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Prevalence of active trachoma among 1-9 years of age children in Ethiopia: a systematic review and meta-analysis

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Keywords: Trachoma, Children, Systematic review, Meta-analysis, Ethiopia

Abstract

Objective: To determine the pooled prevalence of active trachoma among 1-9 years of children in Ethiopia.

Design: A systematic review and meta-analysis was employed in accordance with the Preferred Reporting Items for Systematic Reviews.

Data sources: Medline/PubMed, Scopus, web of science, African journal of online (AJOL) and Google scholar databases were systematically explored to find studies published in English until July 2023.

Eligibility criteria: The following criteria: (1) Condition (Co): Studies examined the prevalence of trachoma among children (1-9) years old; (2) Context (Co): Studies conducted in Ethiopia; (3) Population (Pop): Studies that were done among children (1-9 years); (4) Study type: Observational studies; (5) Language: Studies published in English.

Data extraction and synthesis: The data was extracted using a Microsoft Excel spreadsheet. Random effect model was used to estimate the pooled prevalence of active trachoma among 1-9 years of age children. Cochrane Q-test and I^2 statistics were used across studies to assess heterogeneity. To identify possible publication bias Egger's test was performed.

Primary outcome: Prevalence of active trachoma.

Results: Overall, a total of forty-two articles with 235,005 study participants were included in the final analysis. The estimated pooled prevalence of active trachoma using random effect model was 24% (95% CI: 20-27%). The sub-group analysis by region revealed the highest prevalence of trachoma was 36% (95% CI: 13-58%) in Tigray region and publication year revealed the prevalence of trachoma is decreasing from 32% to 19% after 2015.

Conclusion: In this review, the pooled prevalence of active trachoma was found to be high in Ethiopia compared to World health Organization (WHO) threshold level. This underscores the need for increased focus on high-risk age groups to decrease trachoma and to achieve elimination of trachoma from the country by 2030.

Strength and Limitations of this study

- ☞ It follows the recommended updated PRISMA guidelines
- ☞ We also rigorously searched the literature in different databases and identified eligible studies.
- ☞ Limitations of this review which will be considered while interpreting the result. The first one is we were forced to compare our findings with those of primary studies in some parts of the discussion because of a lack of adequate systematic reviews and meta-analyses.
- ☞ This review have not assessed for associated factors.

Word count: 3285

Introduction

Globally, trachoma is the leading cause of blindness. Trachoma has been named one of 20 neglected tropical diseases (NTD) by the World Health Organization (WHO) [1, 2]. Children are the primary reservoirs of infection. Children aged 1 to 9 years are more likely to have an active trachoma [3]. Due to their tendency for close contact with others, children are frequently infected with *Chlamydia trachomatis* [4].

The poorest of the poor are primarily affected by trachoma [5]. The WHO 2021 report shows that trachoma is responsible for 1.9 million people with blindness and visual impairment, moreover, approximately 125 million people live in trachoma-endemic areas worldwide[1]. Around 3.8 million cases of blinding trachoma and 27.8 million cases of active trachoma have been reported in Africa which is one of the most affected continents [6]. Ethiopia has the world's highest trachoma burden, with 76.2 million people living in endemic areas at risk of contracting the disease. Among Ethiopian children active trachoma is ranged from 10.3%[7] to 74.3% [8] . For children aged 1-9 years living in endemic areas the prevalence of Trachomatous inflammation-follicular (TF) <5% is the elimination target set by WHO(3), However, the prevalence in Ethiopian children is higher than the target. If TF is > =5% among children aged 1-9 years SAFE strategy which includes Antibiotics, Face washing, and Environmental Improvement (A, F, and E) is recommended [9]. Globally an estimated US$ 8 billion in annual product loss is attributed to this disease [1].

