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Worldwide Prevalence of Poor Sleep Quality in Older Adults: A Systematic Review and Meta-Analysis

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Abstract

Objective: The objective of this meta-analysis was to establish the prevalence of poor sleep quality among individuals aged over 60 years old, utilizing the Pittsburgh Sleep Quality Index (PSQI).
Method: To identify appropriate records, a thorough search of PubMed, Scopus, and Web of Knowledge databases was conducted until May 22, 2024. The quality of the included studies was assessed using the Hoy tool. To calculate the pooled prevalence with a 95% confidence interval, the random effects model was utilized. Additionally, subgroup analyses were carried out to investigate the potential sources of heterogeneity.
Results: This study examined 52 cross-sectional studies encompassing 24,217 individuals aged 60 and older. The quality of the studies was assessed, with 4 rated as moderate and 48 as good. China reported the lowest prevalence of poor sleep quality at 14%, while Malaysia recorded the highest at 96%. The overall pooled prevalence was found to be 50% (95% CI: 45-55%), exhibiting significant heterogeneity across the studies ($I^2 = 99.60\%$, Pheterogeneity < 0.001). Subgroup analysis indicated that geographic location significantly influenced this heterogeneity ($p < 0.001$), with Africa showing a lower prevalence of poor sleep quality at 27% (95% CI: 23%-32%) compared to other regions. However, no significant differences were observed in the impact of other factors, such as gender, level of development, sample size, survey time, PSQI cut-off, and response rate on the overall heterogeneity of the analyzed data.
Conclusion: This study reveals that approximately half of older adults experience poor sleep quality. However, this prevalence varies across different locations, underscoring the necessity for targeted interventions that consider regional factors influencing sleep health.

Key words: *Aged; Cross-Sectional Studies; Epidemiology; Prevalence; Sleep Disorders*

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The physiology of sleep undergoes changes as individuals age, and there is an increased prevalence of sleep disorders among the elderly population (1). Sleep quality is determined by an individual's personal experience and satisfaction with their sleep (2). Among the elderly, poor sleep quality is the third most prevalent issue after headaches and digestive disorders (3). Poor sleep quality in the elderly can lead to various detrimental effects on their physical and mental health, such as an increased risk of falls, impaired cognitive function and memory, higher likelihood of experiencing depression and anxiety, weakened immune system, elevated risk of chronic diseases like diabetes and cardiovascular disease, and ultimately a reduced quality of life and well-being (4-7). These negative effects can lead to a considerable financial burden on society. According to a study performed in 2018, sleep disorders in the United States were projected to incur a total of $94.9 billion in direct medical expenses (8). In Australia, a separate study revealed that the financial impact of sleep disorders was estimated at $10.0 billion, equivalent to 0.73% of the country's gross domestic product. Additionally, the nonfinancial cost was estimated to be $25.4 billion, accounting for 3.2% of the total burden of disease in Australia for that year (9).

In 2015, approximately 900 million individuals were aged 60 years or older, with projections indicating that this number will increase to nearly 2 billion by the year 2050 (10). Considering the significant rise in the aging population globally, it is imperative to investigate the spectrum of age-related issues, including poor sleep quality, to develop effective interventions. A meta-analysis in China found that approximately 36% of older adults suffer from poor sleep quality, with higher rates in rural areas (11). Another meta-analysis of community-dwelling older adults reported significant prevalence rates of sleep disorders, including obstructive sleep apnea (46%) and poor sleep quality (40%) (12). Studies have indicated that a substantial proportion of older adults experience poor sleep quality, with estimates varying from 38% to 77% (13, 14), in contrast to the lower rates of 15.9% to 22.3% found in the broader population (1). These differences can be attributed to variations in the populations studied and the assessment tools utilized to evaluate sleep quality.

Sleep quality can be evaluated through objective and subjective approaches. Objective measures, such as polysomnography and actigraphy, are not easily accessible to most clinicians in their daily practice. These methods are costly, time-consuming, and impractical for large-scale epidemiological and research studies (15). Conversely, subjective methods are more frequently employed, with the Pittsburgh Sleep Quality Index (PSQI) being a widely recognized tool for evaluating sleep quality (16). Its extensive validation across diverse populations establishes its reliability as a trusted assessment tool (17, 18). The PSQI is straightforward to administer, making it suitable for large-scale studies, and provides a comprehensive evaluation of sleep quality by examining various domains, such as sleep duration and disturbances. Additionally, its widespread use in previous research allows for comparative analyses.

Given the absence of global prevalence data on poor sleep quality using a standardized measurement in older adults, this study aims to address this gap. The objectives of this study are: 1) to determine the worldwide prevalence of poor sleep quality among older adults aged 60 years and above, utilizing the PSQI questionnaire, and 2) to investigate the factors contributing to the variability in sleep quality through subgroup analyses.

Materials and Methods

This systematic review and meta-analysis followed the guidelines provided by the Meta-Analyses of Observational Studies in Epidemiology (MOOSE) (19) and Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (20).

Information Sources

Electronic databases such as PubMed, Scopus, and Web of Knowledge were searched to find published literature up until May 22, 2024. The reference lists of eligible studies were also checked for any potential additional citations.

