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Practice on hepatitis B virus infection prevention and associated factors in Ethiopia: systematic review and meta-analysis

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Abstract

Background Hepatitis B infection due to poor practices can result in prolonged hospital stays, long-term disability, increased microbial resistance, financial burdens and death. There has been no comprehensive study assessing the practice level of hepatitis B virus infection prevention in Ethiopia despite the high risk of exposure. Thus, this review aimed to assess practice on hepatitis B virus infection prevention in Ethiopia.

Methods For published studies, we conducted a thorough search of the PubMed, African Journal Online, Science Direct, Cochrane Library and Google Scholar databases. The data were exported to STATA version 11 (STATA Corp LLC) for meta-analysis. Heterogeneity between the results of the primary studies was assessed using Cochran's Q chi-square test and quantified with I^2 statistics. A random effect model, specifically the DerSimonian and Laird pooled estimate method, was used due to the presence of heterogeneity between the included articles.

Results and conclusions Initially, 1738 articles were retrieved through electronic database searching. Of these, 910 were from Google Scholar, 4 from PubMed, 378 from Science Direct, 421 from African Journal Online and 25 from the Cochrane Library. The pooled estimate showed that 41.54% (95% CI: 33.81–49.27, $P<0.001$) of individuals had a good practice towards hepatitis B virus infection prevention. Good knowledge of HBV infection prevention (POR = 1.13, 95% CI: (0.28–4.46) and urban residence (POR = 4.27, 95% CI: 1.17–15.49) were factors significantly associated with practices aimed at preventing hepatitis B virus infection. Based on the findings of the current study, most of the participants reported poor practices for hepatitis B virus infection prevention. Residence and knowledge of hepatitis B virus prevention were significantly associated with practices aimed at preventing hepatitis B virus infection. The Ministry of Health should collaborate with the health bureau for continual awareness about the mode of transmission and preventive measures of HBV.

Keywords Practice, Hepatitis B virus prevention, Systematic review, Meta-analysis, Ethiopia

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Introduction

As per the World Health Organization (WHO) in 2019, around 296 million people were living with chronic HBV infection, with 1.5 million new cases annually, leading to 1.3 million deaths from liver cancer and cirrhosis [1, 2]. Globally, hepatitis B infection poses a significant public health challenge for roughly two-thirds of the global population residing in regions with high transmission risks [3]. Without swift and coordinated intervention, the impact of hepatitis B viral infection is expected to worsen, potentially resulting in an estimated 20 million deaths from 2015 to 2030 [4]. A meta-analysis conducted in 2018 found that just 25% of healthcare workers in Africa had received complete vaccination against the hepatitis B virus as part of preventive measures [5]. A systematic review and meta-analysis conducted in Africa revealed that approximately one in fifteen healthcare workers were infected with HBV, and more than one in twenty were infected with HCV. The substantial prevalence of HBV and HCV infections continues to be a significant issue among healthcare workers in Africa [6].

Liver disease advancing to severe stages and the onset of hepatocellular carcinoma (HCC) place substantial burdens on low-income countries. Furthermore, political and socioeconomic challenges often hinder or prevent efforts to prevent, manage, and treat HBV infection and its associated conditions [7]. In the poorest countries with high infection rates, challenges remain due to the cost of vaccines and insufficient implementation of preventive measures. Moving forward, a significant challenge will be addressing social and economic obstacles to sustain and improve global prevention efforts aimed at reducing the worldwide impact of the disease [8].

Both symptomatic and asymptomatic individuals can spread the infection to others, making chronic carriers a continual risk across all demographic groups [9]. Hepatitis B virus (HBV) infection spreads easily from infected individuals to healthy individuals through various means: contact with blood, needle-stick injuries, transmission from mother to fetus during pregnancy, unsafe sexual practices, sharing of personal care equipment like barbershop and beauty salon tools. Additionally, HBV can be transmitted through injection drug use, tattooing, ear piercing, acupuncture, and during dialysis procedures, all of which heighten the risk of infection. [10, 11].

Hepatitis B viral infection poses significant public health risks due to inadequate decontamination and sterilization practices of equipment, as well as poor management of healthcare waste, much of which is hazardous and can lead to various health hazards [12]. All populations face a high risk of hepatitis B viral infection due to frequent exposure to blood and other body fluids, particularly healthcare providers during clinical activities such as administering medications, collecting laboratory samples, and disposing of waste [13]. An updated systematic review and meta-analysis in Ethiopia the pooled prevalence of HBV was high in Ethiopia and it is a major public health threat [14]. Strengthening the scope of the existing vaccination program and the establishment of prevention methods is highly recommended. In addition, it will be better if the existing infection prevention program is revised and target specific task force should be organized at different levels of health facilities [15].

Increased hepatitis B infection burden in Ethiopia resulting from poor practices can lead to prolonged hospital stays, long-term disability, increased microbial resistance, financial strain, and death. Inadequate adherence to hepatitis B virus prevention measures such as improper use of personal protective equipment, needle-stick injuries, and lack of vaccination, particularly in healthcare settings, can contribute to the virus's high contagiousness and increased prevalence. Despite the global decrease in HBV burden due to widespread immunization campaigns, the current infection rates, especially in developing countries, remain a significant public health concern for the future. Enhancing worldwide prevention policies is essential to mitigate the global impact of this disease.

In Ethiopia, although the risk of Hepatitis B Virus (HBV) infection is notably high, there has yet to be a thorough study evaluating current preventive practices. Conducting such research is essential for informing intervention strategies and will offer important insights for stakeholders focused on diminishing the HBV infection burden. The results will be especially beneficial for program managers and health planners as they design vaccination and other preventive initiatives. Hence, this review was conducted to evaluate the practices related to the prevention of HBV infection in Ethiopia.

Materials and methods

The protocol of this systematic review and meta-analysis was designed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols (PRISMA-P 2015) Guidelines (Supplementary file S1). The Prospero registration number is CRD42024573994

Study setting

The review was conducted using primary studies in Ethiopia.

