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Global prevalence of depression, anxiety, and stress in the elderly population: a systematic review and meta-analysis

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Abstract

Background Several preliminary studies have been conducted in the field of the prevalence of depression, anxiety, and stress in the elderly population. These studies have examined the prevalence in limited geographic areas with small sample sizes. Also, there are many limitations in the meta-analysis studies. The objective of the present study was to synthesize the global prevalence statistics of depression, anxiety, and stress in the elderly population through a systematic review and meta-analysis.

Methods The present systematic review included retrieval of primary studies from the oldest relevant study up to 2023. To find the relevant studies, international databases such as Scopus, Embase, PubMed, and Web of Science (WoS) were systematically searched. Also, a manual search was performed through the Google Scholar search engine and a review of the sources of related articles. The qualitative assessment of the studies was conducted using the Joanna Briggs Institute (JBI) checklist. Due to a high heterogeneity among the study results, a Random Effects model was chosen.

Results A total of 42 articles on depression, 47 articles on anxiety and 13 articles on stress were included in the meta-analysis. The overall estimates for prevalence based on a random-effects model were as follows: depression, 19.2% (95% CI: 13.0 – 27.5%); anxiety, 16.5% (95% CI: 11.1 – 22.8%); and stress, 13.9% (95% CI: 5.5 – 30.9%). The highest prevalence of depression and anxiety was recorded in Africa. The prevalence of depression was higher in nursing homes, and stress was more prevalent in individuals with COVID-19 compared to other populations.

Conclusion The findings revealed a high prevalence of depression, anxiety, and stress in the elderly population. Therefore, it is recommended that healthcare professionals and policymakers pay more attention to the prevention and management of these disorders in the elderly population.

Keywords Prevalence, Depression, Anxiety, Elderly population, Systematic review, Meta-analysis

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Introduction

Old age is a sensitive phase in human life, and addressing the issues, needs, and diseases associated with this stage of life is a social imperative [1]. The World Health Organization (WHO) defines individuals aged 65 and above as elderly, and a large portion of the elderly population live in developing countries [2]. Today, advancements in technology, increased life expectancy, and declining fertility rates have led to a global rise in the elderly population, making aging a paramount public health challenge [3, 4]. According to United Nations reports, the global elderly population is projected to double by 2050, reaching one billion individuals compared to 524 million in 2010. Thus, older adults will comprise a substantial proportion of the world's total population in the near future [5, 6].

The process of aging features diverse physiological changes in various bodily systems [7]. According to the WHO, aging is a relative, intrinsic, psychological, and social phenomenon [8]. With aging, chronic diseases such as cardiovascular diseases, cancer, respiratory diseases, and diabetes can threaten the health of the elderl [9, 10]. Furthermore, the onset of old age significantly influences individuals' psychological capacity, and may lead elderly individuals to experience various psychological challenges [11], including depression, anxiety, and stress [12]. Depression in the elderly is a serious mental health concern that can contribute to physical illnesses, reduce post-treatment recovery, and even lead to suicide attempt [13]. Anxiety, another significant psychological issue in the elderly (an unpleasant and vague feeling associated with a sense of uncertainty about an unknown factor) [14–18], can impair functional capabilities and overall quality of life when its intensity increases [19]. Another prominent psychological issue is stress, which affects 5–50% of elderly individuals [20] and has a potentially profound impact on their mental and physical health. The prevalence of stress among the elderly has been gradually increasing and is predicted to double over the next decade [21].

The meta-analysis study by Zenebe et al. found the prevalence of depression in the elderly to be 31.74% [22], Sarokhani et al. prevalence of depression and meta-analysis in Iranian elderly is 43% [23], Abdoli et al. prevalence of major depression (MDD) among the elderly was 13.3% [24], and Yan et al. reported the prevalence of depression and anxiety in Chinese elderly during the Covid-19 era as 26% and 23%, respectively [25].

Several preliminary studies have been conducted in recent years in the field of the prevalence of depression, anxiety, and stress in the elderly population in different regions of the world [26–29]. However, these studies have examined the prevalence in limited geographic areas with small sample sizes. Furthermore, none of the reviewed studies have investigated potential factors such as the study year, sample size, and average age of the elderly subjects. Additionally, given the changing population demographics in different parts of the world, the prevalence rates have not been reported separately for different continents. Also, there are many limitations in the meta-analysis studies. Therefore, it appears necessary to conduct a systematic review and meta-analysis to consolidate, summarize, and resolve discrepancies in the results of previous studies, investigate potential factors, and provide an overall estimate of the prevalence of depression, anxiety, and stress in the elderly population. To our knowledge, such a study has not been conducted thus far. Therefore, the present study aims to determine the global prevalence of depression, anxiety, and stress in the elderly through a systematic review and meta-analysis.

Method

A systematic review and meta-analysis was conducted following the PRISMA 2020 guidelines, comprising Identification, Screening, Eligibility, and Inclusion [30]. To reduce publication bias and errors, all stages of the search, assessment, article selection, and data extraction were independently carried out by two researchers (M.K and Z.K) and, in case of disagreements, consensus was initially reached through discussion and ultimately by consulting a third party (A.J).

Finding studies

To find articles relevant to the research question ("What is the global prevalence of depression, anxiety, and stress in the elderly?"), international databases, including Scopus, Embase, PubMed, and Web of Science (WoS), were examined. Search strategies in the databases were formulated by utilizing relevant and validated keywords, including MeSH terms, and combining them using OR and AND operators. For instance, the search strategy in PubMed was structured as follows:

(((Prevalence[MeSH Terms]) OR (Prevalence[Title/Abstract])) AND (((((((((Depressive Disorder[MeSH Terms]) OR (Depression[MeSH Terms])) OR (Depression*[Title])) OR (Depressiv*[Title])) OR (Anxiety*[Title])) OR (Anxieties[Title])) OR (Anxiety[MeSH Terms])) OR (Stress*[Title])) OR (Stress Disorders, Traumatic, Acute[MeSH Terms]))) AND ((((((Elderly[Title/Abstract]) OR (Old*[Title/Abstract])) OR (Geriat*[Title/Abstract])) OR (Elderlys[Title/Abstract])) OR (Elderlies[Title/Abstract])) OR (Aged[Title/Abstract])). No time restrictions were imposed in the search for studies to retrieve all potentially relevant articles up to July 2023. Ultimately, to maximize the comprehensiveness of the search, the Google Scholar search engine and manual examination of all articles related to the study's objectives were conducted.

Inclusion criteria

1. Observational studies.
2. Availability of the full-text article.
3. Reporting the prevalence rates of depression, anxiety, and stress in the elderly.
4. Specified sample size.

