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REVIEW

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Poor sleep quality and associated factors among people attending antiretroviral treatment clinics in Ethiopia: a systematic review and meta-analysis

Yeshiwas Ayale Ferede[1*], Agerie Mengistie Zeleke[2], Getaw Wubie Assefa[3], Assaye Birhan Getahun[4] and Worku Chekol Tassew[5]

Abstract

Background Sleep disturbances are frequently reported among people living with HIV infection. In Ethiopia, approximately half of people living with HIV/AIDS experience mental health issues, which further degrade sleep quality. This systematic review and meta-analysis aims to assess the national prevalence of poor sleep quality and identify key determinants.

Methods A systematic review and meta-analysis followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines, focusing on English-published studies. The search spanned Google Scholar, HINARI, Scopus, PubMed, EMBASE, Web of Science, and AJOL from April 4, 2023, to May 15, 2023. Three reviewers independently extracted data and evaluated study quality using a modified Newcastle–Ottawa scale for cross-sectional studies. Stata version 11 was used for the meta-analysis, employing a random-effects model to estimate poor sleep quality. Study heterogeneity was assessed using I2 and Cochran's Q test.

Results A total of 6,070 articles regarding poor sleep quality and/or associated factors among people attending antiretroviral treatment clinics in Ethiopia were retrieved. The pooled estimate of poor sleep quality among people living with HIV in Ethiopia was 52.64 (95% CI: 44.08, 61.20). Depression (AOR = 4.61; 95% CI: 1.15, 18.51), a CD4 count < 200 cells/mm^3 (AOR = 1.83; 95% CI: 0.33, 10.18), a viral load > 1000 copies (AOR = 1.42; 95% CI: 0.19, 10.61), and anxiety (AOR = 17.16; 95% CI: 4.47, 65.91) were identified as factors associated with poor sleep quality.

Conclusion A systematic review and meta-analysis found that about half of people living with HIV/AIDS in Ethiopia experience poor sleep quality. Key factors contributing to poor sleep quality include CD4 count, viral load, depression, and anxiety. Policymakers and relevant organizations should address these issues to improve sleep quality and manage the factors affecting it.

Keywords Sleep quality, Factors, HIV/AIDS, Peoples, Ethiopia

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Background

HIV/AIDS stands as one of the most devastating pandemics in recent history (Adane et al. 2022). In 2021, approximately 38.4 million people worldwide were living with HIV (Allavena et al. 2016); (Arbune et al. 2017). Among these, adults represented 95.6% of the HIV-positive population and accounted for 85.3% of all HIV/AIDS-related deaths (Arbune et al. 2017). In sub-Saharan Africa, Ethiopia was particularly impacted by the HIV epidemic, which showed significant regional variations and was concentrated in urban areas and specific hotspot regions (Bedaso et al. 2020); (Brown et al. 2010). The significant number of people living with HIV (PLHIV) in Ethiopia, estimated to have decreased from 617,270 in 2021 to 610,350 in 2022, indicates substantial progress (Buysse et al. 1989). Positive trends in HIV statistics provide patients with hope and confidence, illustrating that effective management and treatment can lead to control of the disease. At the same time, accurate and current data on HIV prevalence is crucial for strategic planning, allowing policymakers to allocate resources effectively and prioritize areas in need of greater focus (Celesia et al. 2017). The epidemic in Ethiopia was driven largely by key and priority populations (Crum-Cianflone et al. 2012). The primary contributors to the spread of HIV/AIDS were sexually active adults aged 15–49, who were also the main focus of national prevention and control initiatives (Crum-Cianflone et al. 2012).

Sleep disturbances are frequently reported among individuals with HIV infection (Darko et al. 1992). These issues can occur at any stage of the infection but are more prevalent in the advanced stages (Faraut et al. 2018). Research indicates that people living with HIV experience insomnia and other sleep problems at significantly higher rates than the general population, with prevalence ranging from 40 to 100% compared to 13% to 30% in the general population (Fortier-Brochu et al. 2012); (Gao et al. 2019); (GebreEyesus et al. 2023).

A meta-analysis revealed that the global prevalence of sleep disturbances among adults living with HIV is 58% (Fortier-Brochu et al. 2012). In Africa, the prevalence of sleep disturbances among adults with HIV ranges from 39.4% to 94% (GebreEyesus et al. 2023); (Gómez-Olivé et al. 2018); (Habte et al. 2022). In Ethiopia, approximately half of people living with HIV/AIDS experience mental health issues such as depression and anxiety, which further degrade sleep quality (Hand et al. 2003). Despite this, awareness of sleep disturbances as a significant health issue, both in general and in relation to HIV, remains low among patients and physicians. Consequently, the impact of disrupted sleep on overall quality of life is often under recognized (Huang et al. 2017).

Poor sleep quality is characterized by challenges in falling and staying asleep, excessive daytime sleepiness, irregular sleep–wake patterns, and dysfunction related to sleep stages (The Ethiopian Public Health Institute 2023). While the precise causes of poor sleep quality in individuals living with HIV are not fully understood, several factors are associated with these disturbances. These include the HIV infection itself, weakened immune system, side effects of antiretroviral medications (Faraut et al. 2018); (Johnston et al. 2017); (Kjøll 2023), low CD4 cell count, efavirenz-based ART regimens, the duration of living with HIV, as well as stress, anxiety, and depression (Gómez-Olivé et al. 2018); (Knutson 2015; Low et al. 2014; McGrath and Reid 2008; Workua M (2020)).