Search strategy for articles

For published studies, we conducted a thorough search of PubMed, African journals online, Science Direct, the Cochrane Library and Google Scholar using a combination of keywords and Boolean operators (AND & OR) on relevant primary articles reporting the level of practice

of hepatitis B virus infection prevention HIV-infected patients in Ethiopia from February 10th to April 10 2024. The keywords used to search the mentioned databases were "prevention practice of hepatitis B virus", "practice towards hepatitis B virus prevention ", "hepatitis B virus prevention practice", "HBV prevention practice", "hepatitis B surface antigen prevention practice", "HBsAg prevention practice", "viral liver disease prevention practice", "viral hepatitis prevention practice", and "Ethiopia". According to the database requirements, the search string was customized for each database. Moreover, a snowball search was used to search the citation lists of included studies. The search incorporated studies articles up to the 10th of April 2024. EndNote (version X7) reference management software was used to download, organize, review, and cite related articles. To identify potentially suitable papers, the two reviewers (WCT and AMZ) blindly examined the titles, abstracts, and full-text search results. Likewise, the whole text of selected papers was thoroughly reviewed in light of the inclusion criteria. For duplicate studies, the first version or the one with all the necessary data was used. Disagreements that occurred during screening were settled by consensus. The qualifying standards for this review were established using the modified Population, Intervention, Comparison, Outcome, and Type of study/context (PICOT) framework Table 1.

Eligibility criteria

Inclusion criteria

Studies were eligible only if they were primary study full-text articles published in peer-reviewed journals, published in the English language, and conducted in Ethiopian settings. In addition, observational studies that reported the prevalence of HBV prevention practices were included.

Exclusion criteria

Studies that did not report the prevalence of HBV prevention practices and studies with poor methodological quality were excluded from the analysis. Other exclusion criteria include studies that are duplicate, unavailable full texts, abstract-only papers containing no extracted data or information, clinical trials, case reports, case series studies, or conference proceedings.

Table 1 Framework for determining the eligibility of studies (PICOS)

criteria	Description
Population	Health care professionals, health science students
Intervention	Practice on hepatitis B virus infection prevention
Comparison	Not applicable for the review
Outcome	Good practice on hepatitis B virus infection prevention, associated factors of good practice
Study area/context	Ethiopia

Outcome of interest

The outcome of the review was the practice level, which is defined in primary studies as Good practice: when the study participants were at least able to answer 70% or more practice items on the questionnaire correctly. Malpractice: when the participants were unable to answer 70% of practice items correctly. The practice questions including the following items (always use glove other protective materials while handling different body fluids, always properly dispose needle/ sharps, had a history of needle-stick injury, always report for needle-stick injury, have you ever screened for hepatitis B or C?, have you got yourself vaccinated against hepatitis B?, always keep my hand hygiene before and after all patient contact and have you ever involved in an unsafe sex [16]?

Article selection and data extraction

All the articles retrieved from the abovementioned electronic databases were exported to EndNote X7, and duplicate articles were removed. After removing duplications, two authors (AMZ & YAF) independently screened and excluded ineligible articles. Data extraction was performed using a tool developed by the 2014 Joanna Brings Institute Reviewers' Manual data extraction format by two authors (AMZ & YAF). The data were extracted by two independent authors (AMZ and YAF) using a data extraction format prepared in a Microsoft Excel spreadsheet. When studies lacked sufficient methodological information or the substance was unclear, the principal authors were approached for clarification via an official email address or phone number. The following data were extracted: the first author's name, publication year, region, design, sample size, sampling method, prevalence of hepatitis B prevention practice, and factors associated with their odds ratios.

Quality appraisal

Quality assessment was performed using the Joanna Briggs Institute (JBI) critical appraisal checklist for cross-sectional studies using 9 criteria. The critical appraisal tool included nine parameters: yes, no, unclear and not applicable options: (1) appropriate sampling frame, (2) proper sampling technique, (3) adequate sample size, (4) study subject and setting description, (5) sufficient data analysis, (6) use of valid methods for the identified conditions, (7) valid measurement for all participants, (8) appropriate statistical analysis, and (9) adequate response rate. Operationally, a score of 1 was assigned for a yes response, whereas a score of 0 was assigned for no and unclear responses. For each question, a score was assigned (0 for 'not reported or not appropriate' and 1 for

'yes'); the scores were summarized across the items to obtain a total quality score that ranged from 0 to 9. Studies were then classified as having low, medium or high quality when the summed points reached 0–4, 5–7 or 7–9, respectively.

Statistical analysis

Heterogeneity test

The extracted data were exported to STATA version 11 (STATA Corp LLC) for meta-analysis. Heterogeneity between the results of the primary studies was assessed using Cochran's Q chi-square test and quantified with I^2 statistics. A p value of less than 0.05 was considered to indicate statistically significant heterogeneity. Based on the I^2 statistics, values less than 25% indicated low heterogeneity, values between 50 and 75% indicated medium heterogeneity, and values greater than 75% indicated high heterogeneity. Thus, a random effect model was used to pool the prevalence of good practice since the studies were found to be heterogeneous. A random effect model, specifically the DerSimonian and Laird (D+L) pooled estimate method, was used due to the presence of heterogeneity between the included articles. This model we assumes a distribution with some central value and some degree of variability. As one of the handling mechanisms of heterogeneity, we performed subgroup analysis for the pooled estimate of hepatitis B virus infection prevention practice by sampling technique. Sensitivity analysis was conducted to assess the role of each study in the final result by excluding each study one by one.