Exclusion criteria

1. Interventional studies, case series, case reports, letters to the editor, conference papers, theses, qualitative studies, animal studies, systematic reviews, and meta-analyses.
2. Studies indexed in more than one database.

Selection process of studies

All studies obtained from the databases were imported into the EndNote X8. Initially, studies that were duplicated across different databases were excluded. Subsequently, the titles and abstracts of studies were reviewed using inclusion and exclusion criteria, and studies unrelated to the topic were excluded. In the eligibility stage, a thorough examination of the full text of the studies was conducted, and studies not aligned with the research objectives were excluded. Finally, articles meeting all inclusion criteria underwent a qualitative assessment. The searchers conducting the article extraction were blind to the authors, institutions, and journals being examined.

Qualitative evaluation

The qualitative assessment of the studies was conducted using the Joanna Briggs Institute (JBI) checklist, a standard and widely recognized tool for evaluating the quality of prevalence studies [31]. This checklist comprises nine distinct questions covering sample frame, participants, sample size, participants, study subjects and the setting described in detail, data analysis, valid methods for identifying conditions, measuring the situation, statistical analysis, and adequate response rate. Each item was assessed as "Yes" if indicated, "No" if not indicated, or "NA" if not reported. Scores ranged from a minimum of 0 to a maximum of 9 based on the number of "Yes" responses.

Data extraction

To extract data, a pre-prepared electronic form based on the checklist was utilized. The items included in this checklist were the first author, publication year, country and continent, mean age, sample size, diagnostic tool, prevalence percentage, study population, and the qualitative assessment score.

Statistical analysis

The index examined in this study was the prevalence percentage of depression, anxiety, and stress in the elderly. To combine the results from different studies, the prevalence rates reported in each study were employed. Heterogeneity among the studies was assessed using the I^2 statistic, and due to a high heterogeneity ($I^2 > 75\%$) among the study results, a Random Effects model was chosen. In this model, parameter variations among studies are also calculated, so that the results of the model have a higher generalizability in heterogeneity conditions than the Fixed Effects model. Funnel plot and Begg and Mazumdar rank correlation were used to check publication bias. Additionally, for assessing the relationship between the global prevalence percentages of depression, anxiety, and stress in the elderly and the publication year, mean age, and sample size, Meta-Regression was employed. Subgroup analyses were performed based on different continents. Data were analyzed using Comprehensive Meta-Analysis (Version 2) software, and a P-value of less than 0.05 was considered statistically significant.

Results

Study characteristics

Summary of the study selection process

The initial search using predefined search strategies across various databases, a total of 30,283 studies were retrieved, of which 24,592 duplicate and overlapping studies across different databases were excluded. Following the evaluation of titles and abstracts, 5,691 studies were retained, while 4,896 studies were subsequently excluded for being irrelevant to the topic. Consequently, 795 remaining studies underwent a full-text review, with 737 studies excluded for failing to meet inclusion criteria. Ultimately, 58 articles meeting the entry criteria were included in the meta-analysis. The flowchart of the PRISMA 2020 process is depicted in Fig. 1.

General specifications of the studies

The oldest study included in this analysis dated back to 1987, while the most recent study was published in 2023. The majority of studies (14 studies) were related to the United States. The study with the largest and smallest sample sizes belonged to Maercker et al. with 65,512 participants [32], and Kvaal et al. with 40 participants [33] respectively. The details of the studies that met the inclusion criteria for the systematic review and meta-analysis are summarized in Table 1.

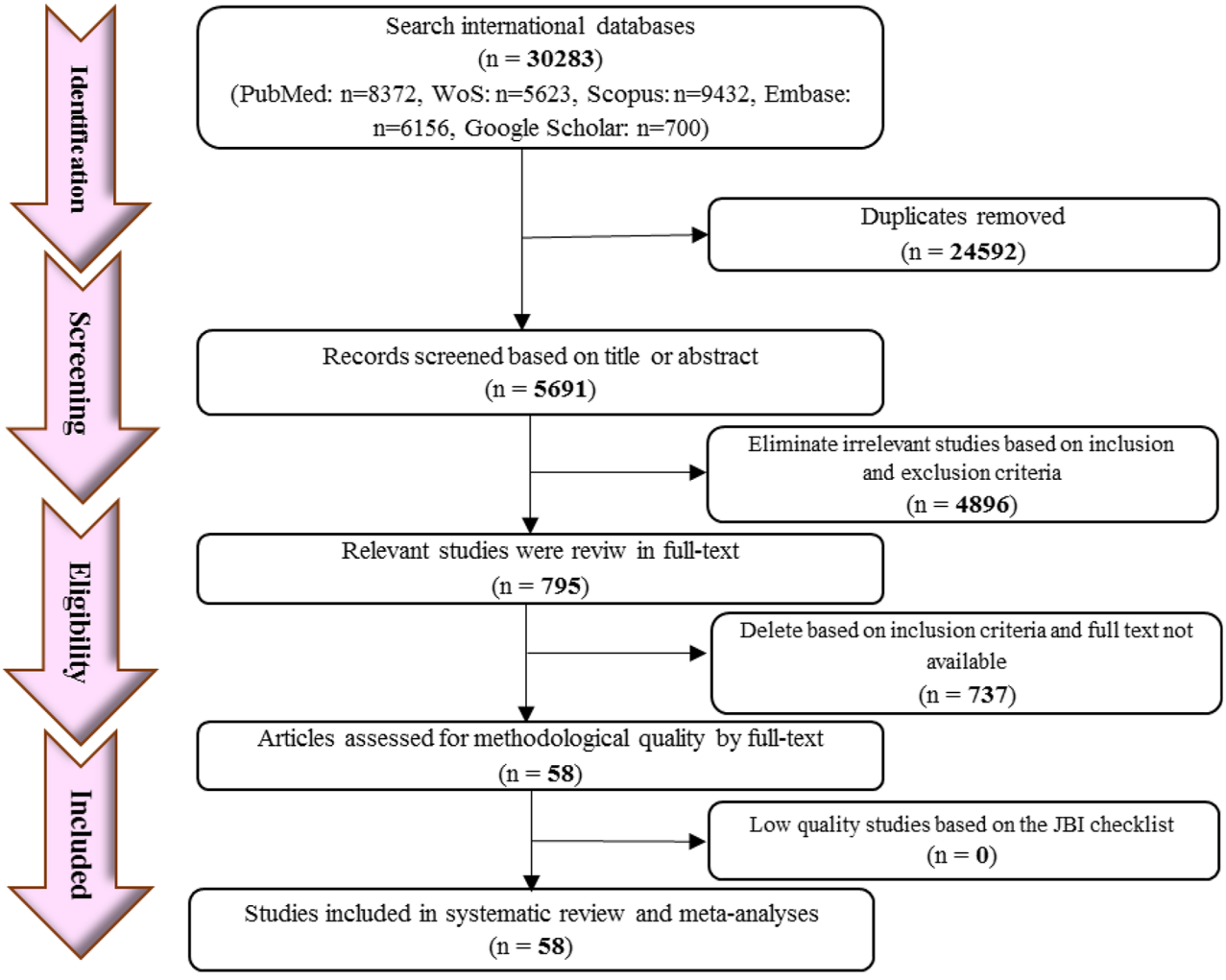

Fig. 1 PRISMA 2020 flow diagram for article selection

Meta-analysis of global prevalence of depression, anxiety, and stress in the elderly