Sleep disruption in individuals with HIV can lead to non-adherence to prescribed medications (Mengistu et al. 2021), which accelerates disease progression to a critical stage (Mirkuzie et al. 2021). It also results in decreased job performance, increased absenteeism, a higher likelihood of accidents, diminished quality of life, elevated healthcare costs, a high prevalence of psychiatric comorbidities (Omonuwa et al. 2009), impaired cognitive function (WHO 2021), and an increased risk of hypertension (Gómez-Olivé et al. 2018), and obesity (WHO 2023). Moreover, poor sleep quality is associated with a higher incidence of unprotected sex. Conversely, better sleep quality in Peoples Living With HIV/AIDS (PLWHIV/AIDS) correlates with enhanced quality of life, including improved general well-being, reduced anxiety, fewer depressive symptoms, and lower symptom severity (Oshinaike 2014).

Despite scattered existing research suggesting varying degrees of poor sleep quality among Ethiopians living with HIV/AIDS, a comprehensive understanding of its prevalence and contributing factors remains elusive. This systematic review and meta-analysis aims to bridge this critical gap by quantifying the national prevalence of poor sleep quality and identifying key determinants. By shedding light on the magnitude and underlying causes of sleep disturbances in this population, our findings will empower decision-makers and stakeholders to develop and implement targeted health sector plans and initiatives. This could include allocating resources for effective sleep management interventions, integrating mental health services into HIV/AIDS care, and ultimately optimizing the well-being of individuals living with the disease.

Methods

This systematic review and meta-analysis was prepared and presented based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)

checklist (Oshinaike 2014) (supplementary file1). The review was registered on the International.

Prospective Register of Systematic Reviews (PROSPERO) with the unique number CRD42024553626.

The eligibility criteria

Studies included were those involving adults receiving care at antiretroviral treatment facilities in Ethiopia, focusing on sleep quality and its related factors, using observational methodologies. Only articles published in peer-reviewed journals in the English language were included in our review. All published articles up to May 15, 2023 were included in the review. Excluded were studies that did not clearly indicate poor sleep quality, lacked complete texts, or were abstracts, editorials, letters, reviews, comments, gray literature, or conducted in other countries.

Search strategy and information sources

A comprehensive and systematic literature search was conducted across various electronic databases, including Google Scholar, HINARI, Scopus, PubMed, EMBASE, Web of Science, and African Journal online (AJOL),spanning from April 4,2023, to May 15,2023. The search utilized specific keywords and Medical Subject Headings (MeSH) terms such as "poor sleep quality" OR "deprived sleep quality" OR "reduced sleep quality" AND "associated factors" OR "predictors" OR "determinants" AND "HIV-positive population" OR "peoples living with HIV/AIDS" AND "Ethiopia". The search was conducted by two authors (YAF and WCT). The objective of this study was to identify epidemiological studies providing insights into poor sleep quality and its determinants in this population.

Data extraction

Following the screening of each included original study's title, abstract, and complete text, data retrieval commenced utilizing a standardized data extraction technique, which had been adapted from the Joanna Briggs Institute (JBI). Independently, three reviewers (YAF, WCT, and GWA) undertook the data extraction process and meticulously scrutinized each included article. In instances of discordance or uncertainties, reviewers engaged in discussions to reach a consensus. Essential study features, encompassing the first author's name, the study's geographic location and setting, its publication year, design, participant demographics, sample size, and response rate, were meticulously extracted. Moreover, pertinent risk variables and the prevalence of poor sleep quality were also captured, accompanied by their respective 95% confidence intervals, providing a comprehensive snapshot of the research landscape on sleep quality.

Risk of bias (quality) assessment

Using the Newcastle–Ottawa scale (NOS) method modified for cross-sectional study quality evaluations, the effectiveness of each original study was evaluated. There are three primary components to the evaluation instrument. The tool's first section, which awards five stars, evaluates each study's methodological excellence (i.e., sampling technique, sample size, response rate, and ascertainment of the risk factor or exposure). The tool's second section evaluates the stud's comparability with the potential for two more stars. The last part of the test evaluates the findings and statistical analyses of the initial investigation, with a potential score increase of three stars. Finally, the quality ratings of the papers included in this systematic review and meta-analysis ranged from medium (5–6 out of 10 stars) to high (> 6 out of 10 stars). The review quality was independently evaluated by three writers (YAF, AMZ and ABG). Discussion was used to resolve disagreements among the reviewers throughout the quality evaluation (Supplemental file 2).

Outcome measure

The primary outcome measure of this meta-analysis and systematic review was poor sleep quality. Poor sleep quality was assessed using the Performance of Routine Information System Management (PRISM) assessment tool. It was defined as if it took you longer than 30 min to fall asleep, if you woke up during the night more than once, or if it took you longer than 20 min to drift back asleep after waking up. Sleep quality was assessed by using the Pittsburgh Sleep Quality Index (PSQI), a 19-item self-rated scale that measures sleep quality and disturbances over a 1-month time interval. The tool mainly addresses seven sleep components: sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of hypnotics, and daytime dysfunction during the last month. The total PSQI score is then calculated by summing the seven component scores, giving an overall score ranging from 0 to 21. A score > 5 points indicates poor sleep quality (Page et al. 2021). The second outcome variable of the study was poor sleep quality among people living with HIV/AIDS on follow-up in Ethiopia, which was measured as the odds ratio (OR). The odds ratio was calculated for each identified factor based on the binary outcome data reported by each primary study.

Data synthesis and analysis

A summary table was used to describe the various primary studies. The results were displayed graphically using a forest plot and a 95% confidence interval. (CI). The statistical program Stata version 11 was utilized to carry out this meta-analysis. To estimate poor sleep

quality, a random-effects model was applied. I2 and the Cochran's Q test were employed to identify study heterogeneity. Additionally, the presence of publication bias was determined by visually examining the asymmetry of funnel plots and using Egger's regression test with a *p* value limit of less than 0.05. The findings showed that there was no indication of publication bias.

