP, covering the period from 2018 to 2022. The search terms used in Chinese included: older population, old people, depression, factors. The search terms used in English included: Chinese, China, older population, older people, old people, old population, depression, depression disorder, factor, factors.

Inclusion and exclusion criteria for literature selection

The criteria for including literature in the review were: (1) subjects were adults aged 60 years old and over; (2) studies designed as cross-sectional or cohort studies on factors influencing depression among the older population in China, published from 2018 to 2022; (3) the research used clear definition criteria based on the threshold of depression screening scales.

Literatures are excluded if: (1)studies irrelevant to the study objectives; (2) conference presentation papers, reviews, and duplicate publications; (3) studies that focused on special population, such as chronic disease patients, hospitalized patients, or disabled older population; (4) valid statistical data cannot be obtained.

Literature selection and data extraction

The search results from different databases were imported into the literature management software Note Express to eliminate duplicates. Two researchers independently screened the literature and cross-checked their findings. In case of disagreements, a third researcher was consulted for a decision. During literature screening, titles and abstracts were initially reviewed to exclude articles clearly not meeting the inclusion criteria. The remaining articles were then assessed in full text to finalize the inclusion of literature. The researchers extracted the first author's name, publication year, survey period, geographic region, sample size, screening scale, depression prevalence, and influencing factors.

Quality control of literature

The assessment of publication bias followed the Cross-sectional Study Quality Assessment recommended by the Agency for Healthcare Research and Quality (AHRQ), evaluating 11 items and assigning scores with articles rated 0–3, 4–7, and 8–11 classified as low, moderate, and high quality, respectively. Two independent researchers conducted the literature quality assessment, resolving any disagreements through discussion or consultation with a third researcher.

Statistical analysis

Meta-analysis was conducted using Stata 15.0 software, with the effect sizes represented by the odds ratios (ORs) and their 95 % confidence intervals (CIs) for factors influencing depression in the older population.

Heterogeneity among the study results was assessed using the I^2 test. An I^2 value more than 50 % and a P-value less than 0.10 indicated significant heterogeneity, for which a random effects model was applied for meta-analysis. An I^2 value less than 50 % and a P-value greater than 0.10 indicated low heterogeneity, for which a fixed-effects model was employed. The sensitivity of the combined results was evaluated by comparing the differences between the random-effects model and the fixed-effects model effect sizes. Publication bias among the included studies was assessed using funnel plots and Egger's test, with $P < 0.05$ considered statistically significant.

Results

Selection of literature

The initial search yielded 3688 publications, with 2889 in Chinese and 799 in English. After two rounds of screening, a total of 23 articles were finally included, comprising 20 in Chinese[4-23] and 3 in English.[24-26] The literature screening process is depicted in Fig. 1.

Characteristics and quality assessment of selected publications

The studies were conducted between 2018 and 2021, covered 75,599 participants in total, from which 13,815 older individuals with depression were identified. The lowest depression detection rate was 5.19 %,[26] and the highest was 58.90 %.[11] Twelve articles[5-6,9-11,17-20,24-26] examined regions in the eastern part of China, five articles[8,13,20,22,23] were from central areas, four articles[4,12,14,21] focused on western areas, and two articles[7,20] explored the northeastern region.

Two articles[15-16] used probability sampling to represent the national demographic, sourced from the China Family Panel Studies (CFPS)[15] and the China Health and Retirement Longitudinal Study (CHARLS)[16]; eleven papers[4-5,7-10,12,14,18,22,26] employed the Geriatric Depression Scale (GDS), seven[11,13,19-21,23-24] adopted the Patient Health Questionnaire (PHQ-9), three[15-17] adopted the Center for Epidemiologic Studies Depression Scale (CES-D), and two[6,25] employed the Self-Rating Depression Scale (SDS); 19 influencing factors were investigated, including gender, age, educational level, marital status, residence, occupation before retirement, personal monthly income, having chronic diseases, number of chronic diseases, self-rated health status, sleep quality, smoking, alcohol consumption, living alone, physical exercise, having friends, religious beliefs, self-care ability, and having children. The basic characteristics of the 23 referenced articles are presented in Table 1.

Quality assessment indicated that six studies[4,13,17,19-20,22] scored 5 points, thirteen articles[5-12,14,18,21,23,26] scored 6 points, and four articles[15-16,24-25] scored 7 points, reflecting moderate-quality studies.