Direct personal contact such as shared towels, flies, clothes, and fingers that interact with the infected person's eyes or nose is known for transmission of trachoma infection. The scarcity of safe drinking water access and sanitation systems has spread Chlamydia trachomatis infections. Corneal scarring and eyelid deformities can occur after inflammation and recurrent infections subsequently, if not treated and eyelid inversion (Entropion) and the lashes turn inward (trichiasis) occur as late complications. Irreversible blindness can result in trichiasis and permanent damage to the cornea [1].

Eliminating trachoma by 2020 through the implementation SAFE strategy (surgery for in-turned eyelashes, antibiotics to clear the infection, and facial cleanliness and environmental improvement to reduce infection transmission) was set by the WHO and

other concerned organizations[1]. Ethiopia intended to eliminate trachoma through the SAFE strategy by implementing a national trachoma action plan in 2012 and implementing a second master plan for 2016 to 2020 [10, 11]. Despite significant development, trachoma elimination was not met by December 2020 and it was pushed back to 2030 to align with the Sustainable Development Goals (SDGs) [1].

Despite the fact that numerous fragmented studies have been conducted in Ethiopian children (1-9 years) to assess the prevalence of trachoma, comprehensive updated nationwide data on the prevalence is lacking. As a result, this study aimed to deliver a summary of the prevalence of trachoma infection among children, and geographical locations, and to assess the ongoing preventive and control measures impact in the country.

Furthermore, the government and other concerned bodies may contribute by focusing on preventive measures such as improving access to water and sanitation specifically in areas of trachoma infection high prevalence.

Research Question: What is the pooled prevalence of trachoma infection among children (1-9yrs) old in Ethiopia?

Methods

Reporting

We performed our analyses according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement [12]. The article screening was based on the PRISMA 2020 statement, and the selection process has been shown using a PRISMA -P flow diagram. The finding is presented using the standard PRISMA checklist **(Supplemental Table 1).** The review protocol is not registered in PROSPERO.

Search Strategy and study identification

To estimate the prevalence of trachoma among children (1-9) years old in Ethiopia a systematic review and meta-analysis were performed. After an initial exploration of Google Scholar, MEDLINE, and SCOPUS with limited parameters, a follow-up search was

conducted using all identified keywords and index terms across several databases including MEDLINE, PubMed, SCOPUS, Web of Science, and African journal online(AJOL). All studies conducted on trachoma Prevalence among children in Ethiopia were retrieved. The search included all articles published until July 31, 2023. English-language studies were only searched. Medical subject heading (MeSH) (((((("Magnitude") OR "prevalence" OR “burden”) AND "Trachoma") OR "Eye infection" OR “Trachomatous intense” OR “Trachomatous Follicular”)) AND Ethiopia) were used in various combinations as the primary search keywords (**Supplemental Table 2).** During the systematic review and meta-analysis, we followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [12].

Eligibility Criteria

We used condition, context, and population (CoCoPop) framework for the search and meta-analysis of eligibility criteria.

Inclusion Criteria

The following criteria were used to include studies in this systematic review and meta-analysis.

- Condition (Co): We include studies examined the prevalence of trachoma among children (1-9) years old.
- Context (Co): Studies conducted in Ethiopia were included.
- Population (Pop): Studies that were done among children (1-9 years).
- Study type: Observational studies
- Language: Studies published in English were included

Exclusion criteria

We excluded studies other than children (1-9 years) as well as with different outcome of interest, qualitative studies, case reports, case series, review paper, conference proceedings and abstracts.

Outcome measurement

This study aimed to gather and analyze data from various studies conducted in Ethiopia to determine the pooled prevalence of Trachoma among children (1-9 years). We used a systematic approach to identify the relevant studies and extract data from them. Then we employ Stastical methods to combine the data from different studies to estimate the overall pooled prevalence of Trachoma among children (1-9 years) in Ethiopia. Prevalence of trachoma defined here as trachomatous inflammation follicular or Trachomatous inflammation intense among children was the major outcome of this review.