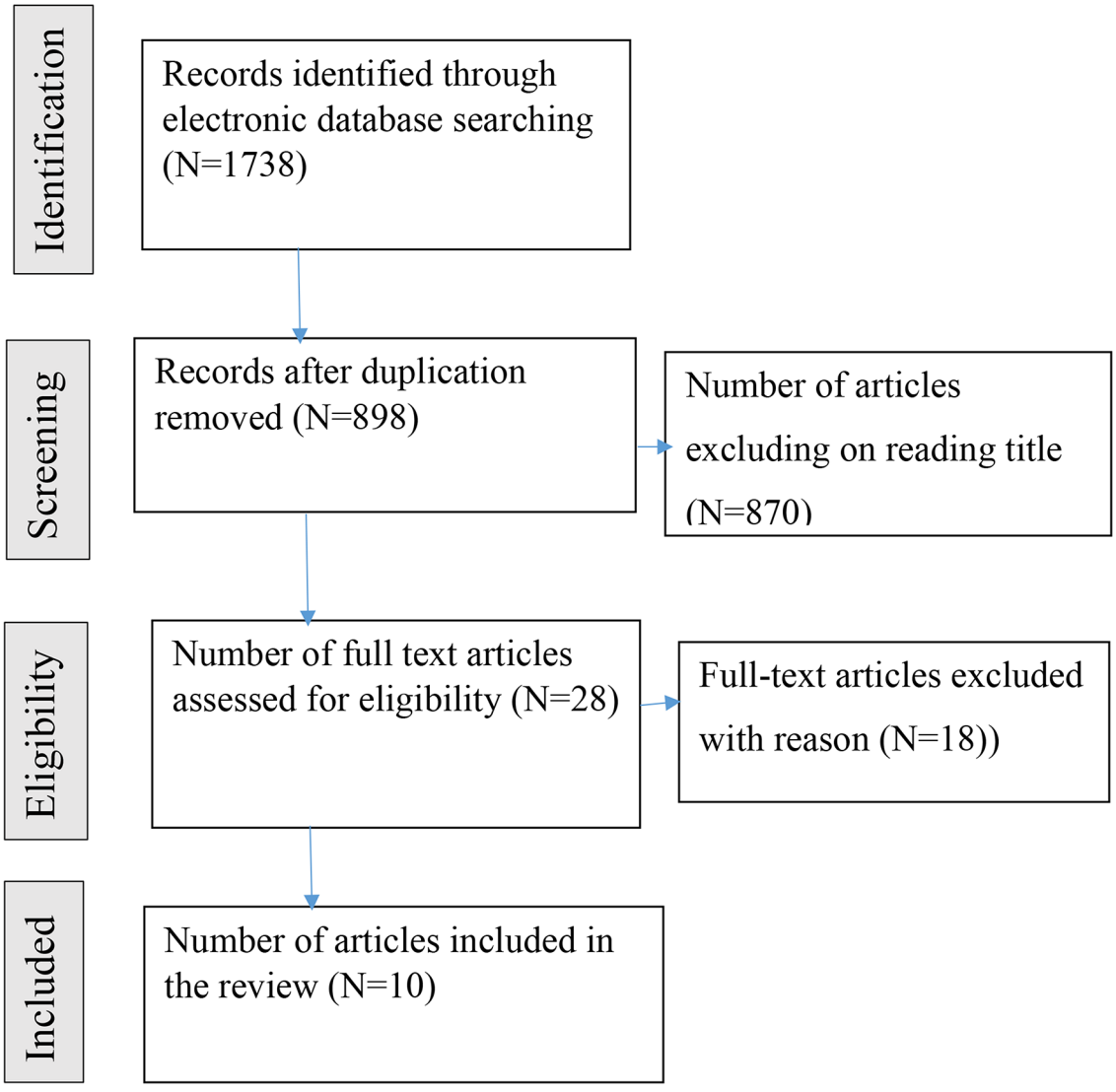

Fig. 1 PRISMA flow diagram for a systematic review and meta-analysis of practice on hepatitis B virus infection prevention and associated factors in Ethiopia (*N* = 10)

Table 2 Baseline characteristics of the included articles on the prevalence of practices for hepatitis B virus infection prevention and associated factors in Ethiopia ($n=10$) *IBCS, Institutional-based cross-sectional study, SS, sample size, SD, Study Design

Author	Pub Year	Region	SD	Study Population	SS	Prevalence (%)	Sampling Procedure
Demsiss et al. (17)	2018	Amhara	IBCS	Health science students	422	50	simple random
Teshome Gebremeskel et al. (18)	2020	Amhara	IBCS	Health science students	200	39.5	systematic random
Amdehiwot Aynalem et al. (26)	2022	South	IBCS	Health science students	404	50.3	systematic random
Debaka Belete et al. (19)	2022	Amhara	IBCS	Health care workers	422	34.8	systematic random
Abdela et al. (21)	2016	Amhara	IBCS	Health science students	246	16.2	simple random
Mesfin, Kibret (24)	2013	Oromia	IBCS	Health science students	322	56.2	systematic random
M.D. Allene, G.G. Delelegn (20)	2020	Amhara	IBCS	Health science students	422	33.8	simple random
Habtemu J. Hebo et al. (25)	2019	Oromia	IBCS	Health care workers	251	42.6	simple random
Teklay Gebrecherkos et al. (22)	2020	Amhara	IBCS	Pregnant women	354	20.3	systematic random
Yazie et al. (23)	2019	Amhara	IBCS	Health care workers	282	57.4	systematic random

*IBCS, Institutional-Based Cross-Sectional Study, SS, Sample Size, SD, Study Design

Publication bias Publication bias was assessed by visual inspection of a funnel plot based on the shape of the graph (subjective assessment). The funnel plot graph was symmetrical, which suggested the absence of publication bias. On the other hand, quantitatively (objective assessment), Egger's regression tests were used to assess publication bias, with a p value less than 0.05 considered indicative of a statistically significant publication bias.