Search Strategy

To develop search strategies for systematic reviews, the PECOS statement (Population, Exposure, Comparison, Outcomes, and Study design) was utilized (21). The PECOS in this meta-analysis was considered: (P) old people, (E) not applicable, (C) not applicable, (O) prevalence of poor sleep quality, and (S) cross sectional studies.

The search keywords included (Aged OR Elderly OR Old OR Aging OR "Older adult") AND ("Sleep Wake Disorder" OR "Sleep Wake Disorders" OR "Sleep Disorder" OR "Sleep Disorders" OR "Sleep disturbance" OR "Sleep disturbances" OR "Sleep quality" OR "Sleep disruption" OR "Sleep disruptions" OR "Sleep problem" OR "Sleep problems" OR "Pittsburgh Sleep Quality Index" OR "PSQI") AND ("Cross sectional" OR "Cross section" OR Prevalence OR Prevalent OR Survey OR Frequency OR Epidemiology).

Eligibility Criteria

The inclusion criteria for the studies were (1) original articles and (2) cross-sectional studies that assessed sleep quality among old people using the PSQI questionnaire. The exclusion criteria were as follows: (1) lack of access to the full text of the articles, (2) non-English full text of the articles, (3) Age group below 60 years (4) non-reported age, (5) non-reported PSQI cut off (6) multiple articles with the same survey, and (7) insufficient information to calculate the prevalence of poor sleep quality.

Study Selection

In this meta-analysis, a single author conducted a search of databases and removed any duplicate studies. The articles for this meta-analysis were selected by two reviewers (MM and FKh), who independently selected articles that met the eligibility criteria. Any disagreements between the two reviewers were resolved by a third researcher.

Data Extraction

After selecting eligible articles, two reviewers (EM and NS) independently collected the following information from each study: title, first author name, publication year, survey time, country, sampling method, sample size, response rate, total effective sample size, effective sample size in men and women, the number of total events, the number of total events in men and women, age group (mean ± SD), and PSQI cut-off.

Quality Assessment

The quality of studies was assessed using the Hoy tool (22) in which its 10-item checklist evaluates the quality of studies based on two dimensions: external validity and internal validity. Items 1 to 4 assess the target population, sampling frame, sampling method, and minimal non-response bias to evaluate external validity. Items 5 to 9 assess the data collection method, case definition, study instrument, and mode of data collection to evaluate internal validity. Lastly, item 10 assesses bias related to the analysis. If the answer to an item is “Yes”, the score will be “1 = low risk,” and if it is “No” or “Unclear,” it will be scored “0 = high risk.” Studies were scored as low quality (1–3), moderate quality (4–6), and high quality (7–10).

Outcome Measurement

The primary outcome of this meta-analysis was the prevalence of poor sleep quality, which was measured using the PSQI Questionnaire. This is a self-report questionnaire that evaluates sleep quality over a period of one month. The measure comprises 19 individual items that are grouped into seven components, and the scores from these components are combined to produce a global score ranging from 0 to 21. Higher scores indicate poorer sleep quality (16).Various cutoff points were used to determine poor sleep quality. To determine the prevalence of poor sleep quality in each study, the number of individuals whose questionnaire score exceeded the specified cutoff point was divided by the total number of individuals who completed the questionnaire.

Statistical Analysis

The weighted pooled estimate was calculated using the Freeman-Tukey double arcsine transformation method. A random effects model was employed to determine the pooled prevalence with a 95% confidence interval. A forest plot was used to visually represent the data points and pooled estimate. The degree of heterogeneity between studies was assessed using two statistics: the I^2 statistic (23) and the Cochrane Q statistic (24). The I^2 statistic categorized heterogeneity as low (25%-49%), moderate (50-74%), or high (≥ 75%). The Cochrane Q statistic tested for statistical significance with a P-value of less than 0.05. Subgroup analyses were performed to examine whether the pooled prevalence estimates of poor sleep quality differed based on various factors such as gender, geographical area, level of development, sample size, survey time, PSQI Cut-Off, and response rate. The aim of these subgroup analyses was to identify potential sources of heterogeneity among the studies included in the meta-analysis. Statistical analyses were conducted using Stata version 11.0 (Stata Corp, College Station, TX)

Results

Study Selection

Out of the 45,446 records that were initially found, 24,217 were removed due to being duplicates. After reviewing the titles and abstracts of 21,229 articles, 147 records were chosen for full-text evaluation. Eventually, 52 records were deemed suitable for meta-analysis, as illustrated in Figure 1.

Study Characteristics

For this meta-analysis, data from 52 studies involving a total of 55,614 individuals aged 60 years or older were analyzed. These studies were conducted in 22 different countries, including China (19), Thailand (4), Taiwan (4), Japan (3), South Korea (3), Brazil (3), Turkey (3), India (2), Iran (2), Greece (1), Saudi Arabia (1), Nigeria (1), Malaysia (1), Croatia (1), Ecuador (1), Slovenia (1), California (1), and Birmingham, Alabama; Minneapolis, Minnesota; Palo Alto, California (1). The published dates of these records ranged from 2009 to 2023. Out of the 52 studies, only 35 (67.30%) reported response rates, which varied from 28.9% to 99.51%. Most of the studies (38.4%) used a cut-off point of > 5 in the PSQI questionnaire to consider poor sleep quality. Table 1 presents the details of the included records.