Data extraction and quality assessment

The Endnote citation manager (Version X8, for Windows, Thomson Reuters, Philadelphia, PA, USA) was used to import the retrieved studies and then duplicates were removed. Two independent reviewers screened all the articles for eligibility criteria. Reviewers began by screening the abstracts and titles, followed by full-text screening. The quality of the articles was assessed by using Newcastle-Ottawa Quality Assessment Scale (adapted for cross-sectional studies) [13]. Disagreements were resolved by a third investigator. The articles were critically appraised by the following criteria from the tool: Representativeness of the sample (1 score maximum), sample size (1 score maximum), non-respondent (1 score maximum), ascertainment of exposure (2 score maximum), Comparability of outcome based on study design (2 score maximum), outcome assessment (2 score maximum) and Statistical analysis (1 score maximum). All the included studies assessed through the tool with a score of ≥5 were included in this systematic review and meta-analysis (**Supplemental Table 3).** After quality rating no study was dismissed. Two investigators used a standardized extraction format prepared in Microsoft Excel. The excel spreadsheet includes the name of the first author, publication year, study design, region, study area, gender, sample size, number of cases and trachoma prevalence.

Statistical Analysis

Data was extracted in Microsoft Excel format and analyzed using STATA software version 16.0 (Stata Corp LLC, Texas, USA). We used forest plots to report the estimated pooled prevalence of the study with confidence interval (CI) to provide a visual summary of the data. Effect sizes were expressed as a proportion with 95% CI around the summary estimate. The data was first presented using narrative synthesis of the included studies. We assumed no, low, medium, and high heterogeneity across studies if the I^2 values were 0%, 25%, 50%, and 75%, respectively. A meta-analysis using a random effects model was performed to analyze the pooled prevalence with 95% confidence intervals (CI) since significant heterogeneity was detected between studies. The heterogeneity of each outcome measure was assessed using both X^2 and I^2 statistics to determine dispersion. Meta-regression analysis was performed to investigate the source of heterogeneity. A Funnel plot and Egger's regression test was conducted to assess publication bias. In addition, a leave one-out sensitivity analysis to evaluate small study effect by excluding each study one at a time, the analysis was performed to assess the effect of each study on the pooled prevalence of trachoma and subgroup analysis was performed to ensure consistency of pooled results. Statistical significance was considered at $p< 0.05$.

Results

Search results

Our searching strategy initially identified 453 Articles and 340 duplicates were excluded by using the endnotes citation manager. Finally, 68 Studies were further excluded after reviewing the title and abstract and then 45 articles full text was reviewed for necessary criteria. Excluding three articles as they were not reported outcomes of interest; finally, 42 studies that fulfilled the inclusion criteria were considered for the final analysis to estimate the overall pooled prevalence of trachoma among children (1-9 years) in Ethiopia. (Figure 1) illustrates the process of the literature review, screening, and eligibility assessment of the study articles.

Included studies characteristics

A total of forty-two cross-sectional studies (235,006 children) were included in this systematic review and meta-analysis. The spanned publication period was from 2005 to 2023. The sample size of the included studies ranges from 178 [14] to 62869[15]. With regard to study sites, sixteen of the primary studies included from Amhara region [2, 15-29], nine from SNNPR region [30-38] and six studies included from Oromia [14, 39-41], three from Tigray [42-44] respectively. However, one study each reported from Afar[45] , Somali[46], Harari[47],Diredawa [8], Gambela [48], BenshangulGumuz [49], and nationwide [50] (Table 1).

222 **Table 1: Summary of 42 included studies on the pooled prevalence of trachoma among 1-9 years of age**
223 **children in Ethiopia, 2023.**