Results

Study selection

Initially, 1738 articles were retrieved through electronic database searching. Of these, 910 were from Google Scholar, 4 from PubMed, 378 from Science Direct, 421 from African Journal Online and 25 from the Cochrane Library. Of these, 840duplicate articles were removed from EndNote X7. After screening the remaining 898

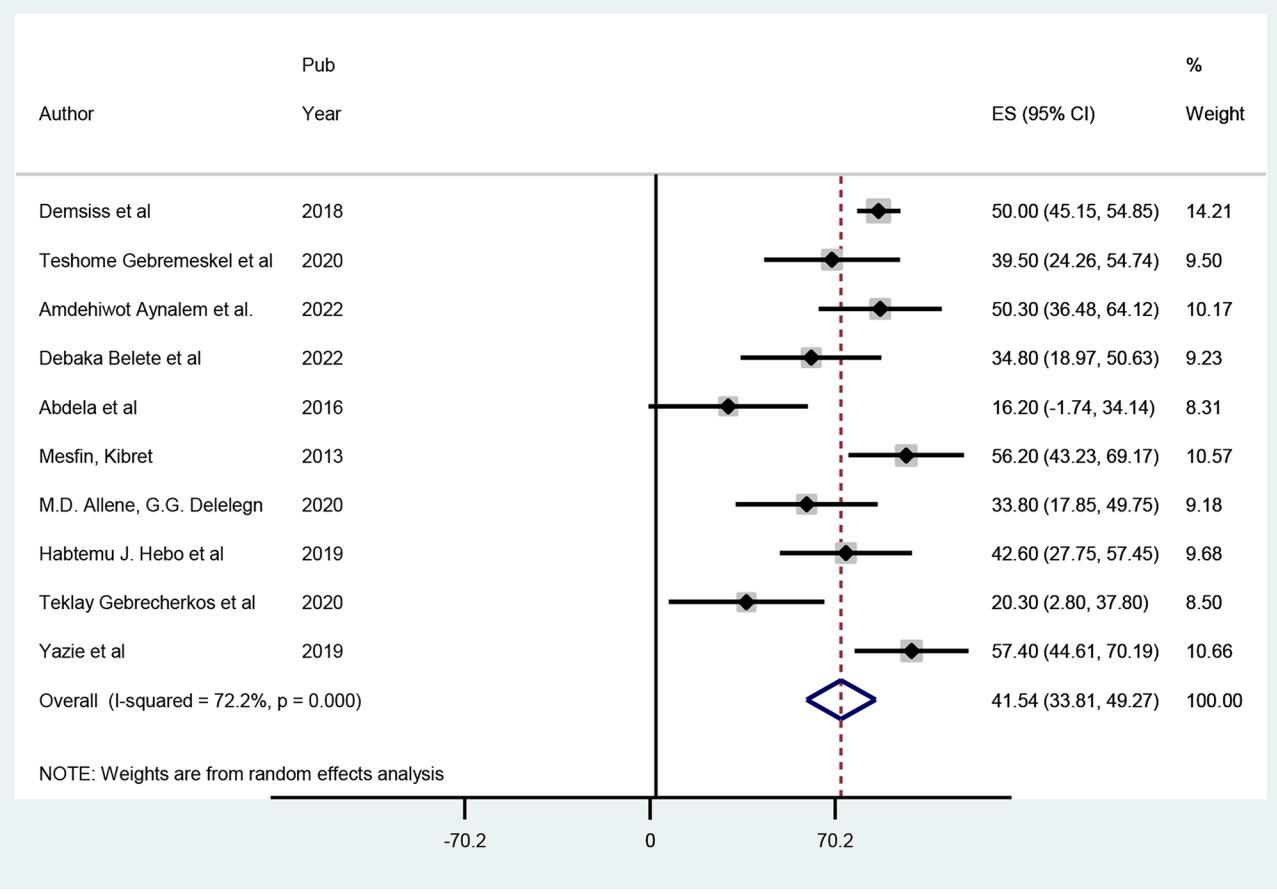

Fig. 2 Forest plot indicating pooled prevalence of good practice on hepatitis B virus infection prevention in Ethiopia ($N=10$)

articles, we excluded 870 articles because their titles were not similar to those of our study and were unrelated to the current study. The full texts of the remaining 28 articles were assessed for eligibility. Additionally, some articles were excluded because their outcomes were not reported or because they were conducted outside of Ethiopia. Finally, the remaining 10 studies fulfilled the inclusion criteria and were enrolled in the study (Fig. 1).

Baseline characteristics of the included articles

Ten published articles were included in this systematic review and meta-analysis. The number of participants in each study ranged from 200 to 422 participants. The included studies utilized cross-sectional methods to assess practices related to hepatitis B virus infection prevention. The included articles were published between 2013 and 2022. Seven of the included studies were from the Amhara region [17–23], 2 were from Oromia [24, 25], and the remaining were from the South region [26]. All the articles were published in peer-reviewed journals Table 2.

Quality of the included articles

Based on the quality assessment results, nine articles (90%) were of high quality, with scores ranging from 7 to 9, and one study was of medium quality. The quality of each of the included studies was evaluated using the nine items of the Joanna Briggs Institute (JBI) critical appraisal checklist. A detailed assessment of the quality of the studies is provided in the supplementary file (Supplementary file S2).

Meta-analysis

The pooled estimate showed that 41.54% (95% CI: 33.81–49.27, $P<0.001$) of individuals had a good practice towards hepatitis B virus infection prevention. The analysis showed that there was medium heterogeneity between the included articles ($I^2=72.2\%$, $P<0.001$). As a result, random effect models, specifically the DerSimonian and the Laird (D+L) pooled method was used to estimate the pooled prevalence of good practice (Fig. 2).