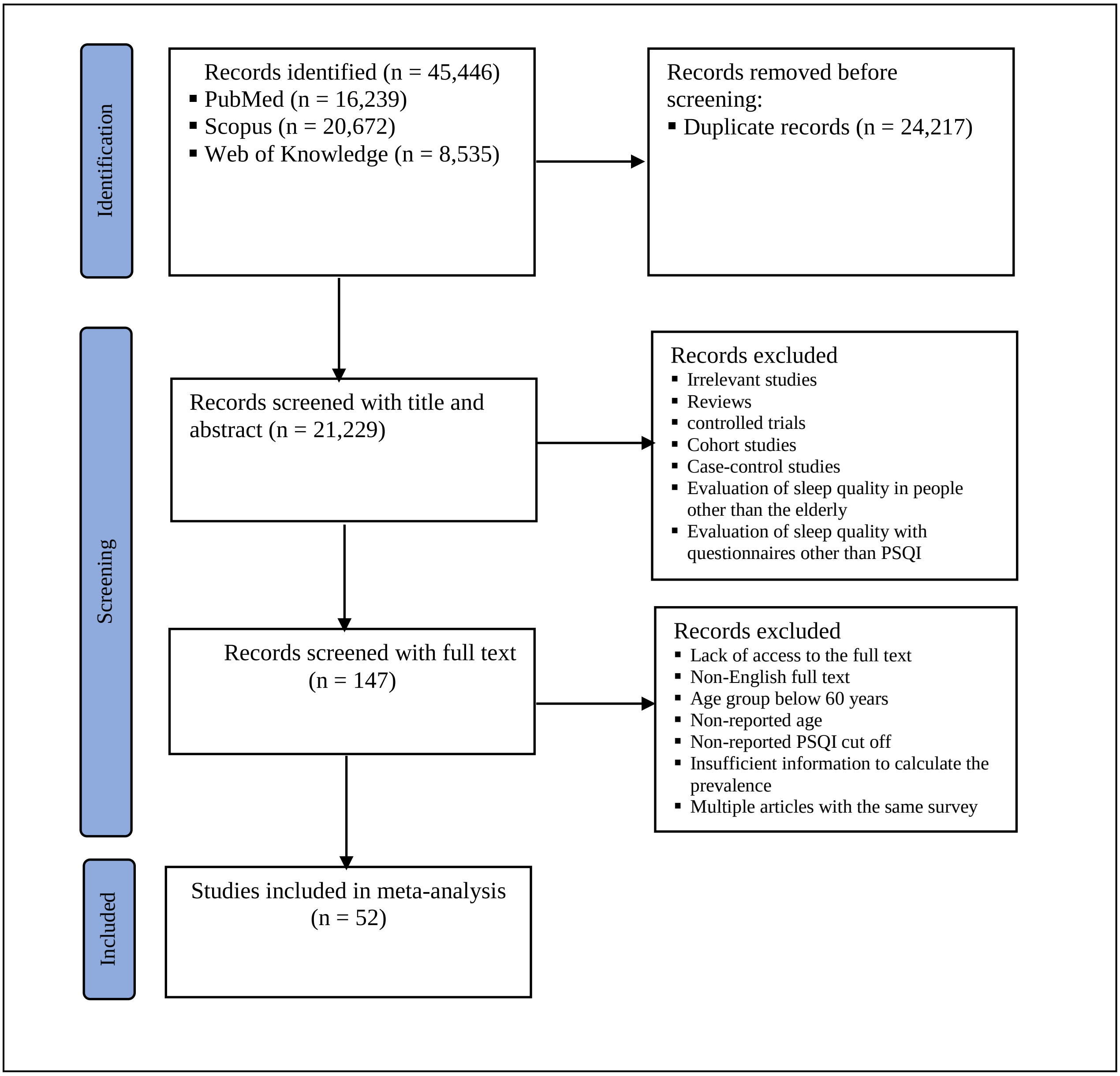

Figure 1. Literature Search Flowchart for Identifying Studies on Poor Sleep Quality in Older Adults

