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Determinants of knowledge of preconception care among healthcare providers in Ethiopia: a systematic review and meta-analysis

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ABSTRACT

Objective To assess the determinants of knowledge of preconception care (PCC) among healthcare providers in Ethiopia.

Design Systematic review and meta-analysis.

Data source Comprehensive literature searches were conducted in PubMed, Scopus and Health Internetwork Access to Research Initiative (HINARI) published until 20 March 2024.

Eligibility criteria for selecting studies Primary studies that reported the prevalence, determinants or associated factors were included.

Data extraction and analysis Three authors extracted all the relevant data using a standardised Joanna Briggs Institute data extraction format. Meta-analysis was done using a random-effects model. A funnel plot and Egger's test were done to assess publication bias, which was corrected by trim and fill analysis.

Result Out of 102 studies, the final analysis included six studies involving 2758 healthcare providers. The pooled knowledge of PCC among healthcare providers in Ethiopia was determined to be 51.43% (Adjusted OR), with a 95% CI ranging from 41.21% to 61.65%. Several factors were identified as determinants of healthcare providers' knowledge based on the pooled estimate. These factors include having an educational qualification above a BSc degree (OR=2.36, 95% CI 1.46, 3.08), the presence of guidelines in their institution (OR=2.07, 95% CI 1.37, 2.77), working in hospitals (OR=2.68, 95% CI 1.83, 3.53) and receiving training on PCC and related topics (OR=4.05, 95% CI 2.52, 5.59).

Conclusion Healthcare professionals exhibited limited knowledge of PCC in Ethiopia. Key elements influencing their comprehension encompass advanced educational credentials beyond a BSc degree, adherence to institutional guidelines, employment in hospital settings and exposure to specialised training. The ORs linked to these factors highlight the substantial influence of education, institutional procedures, hospital roles and specific training in enhancing healthcare providers' expertise. Enhancing awareness and understanding among healthcare practitioners through customised educational programmes, institutional structures and organised training efforts stands out as a crucial approach to improve healthcare services and results throughout Ethiopia.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ Employed a consistent checklist for assessing the primary studies within the review.
⇒ The findings may not generalise to other countries with different socioeconomic and cultural contexts since they were included in the research conducted in Ethiopia only.
⇒ The absence of comparable reviews conducted in other countries makes it difficult to directly compare our findings with other studies, leading to a reliance on comparisons primarily with individual primary studies.
⇒ Due to the cross-sectional nature of the data, establishing a causal relationship between the explanation and outcome variables is challenging.
⇒ Finally, the inclusion of a small number of studies from specific regions hampers the ability to conduct subgroup analysis based on study region and years.

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BACKGROUND

Preconception care (PCC) refers to the delivery of biomedical, behavioural and social health interventions to women and couples either prior to conception or during their reproductive years, as defined by the WHO.[1] The objective of PCC is to reduce the occurrence of unfavourable pregnancy outcomes by enhancing women's and couples' health, promoting health-related behaviours and increasing their knowledge through risk assessment, health promotion, and medical and psychological interventions prior to conception.[2] To establish a successful PCC programme, the WHO developed PCC packages in 2013. These packages encompass 13 essential topics that healthcare professionals need to address.[3]

The PCC packages consist of a range of services, including nutritional assessment,

tobacco cessation support, screening for genetic conditions, addressing environmental health concerns, screening and managing infertility, addressing interpersonal violence, treating sexually transmitted infections, implementing HIV prevention and management strategies, addressing mental health issues, preventing substance abuse, providing immunisations and preventing female genital mutilation.[4]

WHO, which has committed to eliminate avoidable maternal and childhood mortality, has been established to ensure a seamless provision of care spanning pregnancy, childbirth, the postnatal period, infancy, childhood, adolescence and adulthood.[4][5] Despite the prioritisation of maternal and child healthcare services by governments and global stakeholders, especially in developing nations, the expected decline in maternal and child morbidity and mortality has not been achieved.[6] According to research findings, the worldwide maternal mortality rate stood at 223 per 100 000 live births in 2020.[7]

In Ethiopia, the maternal mortality rate was recorded at 412 per 100 000 live births. Similarly, the under-five children, infants and neonatal mortality rates were 67, 45 and 29 per 1000 live births, respectively, in 2016.[6] Providing women with access to PCC of excellent quality is vital in the efforts to decrease maternal mortality.[8] However, in low- and middle-income countries, a significant number of women face inadequate access to essential PCC.[9]

Different African nations have various degrees of PCC implementation.[10][11] A persistent difficulty facing the continent is the acceptance of more recent evidence-based innovations for transformation, such as PCC. Preconception risk factors are associated with various preventable adverse reproductive outcomes, including low birth weight, congenital abnormalities and pregnancy loss.[12][13]

A country like Bangladesh has successfully integrated PCC into its national health system. This integration has helped to address several key challenges, including improving women's awareness of maternal health, enhancing family planning services and reducing the incidence of adverse pregnancy outcomes.[14] Despite the existence of evidence-based clinical guidelines and recommendations for PCC,[15] many low- and middle-income countries, including Ethiopia, have not fully integrated PCC into their national health systems. This is concerning considering that PCC is a crucial strategy in the global effort to eliminate preventable maternal and child mortality.[11]