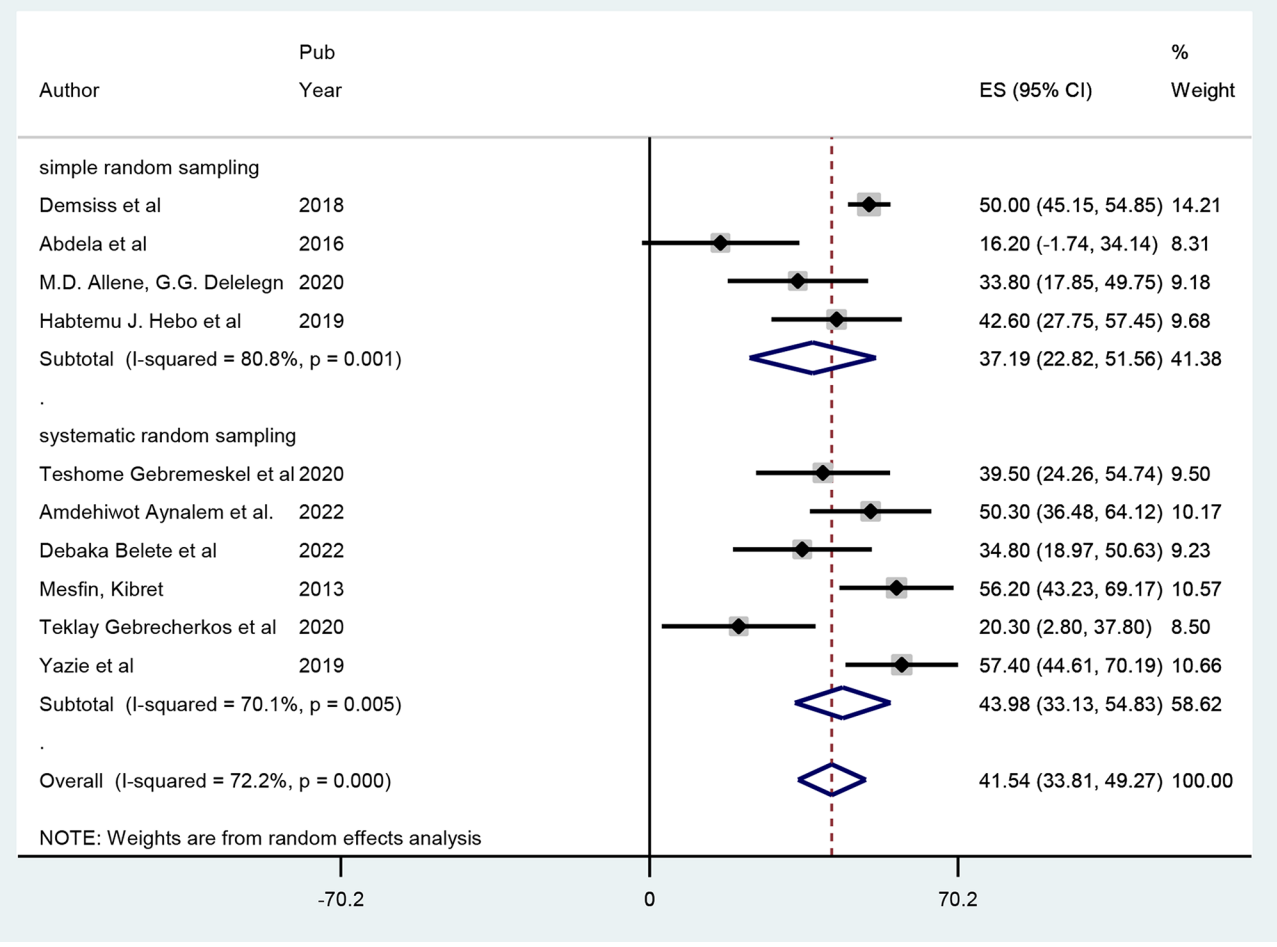

Fig. 3 A forest plot showing sub-group analysis based on sampling procedures

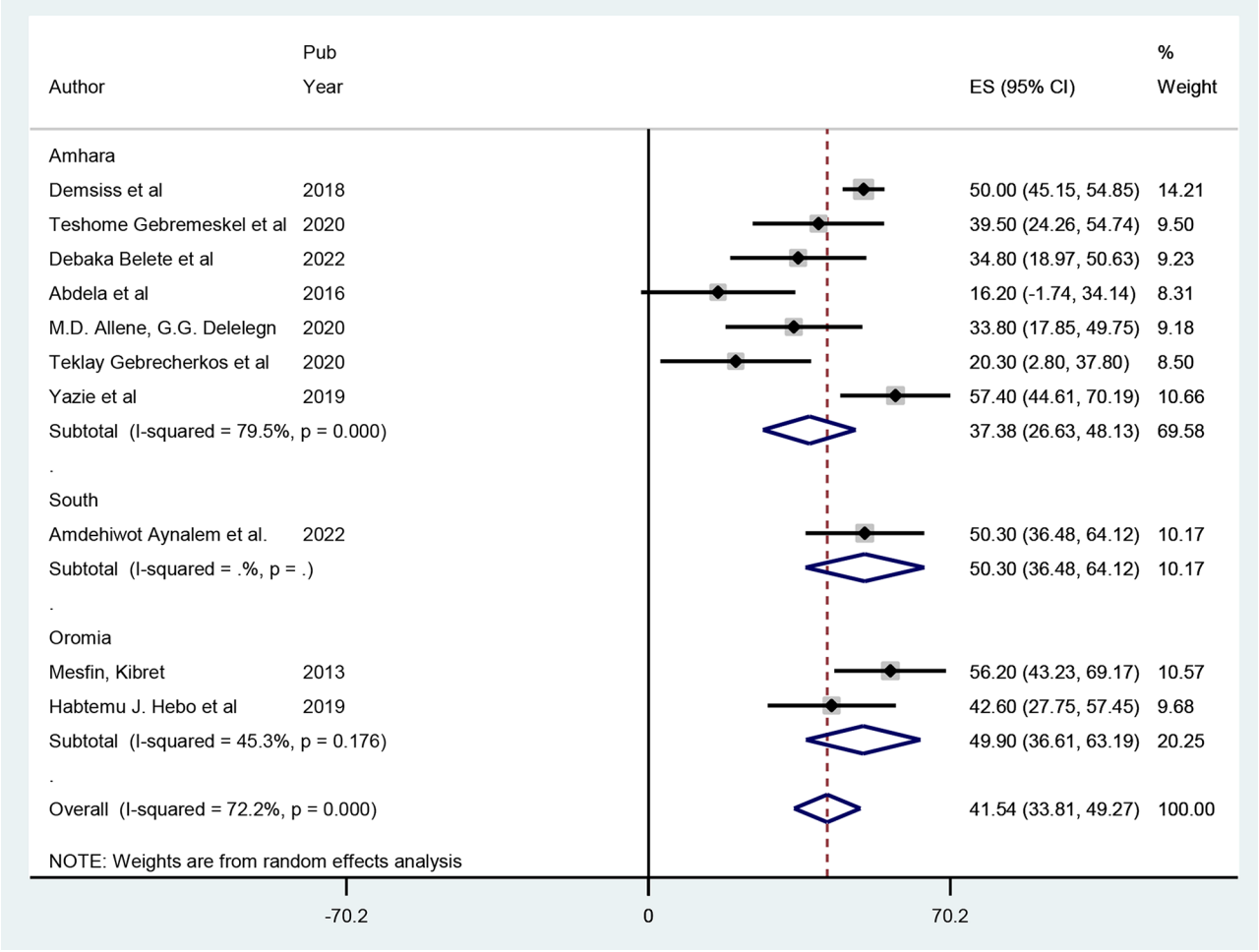

Fig. 4 A forest plot showing sub-group analysis based on region

Subgroup analysis

Since there was a medium level of heterogeneity in this systematic review, subgroup analysis was performed based on the sampling procedure and region. The results of the subgroup analysis based on the sampling procedure