Meta-analysis of prevalence of depression in Chinese older population

Heterogeneity analysis indicated significant heterogeneity among the studies (I^2=99.5 %, P<0.001); therefore, a random-effects model was applied to combine the effect sizes. The results showed that the overall prevalence of depression among Chinese older population was 20.6 % [95 % CI (16.6 %, 24.8 %)], as shown in Fig. 2.

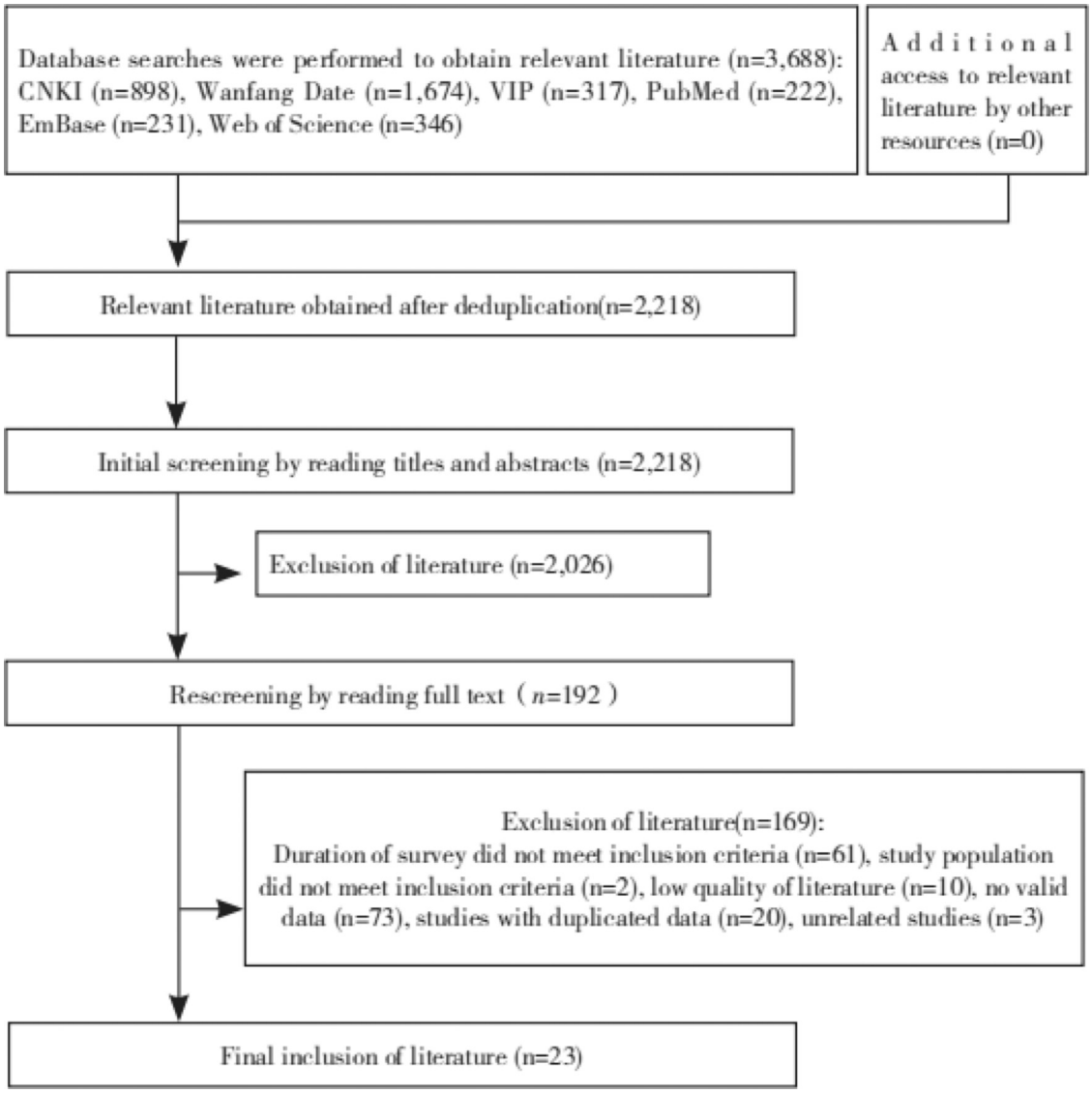

Fig. 1. Literature screening flowchart.