In total, there were 42 studies reporting the prevalence of depression with a sample size of 161,085 individuals, 46 studies reporting the prevalence of anxiety with a sample size of 194,170 individuals, and 13 studies reporting the prevalence of stress with a sample size of 2,306 individuals. The I^2 test results indicated a notable heterogeneity among the studies for global prevalence rates of depression, anxiety, and stress in the elderly (I^2 Depression=99.70, I^2 Anxiety=99.70, and I^2 Stress=99.32). Therefore, a random-effects model was applied to analyze the data. As a result, the combined estimates of the prevalence rates for depression was equal to 19.2% (95% CI: 13.0-27.5), 16.5% (95% CI: 11.1–22.8) for anxiety, and 13.9% (95% CI: 5.5–30.9) for stress. Based on the random-effects model, in Figs. 2, 3 and 4 the black square represents the percentage; the horizontal line represents the 95% confidence interval for each study; and the diamond sign represents the overall prevalence percentage for all studies. Based on the results of Begg and Mazumdar rank correlation, there was no publication bias in the studies at the level of 0.1 (P-value (Depression)=0.121, P-value (Anxiety)=0.172 and P-value (Stress)=0.854) (Figs. 5, 6 and 7).

Meta-regression analysis

Using meta-regression analysis, the relationship between the year of the study, sample size, mean age, and JBI score with the overall prevalence of depression, anxiety, and stress worldwide was examined. The results indicated that with an increase in the year, age, and JBI score, the prevalence of depression, anxiety, and stress exhibits an upward trend, while an increase in the sample size was associated with a downward trend ($P<0.001$) (Table 2).

Subgroup analysis

Considering the high heterogeneity among studies regarding the prevalence of depression, anxiety, and stress in the elderly ($I^2>99\%$), subgroup analysis was

Table 1 Summary of studies included in the systematic review and meta-analysis

First author, Year, Reference	Age (years)	Country/ Continent	Sample size (*n*)	Prevalence (%)			Diagnostic tool	Population	Quality Score
				Depression	Anxiety	Stress			
Babazadeh, 2015 [34]	68.2±6.8	Iran / Asia	383	1.3	3.1	1.3	DASS- 21	General Population	7
Thapa, 2020 [35]	71.1±8.2	Nepal / Asia	794	15.4	18.1	12.1	DASS- 21	General Population	7
Blazer, 1987 [29]	> 60	USA / America	3000	2.1	-	-	DSM-III	General Population	5
Kirmizioglu, 2009 [36]	> 65	Turkey / Europe	462	-	17.1	-	DSM-IV	General Population	6
Wongpakaran, 2019 [37]	69.24±6.8	Thailand/Asia	803	23.7	6.4	-	DSM-IV	General Population	6
Raeisvandi, 2023 [38]	69.86±7.2	Iran/ Asia	301	45.5	35.5	40.2	DASS- 21	General Population	9
Jayakody, 2018 [39]	64.44±10.77	Australia / Australia	151	27.51	5.89	5.64	DASS- 21	General Population	7
Chen, 2022 [40]	70.2±7.1	China/ Asia	966	7.8	6.3	-	DASS- 21	Hospitalization	8
Milani and Lavie, 1998 [41]	71±4	USA / America	268	18	-	-	SF-36	Coronary Heart Disease	6
Malhotra, 2023 [42]	67.4±6.5	India / Asia	690	7.83	12.02	5.2	DASS- 21	COVID-19	6
Maercker, 2008 [32]	75.2±7.5	Switzerland / Europe	65,512	2.3	4.2	-	DSM-IV	General Population	5
Molyneux, 2008 [43]	79.2	Ireland / Europe	100	21	-	-	GDS-15	Hospitalization	6
Lindesay, 1989 [44]	> 65	England / Europe	890	13.5	3.7	-	DSM-III	General Population	5
Pasha, 2023 [45]	71.4	Iran / Asia	140	62.9	97.1	58.6	DASS- 21	COVID-19	8
Marsa, 2020 [46]	72.1	Iran / Asia	436	60.3	51.7	24.6	DASS- 21	General Population	7
Barakat, 2019 [28]	66.2±7.73	Egypt / Africa	756	60	38	-	Beck's	General Population	6
Lu, 2023 [47]	72.74±6.5	China / Asia	1173	37.34	32.74	-	DASS- 21	General Population	8
Canuto, 2018 [48]	65-84	Germany, Italy, England, Spain, Switzerland, and Israel / Europe	3142	-	17.2	-	CIDI65+	General Population	7
Zhang, 2015 [49]	72.8±5.3	France/Europe	1974	-	11	-	DSM-IV	General Population	6
Curran, 2020 [50]	> 60	England / Europe	1863	8	2.6	-	DASS- 21	General Population	5
Richardson, 2012 [51]	76.5±9.2	USA / America	378	31	-	-	DSM-IV-TR	General Population	6
Zhang, 2012 [52]	68.96±7.1	China / Asia	284	35.2	42.9	-	DSM-IV-TR	General Population	5
Kang, 2016 [53]	72.2±5.9	South korea / Asia	1204	-	38.1	-	GMS-B3	General Population	6
Sari and Manungkalit, 2019 [54]	75-90	Indonesia / Asia	145	65.5	15.2	0.7	HARS, SPST-20, GDS	General Population	6
Malhotra, 2023 [42]	67.45 ± 6.5	India / Asia	690	7.83	12.02	5.2	DASS-21	COVID-19	7
Dura, 1990 [55]	68.1±8.3	USA / America	756	30	-	-	DSM-III	General Population	5
Nayak, 2019 [56]	66.5	India / Asia	244	46.7	57.3	-	GDS-15	General Population	7
Prina, 2011 [57]	> 65	China and India/Asia	15,021	-	2.9	-	GMS	General Population	6
Yang, 2021 [58]	> 65	China/Asia	953	19.4	44	-	SDS and SAS	General Population	7
Gum, 2009 [59]	> 65	USA / America	1461	-	7	-	DSM-III	General Population	5
Raeisvandi, 2022 [60]	69.86	Iran / Asia	301	45.5	35.5	40.2	DASS-21	General Population	8
Ganatra, 2008 [61]	> 65	Pakistan /Asia	402	22.9	-	-	DSM-III	General Population	6
Mehta, 2003 [62]	74±3	USA / America	3075	-	20	-	DSM-III	General Population	5
Choulagai, 2013 [63]	78	Nepal / Asia	78	66.7	-	-	GDS-15	Geriatric Homes	7
Murrell, 1983 [64]	> 60	USA / America	2517	13.7	-	-	CES-D	General Population	5