Table 1. Features of Studies Examining Poor Sleep Quality in Older Adults

First Author, Publication Year	Survey Time	Country	Sampling Method	Age Group (Mean ± Age)	Sample Size (Number of Males)	Response Rate (%)	Number of Events in Males	Prevalence of Poor Sleep Quality (%) (95% CI)	PSQI Cut-Off
Chueh et al., 2009 (31)	2008	Taiwan	Stratified sampling	≥ 60 (69.35 ± 5.42)	1500 (NR)	84	NR	21 (18-23)	≥ 5
Araujo et al., 2009 (32)	2007	Brazil	non-probability sampling	≥ 60 (70.5 ± 8.1)	105 (15)	36.2	NR	63 (46-78)	> 5
Wu et al., 2011 (26)	2001	Taiwan	Simple random sampling	≥ 65 (74.75 ± 5.3)	180 (45)	55.6	NR	49 (39-59)	> 5
Blackwell et al., 2011 (33)	2005	United States	NR	≥ 65 (76 ± 7)	3135 (NR)	99	NR	44 (42-46)	> 5
Yang et al., 2012(34)	2008	Taiwan	NR	≥ 60 (72.56 ± 4.42)	225 (91)	71	40	42 (34-50)	≥ 5
Park et al., 2012 (35)	2010	South Korea	non-probability sampling	65-89 (74 ± 5.79)	162 (41)	NR	NR	64 (56-72)	> 5
Orhan et al., 2012 (36)	NR	Turkey	NR	≥ 60 (74 ± 6.7)	100 (15)	73	NR	60 (48-72)	> 5
Luo et al., 2012 (37)	NR	China	NR	≥ 60 (72.2 ± 5.9)	1763 (464)	61.5	166	42 (39-45)	> 5
Jirong et al., 2012 (38)	2005	China	NR	> 90 (93.52 ± 3.37)	660 (220)	NR	NR	42 (38-46)	> 5
MH Lo et al., 2012 (39)	2010	China	non-probability sampling	≥ 60 (76.06 ± 7.6)	318 (47)	97	3	78 (73-82)	≥ 5
Jie Li et al., 2012 (40)	2009	China	Stratified-cluster sampling	60-98 (68.44 ± 7.01)	2700 (1169)	89.5	498	50 (48-52)	> 7
Daglar et al., 2014 (41)	2012	Turkey	NR	62-88	112 (NR)	NR	NR	60 (50-69)	≥ 5
Kanga et al., 2015 (42)	2011	South Korea	Systematic sampling	≥ 60 (68.2 ± 6.1)	459 (143)	76	51	45 (40-51)	> 5

Ichimori et al., 2015 (43)	2009	Japan	non-probability sampling	64-90 (82.8 ± 5.3)	49 (8)	89	NR	34 (20-50)	≥ 5
Chien et al., 2015 (44)	NR	Taiwan	NR	65-96 (77.9 ± 7.3)	236 (76)	90.3	NR	52 (45-59)	> 5
Aunjitsakul et al., 2016 (45)	2015	Thailand	Cluster sampling	65-99 (72.3 ± 5.5)	604 (176)	NR	106	63 (59-66)	> 5
Fawale et al., 2017 (46)	2014	Nigeria	non-probability sampling	≥ 65 (72.7 ± 7.8)	528 (NR)	81	NR	27 (23-32)	> 5
Thichumpa et al., 2018 (47)	2015	Thailand	Simple random sampling	≥ 60 (67.8 ± 7.1)	279 (108)	95	NR	42 (36-48)	> 5
Siripanich et al., 2018 (48)	NR	Thailand	Stratified sampling	60-97	208 (76)	NR	52	66 (59-73)	≥ 5
Štefan et al., 2018 (49)	2018	Croatia	Simple random sampling	≥ 65 (80 ± 3)	1187 (393)	75.3	NR	54 (51-58)	≥ 5
Liu et al., 2018 (50)	2015	China	Simple random sampling	60-97 (72.71 ± 8.29)	1050 (509)	98.3	NR	31 (28-34)	> 7
Jiyeon Ha et al., 2018 (51)	2018	Japan	non-probability sampling	≥ 65 (72.76 ± 4.41)	176 (31)	99	NR	42 (35-50)	≥ 5
Ning Li et al., 2019 (28)	2011	China	NR	≥ 60	3325 (1488)	98.4	143	14 (13-16)	> 7
Kumar et al., 2019 (52)	2017	Malaysia	non-probability sampling	70-98 (74.5 ± 8.4)	151 (77)	NR	NR	96 (92-99)	> 5
Ansari et al., 2019 (53)	2016	Iran	non-probability sampling	≥ 60 (68.5 ± 6.78)	200 (72)	65	43	60 (51-68)	> 5
Honarvar et al., 2019 (54)	2017	Iran	Cluster sampling	≥ 60 (67 ± 6.1)	408 (186)	94	77	55 (50-60)	> 5
BruttO et al., 2020 (55)	2017	Ecuador	non-probability sampling	≥ 60 (70.3 ± 7.8)	437 (125)	69.3	33	30 (25-36)	≥ 6
Jia et al., 2020 (56)	2016	China	Cluster sampling	≥ 60 (70.41 ± 7.63)	1763 (818)	94.27	NR	50 (48-52)	> 7