Earlier studies conducted in different regions of Ethiopia have revealed disparities in the knowledge of PCC. For instance, a research examining women's awareness of PCC has reported varying levels of knowledge, with estimates as low as 13.7% in Mekelle, located in northern Ethiopia,[16] to 63.4%[17] in west Shoa. These disparities can often be attributed to variations in the availability of health education programmes, cultural attitudes towards reproductive health and access to healthcare services.[18][19] For example, areas with more comprehensive

health extension programmes or community-based initiatives tend to report higher levels of awareness.[20]

The knowledge and proficiency of healthcare professionals in educating patients about PCC play crucial roles in influencing patients' utilisation of these services.[21] According to certain research, more than 85% of healthcare professionals in Ethiopia are performing inadequately,[22] and more than half of them have inadequate expertise.[23–25]

Several studies also have identified multiple predictors of healthcare providers' strong knowledge of PCC. These include actively practising PCC, familiarity with guidelines, specialisation in relevant fields, receiving training on PCC and related topics, possessing a higher level of education and being employed in a supportive workplace environment.[25–29] Moreover, previous studies have identified several factors that impact the knowledge and practice of healthcare providers regarding PCC. These factors encompass socio-demographic characteristics, attitudes towards PCC, the existence of policies or protocols related to PCC, access to the internet and the presence of a workplace library.[22–25]

Studies also suggest that knowledge is significantly affected by educational status, age and socioeconomic status; counselling and the use of family planning play crucial roles.[30][31] Access to healthcare services and exposure to health education programmes further enhance knowledge, indicating that improved healthcare infrastructure and targeted educational initiatives are essential for raising awareness about PCC.[15]

PCC in Ethiopia began to gain structured recognition and integration into the healthcare system in the early 2000s, particularly with the launch of the Health Extension Program in 2003, which aimed to improve maternal and child health through community-based services. The integration of PCC into Ethiopia's healthcare system is still ongoing and faces challenges in achieving full integration due to various factors. Insufficient awareness among women and families limits service utilisation, inadequate training for healthcare providers results in inconsistent service standards[20] and accessibility barriers, particularly in rural regions, remain prevalent.[32] In Ethiopia, numerous studies have examined the prevalence of knowledge of PCC and its associated factors among healthcare providers. While primary studies have been conducted, the inconsistent nature of the findings poses challenges for healthcare programmes and clinical decision-making. Knowledge and proficiency of healthcare professionals play a role—not only through influencing participants' decision to use services but also in the availability and delivery of quality services. Given the importance of addressing issues related to PCC among healthcare providers, it is crucial to gather evidence on their knowledge of PCC and the factors contributing to low adherence. Therefore, the main objective of this meta-analysis and systematic review was to provide a comprehensive summary of healthcare providers' knowledge of PCC and to

summarise the evidence around determinants of knowledge of PCC in Ethiopia.

METHODS
Study design and protocol
This study uses a systemic review and meta-analysis approach of relevant articles on the prevalence of knowledge of PCC among healthcare providers and determinants in Ethiopia. This systematic review was registered with the prospective international register of systematic reviews (PROSPERO, number CRD42024516077) and was conducted following the guidelines outlined in the Preferred Reporting Items for Systematic Review and Meta-Analyses (online supplemental figure 1).

Patient and public involvement
None

Eligibility criteria
Inclusion criteria
This meta-analysis and systematic review included primary studies involving healthcare professionals residing in Ethiopia, encompassing individuals from various socio-economic backgrounds, ethnic groups and linguistic diversity. Studies were included in this systematic review and meta-analysis if they followed the following guidelines: (1) all observational study designs (cross-sectional, case–control and cohort studies) that reported the prevalence of knowledge of PCC among healthcare providers and determinants or one of them; (2) published until 20 March 2024; and published in the English language (3) abstract and/or full text available for this review; (4) primary studies that assess knowledge of PCC by using the validated structured tool, the 'Andarg-Ethio PCC-Knowledge, Attitude, and Practice (KAP)-Questionnaire for Healthcare Providers'[33] and (5) conducted in Ethiopia.

Exclusion criteria
Studies were excluded if they (1) possessed a poor-quality score as per the stated criteria, (2) failed to determine the desired outcomes knowledge of PCC among healthcare providers and determinants and (3) it was considered that the exclusion of articles published in other languages due to translation issues might create language bias. However, no articles published in other languages, including the Amharic language, were obtained during the search period.

Searching strategy and data source
First, the Cochrane Library, Joanna Briggs Institute (JBI) and PROSPERO databases were searched to check whether systematic review and meta-analysis studies exist or for the presence of ongoing projects related to knowledge of PCC among healthcare providers in Ethiopia. A comprehensive literature search was conducted using PubMed, EMBASE, HINARI, Scopus, Web of Sciences and African journals online. For this study, relevant articles were identified using the following terms:

"preconception," "preconception care," "'knowledge," "healthcare provider," "'healthcare professional," "determinants," "factors," "reproductive health," and "Ethiopia." The key terms were used in combination using Boolean operators like "OR" or "AND" (online supplemental additional file 1). The searches were restricted to full texts, free articles, human studies and English language publications. This search involved articles published until 20 March 2024. Grey literature like surveillance reports, academic dissertations and conference abstracts were also examined and included when they were deemed low-risk. Furthermore, Ethiopian universities' digital libraries were searched (Addis Ababa University, University of Gondar, Mekelle University and Haramaya University). The search periods were from 21 February to 20 March 2024. The review used the PECO (population, exposure, comparison and outcomes) search format to ensure the inclusion of relevant studies.