Table 1 (continued)

First author, Year, Reference	Age (years)	Country/ Continent	Sample size (*n*)	Prevalence (%)			Diagnostic tool	Population	Quality Score
				Depression	Anxiety	Stress			
Sjoberg, 2017 [65]	˃ 60	Sweden / Europe	3353	21	-	-	DSM-IVTR/DSM-5	General Population	7
Assil and Zeidan, 2013 [27]	˃ 60	Sudanese / Africa	300	47.5	-	-	GDS	General Population	5
El-Gabalawy, 2011 [66]	67.1±0.1	Canada / America	12,792	7.7	4.9	-	CIDI	General Population	6
Anwar, 2023 [26]	˃ 60	Myanmar/Asia	864	-	68	93	CAS	COVID-19	7
de Oliveira Andrade, 2022 [67]	˃ 65	Brazil / America	380	28.7	26.1	-	GDS and GAD	COVID-19	7
Neville and Teri, 2011 [68]	86.2	USA / America	148	-	11	-	CAS	General Population	5
Suri, 2018 [69]	˃ 65	India / Asia	697	23	38	-	HAM-D and HAM-A	General Population	7
Mackenzie, 2011 [70]	˃ 65	USA / America	12,312	-	2.80	-	GAD	General Population	7
Cohen, 2006 [71]	70.3±2.5	USA / America	1074	-	15.6	-	DSM-III	General Population	5
Maung, 2022 [72]	˃ 65	Malaysia / Asia	178	23.6	18.5	7.9	DASS-21	General Population	8
Suradom, 2019 [73]	68.39±6.74	Thailand / Asia	803	23.66	16.84	-	HAMD-7	General Population	8
Yao, 2021 [74]	˃ 65	China / Asia	206	-	30.1	-	HAMA	Diabetes and hypertension	7
Mutepfa, 2021 [75]	71.8±9.1	Botswana / Africa	378	-	18.6	-	GAD-7	General Population	5
Zhang and Cooper, 2010 [76]	˃ 65	USA / America	56,182	0.8	1.2	-	ICD-9	Colorectal Cancer	5
Choi and McDougall-1, 2007 [77]	76.2	USA / America	81	4.6	-	-	GDS	Hospitalization	6
Choi and McDougall-2, 2007 [77]	76.2	USA / America	130	1.96	-	-	GDS	General Population	6
Bloch, 2014 [78]	˃ 75	France/Europe	52	-	30.5	-	GAD	After the fall	7
Gonçalves, 2011 [79]	68±8	Australia / Australia	3035	-	2.76	-	GAD	General Population	5
Forlani, 2014 [80]	83.7±6.2	Italy / Europe	366	25.2	21.04	-	CAMDEXR	General Population	7
Taha and Rahman, 2006 [81]	65.0±4.5	Egypt / Africa	332	57.1	34.1	-	HAMA	Geriatric Homes	6
Kvaal, 2001 [33]	˃ 70	Norway / Europe	40	-	41	-	STAI	Hospitalization	5
Arbus, 2014 [82]	73.8±8.5	France / Europe	3651	-	-	3.7	DSM-IV	General Population	6

Table 1 (continued)

First author, Year, Reference	Age (years)	Country/ Continent	Sample size (*n*)	Prevalence (%)			Diagnostic tool	Population	Quality Score
				Depression	Anxiety	Stress			
Bunce, 2012 [83]	66.61±5.638	Brazil / America	120	15.38	8.33	-	GDS	General Population	7
Silveira and Portuguez, 2017 [84]	> 60	USA / America	397	16.6	4.5	-	GAD- 7	General Population	7

DASS- 21: Depression, Anxiety, Stress Scale 21
GDS-15: Geriatric Depression Scale-15
GMS-B3: Geriatric Mental State Schedule
HARS: Hamilton Anxiety Rating Scale
SPST-20: Suan Prung Stress Test 20
GDS: Geriatric Depression Scale
GAD: Geriatric Anxiety Scale
GMS: Geriatric Mental State
SDS: self-rating depression scale
CAS: Coronavirus Anxiety Scale
SAS: self-rating anxiety scale
CIDI: Composite International Diagnostic Interview
HAM-D: Hamilton depression rating
HAM-A: Hamilton anxiety rating scale
CAMDEXR: Cambridge Mental Disorders of the Elderly Examination-Revised

conducted based on the continent and the study population (Table 3). The highest prevalence of depression and anxiety was recorded in Africa, with estimates of 55.1% (95% CI: 47.7–62.3) and 29.5% (95% CI: 19.4–42.1) respectively. Additionally, the prevalence of depression was higher in nursing homes (60.7%), and stress was more prevalent in individuals with COVID-19 (18.2%) compared to other populations (Table 3).

Discussion

The global prevalence statistics of depression, anxiety, and stress in the elderly was standardized using a systematic review and meta-analysis approach. After reviewing studies retrieved from various databases, a total of 43 studies on the prevalence of depression with a sample size of 161,085 individuals, 47 studies on the prevalence of anxiety with a sample size of 194,170 individuals, and 13 studies on the prevalence of stress with a sample size of 2,306 individuals were included in the meta-analysis. The overall estimated prevalence rates were 19.2% for depression, 16.5% for anxiety, and 11.2% for stress based on the random-effects model.

The highest qualitative assessment score, based on the JBI checklist, was obtained by Raeisvandi et al. with a score of 9, reporting depression, anxiety, and stress prevalence rates of 45.5%, 35.5%, and 40.2%, respectively [38]. Villagrasa et al. reported a prevalence of anxiety in Spanish elderly individuals as 11% [25]. Sarokhani et al. reported the prevalence of depression in Iranian elderly individuals as 43% [23]. Abdoli et al. estimated the prevalence of major depressive disorder (MDD) in the elderly as 13.3% [24]. The statistical differences reported in the present study compared to other studies may be attributed to variations in study methodology, data collection tools, the number of articles included in the study, as well as geographical and population differences.