Meta-analysis of influencing factors of depression in Chinese older population

A meta-analysis was performed on the 19 influencing factors. There was no heterogeneity among studies regarding the factor of having friends, thus a fixed-effect model was applied to the meta-analysis.

In the case of factors such as gender, age, educational level, marital status, residence, occupation before retirement, personal monthly income, having chronic diseases, number of chronic diseases, self-rated health status, sleep quality, smoking, alcohol consumption, living alone, physical exercise, religious beliefs, self-care ability, and having children, significant heterogeneity was observed among the studies, a random-effects model was used for the meta-analysis.

The results of the meta-analysis showed that being female, older age (≥ 80 years), lower educational level, absence of a spouse, rural residency, having chronic disease, comorbidity of two or more chronic diseases, poor self-rated health, insomnia, living alone, lack of exercise, and requiring full or partial assistance for daily living were risk factors for depression in the older population ($P < 0.05$). Conversely, alcohol consumption and having friends were protective factors against depression ($P < 0.05$), as shown in Table 2.

Sensitivity analysis

Sensitivity analysis was conducted under both fixed-effect and random-effects models, determining the OR values and 95 % CIs for each influencing factor.

The findings indicated that, except for the calculations for poor self-rated health and the requiring full or partial assistance for daily living, which showed significant differences, the OR values and their 95 % CIs remained consistent across both models for the other factors. This consistency underscores the stability of the meta-analysis results, as detailed in Table 3.

Publication bias analysis

In this study, more than 10 articles were considered for the factors of gender, age, educational level, marital status, living alone, and physical exercise, facilitating an evaluation of publication bias. The funnel plot showed a predominantly symmetrical distribution of the studies of these six factors, as illustrated in Fig. 3. Egger's test(P=0.774, 0.513, 0.398, 0.795, 0.132, 0.212) indicated no evident publication bias ($P > 0.05$).

Table 1
Characteristics of the studies included in the meta-analysis.

First author	Year	Time of investigation (year)	Area	Sample size	Detection scale	Detection rate (%)	Influencing factors
Ying Cao[4]	2019	2018	Sichuan	615	GDS-30	24.72	①③⑧⑩⑪⑫⑬⑭⑮
Guorui Li[5]	2020	2018	Fujian	1 029	GDS-15	8.30	①④⑤⑩⑭⑯
Weiquan Lin[6]	2020	2018	Guangdong	338	SDS	27.81	①②③④⑥⑱
Shuang Zhang[7]	2020	2019	Liaoning	120	GDS-30	21.70	①③④⑦⑧⑭⑮
Xueyan Cui[8]	2021	2019	Henan	430	GDS-15	22.30	①②③⑨⑭
Yue Han[9]	2021	2019	Shandong	915	GDS-15	16.90	①②③⑧
Minmin Jiang[10]	2021	2018	Guangdong	300	GDS-30	31.66	①②③④
Cuiling Jin[11]	2021	2020	Beijing	224	PHQ-9	58.90	①③④⑧⑭⑱⑲
Jiazhong Li[12]	2021	2019	Sichuan	783	GDS-30	20.56	①②③④⑩⑪⑮⑱
Yi Liu[13]	2021	2019	Hunan	13 362	PHQ-9	8.79	①⑤⑨⑭⑰
Xiangeng Zhang[14]	2021	2019	Chongqing	290	GDS-30	30.30	①②④⑫⑬⑭⑮
Ting Yang[15]	2021	2018	Nationwide	7 138	CES-D	30.70	①④⑤⑩⑮⑰
Han Zhao[16]	2021	2018	Nationwide	6 159	CES-D	24.05	①③⑤⑥⑧⑫⑬⑮
Chuangchuang Guo[17]	2022	2019—2020	Jiangsu	2 345	CES-D	23.60	①②③④⑤⑫⑬⑮⑰
Yang Li[18]	2022	2019	Shanghai	2 518	GDS-30	13.38	①②③④⑦⑪⑫⑬⑭
Yiwen Qin[19]	2022	2020	Shandong	1 004	PHQ-9	9.26	①②④⑥⑧⑫⑬⑭⑮⑯
Dan Wang[20]	2022	2019	Liaoning, Henan and Guangdong	14 335	PHQ-9	15.45	①②③④⑤⑭⑮
Jiqing Yu[21]	2022	2021	Ningxia	1 937	PHQ-9	39.24	①③④⑤⑭
Zhengjun Guo[22]	2022	2020	Henan	7 673	GDS-15	29.52	①②③④⑤⑦⑩⑰⑱⑲
Hongyu Wang[23]	2022	2020—2021	Anhui	1 382	PHQ-9	11.00	①②③④⑤⑧⑭⑮⑯⑰⑲
QIU[24]	2020	2019	Jiangsu	5 090	PHQ-9	15.10	①③④⑨⑭⑱
LIN[25]	2021	2018—2019	Tianjin	4 933	SDS	12.20	①③⑨⑭⑮
WANG[26]	2022	2018	Hebei	2 679	GDS-30	5.19	①③⑨⑫⑬