Zitser et al., 2020 (27)	2011	USA	NR	67-84 (74 ± 0.3)	32 (13)	NR	NR	22 (9-40)	≥ 5
Nanthakwang et al., 2020 (57)	2017	Thailand	Simple random sampling	≥ 60 (69.03 ± 7.3)	1180 (422)	NR	177	44 (41-47)	≥ 5
Ilkhan et al., 2020 (57)	2019	Turkey	NR	≥ 65 (75.49 ± 8.62)	1150 (670)	NR	NR	83 (81-86)	≥ 5
Zhang et al., 2020 (58)	2017	China	Stratified-cluster sampling	≥ 60	588 (253)	86.2	125	50 (46-55)	> 7
Sun et al., 2020 (59)	2014	China	Stratified sampling	70-87 (77.6 ± 3.9)	1726 (816)	NR	NR	43 (41-46)	> 5
Zhao Hu et al., 2020 (60)	2018	China	Simple random sampling	≥ 60 (79.1 ± 8.7)	829 (367)	98	251	67 (64-71)	> 5
Xidi Zhu et al., 2020 (61)	2018	China	Stratified-cluster sampling	≥ 60	829 (376)	98.5	251	67 (64-71)	≥ 5
SILVA et al., 2020 (25)	2018	Brazil	NR	63-73 (69.64 ± 0.66)	105 (16)	NR	11	53 (43-63)	> 5
Zhang et al., 2020 (62)	2018	China	Stratified-cluster sampling	≥ 65 (72 ± 6.09)	3911 (1892)	NR	253	21 (20-22)	> 7
Bader A. Alqahtani, 2021 (63)	2019	Saudi Arabia	NR	≥ 60 (69.9 ± 6.2)	276 (176)	97	NR	66 (60-72)	> 5
Benli Xue et al., 2021 (64)	2019	China	Stratified-cluster sampling	≥ 60	3266 (1515)	99.51	NR	49 (47-51)	≥ 5
Xinyi Liu et al., 2021 (65)	2019	China	NR	≥ 60 (70.2 ± 6.1)	1367 (290)	68.4	NR	34 (31-37)	≥ 7
Mota et al., 2021 (66)	2019	Brazil	NR	≥ 60	156 (39)	51.9	21	67 (55-77)	≥ 5
Wen-Qi Xu et al., 2021 (67)	2020	China	NR	60-101 (73.72 ± 8.27)	717 (265)	NR	NR	53 (49-56)	≥ 7
Hao et al., 2021 (68)	2017	China	non-probability sampling	≥ 60 (67.69 ± 6.05)	250 (106)	98.8	NR	40 (34-46)	> 7

Jesudoss et al., 2021 (69)	2019	India	non-probability sampling	60-81 (70.5 ± 7.61)	100 (50)	NR	NR	66 (56-75)	> 5
Yokoro et al., 2021 (70)	2017	Japan	NR	≥ 65 (80 ± 5.7)	170 (77)	94	NR	37 (29-45)	≥ 6
Cao et al., 2022 (71)	2022	China	NR	≥ 65 (72.74 ± 6.47)	1200 (629)	97.8	NR	41 (38-44)	> 7
Sik Chu et al., 2022 (72)	2018	South Korea	NR	≥ 65 (73.5 ± 0.11)	4756 (2029)	NR	NR	39 (38-41)	> 6
Regati et al., 2022 (73)	2019	India	NR	60-88 (73.4 ± 6.2)	422 (52)	28.9	25	52 (43-62)	≥ 5
Wang et al., 2022 (74)	2021	China	Cluster sampling	≥ 60	613 (165)	NR	15	18 (15-22)	> 7
Liu et al., 2022 (75)	2021	China	Simple random sampling	≥ 60 (77.32 ± 8.87)	1206 (597)	NR	NR	61 (58-64)	> 7
Lorber et al., 2022 (76)	2019	Slovenia	non-probability sampling	67-99 (79 ± 9.04)	2000 (278)	41.5	NR	84 (81-86)	≥ 5
Papadopoulou et al., 2023 (77)	2014	Greek	Simple random sampling	≥ 65 (74.6 ± 8.3)	6745 (1750)	50.4	NR	41 (39-43)	≥ 5

*NR = Non-Reported

Quality of Studies

All records were evaluated as moderate (n = 4) and good quality (n = 48), with scores ranging from 6 to 10. The quality scores of the articles were distributed as follows: 6 (n = 4), 7 (n = 9), 8 (n = 13), 9 (n = 11), and 10 (n = 15) (Table 2).

Table 2. Quality Assessment of Descriptive Cross-Sectional Studies on Poor Sleep Quality in Older Adults Using the Hoy Tool

First Author, Publication Year	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Total Score
Chueh et al.,2009 (31)	1	1	1	1	1	1	1	1	1	1	10
Araujo et al., 2009 (32)	1	0	0	0	0	1	1	1	1	1	7
Chia-Yi Wu et al.,2011 (26)	1	1	0	1	1	1	1	1	1	1	9
Blackwell et al.,2011 (33)	1	0	1	1	0	1	1	1	1	1	8
Yang et al., 2012(34)	1	0	1	1	1	1	1	1	1	1	9
Park et al., 2012 (35)	1	0	0	0	0	1	1	1	1	1	6
Orhan et al., 2012 (36)	1	0	0	1	1	1	1	1	1	1	8