The meta-regression analysis indicated an increasing trend in the global prevalence of depression, anxiety, and stress with age among the elderly. Reasons for this trend may include excessive weight gain [85], tobacco consumption [86, 87], excessive consumption of alcoholic beverages and coffee [86], inadequate and irregular sleep patterns [88], diseases such as Alzheimer's and dementia [89], loneliness [90], fear of falling from bed [91], and various physical illnesses such as stroke [92] and heart diseases [93]. Therefore, health authorities and policymakers need to take action to address and prevent cognitive, physical, and mental health issues in the elderly.

Given the changing demographics, cultures, races, genetics, treatment types, socio-economic statuses, stress factors, diagnostic tools, and more across different countries and regions, we decided to conduct subgroup analysis. The highest prevalence rates of depression and anxiety were reported among elderly individuals in

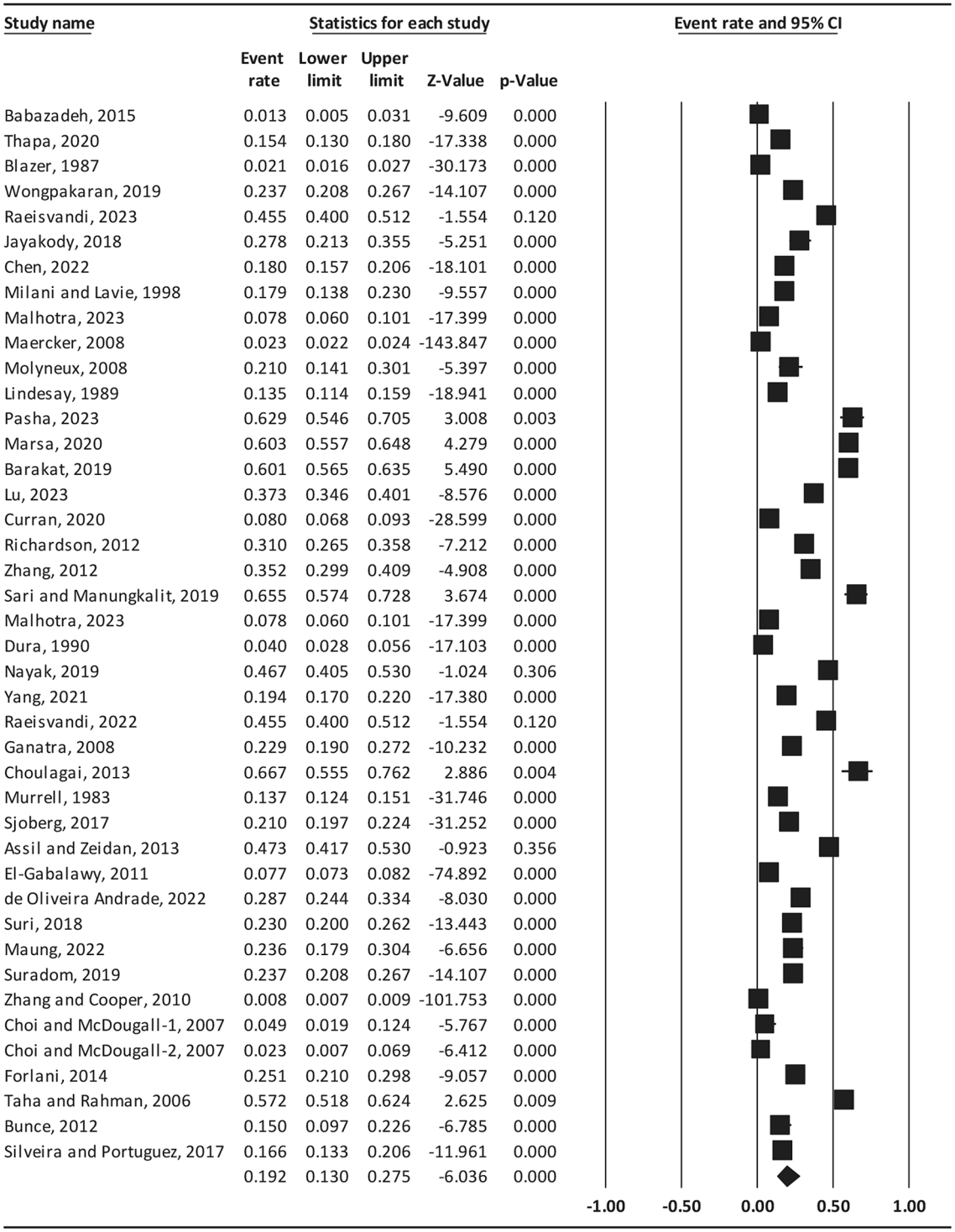

Fig. 2 Forest plot of the overall estimate of the global prevalence of depression in the elderly based on the random effects model

Africa. Limited access to mental health outgoing services, lack of trust in medical services, stigma, and social barriers, along with concerns about antidepressant and anti-anxiety medications, may contribute to the increased risk of depression and anxiety in the African population [94, 95].

The results demonstrated that the prevalence of depression in elderly residents of nursing homes was higher