Note: GDS=Geriatric Depression Scale, SDS=Self Rating Depression Scale, PHQ-9=Patient Health Questionnaire, CES-D=Center for Epidemiological Research Depression Scale; ① Gender; ② Age; ③ Educational level; ④ Marital status; ⑤ Residence; ⑥ Occupation before retirement; ⑦ Monthly Personal Income; ⑧ Chronic diseases; ⑨ Number of chronic diseases;⑩ Self-assessed health status; ⑪ Sleep; ⑫ Smoking; ⑬ Alcohol consumption; ⑭ Living alone; ⑮ Physical activity; ⑯ Having friends; ⑰ Religious beliefs; ⑱ Self-care situation; ⑲ Having children.

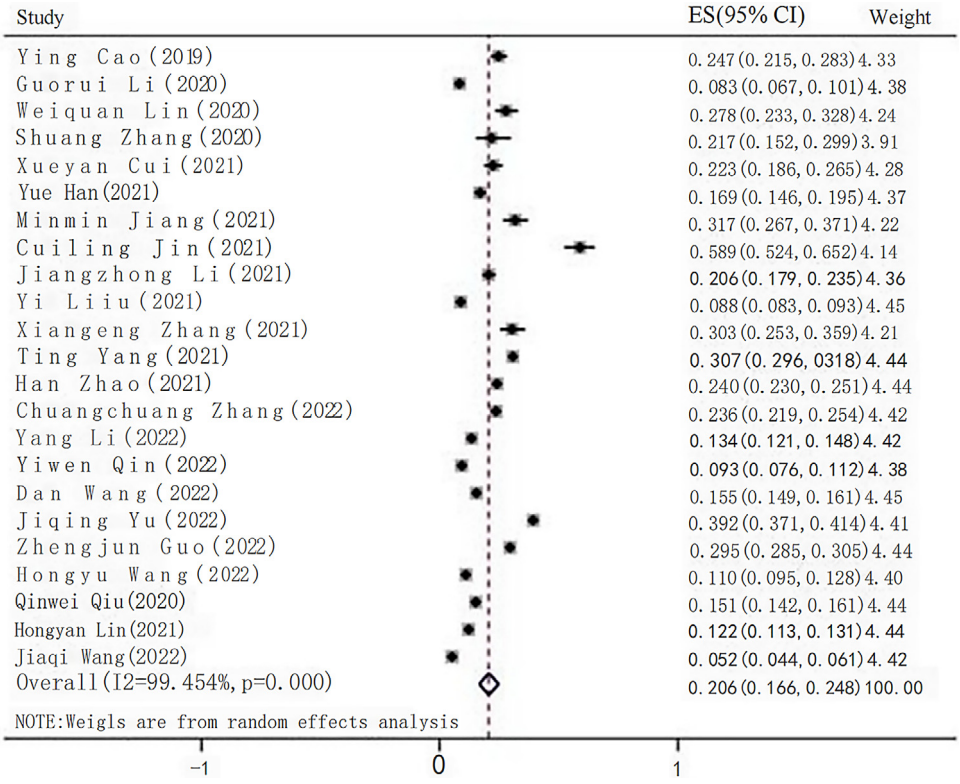

Fig. 2. Forest plot for depression detection rate of the older population in China.