Results

Search results

A total of 6,070 articles regarding poor sleep quality and/or associated factors among people attending antiretroviral treatment clinics were retrieved through a thorough search of different databases. Of this 5,897 from Google scholar, 13 from HINARI, 9 from Scopus,73 from PubMed,18 from EMBASE, 23 from Web of Science, and 37 from African Journal Online (AJOL). Among the total retrieved studies, 979 studies were removed due to duplication. After assessing the articles based on their titles and abstracts, 5,050 articles were excluded. The remaining 41 full-text articles were assessed for eligibility, which resulted in the further exclusion of 36 articles, mainly because of variation in the study population and unreported outcomes of interest. As a result, 5 studies were included in the final meta-analysis (Fig. 1).

Characteristics of the included studies

A facility-based cross-sectional research design was utilized in all included studies to estimate poor sleep quality. All of the papers included in this study were published between 2020 and 2023. A total of 2,013 persons out of an estimated 2,076 total participated, and the sample size ranged from 404 (Hand et al. 2003) to 422 (Peltzer and Phaswana-Mafuya 2008). According to the included studies, the percentage of poor sleep quality ranged from 36% (Phillips et al. 2005) to 59% (Ren et al. 2018). Two studies were from the Amhara Region (Hand et al. 2003), one study was from the Sidama Region (Gómez-Olivé et al. 2018), one study was from the Oromia Region, and one study was from the Addis Ababa Region (Hand et al. 2003); (Peltzer and Phaswana-Mafuya 2008); (Ren et al. 2018); (Rodríguez Estrada et al. 2018) (Table1).

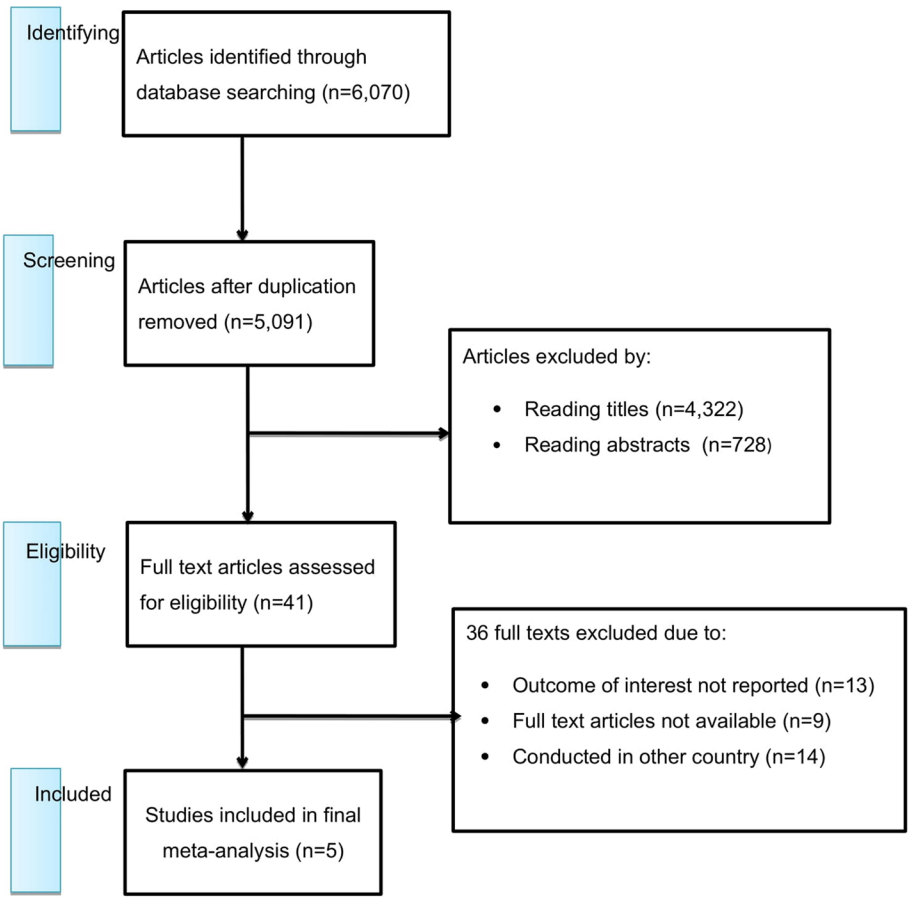

Fig. 1 Flow chart of study selection for systematic review and meta-analysis of poor sleep quality and associated factors among ART users in Ethiopia, 2023

Table 1 Descriptive summary of primary studies included in the meta-analysis of poor sleep quality and associated factors among people living with HIV on follow up in Ethiopia, 2023

id	Author	Pub year	Region	Study Area	Study design	Study population	Sample size	Prevalence (%)	Response rate (%)
1	M. Adane (2022)	2022	Amhara	Finoteselam	Cross-sectional	ART users	417	55.1%	95.6%
2	Workua M (2020)	2021	Oromia	Jima	Cross-sectional	ART users	410	59	100%
3	GebreEyesus et al (2023)	2023	Amhara	Dessie	Cross-sectional	ART users	419	36	100%
4	Asres B (2020)	2020	Sidama	Hawasa	Cross-sectional	ART users	422	57.6%	92.18%
5	Mengistu et a (2021)	2021	Addis Ababa	Addis Ababa	Cross-sectional	ART users	408	55.6%	97%

Meta-analysis

Risk of bias assessment for the included studies

The Newcastle–Ottawa scale tool, which has been modified for cross-sectional research, was used to objectively evaluate the quality of each original investigation. Overall, approximately four-five ($n=4$, 80%) of the included studies had excellent quality, while the remaining one-five ($n=1$, 20%) had medium quality, according to the quality assessment summary (Table 2).