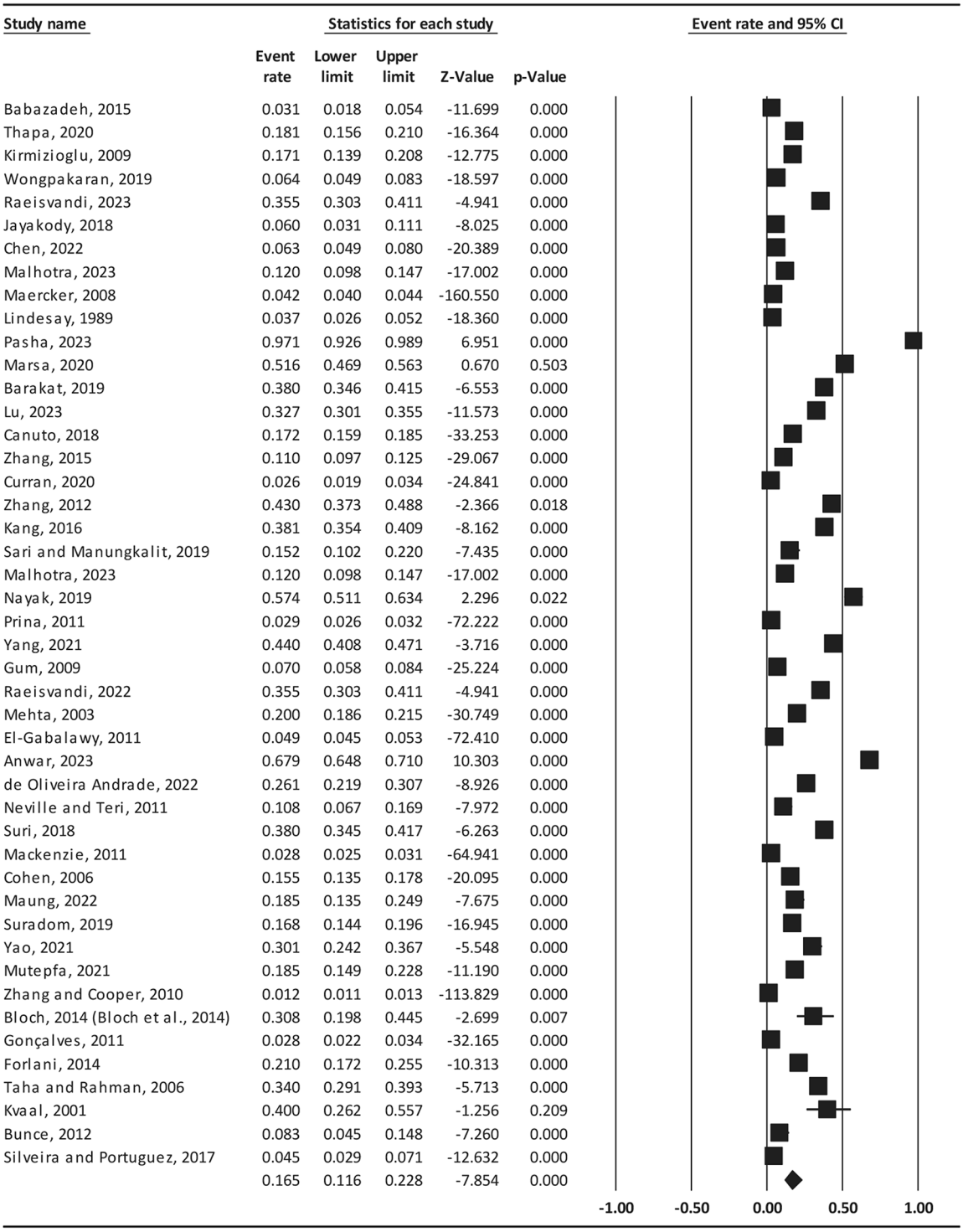

Fig. 3 Forest plot of the overall estimate of the global prevalence of anxiety in the elderly based on the random effects model

than in other elderly populations. This finding suggests a correlation between the elderly's place of residence and their levels of anxiety, stress, and depression. These findings are consistent with the study by Vigod et al., which indicated that the living environment of the elderly was an important and influential factor in their mental health and psychiatric conditions [96]. It is plausible that psychosocial variables present in the living environment,

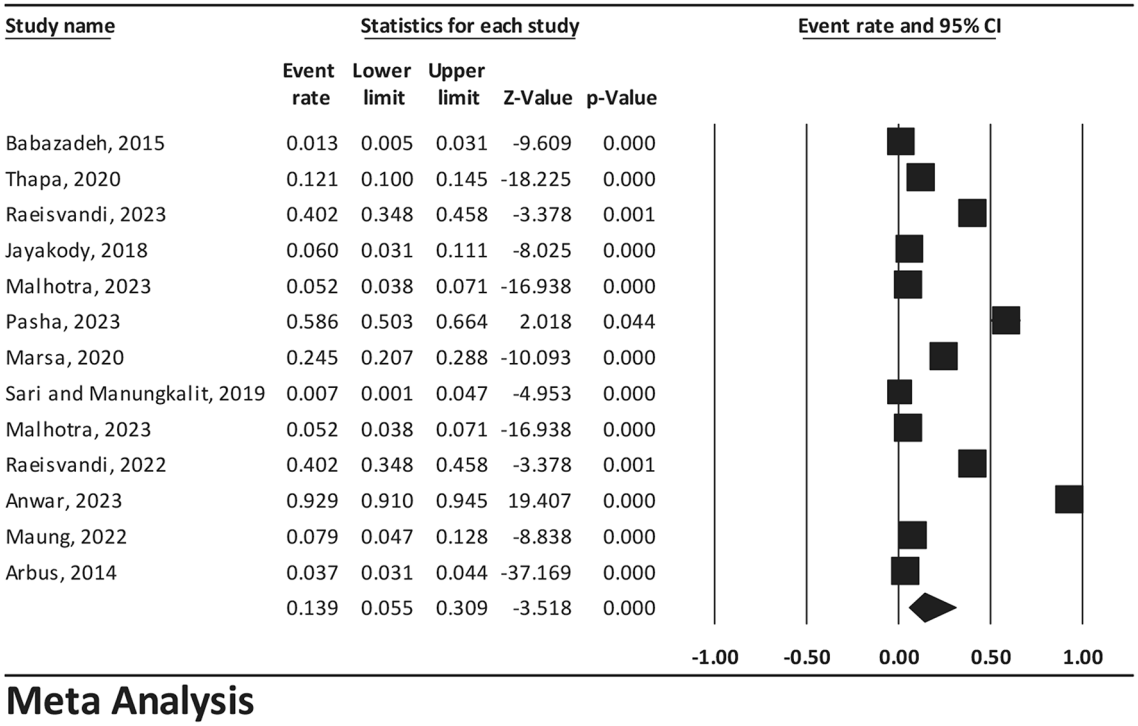

Fig. 4 Forest plot of the overall estimate of the global prevalence of stress in the elderly based on the random effects model