Discussion

This study included 23 cross-sectional studies on the prevalence of depression and its influencing factors among the older population in China since 2018. The meta-analysis indicates that the prevalence of depression among the older population in China is 20.6 % [95 % CI (16.6 %, 24.8 %)], which is lower than the results of previous studies.[27-28] The variation among different study results can be attributed in part to factors such as sample size, survey regions, and study populations; additionally, it reflects the growing attention and support policies for the mental health of the older population. However, the figure is higher than that published in the "China National

Table 2
Meta analysis of factors influencing depression in older population.

Influencing factors	Comparison group	Control group	Included studies	Heterogeneity test		Heterogeneity test	Heterogeneity test	
				I^2 (%)	*P* value		*OR* (95 %*CI*)	*P* value
Gender	Female	Male	23[4-26]	84.1	<0.001	Random	1.46 (1.30, 1.64)	<0.001
Age	≥80 years	60–79 years	12[6,8-10,12,14,17-20,22-23]	86.5	<0.001	Random	1.48 (1.13, 1.94)	0.005
Educational level	Lower	Higher	18[4,6-12,16-18,20-26]	83.8	<0.001	Random	1.52 (1.32, 1.75)	<0.001
Marital status	No spouse	With a spouse	16[5-7,10-12,14-15,17-24]	87.6	<0.001	Random	1.60 (1.35, 1.91)	<0.001
Residence	Rural	Urban	9[5,13,15-17,20-23]	92.8	<0.001	Random	1.38 (1.14, 1.66)	0.001
Occupation before retirement	Agriculture and animal husbandry	Non-farming and animal husbandry	3[6,16,19]	90.7	<0.001	Random	1.24 (0.51, 3.04)	0.636
Monthly Personal Income	0–999 Yuan	≥2 000 Yuan	3[7,18,22]	68.2	0.043	Random	1.43 (0.91, 2.24)	0.124
	1000–1999 Yuan	≥2 000 Yuan	3[7,18,22]	89.4	<0.001	Random	1.32 (0.64, 2.73)	0.460
Chronic Disease	With	None	7[4,7,9,11,16,19,23]	58.6	0.025	Random	2.75 (2.07, 3.66)	<0.001
Number of chronic diseases	1	0	4[8,13,25-26]	87.7	<0.001	Random	1.22 (0.79, 1.88)	0.361
	2	0	3[8,13,26]	69.7	0.037	Random	1.84 (1.07, 3.14)	0.027
	≥3	0	3[8,13,24]	61.0	0.077	Random	3.86 (2.89, 5.15)	<0.001
Self-assessed health status	General	Good	5[4-5,12,15,22]	97.8	<0.001	Random	1.34 (0.64, 2.82)	0.435
	Poor	Good	5[4-5,12,15,22]	99.1	<0.001	Random	3.47 (1.14, 10.53)	0.028
Sleep	Insomnia	No insomnia	3[4,12,18]	62.1	0.071	Random	2.62 (1.88, 3.66)	<0.001
Smoking	Yes	No	7[4,14,16-19,26]	90.6	<0.001	Random	0.68 (0.46, 1.02)	0.061
Alcohol consumption	Yes	No	7[4,14,16-19,26]	80.6	<0.001	Random	0.67 (0.50, 0.88)	0.005
Living alone	Yes	No	14[4,5,7-8,11,13-14,18-21,23-25]	70.1	<0.001	Random	1.86 (1.56, 2.21)	<0.001
Physical activity	No Exercise	Exercise	11[4,7,12,14-17,19-20,23,25]	76.5	<0.001	Random	1.88 (1.60, 2.20)	<0.001
Having friends	Yes	No	3[5,19,23]	0	0.587	Fixed	0.52 (0.38, 0.71)	<0.001
Religious beliefs	Yes	No	5[13,15,17,22-23]	58.1	0.049	Random	1.13 (0.95, 1.33)	0.167
Self-care situation	Required or partially required	Not Required	5[6,11-12,22,24]	98.3	<0.001	Random	2.96 (1.12, 7.85)	0.029
Having children	Yes	No	3[11,22-23]	79.9	0.007	Random	0.91 (0.30, 2.80)	0.875