Luo et al., 2012 (37)	1	0	1	1	1	1	1	1	1	1	9
Jirong et al., 2012 (38)	1	0	1	0	0	1	1	1	1	1	7
MH Lo et al., 2012 (39)	0	0	1	1	1	1	1	1	1	1	8
Jie Li et al., 2012 (40)	1	1	1	1	1	1	1	1	1	1	10
Daglar et al., 2014 (41)	1	0	0	0	0	1	1	1	1	1	6
Kanga et al., 2015 (42)	1	1	1	1	1	1	1	1	1	1	10
Ichimori et al., 2015 (43)	1	0	0	1	1	1	1	1	1	1	8
Chien et al., 2015 (44)	1	0	1	1	0	1	1	1	1	1	8
Aunjitsakul et al., 2016 (45)	1	1	1	0	1	1	1	1	1	1	9
Fawale et al., 2017 (46)	1	0	1	1	1	1	1	1	1	1	9
Thichumpa et al., 2018 (47)	1	1	1	1	1	1	1	1	1	1	10
Siripanich et al., 2018 (48)	1	1	1	0	1	1	1	1	1	1	9
Štefan et al., 2018 (49)	1	1	1	1	1	1	1	1	1	1	10
Liu et al., 2018 (50)	1	1	1	1	1	1	1	1	1	1	10
Jiyeon Ha et al., 2018 (51)	1	0	0	1	1	1	1	1	1	1	8
Ning Li et al., 2019 (28)	1	1	1	1	1	1	1	1	1	1	10
Kumar et al., 2019 (52)	1	1	0	0	1	1	1	1	1	1	8
Ansari et al., 2019 (53)	1	0	1	1	0	1	1	1	1	1	8
Honarvar et al., 2019 (54)	1	1	1	1	1	1	1	1	1	1	10
BruttO et al., 2020 (55)	1	0	1	1	0	1	1	1	1	1	8
Jia et al., 2020 (56)	1	1	1	1	1	1	1	1	1	1	10
Zitser et al., 2020 (27)	1	0	0	0	1	1	1	1	1	1	7
Nanthakwang et al., 2020 (57)	1	1	1	0	1	1	1	1	1	1	9
Ilkhan et al., 2020 (57)	1	0	1	0	0	1	1	1	1	1	7
Zhang et al., 2020 (58)	1	1	1	1	1	1	1	1	1	1	10
Sun et al., 2020 (59)	1	1	1	0	1	1	1	1	1	1	9
Zhao Hu et al., 2020 (60)	1	1	1	1	1	1	1	1	1	1	10
Xidi Zhu et al., 2020 (61)	1	1	1	1	1	1	1	1	1	1	10
SILVA et al., 2020 (25)	1	0	0	0	0	1	1	1	1	1	6
Zhang et al., 2020 (62)	1	1	1	0	1	1	1	1	1	1	9
Alqahtani et al., 2021 (63)	1	0	1	1	0	1	1	1	1	1	8

Xue et al., 2021 (64)	1	1	1	1	1	1	1	1	1	1	10
Xinyi Liu et al., 2021 (65)	1	1	1	1	1	1	1	1	1	1	10
Mota et al., 2021 (66)	1	0	0	1	0	1	1	1	1	1	7
Xu et al.,2021 (67)	1	0	1	0	0	1	1	1	1	1	7
Hao et al., 2021 (68)	1	0	1	1	0	1	1	1	1	1	8
Jesudoss et al., 2021 (69)	1	0	0	0	0	1	1	1	1	1	6
Yokoro et al., 2021 (70)	1	0	0	1	0	1	1	1	1	1	7
Jiri Cao et al., 2022 (71)	1	0	1	1	0	1	1	1	1	1	8
Chu et al., 2022 (72)	1	0	1	0	0	1	1	1	1	1	7
Regati et al., 2022 (73)	1	0	1	0	0	1	1	1	1	1	7
Wang et al., 2022 (74)	1	1	1	0	1	1	1	1	1	1	9
Liu et al., 2022 (75)	1	1	1	0	1	1	1	1	1	1	9
Lorber et al., 2022 (76)	1	0	1	0	1	1	1	1	1	1	8
Papadopoulou et al., 2023 (77)	1	1	1	1	1	1	1	1	1	1	10

Q1- Was the study's target population a close representation of the national population in relation to relevant variables?
Q2. Was the sampling frame a true and close representation of the target population?
Q3. An appropriate sample size was used? 200: Yes (Low risk), < 200: No (High risk)
Q4. Was the likelihood of non-response bias minimal?
Q5. Did the study evaluate limitations to extrapolation of prevalence to population?
Q6. Were data collected directly from the subjects (as opposed to a proxy)?
Q7. Was an acceptable case definition used in the study?
Q8. Was the study instrument that measured the parameter of interest (e.g. prevalence of anemia) shown to have reliability and validity (if necessary)?
Q9. Was the same mode of data collection used for all subjects?
Q10. Were the numerator(s) and denominator(s) for the parameter of interest appropriate?
* Each Item was scored as follows: yes = 1; no/unclear = 0.
* The quality of the studies was evaluated as follows: low quality, 0–3; moderate quality, 4–6; good quality, 7–10.

Prevalence of Poor Sleep Quality

The prevalence of poor sleep quality among older adults varied greatly across countries, with China reporting the lowest prevalence at 14% and Malaysia the highest at 96%. The overall pooled prevalence was found to be 50% (95% CI:45%–55%). The studies demonstrated significant heterogeneity (I^2 = 99.60%, $P_{\text{heterogeneity}} < 0.001$) (Figure 2).