Population
Healthcare professionals.

Exposure
Determinants of knowledge of PCC among healthcare providers include socio-demographic variables like age and education, reproductive factors, the healthcare system, availability of PCC guidelines, workplace environment and completion of PCC training.

Comparison
Comparisons have been made between different groups regarding factors influencing knowledge of PCC among healthcare providers. For example, these comparisons involve individuals with advanced degrees (such as a master's or higher) compared with those with basic qualifications (like a bachelor's degree or lower). Additionally, they consider healthcare providers who have undergone specific training in PCC against those who have not received such training. Moreover, comparisons extend to the workplace setting of healthcare providers, contrasting those based in health centres with their counterparts in hospitals. These comparative assessments are essential for gauging how educational backgrounds, training initiatives and work environments influence the level of awareness and integration of PCC principles among healthcare providers.

Outcome
Four authors (BDT, GY, BBA and NA) conducted a thorough search for studies on the level of knowledge of PCC among healthcare professionals. Comprehensive search strategies were employed, starting with examining the full titles of articles such as 'Knowledge of PCC and associated factors among healthcare professionals in Ethiopia'. Keywords including "knowledge," "preconception care determinants," "predictors," "associated factors," "healthcare professionals" and "Ethiopia" were also used in the search. Additionally, the reference lists of included studies were reviewed to identify any additional relevant

articles not captured in the initial search. Furthermore, digital libraries of Ethiopian universities (Addis Ababa University, University of Gondar, Haramaya University, Jimma University and Mekelle University) were searched to identify relevant unpublished studies.

The primary aim of this research was to pinpoint the prevalence and determinants of healthcare providers' knowledge of PCC in Ethiopia. PCC, defined by the WHO, encompasses delivering medical, behavioural and societal health interventions to women and couples before conception. Across all studies included in our meta and systematic reviews, we included primary studies that evaluate understanding of PCC using the endorsed structured self-administered assessment tool called the 'Andarg-Ethio PCC-KAP-Questionnaire for Healthcare Professionals'.[33] This questionnaire, developed by Andargachew Kassa in November 2017, serves as a validated instrument for measuring knowledge levels regarding PCC among healthcare providers. It was determined that healthcare providers had a sufficient understanding of PCC when they achieved a score of 50% or higher on the questionnaire.

Identification and study selection

All the identified studies were imported into the EndNote X8 reference manager software, and any duplicate articles were removed. The screening process involved evaluating the titles and abstracts of the studies. Three authors (BDT, ESL and MA) together screened and assessed the articles. The full text of the selected studies was then evaluated based on their objectives, methodology, participants/ population, key findings related to the knowledge of PCC and factors influencing healthcare professionals' knowledge. In case of any disagreements during the screening process, a consensus meeting was held involving other senior reviewers (TAK and BBA) to resolve them.

Data extraction

The authors developed an Excel sheet to create a data extraction form, which included fields such as author name, year of publication, region, study design, sample size, level of knowledge of healthcare professionals about PCC and reported determinant factors. To ensure the effectiveness of the data extraction form, a pilot test was conducted using four randomly selected papers. Based on the findings from the pilot phase, adjustments were made to the extraction form template. Subsequently, two authors (BDT and NA) collaborated to extract the data using the revised extraction form. The accuracy of the extracted data was verified together by the third and fourth (TAK and BBA) authors. In cases where discrepancies arose between the reviewers, discussions were held involving a third and fourth (TAK and BBA) reviewer to reach a consensus. To minimise errors in data entry, cross-checking with the included papers was performed to rectify any mistyping or inaccuracies (online supplemental table 1).

Quality assessment

On consolidating the search results from the databases, duplicate articles were removed using Endnote (V. X8). The quality of the included studies was assessed using the JBI's quality appraisal checklist.[34] Four independent authors (TAK, ESL, AWA and MA) were assigned the task of assessing study quality, with each author responsible for conducting individual evaluations. The assessment covered various aspects, including methodological quality, sample selection, sample size, comparability, outcome assessment and statistical analysis. To ensure thoroughness and comprehensiveness, multiple rounds of appraisals were conducted, during which authors exchanged assessments with one another. As a result, each paper underwent assessment by two authors (BDT and NA). In cases of disagreement, discussions were held, and a senior author (BB) was consulted for resolution. The JBI's quality appraisal checklist score is 1 for 'yes', 0 for 'no' and U for 'unclear'. The final scores for each study were summed and transformed into percentages. Finally, the ranking was given as follows: ≤49%=high risk of bias, 50%–69%=moderate risk of bias and above 70%=low risk of bias. Only studies that scored ≥50% were considered in this systemic review and meta-analysis. In the case of ongoing disputes between reviewers, the average ratings of the reviewers were computed. The quality of the primary study results was recorded in a separate column in the data extraction form. This meticulous process ensured that the quality assessment was conducted rigorously and comprehensively, incorporating diverse perspectives and the expertise of the author team (online supplemental additional file 2).