showed that a higher prevalence of good practices on hepatitis B prevention was reported in articles that used systematic random sampling (43.98% CI: 33.13,

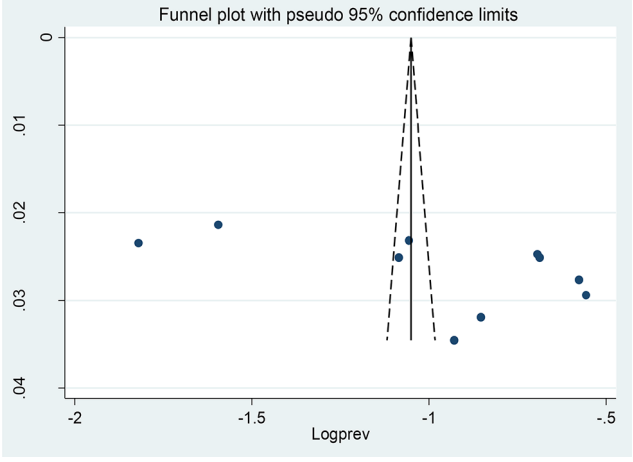

Fig. 5 Funnel plot assessed for publication bias in 10 studies

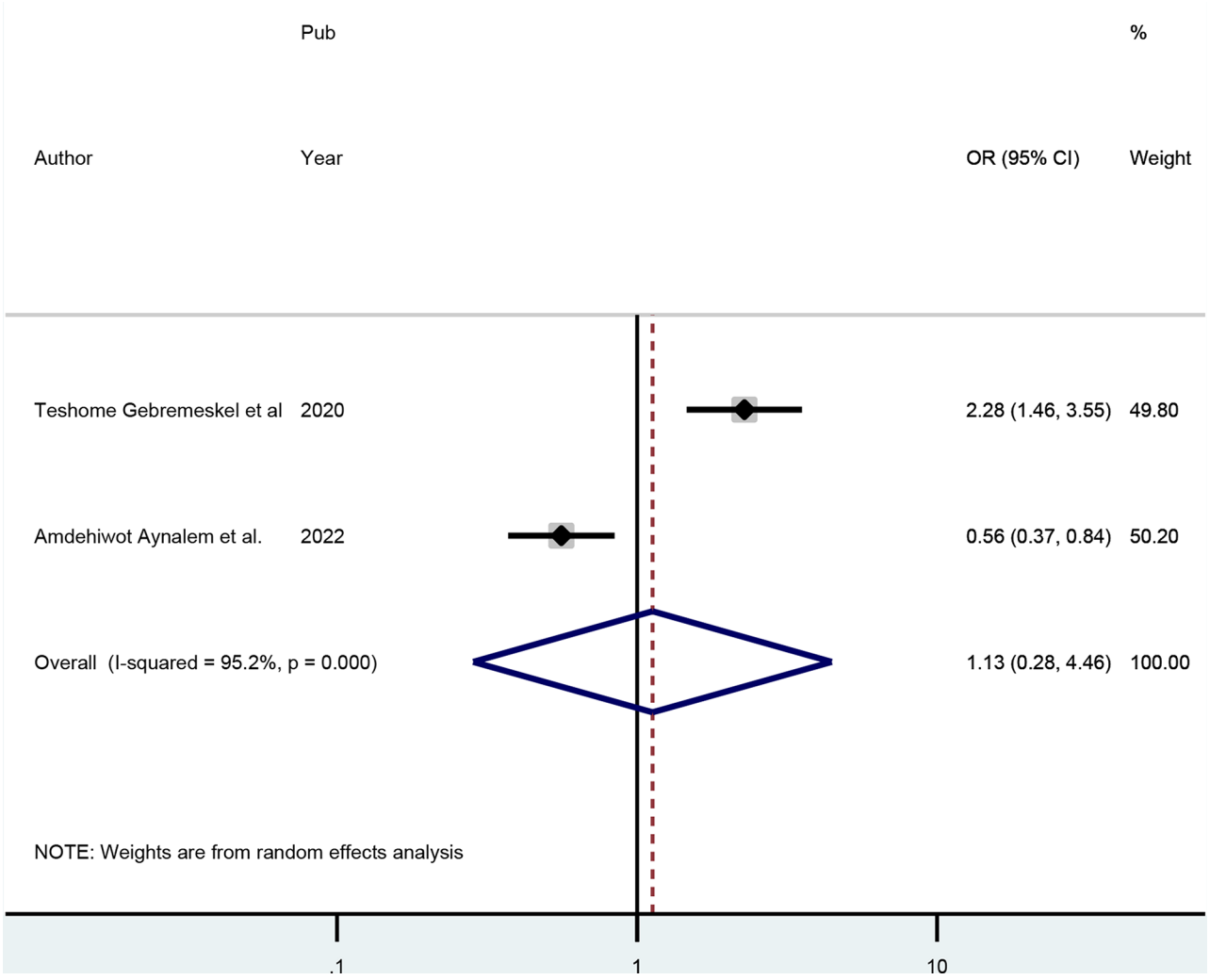

Fig. 6 Forest plot showing the pooled odds ratio of the association between good knowledge and good practice on hepatitis B virus infection prevention