Author's	Publication year	Region	Study Area	Sample	Male(n)	Female (n)	No of cases(n)	Prevalence %
Abashawl et.al[48]	2016	Gambela	Region-wide	3238	NA	NA	557	17.2
Adamu et.al[49]	2016	Benishangul Gumuz	Region-wide	7417	3212	4205	612	8.3
Adera et.al[30]	2016	SNNP	Region-wide	41,155	NA	NA	11647	28.3
Admassu et.al[31]	2013	SNNP	Guragie	768	386	382	175	22.8
Admasu et.al[32]	2015	SNNP	Dawro	267	113	154	61	22.9
Alambo et.al[38]	2018	SNNP	Areka	586	317	269	222	37.9
Alemayehu et.al[51]	2015	Amhara	Dera	671	351	320	105	15.6
Alemayehu et.al [33]	2005	SNNP	Guragie	2788	NA	NA	1566	56.5
Anteneh et.al[16]	2016	Amhara	Gazegibela	601	268	333	315	52.4
Asres et.al[17]	2016	Amhara	Gondar	586	285	301	71	12.1
Assefa et.al[47]	2017	Harari	Harari	1722	804	918	22	1.3
Belsti et.al[52]	2021	Southwest	Lare	610	283	327	132	21.6

Bero et.al[39]	2016	Oromia	Regionwide	41642	NA	NA	6744	23.4
Brhane et.al[50]	2007	Nationwide	Nationwide	9289	NA	NA	3726	40.1
Duale et.al[46]	2018	Somali	Region-wide	23620	11462	12158	3554	15
Ejigu et.al[53]	2013	Southwest	Kersa	305	154	151	77	25.2
Emerson et.al[18]	2008	Amhara	Region wide	5485	NA	NA	1792	32.7
Ferede et.al[19]	2017	Amhara	Dembia	681	NA	NA	124	18.2
Gedefaw et.al[20]	2013	Amhara	Dangila	409	215	194	49	12
Genet et.al [21]	2022	Amhara	Dangila	704	337	367	43	6.1
Golovaty et.al[22]	2009	Amhara	Ankober	507	219	288	2775	53.9
Kassahun et.al[41]	2012	Oromia	Mojo	431	NA	NA	97	22.5
Kedir et.al[34]	2020	SNNP	Silte	561	279	282	1665	29.4
Kemal et.al[40]	2019	Oromia	Medawalebu	406	215	191	89	22
Kessete et.al[29]	2021	Amhara	Metema	752	352	400	88	11.8
Ketema et.al[23]	2012	Amhara	Baso Liben	792	391	401	191	24.1
Mehari et.al [35]	2014	SNNP	Guragie	735	366	369	47	6.4

Mekonnen et.al[14]	2022	Oromia	Arsi Negele	178	93	85	39	21.91
Mengistu et.al[36]	2016	SNNP	Zala	611	286	325	224	36.7
Mesfin et.al[42]	2006	Tigray	Regionwide	1526	NA	NA	908	59.2
Mesfin et.al[2]	2005	Amhara	Ebinet	1244	601	643	527	42.4
Mohammed et.al[8]	2005	Diredawa	Goro	826	438	388	278	33.7
Negash et.al[45]	2018	Afar	Regionwide	6339	NA	NA	61	9.6
Nigussie et.al[24]	2015	Amhara	Gonji Kolella	618	353	265	143	23.1
Nigusu et.al[25]	2022	Amhara	Tarimaber	736	380	356	116	15.8
Oswald et.al[15]	2017	Amhara	Region wide	62869	NA	NA	6031	9.6
Reda et.al[43]	2020	Tigray	Deguatemben	502	257	245	108	21.5
Sadik et.al[44]	2016	Tigray	Regionwide	10023	NA	NA	2670	26.7
Shiferaw et.al[26]	2013	Amhara	Makisegnit	420	209	211	100	23.8
Shimelash et.al[27]	2022	Amhara	Debretabor	394	70	324	39	9.9
Tadesse et.al[28]	2017	Amhara	Wollo	1358	638	720	293	21.6
Woldekidan et.al[37]	2019	SNNP	Lemo	574	NA	NA	87	15.2

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The pooled prevalence estimates of trachoma among children in Ethiopia

The pooled prevalence of trachoma among children (1-9 years) in Ethiopia was identified in 42 studies, from a total of 235,006 children, 45,711 children were infected with trachoma. Stastically significant heterogeneity was observed (I^2= 99.8%); p<0.0001). There we used random effect model to estimate the pooled prevalence of trachoma among children (1-9 years) which was 24.01 %(95% CI: 20.67-27.40%) (Figure 2).