Poor sleep quality among people living with HIV in Ethiopia

Overall, poor sleep quality among people living with HIV on follow-up in Ethiopia was estimated to be 52.64% (95% CI: 44.08, 61.20). When assessing overall poor sleep quality among people living with HIV during follow-up, there was significant variability among the included studies (I2 = 93.7%; $p=0.000$). Hence, during the meta-analysis, a random effects model was employed to determine the pooled prevalence of poor sleep quality among people living with HIV during follow-up (Fig. 2).

Subgroup analysis Based on the regions where the primary studies were performed, subgroup analysis was performed. Similarly, the Oromia region had the highest prevalence of poor sleep quality among people living with HIV at follow-up, at 59 (95% CI: 54.24, 63.76), while the Amhara region had the lowest prevalence of poor sleep quality among people living with HIV at follow-up, at 45.53% (95% CI: 26.81, 64.25) (Fig. 3).

Publication bias Visual inspection of the asymmetry in funnel plots and Egger regression tests were employed to assess the existence of publication bias. Accordingly, the results of both the funnel plots and Egger's tests revealed the absence of publication bias in the included studies. Egger's test was not statistically significant ($p=0.196$), indicating the absence of publication bias. Additionally, visual inspection of the funnel plots showed a symmetric distribution of studies (Fig. 4).

Factors associated with poor sleep quality

Due to uneven categorization (grouping) of the independent variables, some of the characteristics linked with poor sleep quality were quantitatively pooled, and some were not due to inconsistent classification (grouping) of the independent variables with respect to the outcome (poor sleep quality).

Five studies revealed a strong correlation between depression and poor sleep quality among people living with HIV during follow-up. When comparing poor sleep quality with depression, the odds of poor sleep quality among people living with HIV on follow-up who had depression were 4.61 times greater (AOR = 4.61; 95% CI: 1.15,18.51). The included papers in this meta-analysis were characterized by the presence of heterogeneity (I2 = 97.6%, $P=0.000$). Random effect model analysis was therefore employed (Fig. 5).

Four studies revealed a strong correlation between CD4 count and poor sleep quality among people living with HIV during follow-up. When comparing poor sleep quality with poor sleep quality according to the CD4 count, for people who had a CD4 count less than 200 cells/mm3, the odds of poor sleep quality among people living with HIV at follow-up were 1.83 times greater (AOR = 1.83; 95% CI: 0.33, 10.18). The included papers in this meta-analysis were characterized by the presence of heterogeneity (I2 = 97.5%, $P=0.000$). Random effect model analysis was therefore employed (Fig. 6).

Three studies revealed a strong correlation between viral load and poor sleep quality among people living with HIV during follow-up. When comparing poor sleep quality with viral load, for people who had a viral load greater than 1000 copies, the odds of poor sleep quality among people living with HIV during follow-up were 1.42 times greater (AOR = 1.42; 95% CI: 0.19, 10.61). The

Table 2 Methodological quality assessment of included studies using modified Newcastle—Ottawa Scale (NOS)

Corresponding author [reference]	Study Design	Criteria								
		Selection				Comparability		Outcome		
		Representativeness of the sample	Sample size (Darko et al. 1992)	Non – responders	Ascertainment of exposure/ risk factor	The study controls for the most important factor	The study control for any additional factor	Assessment of the outcome	Statistical test	Quality score
M. Adane (2022)	Cross-sectional	A*	**A***	**A***	**B***	A**	-	A*	**A***	**8**
Workua M (2020)	Cross-sectional	A*	**B***	**B***	**B***	–	-	A*	**A***	**6**
GebreEyesus et al (2023)	Cross-sectional	B*	**B***	**B***	**B***	A**	-	A*	**A***	**8**
Asres B (2020)	Cross-sectional	B*	**A***	**B***	**A***	A**	**B***	A*	**A***	**9**
Mengistu et a (2021)	Cross-sectional	A*	A*	A*	**B***	**B***	–-	A*	A*	**7**