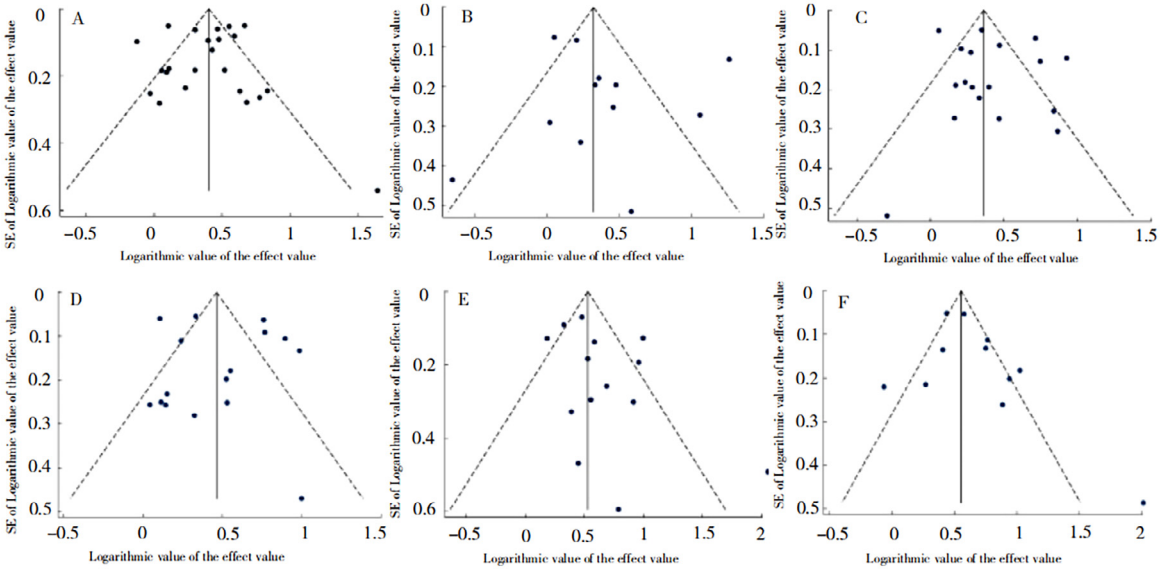

Fig. 3. Funnel plot of publication bias for each influencing factor.
Note: A represents gender, B represents age, C represents education level, D represents marital status, E represents living alone, and F represents exercise.

Mental Health Development Report (2021–2022)" ,[29] where the prevalence of depression among Chinese adults was 10.6 %, indicating a need to increase future efforts in psychological care for the older population.

Being female is identified as a risk factor for depression in the older population, likely due to neurohormonal and psychological differences that result in gender-related susceptibility to depression.[24] Additionally, comparing with older males, older females are more potential widowed and live alone, increasing the risk of depression.[30-31] Advanced age further compounds this risk, possibly due to declines in self-care abilities and cognitive functions that accompany aging.[32] Furthermore, older adults at advanced ages are more likely to live alone and experience frailty,[33-34] both of which can increase the risk of depression. Conversely, higher levels of education appear to lower the risk of depression among the older population; this is likely because higher education levels are associated with better health literacy,[35] and enhanced health literacy empowers older adults to better maintain and promote their mental health.[36] Living in rural areas has been identified as a risk factor for depression among the older population, possibly due to the disparities in economic and health statuses between urban and rural seniors,[37] with those in urban areas generally having greater access to health information and resources. The findings of this study highlight

Table 3
Sensitivity analysis of factors influencing depression in older population.

Influence factors	Random effects model 〔*OR* (95 %*CI*)〕	Fixed effects model 〔*OR* (95 %*CI*)〕
Female	1.46 (1.30, 1.64)	1.50 (1.44, 1.56)
≥80 years old	1.48 (1.13, 1.94)	1.35 (1.24, 1.47)
Lower educational level	1.52 (1.32, 1.75)	1.44 (1.38, 1.52)
No spouse	1.60 (1.35, 1.91)	1.57 (1.49, 1.66)
Living in rural areas	1.38 (1.14, 1.66)	1.39 (1.33, 1.46)
Chronic diseases	2.75 (2.07, 3.66)	2.45 (2.12, 2.82)
Suffering from 2 chronic diseases	1.84 (1.07, 3.14)	2.41 (1.98, 2.92)
Suffering from more than 3 chronic diseases	3.86 (2.89, 5.15)	4.16 (3.55, 4.87)
Poor self-rated health	3.47 (1.14, 10.53)	2.03 (1.87, 2.20)
Insomnia	2.62 (1.88, 3.66)	2.78 (2.30, 3.36)
Alcohol Consumption	0.67 (0.50, 0.88)	0.72 (0.66, 0.79)
Lives alone	1.86 (1.56, 2.21)	1.68 (1.55, 1.82)
No exercise	1.88 (1.60, 2.20)	1.74 (1.63, 1.85)
Having friends	0.52 (0.38, 0.70)	0.52 (0.38, 0.71)
Requiring full or partial assistance for daily living	2.96 (1.12, 7.85)	2.40 (2.16, 2.67)