54.83), and a lower prevalence was reported in articles that used simple random sampling (37.19% CI: 22.82, 51.56) (Fig. 3). The results of the subgroup analysis based on the region showed that a higher prevalence of good practices on hepatitis B prevention was reported in articles that were conducted in South Region (50.30% CI: 36.48, 64.12) (Fig. 4).

Sensitivity analysis

Due to the presence of heterogeneity in the review, a sensitivity analysis was also performed by applying a random effects model. The analysis was performed to evaluate the influence of each study on the pooled prevalence by excluding each study step-by-step. The results showed that the omitted studies did not have a significant influence on the pooled prevalence of good practices aimed at preventing hepatitis B virus infection.

Study omitted	Estimate	[95% Conf. Interval]
Demsiss et al.	1.126183	0 0.28447133, 4.458405
Teshome Gebremeskel et al.	0.55966002	0.3721172, 2.84172225
Amdehiwot Aynalem et al.	2.27868531	0.4631519, 3.5487819
Debaka Belete et al.	1.126183	0.28447133, 4.458405
Abdela et al.	1.126183	0.28447133, 4.458405
Mesfin, Kibret	1.126183	0.28447133, 4.458405
M.D. Allene, G.G. Delelegn	1.126183	0.28447133, 4.458405
Habtemu J. Hebo et al.	1.126183	0.28447133, 4.458405
Teklay Gebrecherkos et al.	1.126183	0.28447133, 4.458405
Yazie et al.	1.126183	0.28447133, 4.458405
Combined	1.1261831	0.28447132, 4.4584049

Publication bias We used a funnel plot and Egger's regression test to check for evidence of publication bias. Visual inspection of the funnel plot indicated a symmetrical distribution (Fig. 5), which was not statistically significant according to the Egger test (P value = 0.091), indicat-

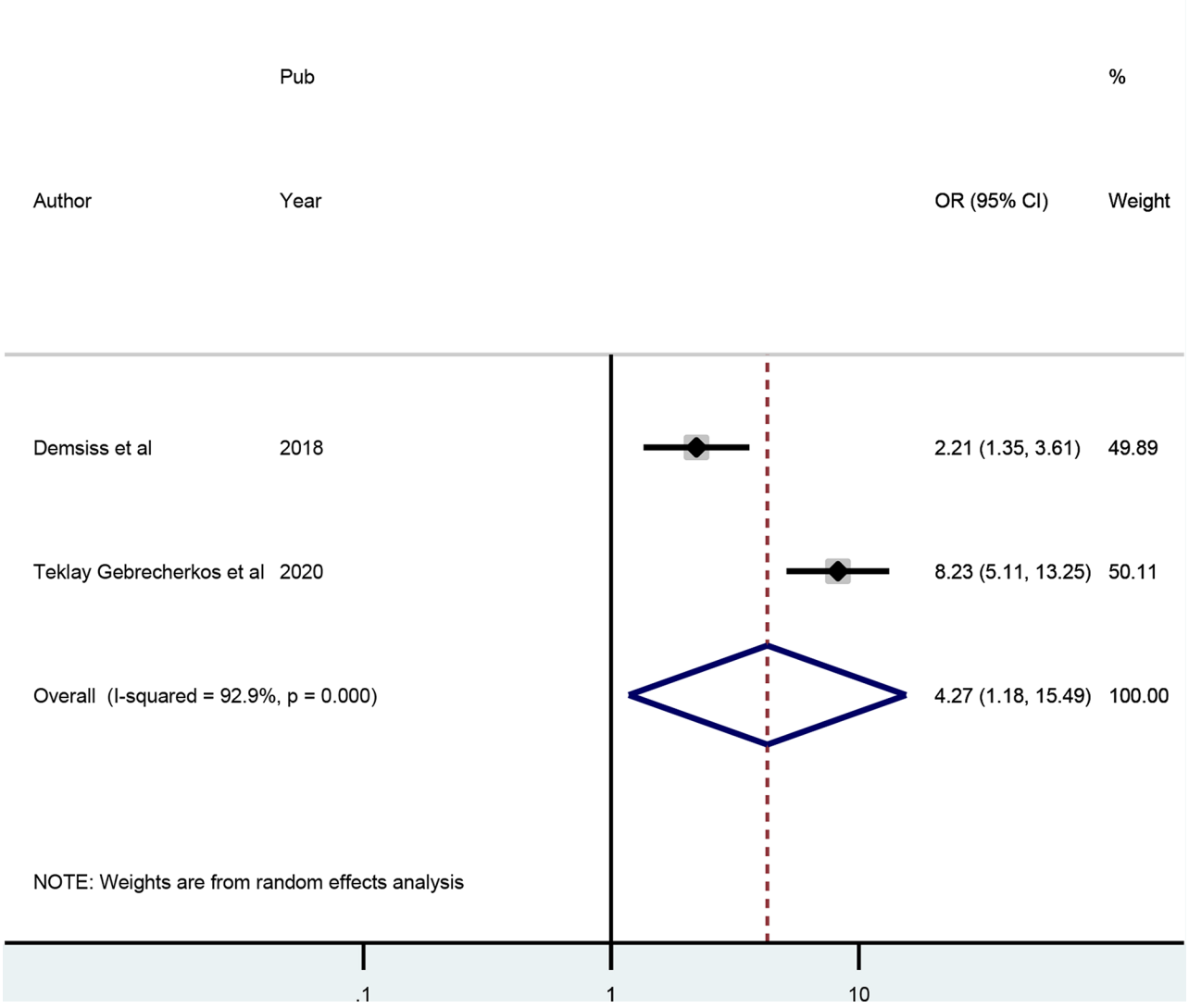

Fig. 7 Forest plot showing the pooled odds ratio of the association between urban residence and good practice on hepatitis B virus infection prevention

ing that there was no significant publication bias among the included studies.