Subgroup analysis

To identify the potential source of heterogeneity, a subgroup analysis was executed based on study area (region) and publication year. Based on the subgroup analysis by study are (region) of Ethiopia the highest prevalence of trachoma was reported in Tigray region 35.81 (95% CI: 13.84-57.78) and followed by SNNP where 28.98 (20.14-37.82). According to subgroup analysis by publication year the pooled prevalence of trachoma among children was significantly different 32.53% (95%CI: 24.32-40.76) and 19.93% (95% CI: 16.35-23.51) before 2015 and since 2015 (Table 2).

Table 2: Subgroup-analysis on the pooled prevalence of trachoma infection among children (1-9 years) in Ethiopia, 2023

Subgroups	Number of studies	Prevalence (95%CI)	I^2	P-value
Regions				
Amhara	16	23.02(16.7,29.31)	59.5	0.001
SNNPR	10	28.58 (20.14,37.82)	99.5	0.001
Oromia	6	23.36(22.96,23.75)	0.00	0.107
Tigray	3	35.81(13.84,57.78)	59.7	0.100
Others	7	15.29(7.33,23.26)	59.9	0.600
Over all	**42**	**24.01(20.61,27.40)**	**59.8**	**0.001**
Publication year				
>= 2015	28	19.71(16.27,23.15)	99.8	0.001
<2015	14	32.53(24.31,40.76)	99.5	0.001
Over all	**42**	**24.01(20.61,27.40)**	**59.8**	**0.001**

Publication bias assessment

The funnel plot was visually inspected to assess potential publication bias, which was statistically supported by Egger's test. The symmetrical distribution of the included publications in a large inverted funnel indicated the absence of a publication bias (**Supplemental Figure 1**). The Egger tests revealed no publication bias among the studies included to estimate the pooled prevalence of trachoma infection among children in Ethiopia, with p - values of (p = 0.260).

Meta-Regression

Meta-regression was used to identify factors associated with the pooled prevalence of trachoma among children (1-9 years) old. For the meta-regression, publication year,

region and sample size were considered. The analysis revealed a significant correlation between the pooled prevalence of trachoma among children (1-9 years) and publication year (P<0.001) but no significant correlation with sample size and region (**Supplemental Table 4**).

Sensitivity analysis

By excluding each study individually, a leave-out-one sensitivity analysis was used to determine the effect of a single study on pooled prevalence of trachoma among children (1-9 years) in Ethiopia. Our finding revealed no single study had a significant impact on the pooled prevalence of trachoma among children (1-9 years) in Ethiopia (Figure 3).

Discussion

The purpose of this systematic review and meta-analysis is to append national data on the prevalence of trachoma infection among Ethiopian children to eliminate the disease. Although different studies from different regions have been published in the country, the data on trachoma infections have to be organized and updated every time. Therefore, updating the information has the potential to inform and help develop different strategies by targeting highly endemic areas.

The pooled overall prevalence of Trachoma (24.01 %) observed in the current review is comparable with a study from Colombia [54], but higher than the study done in the Democratic Republic of Congo (2.5%) [55], Nigeria (0.4%)[56], Uganda (0.3%)[57], Brazil (6.65%) [58], Kenya (15.7%)[59]. This prevalence is lower than studies from South Sudan (70.5%) [60] and Guinea (41.8%)[61]. The disparity among the findings might be due to environmental factors such as the level of participants' hygiene, sanitation, Access to functional latrines, and clear water supply, and recent studies were included in our review that reported ongoing Sustainable water, sanitation, and hygiene (WASH) program and Mass drug administration (MDA) with Azithromycin which might reduce trachoma prevalence among children in Ethiopia, unlike the South Sudan study which lacks MDA and targeted SAFE strategy [60].