Subgroup Analyses

The subgroup analysis results indicated that only the geographical area was identified as a significant factor impacting the heterogeneity of the studies (P < 0.001). Specifically, studies conducted in Africa reported a lower prevalence rate (27%; 95% CI = 23%–32%) compared to those conducted in other regions (48%, 61%, 69%, and 46% for Asia, Europe, Eurasia, and America, respectively). On the other hand, no significant differences were observed in the impact of other factors such as gender, level of development, sample size, survey time, PSQI cut-off, and response rate, on the overall heterogeneity of the analyzed data (Table 3).

Discussion

The meta-analysis findings indicate that approximately 50% (95% CI: 45%–55%) of the older adult population reports poor sleep quality, with prevalence rates ranging significantly from 14% in China to 96% in Malaysia. Subgroup analyses revealed that only geographical region significantly affects the heterogeneity of the pooled prevalence.

In this review, the global prevalence of poor sleep quality, reported at 50.0%, aligns with findings from Brazil (53%) (25) and Taiwan (49%) (26). However, these figures are significantly higher than those observed in population-based studies in the United States (22%) (27) and China (14%) (28). A comprehensive meta-analysis encompassing a sample of 995,544 participants across 36 countries identified obstructive sleep apnea as the most prevalent sleep disorder worldwide, affecting

46.0% of individuals, followed by poor sleep quality (40.0%), other sleep problems (37.0%), insomnia (29.0%), and excessive daytime sleepiness (19.0%) (12). Furthermore, a meta-analysis conducted in China revealed a pooled prevalence of sleep disturbances among older adults at 35.9% (95% CI: 30.6%–41.2%) (29).

The substantial heterogeneity observed among the studies (I² = 99.60%) suggests that multiple factors may influence sleep quality in older adults. In our analysis, geographical location emerged as a significant determinant of prevalence rates, with studies conducted in Africa reporting notably lower rates compared to those in other regions. However, it is essential to acknowledge that our study included only one sample from Africa, which may not adequately represent the entire continent. Furthermore, a review indicates that sleep parameters in low- and middle-income countries exhibit similarities to those in high-income countries (29). The absence of significant differences related to other demographic and methodological factors, such as gender and sample size, underscores the importance of cultural, environmental, and potentially healthcare-related influences on sleep quality. Additionally, a meta-analysis highlighted considerable variability in sleep quality that could not be accounted for by regional factors, rurality, gender, age group, or sleep assessment methods (30). A separate meta-analysis conducted in China also found no significant differences in sleep quality between genders or between rural and urban populations (29).