Statistical analysis

After extracting the data in Microsoft Excel format, it was imported into STATA V.14.0 statistical software for further analysis. The SE for each study was calculated using the binomial distribution formula. To determine the overall estimates of the level of knowledge of healthcare professionals about PCC, a random-effects meta-analysis was conducted by pooling the data. The pooled prevalence of the level of knowledge of healthcare professionals, along with a 95% CI, was presented using forest plots. Forest plots were also used to present the OR with a 95% CI, illustrating the determinants of the level of knowledge of healthcare professionals. To assess heterogeneity among the studies, Cochrane's Q statistic (χ^2), inverse variance (I^2) and p values were employed. In this study, an I^2 value of 0 indicated true homogeneity, while values of 25%, 50% and 75% denoted low, moderate and high heterogeneity, respectively.[35] For data identified as heterogeneous, a random-effects model analysis was employed. Sensitivity analysis was conducted to evaluate the impact of individual studies on the overall estimation. Publication bias was assessed through the funnel plot and, additionally, using Egger's regression test for a more objective evaluation.

Publication bias and heterogeneity

Comprehensive and thorough searches, including electronic and database searches and manual searches, were conducted to minimise bias risks. The authors' collaborative efforts played a crucial role in reducing bias by adhering to clear objectives and eligibility criteria, evaluating the quality of studies, and extracting and compiling the data. Publication bias was assessed through a visual inspection of the funnel plot graph, providing a qualitative evaluation. Additionally, Egger's correlation tests were conducted at a significance level of 5% to further assess the presence of publication bias. Sensitivity analysis was performed to identify potential sources of heterogeneity.

RESULTS

A total of 719 articles were identified using electronic searches, and another article was located through alternative search methods. Out of these, 644 articles were duplicates, leaving 75 distinct articles for evaluation. Among the 75 articles, 69 were deemed irrelevant or incomplete, lacking either full text or abstracts. Finally, after careful assessment, six articles that fulfilled the eligibility criteria were chosen for inclusion in this systematic review and meta-analysis (online supplemental figure 1).

Characteristics of the included studies

The included studies, a total of six, were designed as cross-sectional and were conducted in English. The sample sizes varied, with the smallest study involving 156 healthcare professionals residing in Addis Ababa[36] while the largest study included 660 participants in Amhara.[24] In terms of geographical distribution, two studies were conducted in Oromia,[37] two from Amhara,[24 25] one from Addis Ababa[36] and one from Southern Nations, Nationalities, and Peoples (SNNP).[23] This systematic review and meta-analysis included 2758 healthcare professionals to assess the combined prevalence of knowledge regarding PCC within this professional group (online supplemental table 2).

Knowledge of PCC among healthcare professionals

The combined prevalence of knowledge of PCC among healthcare professionals in Ethiopia was found to be 51.43% (95% CI 41.21 to 61.65) (as shown in figure 1).

Publication bias

A funnel plot showed asymmetrical distribution. Egger's regression test p value was 0.037, which indicated the presence of publication bias (online supplemental figure 2).
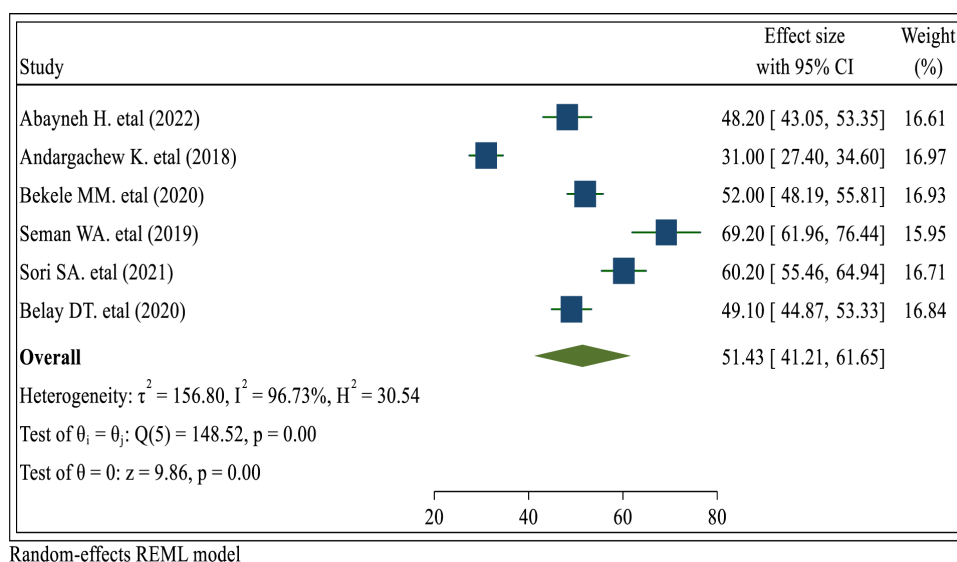
Sensitivity analysis (leave-one-out meta-analysis)

The systematic review and meta-analysis (SRMA) employed a random-effects model and revealed that none of the individual studies had a significant impact on the collective prevalence of healthcare providers' knowledge of PCC. This implies that the overall prevalence estimate was strong and not unduly swayed by any one study, affirming the reliability and applicability of the combined results across the studies included in the analysis (online supplemental figure 3).