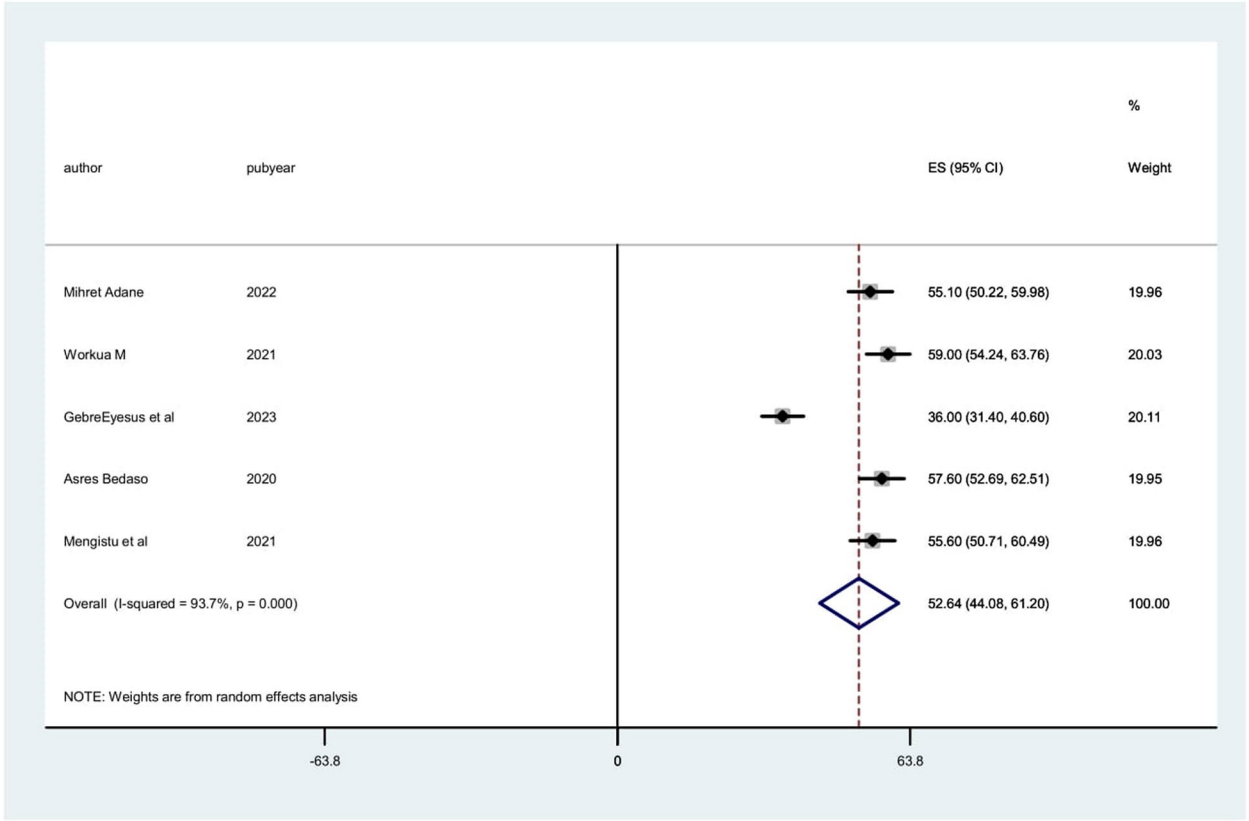

Fig. 2 Forest plot of the pooled poor sleep quality among ART user in Ethiopia, 2023

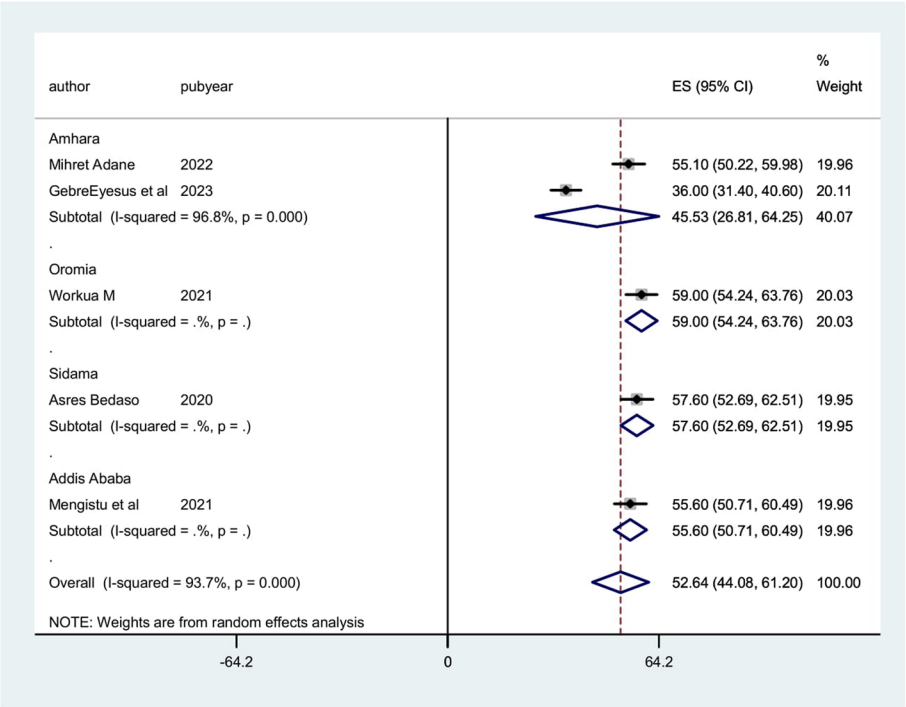

Fig. 3 Subgroup analysis of poor sleep quality among ART users in Ethiopia, 2023

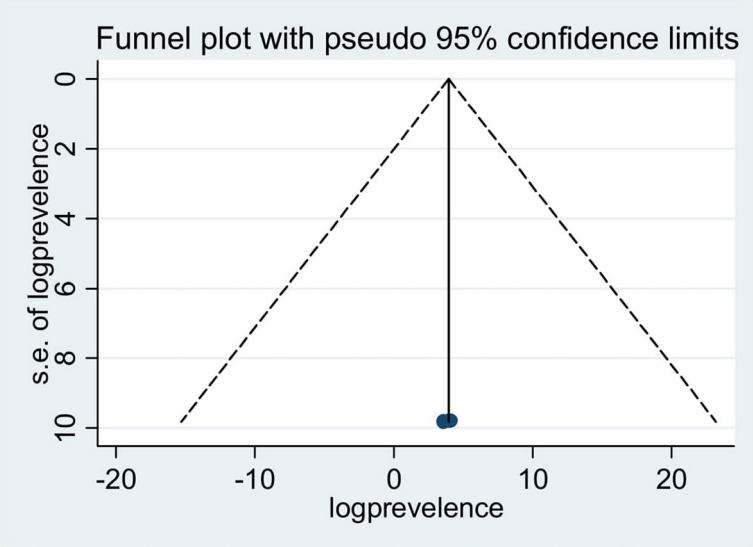

Fig. 4 Graphic representation of publication bias using funnel plots of all included studies, 2023