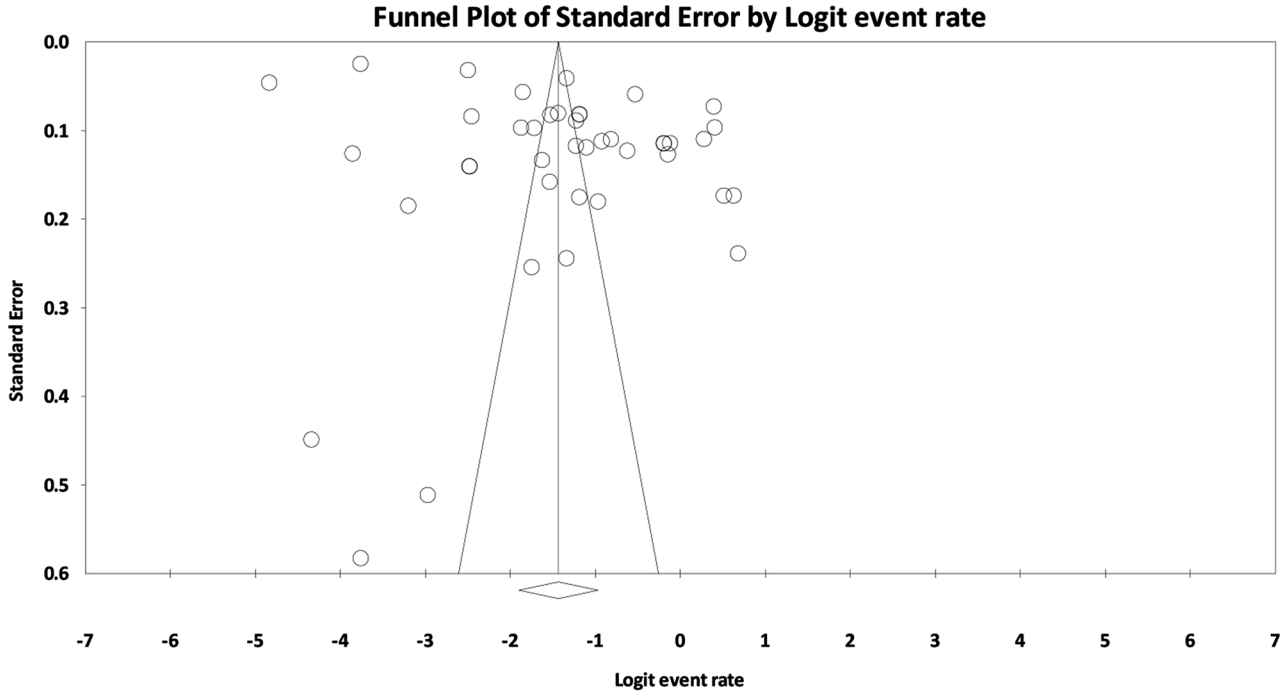

Fig. 5 Funnel plot of the results related to the overall estimate of the global prevalence of depression in the elderly

such as a sense of belonging and acceptance, feeling valued and effective, warmer social interactions, and greater daily life responsibilities, along with the sense of being supported and having positive and meaningful social roles in relationships with spouses, children, sons-in-law, daughters-in-law, and grandchildren residing in the same household, contribute significantly to the observed differences [46].

Furthermore, this study revealed that the prevalence of stress during the COVID-19 pandemic was higher,

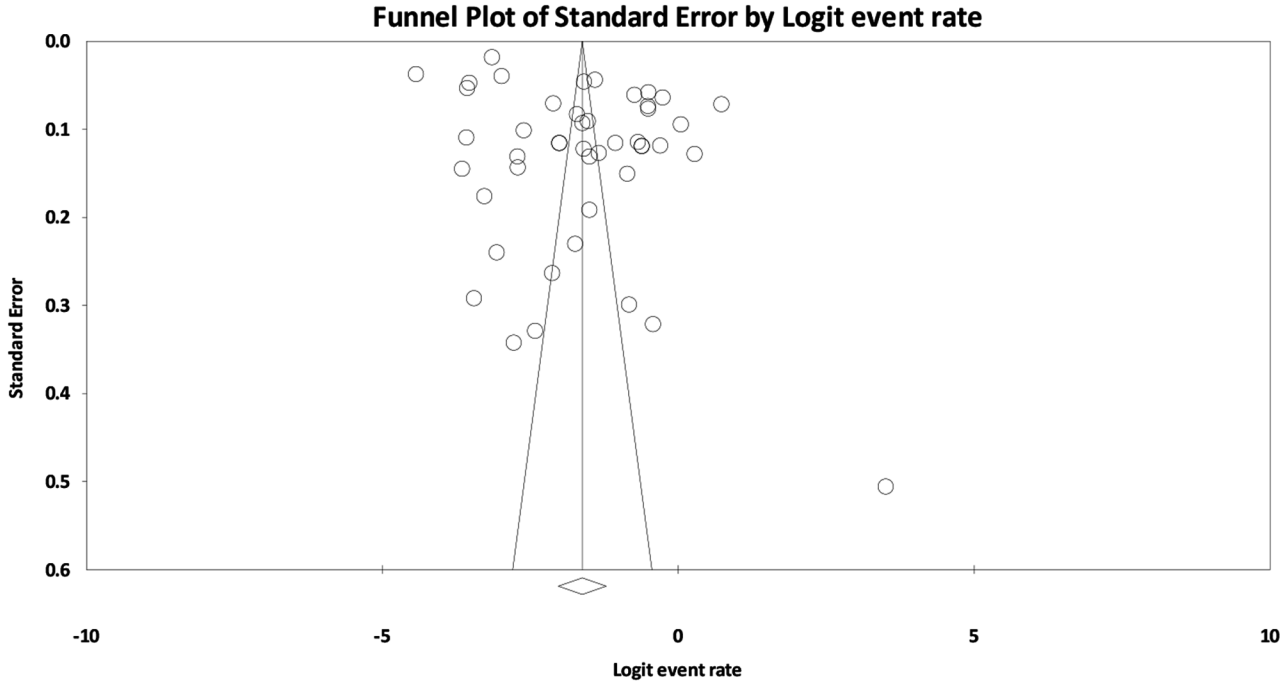

Fig. 6 Funnel plot of the results related to the overall estimate of the global prevalence of anxiety in the elderly