Determinants of healthcare professional knowledge about PCC

Association between the educational status of health professionals and knowledge about PCC

A meta-analysis incorporated four studies.[23 25 37 38] The results demonstrated that individuals with a bachelor's degree or higher were 2.36 times more likely (OR=2.36, 95% CI 1.46, 3.08) to possess good knowledge compared with those with educational qualifications lower than a bachelor's degree. The studies included in this meta-analysis exhibited homogeneity, with no significant heterogeneity observed ($I^2=0.0\%$, p<0.01). Thus, the analysis was undertaken with a random-effects model (as shown in figure 2).

Study		Effect size with 95% CI	Weight (%)
Abayneh H. etal (2022)		48.20 [43.05, 53.35]	16.61
Andargachew K. etal (2018)		31.00 [27.40, 34.60]	16.97
Bekele MM. etal (2020)		52.00 [48.19, 55.81]	16.93
Seman WA. etal (2019)		69.20 [61.96, 76.44]	15.95
Sori SA. etal (2021)		60.20 [55.46, 64.94]	16.71
Belay DT. etal (2020)		49.10 [44.87, 53.33]	16.84
Overall		51.43 [41.21, 61.65]	

Heterogeneity: $\tau^2 = 156.80$, $I^2 = 96.73\%$, $H^2 = 30.54$

Test of $\theta_i = \theta_j$: Q(5) = 148.52, p = 0.00

Test of $\theta = 0$: z = 9.86, p = 0.00

Random-effects REML model

Figure 1 Forest plot of the pooled prevalence of healthcare providers' knowledge on preconception care in Ethiopia, 2024.
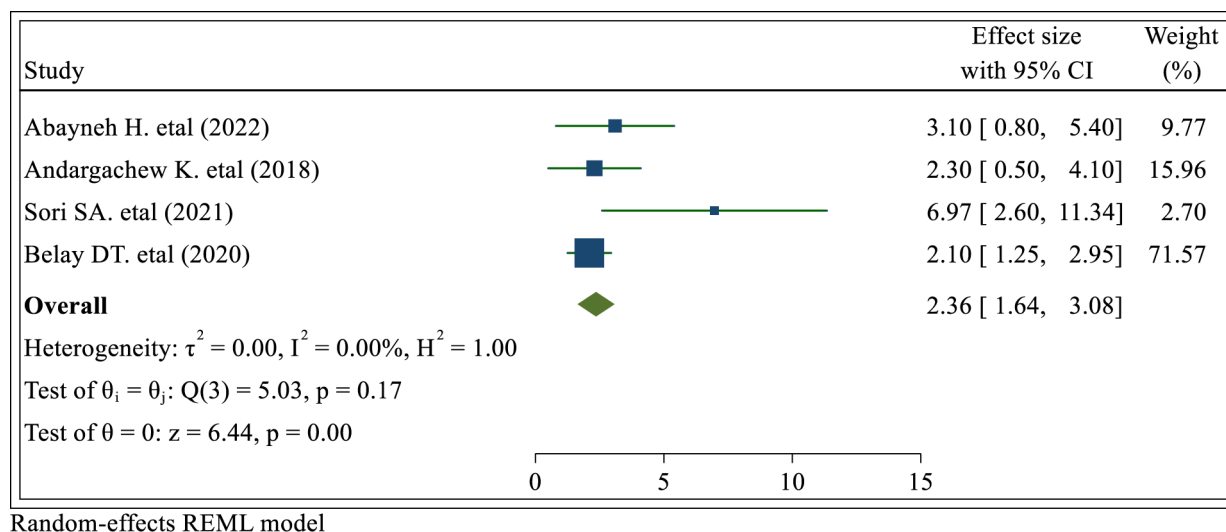
Figure 2 The pooled estimate of Adjusted OR of having above BSc degree and knowledge of preconception care in Ethiopia.

Association between the presence of guidelines and knowledge of health professionals about PCC

A meta-analysis involving five studies was conducted to analyse a specific category.[23–25 37] The findings revealed that individuals who had guidelines in their institution were 2.07 times more likely to possess good knowledge compared with those who did not have guidelines in their institution (OR=2.07, 95% CI 1.37, 2.77). Studies included in this meta-analysis were characterised by heterogeneity (I^2=43.57%, p=0.06). Thus, the analysis was undertaken with a random-effects model (as shown in figure 3).