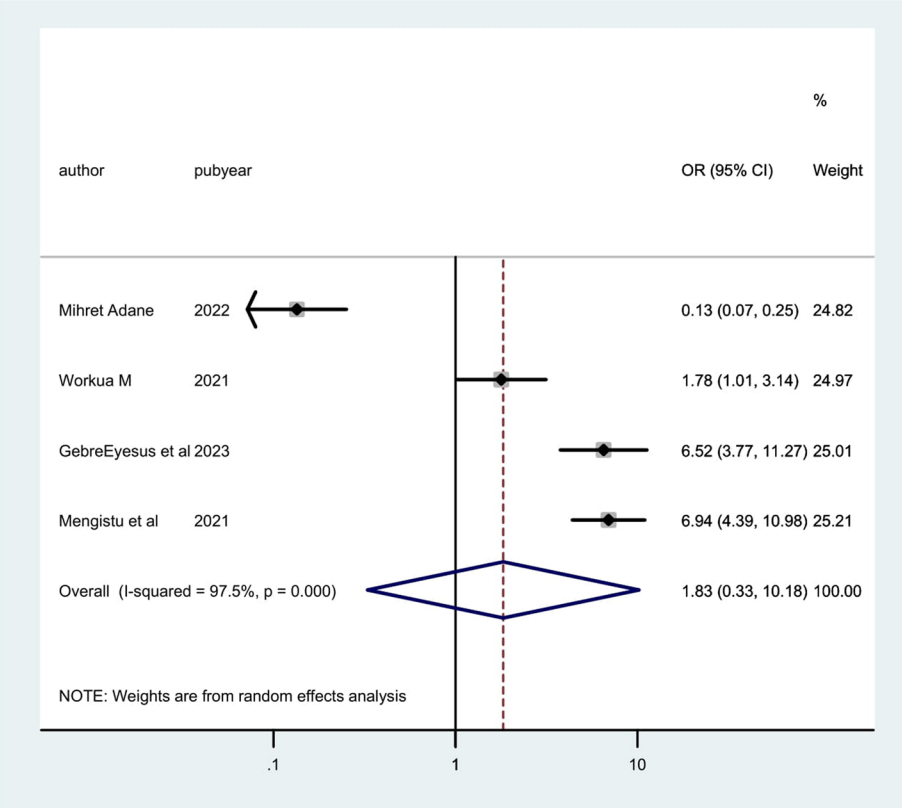

Fig. 5 Forest plot showing the pooled odds ratio of the association between depression and poor sleep quality among living with HIV on follow up in Ethiopia, 2023

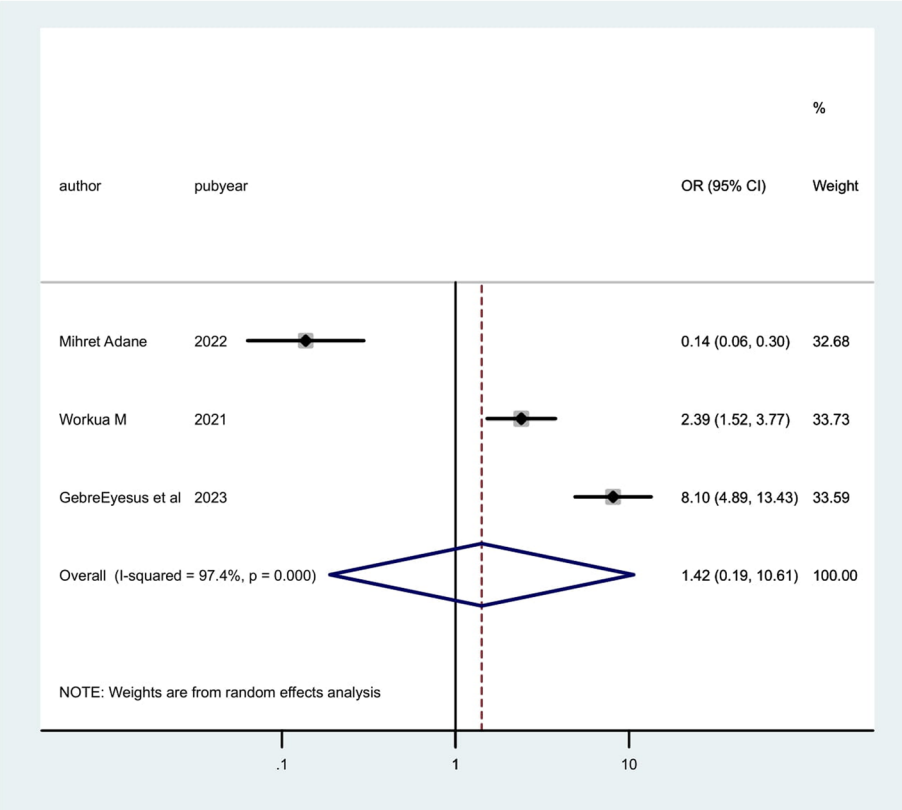

Fig. 6 Forest plot showing the pooled odds ratio of the association between CD4 count and poor sleep quality among living with HIV on follow up in Ethiopia, 2023

included papers in this meta-analysis were characterized by the presence of heterogeneity (I2 = 97.4%, *P* = 0.000). Random effect model analysis was therefore employed (Fig. 7).