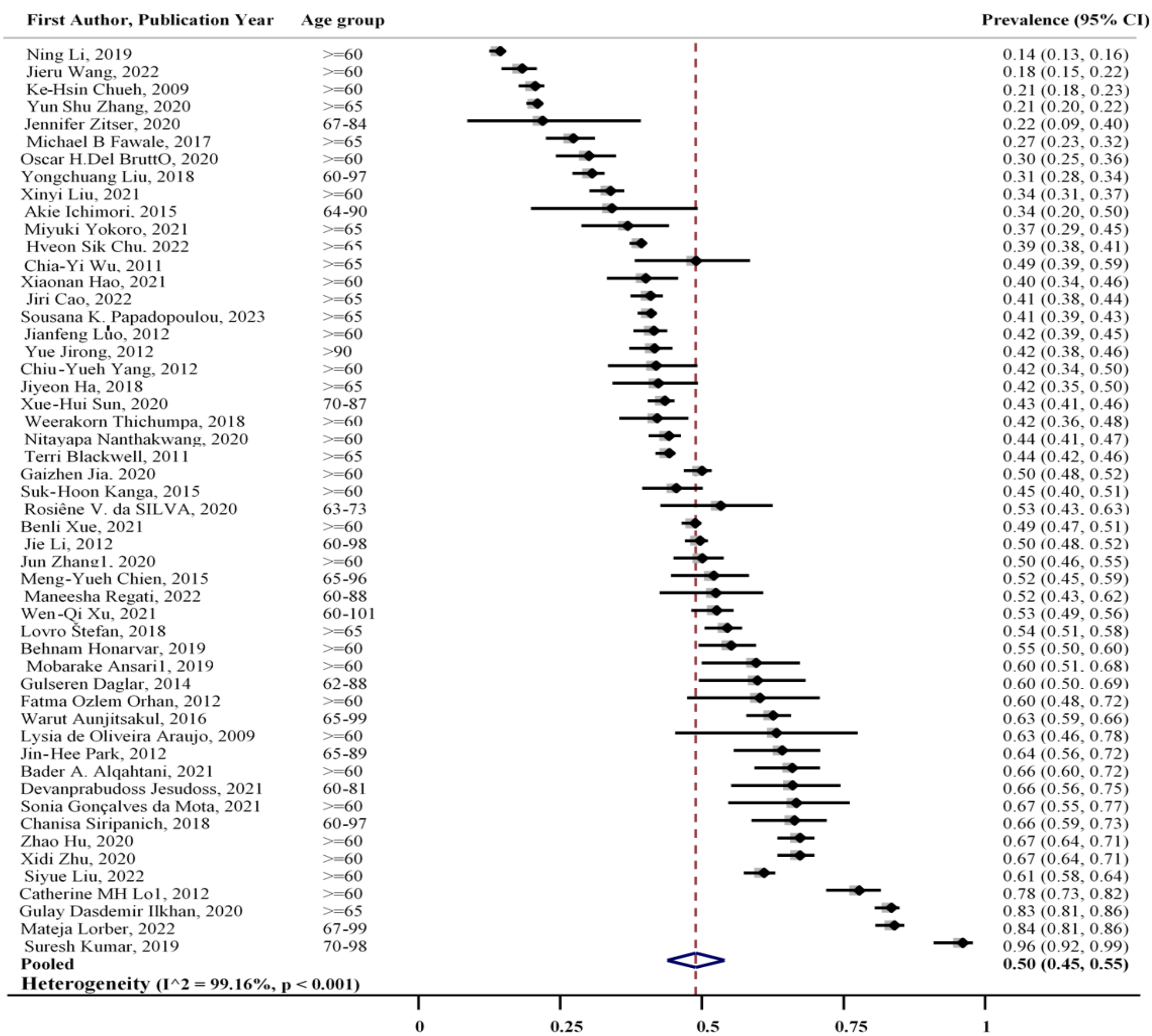

Figure 2. The Pooled Prevalence of Poor Sleep Quality in Older Adult

Table 3. Prevalence of Poor Sleep Quality in Older Adults: A Subgroup Analysis across Demographic, Geographical, and Methodological Factors

Subgroups	Number of Studies	Event	Effective Sample Size	Pooled Prevalence% (95% CI)	Between Studies		Between-Group	
					I^2	$P_{heterogeneity}$	Q	$P_{heterogeneity}$
Gender								
Male	20	2,369	7,619	44 (33-55)	98.80	< 0.001	1.08	0.30
Female	20	4,085	9,530	52 (42-61)	98.70	< 0.001		
Geographical Area								
Asia	39	15,068	37,148	48 (43-54)	99.10	< 0.001	49.96	< 0.001*
Europe	3	2,581	5,130	61 (34-84)	-	-		
Eurasia	3	1,071	1,335	69 (48-86)	-	-		
America	6	1,617	3,691	46 (36-57)	91.42	< 0.001		
Africa	1	117	428	27 (23-32)	-	-		
Level of Development								
Developing countries	44	4,121	8,673	50 (45-56)	99.19	< 0.001	0.39	0.53
Developed countries	8	16,333	39,059	46 (35-58)	98.90	< 0.001		
Sample Size								
< 500	26	2,426	4,720	53 (46-60)	95.85	< 0.001	4.88	0.09
500-1000	10	3,998	7,396	53 (41-66)	99.16	< 0.001		
> 1000	16	14,030	35,616	42 (34-50)	99.58	< 0.001		
Survey Time								
NR	4	744	1,580	55 (42-67)	94.28	< 0.001	5.48	0.14
2001-2010	10	3,613	8,274	38 (28-50)	99.20	< 0.001		
2011-2015	10	3,774	11,231	48 (39-58)	98.35	< 0.001		
2016-2022	28	12,323	26,674	53 (46-61)	99.27	< 0.001		
PSQI Cut-Off								
> 5	20	5,246	10,800	55 (49-61)	96.98	< 0.001	49.45	< 0.001
≥ 5	17	7,178	14,023	54 (44-64)	99.19	< 0.001		
> 6	1	1,869	4,756	39 (38-41)	-	-		
≥ 6	2	150	463	32 (28-37)	-	-		
> 7	10	5,317	16,037	37 (26-49)	99.54	< 0.001		
≥ 7	2	694	1,653	50 (45-55)	-	-		
Response Rate								
Yes	35	13,074	30,339	48 (42-54)	99	< 0.001	0.84	0.36
Non-reported	17	7,380	17,393	53 (45-55)	99.39	< 0.001		

*P-value < 0.05

Limitation

The current study has several strengths that contribute to the reliability and generalizability of its findings. These include a large sample size, a comprehensive search strategy, the use of studies with consistent methods for measuring sleep quality, inclusion of high-quality studies, representation of various regions of the world, and the use of subgroup analysis. However, there are also limitations to the study, such as high heterogeneity among the included studies, inadequate reporting of sampling methods in most studies, which limits subgroup analysis, and the lack of representation from the Africa continent. These limitations should be considered when interpreting the results to gain a more complete understanding of the global prevalence of poor sleep quality among adolescents.

Conclusion

This study reveals that approximately half of older adults experience poor sleep quality, a significant concern given its potential impact on their overall health and well-being. However, this prevalence is not uniform; it varies considerably across different geographic locations, indicating that environmental, cultural, and socioeconomic factors play a crucial role in shaping sleep health outcomes. Such disparities underscore the necessity for targeted interventions that consider these regional factors, ensuring that strategies to improve sleep quality are tailored to the specific needs and circumstances of diverse populations.

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Conflict of Interest

None.

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