Association between working area and knowledge of health professionals about PCC

A meta-analysis involving five studies was conducted to examine a specific category.[23–25 37] The results indicated that individuals working in hospitals were 2.68 times more likely (OR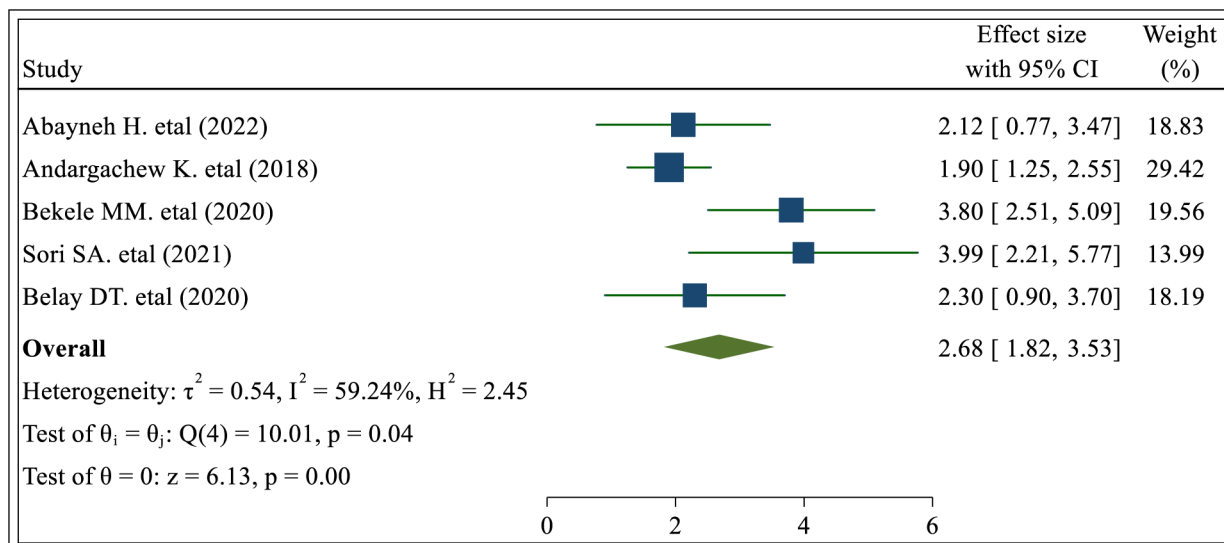=2.68, 95% CI 1.83, 3.53) to possess good knowledge compared with those working in health centres. Studies included in this meta-analysis were characterised by no heterogeneity (I^2=59.24%, p<0.01). Thus, the analysis was undertaken with random-effect models (as shown in figure 4).

Association taking training and knowledge of health professionals about PCC

Three studies were involved in the meta-analysis of this category.[24 37 38] The results indicated that individuals who had received training were 4.05 times more likely (OR=4.05, 95% CI 2.52, 5.59) to possess good knowledge compared with those who had not received any training. Studies included in this meta-analysis were characterised by no heterogeneity (I^2=33.3.%, p<0.01). Thus, the analysis was undertaken with random-effect models (as shown in figure 5).
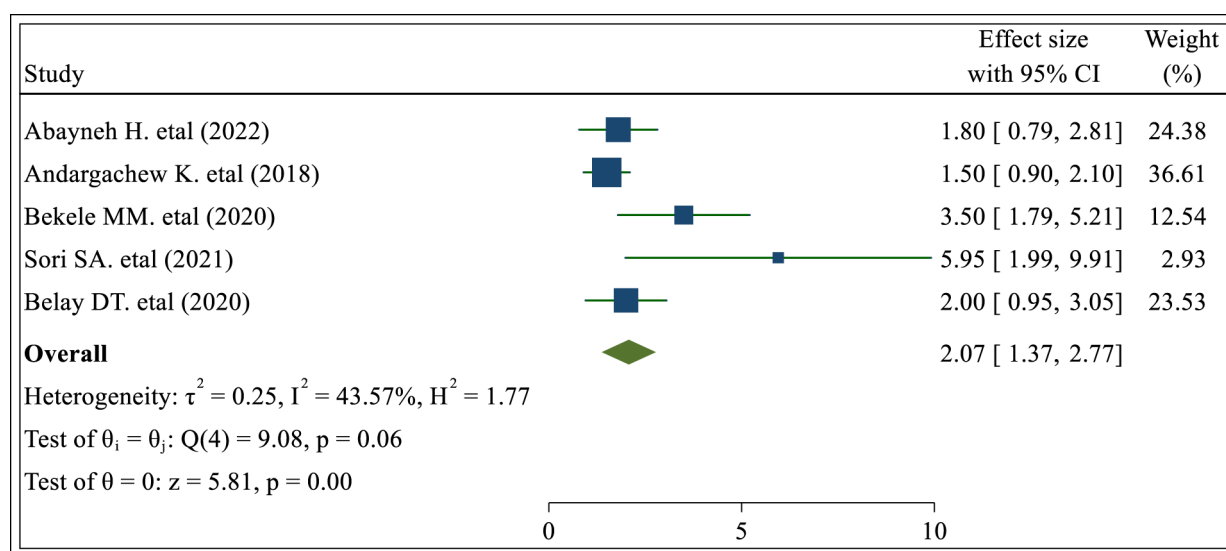
Figure 3 The pooled estimate of Adjusted OR of having guidelines in their institution and knowledge of preconception care in Ethiopia.
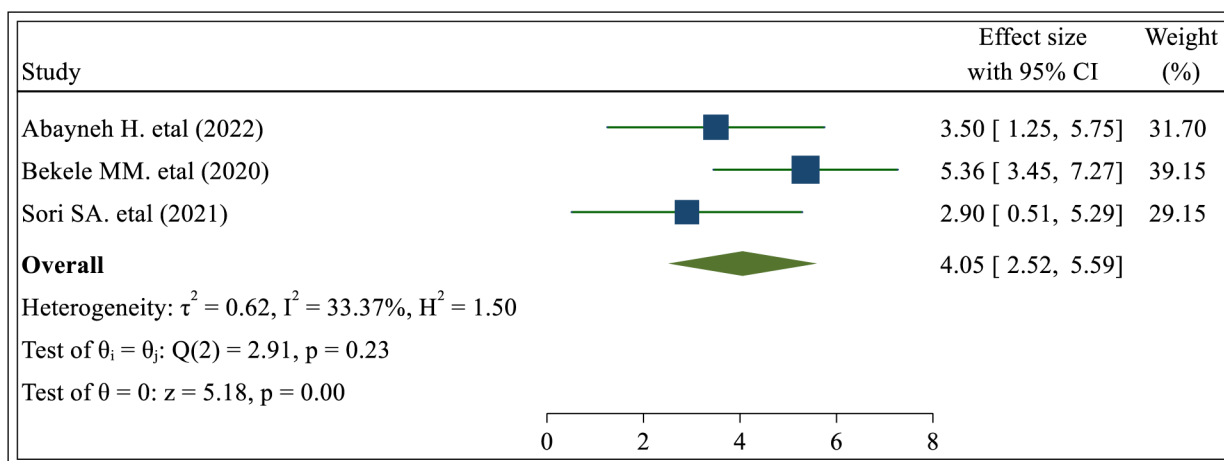
Study		Effect size with 95% CI	Weight (%)
Abayneh H. etal (2022)		2.12 [0.77, 3.47]	18.83
Andargachew K. etal (2018)		1.90 [1.25, 2.55]	29.42
Bekele MM. etal (2020)		3.80 [2.51, 5.09]	19.56
Sori SA. etal (2021)		3.99 [2.21, 5.77]	13.99
Belay DT. etal (2020)		2.30 [0.90, 3.70]	18.19
Overall		2.68 [1.82, 3.53]	