Two studies revealed a strong correlation between anxiety and poor sleep quality among people living with HIV during follow-up. When comparing poor sleep quality with anxiety, for people with anxiety, the odds of poor sleep quality among people living with HIV at follow-up were 17.16 times greater (AOR = 17.16; 95% CI: 4.47, 65.91). The included papers in this meta-analysis exhibited heterogeneity (I2 = 90.6%, *P* = 0.001). Random effect model analysis was therefore employed (Fig. 8).

Discussion

This meta-analysis was performed to estimate the national prevalence of poor sleep quality and associated factors. To the best of our knowledge, this meta-analysis is the first to estimate the pooled prevalence of poor sleep quality and associated factors among people living with HIV during follow-up in Ethiopia. This review indicated a wide range of poor sleep quality among HIV patients at follow-up, ranging from as low as 36% to as high as 59%. The pooled prevalence of poor sleep quality among people living with HIV in Ethiopia was 52.64 (95% CI: 44.08, 61.20). Although there is no meta-analysis on this topic, the poor sleep quality among people living with HIV reported in the present study is consistent with that reported in other studies conducted in France (47%) (Faraut et al. 2018), Nigeria (59.3%) (Roth 2007), Italy (46.9%) (Saberi et al. 2011), and the USA (58%) (Fortier-Brochu et al. 2012); (Sandoval et al. 2014). However, this percentage is lower than that reported in other studies conducted in Cameroun (66.7% (Sandoval et al. 2014), Germany (63% (Schwartz et al. 1987), and Paris (68% (Shittu et al. 2015). The possible discrepancy is due to variations in sociocultural characteristics, study setting and design, type of measurement tools, sampling methods, and data collection methods.

However, the findings of this study were greater than those of studies conducted in South Africa (16%) (Vosvick et al. 2004), China (43.1%) (Workua M (2020)), and Romania (42%) (Wakeham et al. 2018). The possible reasons for these discrepancies might be cultural differences; cultural differences in sleeping locations (on the ground, on communal platforms, in beds, etc.) and

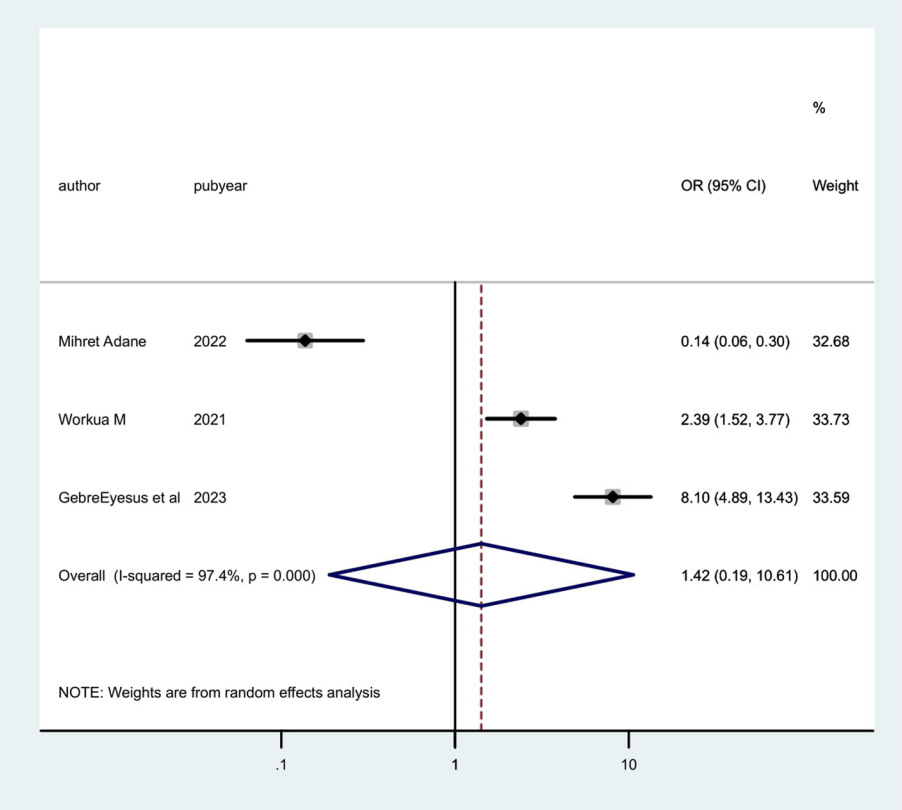

Fig. 7 Forest plot showing the pooled odds ratio of the association between viral load and poor sleep quality among living with HIV on follow up in Ethiopia, 2023

sleeping partners (alone, with a spouse, with immediate family, in community groups, etc.) in different traditions and societies also affect the timing, duration and regularity of sleep.

This meta-analysis showed that ART patients with depression had fourfold-fold greater odds of having poor sleep quality than HIV patients without depression. This finding is supported by a study performed in France (Faraut et al. 2018), Italy (Saberi et al. 2011), the US and the southern United States (Fortier-Brochu et al. 2012); (Sandoval et al. 2014), which indicated that the presence of comorbidities of mental disorders further complicates the sleep quality of HIV-positive patients.

Regarding viral load, the odds of reporting poor sleep quality are greater among HIV patients with a viral load > 1000 copies than among those with a viral load < 1000 copies. This finding is in line with studies performed in Los Angeles (Mengistu et al. 2021) and the USA (Wibbeler et al. 2012). The possible reason might be that the detectable levels of HIV in a viral load test cause sleep disturbances very early during infection and have been hypothesized to be associated with the rapid and hyperactive immune response soon after infection. In addition, HIV has the ability to cross the blood–brain barrier and directly affect glial cells, resulting in sleep alterations.