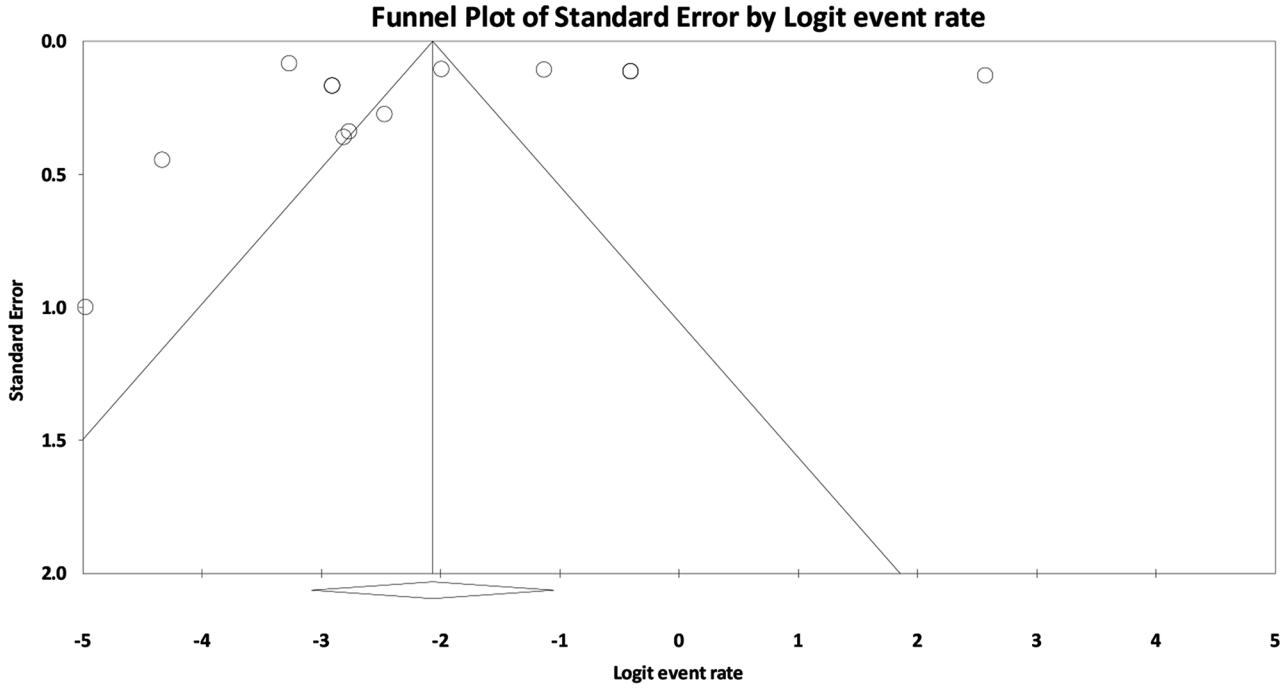

Fig. 7 Funnel plot of the results related to the overall estimate of the global prevalence of stress in the elderly

consistent with Salari et al. [97], Al Maqbali et al. [98], and Zhang et al. [99]. The COVID-19 virus, originating from China, not only presents physical health challenges but also causes fatigue, stress, and anxiety [100]. Fears of death, illness, the spread of false news and rumors, and reduced social interactions were among the factors that heightened stress due to the coronavirus.

The high prevalence of depression, anxiety, and stress found in the present systematic review and meta-analysis underscores the need for further investigation and follow-up for these conditions. Depression, anxiety, and

Table 2 Meta-regression of the relationship between year, sample size, average age and JBI score

Disorder	Variable	Relationship	Tau- squared	Model Q	*P*-value
Depression	Year	Straight	2.07	5.77	0.000
	Sample size	Inverse	0.81	23.22	0.000
	Age	Straight	1.23	8.23	0.000
	JBI scor	Straight	1.32	9.97	0.000
Anxiety	Year	Straight	1.36	8.28	0.000
	Sample size	Inverse	1.28	11.62	0.000
	Age	Straight	1.56	8.37	0.000
	JBI scor	Straight	1.44	9.10	0.000
Stress	Year	Straight	2.33	6.97	0.000
	Sample size	Inverse	2.98	0.32	0.000
	Age	Straight	2.65	3.26	0.000
	JBI scor	Straight	2.79	4.30	0.000

Table 3 Subgroup analysis to estimate the prevalence of depression, anxiety and stress by continent and study population

Type of disorder	Subgroups		Number Studies	Prevalence %	*P*-value	*P*-value between	I^2	Tau
Depression	Continent	Africa	3	55.1 (95% CI: 47.7–62.3)	0.176	0.000	85.80	0.244
		America	12	0.08 (95% CI: 3.7–16.6)	0.000		99.63	1.438
		Asia	20	28.3 (95% CI: 21.7–36.0)	0.000		98.16	0.792
		Australia	1	27.8 (95% CI: 21.3–35.5)	0.000		0.000	0.000
		Europe	6	12.3 (95% CI: 4.1–31.5)	0.001		99.82	1.485
	Population	COVID-19	4	20.9 (95% CI: 7.0–48.3)	0.039	0.000	98.81	1.280
		General Population	31	19.6 (95% CI: 13.0–28.6)	0.000		99.68	1.394
		Geriatric Homes	2	60.7 (95% CI: 51.4–69.3)	0.024		56.67	0.214
		Hospitalization	3	15.1 (95% CI: 9.2–24.0)	0.000		76.40	0.421
Anxiety	Continent	Africa	3	29.5 (95% CI: 19.4–42.1)	0.002	0.000	95.31	0.477
		America	10	7.4 (95% CI: 3.5–15.3)	0.000		99.72	1.290
		Asia	22	26.3 (95% CI: 16.7–39.0)	0.001		99.52	1.378
		Australia	2	3.8 (95% CI: 1.8–7.9)	0.000		79.65	0.505
		Europe	9	11.9 (95% CI: 6.6–20.7)	0.000		99.44	0.989
	Population	COVID-19	5	30.8 (95% CI: 19.8–44.5)	0.760	0.000	99.43	1.563
		General Population	35	44.6 (95% CI: 16.8–76.3)	0.000		99.65	1.233
		Hospitalization	2	17.2 (95% CI: 2.2–66.3)	0.171		97.68	1.602
Stress	Population	COVID-19	4	18.2 (95% CI: 9.0–84.7)	0.360	0.651	99.69	3.273
		General Population	9	9.3 (95% CI: 4.1–20.0)	0.000		98.78	1.308

stress are considered among the most significant health challenges facing the elderly, with far-reaching health and economic consequences, including an increased risk of suicide. The implementation of policies and strategies to reduce and control risk factors can mitigate the long-term burden of these disorders on society. Identifying populations at higher risk and providing effective and regular quality medical care can slow down the disease progression and reduce its adverse effects.

One of the limitations of this study was the limited number of studies conducted on the prevalence of stress in cardiac patients. It is recommended to conduct more studies with larger sample sizes in different countries to better understand the prevalence of stress in the elderly. Other limitations of the current research were not accessing all articles and unpublished reports, different reporting methods, non-random selection of some samples, methodological heterogeneity, and inadequate and low-quality reporting in some studies. Furthermore, the high heterogeneity in studies (over 99%) led us to perform subgroup analysis, which reduced the level of heterogeneity; however, heterogeneity was still high in the sugroups, possibly due to differences in sample size, demographic characteristics, and study methodology. Further systematic reviews and meta-analyses are recommended in the field of the prevalence of other mental disorders in the elderly and also the prevalence of depression, anxiety, and stress in other populations such as diabetic patients, hemodialysis patients, cancer patients, etc., while addressing the limitations mentioned in the current study.

Conclusion

The results of this study indicated a high prevalence of depression, anxiety, and stress in the elderly. Therefore, healthcare professionals and policymakers need to

pay more attention to prevention and control of these disorders.

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Author contributions
M.K, A.Z and A.J contributed to the design, Z.K, R. P. K, A.J and M. K participated in most of the study steps. M.K, B.E, M.R and A.Z prepared the manuscript. M.K, J. S.M, A.Z and A.J assisted in designing the study, and helped in the, interpretation of the study. All authors have read and approved the content of the manuscript.

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There is no confict of interest.

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