Heterogeneity: $\tau^2 = 0.54$, $I^2 = 59.24\%$, $H^2 = 2.45$

Test of $\theta_i = \theta_j$: Q(4) = 10.01, p = 0.04

Test of $\theta = 0$: z = 6.13, p = 0.00

Random-effects REML model

Figure 4 The pooled estimate of Adjusted OR of working in hospitals and knowledge of preconception care in Ethiopia.

DISCUSSION

This systematic review and meta-analysis focus on the assessment of PCC knowledge among healthcare providers in Ethiopia. The findings of this study provide a summary of the knowledge level regarding PCC among healthcare providers residing in Ethiopia. PCC encompasses a comprehensive range of healthcare services aimed at addressing the various health needs of women, couples and their offspring, including support during pregnancy and the well-being of the foetus and neonates. Various factors like resource insufficiency, resistance to change, lack of awareness, inadequate training, organisational hierarchies, communication challenges, time constraints and misinformation can impede PCC in healthcare.[39–41] Overcoming these barriers is crucial for successful implementation and better outcomes. Although PCC has the potential to address a wide range of health needs for women, couples and the overall community, there is a lack of a similar meta-analysis study specifically focussed on this research question within this field.

Based on the findings of this meta-analysis, the combined prevalence of a satisfactory level of knowledge regarding PCC among healthcare providers was determined to be 51.43% (95% CI 41.21 to 61.65). This prevalence is consistent with a study conducted in Malawi, which reported a prevalence of 57.7%.[42] However, it is lower than survey studies conducted in Nigeria, which reported prevalence rates of 65.8%[43] and 85.9%[41] and in Iran with 73.21%[29] and 66.7%.[44] On the other hand, it is higher than the prevalence reported in Japan of 8%.[45] These variations in prevalence rates could be attributed to differences in healthcare infrastructure and resources across countries, which can impact the availability of training programmes, access to updated information and opportunities for healthcare providers to enhance their knowledge in PCC. Countries with better healthcare infrastructure might provide more comprehensive training and resources, resulting in higher knowledge levels.[46] Cultural and societal factors also play a significant role in shaping healthcare practices and knowledge. Different countries have varying cultural beliefs, attitudes

Study		Effect size with 95% CI	Weight (%)
Abayneh H. etal (2022)		3.50 [1.25, 5.75]	31.70
Bekele MM. etal (2020)		5.36 [3.45, 7.27]	39.15
Sori SA. etal (2021)		2.90 [0.51, 5.29]	29.15
Overall		4.05 [2.52, 5.59]	

Heterogeneity: $\tau^2 = 0.62$, $I^2 = 33.37\%$, $H^2 = 1.50$

Test of $\theta_i = \theta_j$: Q(2) = 2.91, p = 0.23

Test of $\theta = 0$: z = 5.18, p = 0.00

Random-effects REML model

Figure 5 The pooled estimate of Adjusted OR of having training and knowledge of preconception care in Ethiopia.

and practices related to pregnancy care. In Ethiopian traditional beliefs, deeply rooted culture, societal taboos regarding discussions on reproductive health, varying community perceptions and prevailing gender dynamics all impact the understanding and implementation of PCC.[18 19] These factors can influence the emphasis placed on PCC education and its integration into healthcare systems.[47] By adopting strategies such as culturally sensitive communication approaches and actively engaging with local communities, it is possible to enhance both the knowledge and delivery of PCC services in Ethiopia.[19 48] Moreover, differences in research methodologies, including sample sizes, sampling techniques and data collection instruments, can contribute to variations in reported prevalence rates. Variations in the study population, such as the inclusion of healthcare providers from specific settings or regions, can also impact the findings.