Furthermore, the odds of poor sleep quality are greater among HIV patients with CD4 counts < 200 cells/mm^3 than among those with CD4 counts > 200 cells/mm^3. This could be because CD4 + T cells in the immune system are directly linked to the psyche by a complex network of nerves, hormones, and neuropeptides. This network of specific physiological pathways allows immune function to have a direct impact on health, especially sleep.

Moreover, regarding anxiety, the odds of reporting poor sleep quality were greater among HIV patients who had anxiety than among those with no anxiety. This is supported by a study conducted in China (Workua M (2020)) and the USA (Womack et al. 2017). The reason is that the polysomnographic features that characterize patients with anxiety include longer sleep onset latency, a greater number of arousals, and greater wake time during the night (Wu et al. (Wu et al. 2015).

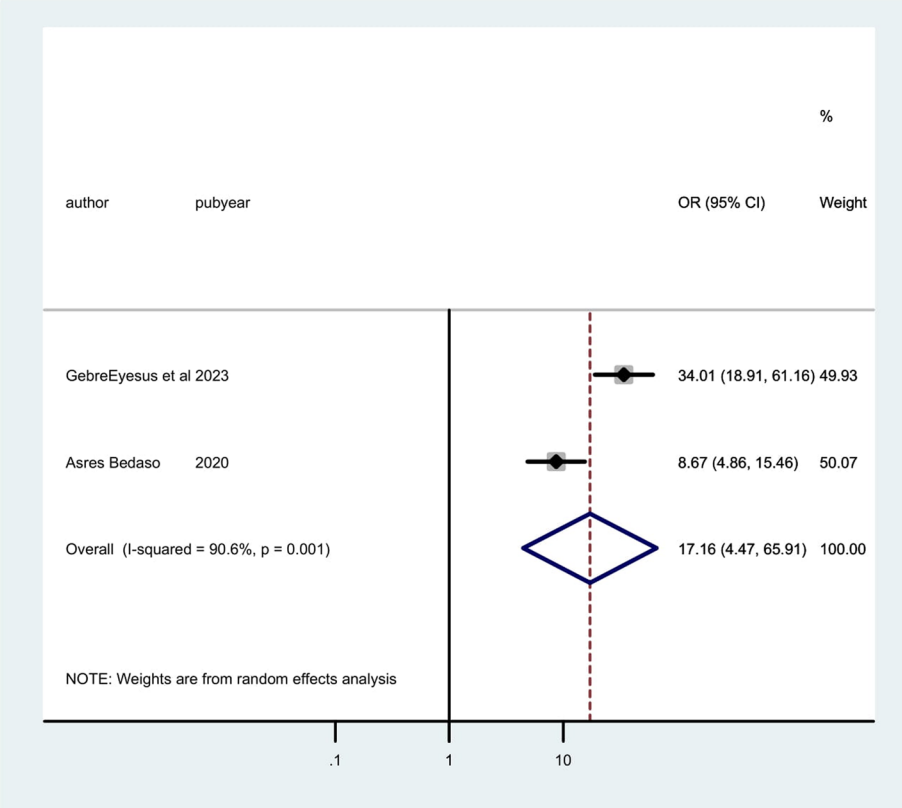

Fig. 8 Forest plot showing the pooled odds ratio of the association between anxiety and poor sleep quality among living with HIV on follow up in Ethiopia, 2023

Limitations of the study

Although this study is the first systematic review and meta-analysis of poor sleep quality among people living with HIV in Ethiopia, it has several limitations. In this meta-analysis, only articles published in the English language and with accessible full-text versions were included. The pooled odds ratios for all variables associated with poor sleep quality among people living with HIV were not examined because the included studies classified the variables in different ways. All of the included articles were facility-based cross-sectional studies, which may reduce the generalizability of the findings. Furthermore, this study included only studies from four regions, which may have affected the pooled prevalence of poor sleep quality in HIV patients.

Conclusion

This systematic review and meta-analysis revealed that approximately one-half of HIV patients had poor sleep quality. In this study, CD4 count, viral load, depression, and anxiety were identified as factors associated with poor sleep quality among people living with HIV in Ethiopia. Thus, policy makers, FMOHs, and interested bodies should discuss this issue to enhance the quality of sleep and to develop a system to control factors that affect sleep quality.

Abbreviations

POR	Pooled odd ratio
POR	Adjusted odd ratio
CI	Confidence intervals
PRISMA	Preferred Reporting Items for Systematic review and Meta-analysis
PSQI	Pittsburgh Sleep Quality Index
NOS	Newcastle–Ottawa scale
FMOH	Federal, Ministry, of Health
PLWHIV/AIDS	Peoples Living With HIV/AIDS

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s41606-024-00106-7.

Supplementary Material 1: Supplemental file 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist. Supplemental file 2. Methodological quality assessment of the included studies was performed using the Newcastle–Ottawa Scale (NOS).

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Informed consent
Not applicable.

Authors' contributions
Conceptualization: Yeshiwas Ayale. Data curation: Yeshiwas Ayale, Worku Chekol. Formal analysis: Yeshiwas Ayale, Agere Mengistie. Funding acquisition: Yeshiwas Ayale. Investigation: Yeshiwas Ayale. Methodology: Yeshiwas Ayale, Worku Chekol, Getaw Wubie. Supervision: Agere Mengistie, Worku Chekol, Assaye Birhan. Validation: Yeshiwas Ayale, Worku Chekol, Agere Mengistie. Visualization: Yeshiwas Ayale. Writing – original draft: Yeshiwas Ayale, Worku Chekol, Agere Mengistie. Writing – review& editing.

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Availability of data and materials
All relevant data generated and analyzed in the analysis process are included in this article.

Declarations

Ethics approval and consent to participate
Not applicable.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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