Associated factors of good practice

The pooled estimate of two studies showed that there is a significant association between knowledge of and good practices on hepatitis B virus infection prevention. Those who had good knowledge of HBV infection prevention (POR=1.13, 95% CI: (0.28–4.46) were 1.13 times more likely to have good practices than those who had poor knowledge of HBV infection prevention. In the random-effects model, heterogeneity was observed among studies ($I^2 = 95.2\%$) (Fig. 6).

In a meta-analysis of two studies, urban residence was found to be significantly associated with practices for hepatitis B prevention. Participants who lived in urban areas were 4.27 times more likely to practice well than those who lived in rural areas (POR=4.27, 95% CI: 1.17– 15.49). There was high heterogeneity between studies in the analysis ($I^2 = 92.9\%$) (Fig. 7).

Discussion

Exposure to hepatitis B virus infection remains a major occupational hazard to the majority of the population, especially in countries where hepatitis B virus infection is prevalent. In Ethiopia, there are no systematic reviews or meta-analyses concerning the prevention of hepatitis B virus infection practice and its associated factors. This study revealed practices for preventing hepatitis B virus infection and its associated factors in Ethiopia. Despite the wide variation of the study participants, this study revealed that 41.54% (95% CI: 33.81– 49.27, $P<0.001$) of the study participants practiced HBV infection prevention well. The result of this study is comparable to those of a study conducted in Saudi Arabia, which indicated

that 47.2% of the study participants had good practices for HBV infection prevention [27].

However, the findings of this study are greater than those of a study conducted in Nepal, which showed that only 14.2% of the study respondents had good practices [28], and in Honiara, Solomon Islands, which showed that 26.3% of study participants had good practices [29]. The finding from the current study is lower than those from a study conducted in Egypt, in which 68.1% of the participants had good practices, and a study performed in Tamil Nadu, India, in which 76.59% of the study participants had good practices for hepatitis B virus infection prevention [30, 31]. It is still a burden that represents an additional challenge for the national health system which is already fighting with the different infectious and noninfectious disease. This may be due to differences in resource allocation and the perceptions of participants in the area. In the current study, a lack of resources was the main reason for the low prevalence of hepatitis B virus prevention. Unawareness of the vaccine, expensiveness of the vaccine, fear or perceived high risk of HBV infection through occupational exposure, fear of contracting hepatitis from the vaccine, doubt about the efficacy of the vaccine, and absence of post-exposure prophylaxis might be reasons for the low prevalence of clinical practice.

Those who had good knowledge of HBV infection prevention were more likely to practice well than those who had poor knowledge of HBV infection prevention. This finding is consistent with a study performed in Malaysia [32]. Knowledge about prevention methods plays an important role in controlling the risk of hepatitis B infections. Therefore, education should be given regarding the transmission and prevention of HBV with particular emphasis to needle-stick injury and post exposure prophylaxis for every population. This may be because when participants' knowledge of HBV prevention increases, their practice of preventing hepatitis B virus infection will also increase. Participants who lived in urban areas were more likely to practice well than those who lived in rural areas. Similar results were reported in America [33]. This might be due to the adequate availability of healthcare, high awareness about the availability of vaccines, and the importance of screening for HBV prevention and control through different media for participants living in urban areas.

Limitations

Although this systematic review and meta-analysis provides up-to-date evidence regarding the practice of preventing hepatitis B virus infection, there are several limitations that need to be considered in future research. First, this study lacks studies from some regions of Ethiopia (Afar, Benishangul Gumuz, Somalia, and Tigray), and other regions have a limited number of studies (SNNPR has one study); therefore, it may be difficult to generalize the findings to the national level. Finally, we identified significant heterogeneity across the included studies; thus, the results must be interpreted carefully.

Conclusion and recommendation

Based on the findings of the current study, most of the participants had poor practices for preventing HBV infection. Residence and knowledge of HBV prevention were significantly associated with practices aimed at preventing hepatitis B virus infection. The Ministry of Health should collaborate with the health bureau for continual awareness about the mode of HBV transmission and preventive measures, as well as for providing personal protective equipment and improving the knowledge of communities and good practices to prevent HBV infection, with a focus on rural residents. Therefore, strengthening the scope of the existing vaccination program and the establishment of new sensitive screening methods is highly recommended. In addition, it will be better if the existing infection prevention program is revised and target specific task force should be organized at different levels of health facilities in order to increase the awareness of the community. Control efforts should be scaled up countrywide and novel approaches including screen-and-treat could be implemented to reduce the burden of the disease in Ethiopia. Further political will and strong community awareness will be key to effectively tackling the burden of HBV problem in Ethiopia.

Abbreviations

HBV	Hepatitis B Virus
IBCS	Institutional-Based Cross-Sectional Study
POR	Pooled odds ratio
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analysis

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12879-024-09751-w.

Supplementary Material 1

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Author contributions

WCT: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. SSW, AMZ and YAF conceived the idea and participated in the data extraction, analysis, and draft writing. WCT, AMZ and YAF participated in the analysis, manuscript preparation, and manuscript revision. All the authors have read and approved the final version of the manuscript to be considered for publication.

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Data availability
The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Declarations

Ethical approval
Not applicable since the study used a systematic review and meta-analysis method.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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