Healthcare providers with a bachelor's degree or higher were 2.36 times more likely to possess good knowledge of PCC compared with those with educational qualifications below a bachelor's degree (OR=2.36, 95% CI 1.46, 3.08). This finding is consistent with similar studies conducted;[42 45 49 50] this may be due to higher education, such as a BSc degree, typically involving a more extensive and specialised curriculum, providing individuals with a broader understanding of various subjects, including health sciences. This broader knowledge base may contribute to a better understanding of PCC and its importance in promoting healthy pregnancies.[29 51 52] Moreover, individuals pursuing higher education often have access to advanced courses, research opportunities and specialised training programmes. These additional educational experiences can deepen their understanding of PCC, expose them to current research findings and best practices, and enhance their critical thinking and analytical skills.

The probability of possessing good knowledge in PCC was 2.07 times higher among individuals who had guidelines implemented in their institution (OR=2.07, 95% CI 1.37, 2.77) than those who had no guidelines in their institution. The results of this study, consistent with other studies,[42 53 54] suggest that the presence of guidelines within an institution regarding PCC is associated with an increased likelihood of possessing good knowledge. This relationship can be attributed to the presence of a structured framework or set of recommendations provided by the guidelines, which guide healthcare professionals and individuals in understanding and implementing PCC practices. These guidelines serve as a valuable resource, offering information, best practices and evidence-based recommendations on PCC.[32 55] Consequently, the availability of such guidelines enhances awareness and knowledge among healthcare professionals and individuals, leading to improved understanding and implementation of PCC measures.[56]

Healthcare providers working in hospitals had a 2.68 times higher likelihood of possessing good knowledge of PCC compared with those working in health centres (OR=2.68, 95% CI 1.83, 3.53); this is consistent with other studies.[49] This may be due to hospitals often have more resources, including access to updated medical literature, specialised training programmes and technological advancements. These resources can support continuous education and enhance the knowledge base of healthcare providers.[57] Hospitals tend to have specialised departments and units, including reproductive medicine, obstetrics and gynaecology, which may provide more exposure and opportunities for healthcare providers to gain knowledge and expertise in PCC.[58] In contrast, health centres may have a broader scope of services and may not focus as heavily on PCC. Moreover, hospitals often have a larger network of professionals, including specialists and consultants, who can provide guidance and share knowledge. This collaborative environment can facilitate the exchange of information and promote learning among healthcare providers.[59]

Healthcare providers who received training on preconception and related topics were 4.05 times more likely to have good knowledge of PCC compared with those who did not receive such training. This implies that training in PCC positively influences the knowledge level of healthcare providers in this particular domain; this is consistent with other studies.[31 45 49 60] This may be due to the training received by healthcare providers on PCC and related topics enhancing their knowledge through specialised education, evidence-based practices, increased awareness, improved communication skills and a commitment to continuous professional development.[61–63] These factors collectively contribute to their ability to offer comprehensive and effective PCC, making them 2.36 times more likely to possess good knowledge in this area compared with those who did not receive such training.

CONCLUSION AND RECOMMENDATION

Our findings presented in this study showed that healthcare providers' level of knowledge of PCC was 51.43%. Educational status, presence of guidelines in their institution, working in a hospital and having training on preconception and related topics were factors shown to affect knowledge of PCC. The ORs associated with these variables underscore the undeniable impact of educational attainment, institutional protocols, hospital responsibilities and targeted training in augmenting the proficiency of healthcare providers. A pivotal strategy to address this issue and elevate the standard of healthcare services and outcomes across Ethiopia involves fostering heightened awareness and understanding among healthcare practitioners through the implementation of tailored educational initiatives, the establishment of effective institutional frameworks, and the implementation of structured training programmes and allocate resources and make information readily available to healthcare providers in health centres to improve their knowledge of PCC. By investing in these measures, the healthcare sector in Ethiopia can strive towards comprehensive improvement and more favourable health outcomes for its population. Finally, researchers are recommended to undertake qualitative studies to pinpoint

the cultural and behavioural factors intertwined with knowledge of PCC among healthcare providers.

Strengths and limitations of the study

One of the notable strengths of this review is its examination of healthcare provider knowledge outcomes using a consistent checklist and Andarg-Ethio PCC-KAP Questionnaire for HCPs[33] across the primary studies included. We adhered to a predetermined search strategy and data extraction method and employed internationally recognised criteria to critically evaluate the quality of each individual study. Despite our efforts to minimise or address potential limitations, it is important to consider certain constraints when interpreting the results. First, the inclusion of a small number of primary studies was inevitable due to the scarcity of available research, which hinders the generalisability of our findings globally. Second, the absence of similar reviews conducted in other countries creates challenges in directly comparing our results with those of other studies, necessitating primarily comparisons with individual primary studies. Moreover, only a limited number of studies from specific regions were included, which makes it difficult to conduct subgroup analyses based on study region and years. The absence of independent double screening in articles could potentially introduce bias into the research findings. Lastly, to meaningfully assess publication bias using techniques like funnel plots, there should ideally be a minimum of 10 studies included in the analysis. Since we have included a smaller number of studies that limit the ability to accurately assess publication bias.

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