the critical need to focus on women, the older population, those with lower educational levels, and rural residents in the screening and intervention processes for depression.

Integration of mental health screenings with family doctor contract services and incorporating them into health examinations for the older population at primary health care facilities, coupled with community-based health education initiatives for the older population, could enhance their health literacy and mental health status.

In terms of subjective factors, poor self-rated health status emerges as a significant risk factor for depression among the Chinese older population, with those perceiving their health as poor being 3.47 times more likely to experience depression compared to those with positive self-assessments. This may be attributed to the fact that self-rated health significantly reflects the older population's objective health status, which in turn significantly affects depression levels.[38] In contrast to negative and pessimistic older adults, those who are positive and optimistic often perceive their health more favorably than their actual condition.[39] Consequently, an optimistic personality is significantly negatively correlated with depression.[40] Therefore, it's essential not only to focus on improving the physical health conditions of the older population but also to promote their mental health, encouraging a more positive and optimistic approach to life.

In terms of objective factors, absence of a spouse, suffering from chronic diseases, suffering from two or more chronic diseases, experiencing insomnia, living alone, lack of exercise, and requiring full or partial assistance for daily living are identified as risk factors for depression in the older population. Conversely, alcohol consumption and having a supportive social network (friends) act as protective factors.

This study demonstrates that older individuals with chronic diseases are at a 2.75 times greater risk of developing depression compared to those without such conditions, and this risk increases to 3.86 times for those with three or more chronic diseases. Moreover, older individuals experiencing insomnia are at a 2.62 times higher risk of depression than those without sleep issues, and those requiring full or partial assistance for daily living face a 2.96 times greater risk than those who are mostly independent. Consequently, increased attention should be paid to older individuals with chronic diseases and comorbidities, insomnia, and those requiring full or partial assistance for daily living. Efforts should be accelerated to improve the prevention health service system for chronic diseases , focus on the quality of sleep, and increase health care services for disabled older adults.

There are several limitations associated with this study: (1) The depression screening scales used in the reviewed literatures were not standardized, potentially leading to biased results; (2) The number of studies addressing certain influencing factors was limited, which may result in biased conclusions, and these findings need further validation; (3) The definitions and measurement standards for some influencing factors, such as marital status, varied across the reviewed literature, causing significant heterogeneity among the studies and impacting result accuracy; (4) Due to publication delays, some studies conducted in 2022 were not included, leading to potential time-lag bias. To address these issues, future research should involve more large-scale, high-quality epidemiological surveys employing random sampling methods to validate and refine the findings of this study.

Conclusion

In summary, the prevalence of depression among the older population in China remains elevated. Notably, older individuals who are female, of advanced age, less educated, without a spouse, residing in rural areas, suffering from chronic diseases, experiencing comorbidities, reporting poor self-rated health, experiencing insomnia, living alone, not engaging in physical exercise, and those requiring full or partial assistance in daily living exhibit higher prevalence of depression. Future efforts in caring for the mental health of the older population could take these findings as reference points for focusing their initiatives.

Authors' contributions

Conceptualization, W.Y.; Methodology, W.Y.; Data curation, W.Y. and C.Q.; Formal analysis, W.Y.; Funding acquisition, not applicable; Project administration, not applicable; Resources, not applicable; Supervision, L.L.; Validation, L.L.; Writing—original draft, W.Y. and C.Q.; Writing—review and editing, L.L. All authors have read and agreed to the published version of the manuscript.

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data and materials

Not applicable.

Declaration of competing interest

The authors declare that they have no competing interests.

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Authors' other information

Not applicable.

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