The Subgroup analysis of this review also shows a statistically significant (p=0.01) difference among regions. Trachoma was highly prevalent in Tigray (35.81%) and SNNP (28.98) followed by Oromia (23.06) and Amhara regions (23.02). Trachoma infection is related to inadequate hygiene, low standard of living, inadequate access to water, and inadequate access to sanitation use. In the Tigray region trachoma prevalence is high which might also be related to extreme climatic events which favor a decline in water availability during dry periods which affects personal hygiene. Another reason for the difference is attributed to baseline and intervention disparity in the communities. MDA with Azithromycin once yearly is needed based on review finding (24%) and Ethiopia is known to require intervention based on WHO 2021 report(1).

Though the decline is not statistically significant (p=0.30) our result from this review revealed studies conducted between 2005-2014 and 2015-2022 show decrement on the prevalence of trachoma from 32 to 19%. The expansion of MDA and WASH programs might be attributed to the decrease in the prevalence. This is review has an implication revealing the national burden of trachoma infection among children, who are a special population accounted for one third of the national population. Moreover, this large magnitude of trachoma infection show significant gap in the implementation of devised WHO and national elimination strategies. Last but not least, from research perspective we recommend to conduct operational studies on the topic.

Conclusions

An effort has been made to eliminate, trachoma infection is still highly prevalent across the Ethiopian regions. Even though the decline is not statistically significant we saw decreased trachoma prevalence in Ethiopian children. Trachoma is highly prevalent in Tigray followed by SNNP. Despite the effort made by the country to eliminate Trachoma infection, According to WHO risk classification, it remains a public health problem in the country. The output of this review will offer valuable data to the Ministry of Health, policymakers, and concerned bodies which work on eliminating trachoma infection in the country. Trachoma infection is highly prevalent based on this review and it

underlines the need for improved prevention and control strategies for one of the Neglected tropical diseases in Ethiopia.

List of Abbreviations CI: Confidence interval; NTD: Neglected tropical disease; PRISMA: Preferred reporting items for systematic review and meta-analysis; SAFE: Surgery for Trichiasis, Antibiotics, Face Washing and Environmental improvement strategy; SDG: Sustainable development goal; SNNPR: South Nation and Nationalities people; WHO: World Health Organization.

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Data Availability: All associated data and supporting information are included in this systematic review and meta-analysis.

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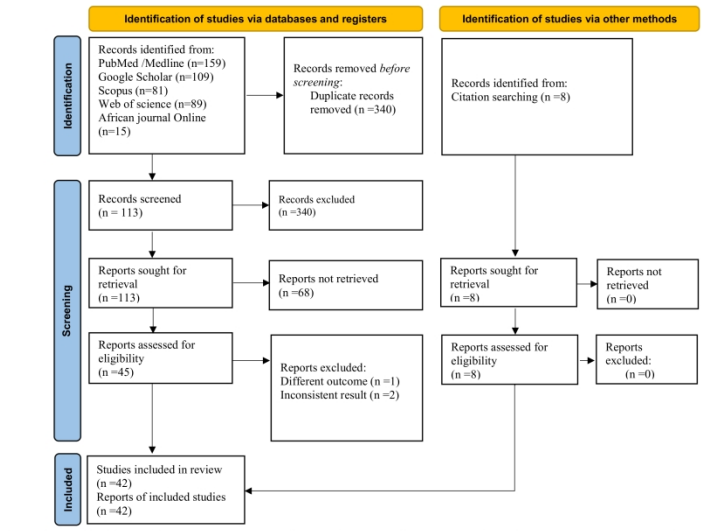


Figure 1 PRISMA flow diagram of screened articles and the selection process of studies on pooled prevalence of trachoma infection among 1-9 years of age children in Ethiopia,2023

Figure 1 PRISMA flow diagram of screened articles and the selection process of studies on the pooled prevalence of trachoma among 1-9 years of age children in Ethiopia,2023

297x210mm (300 x 300 DPI)

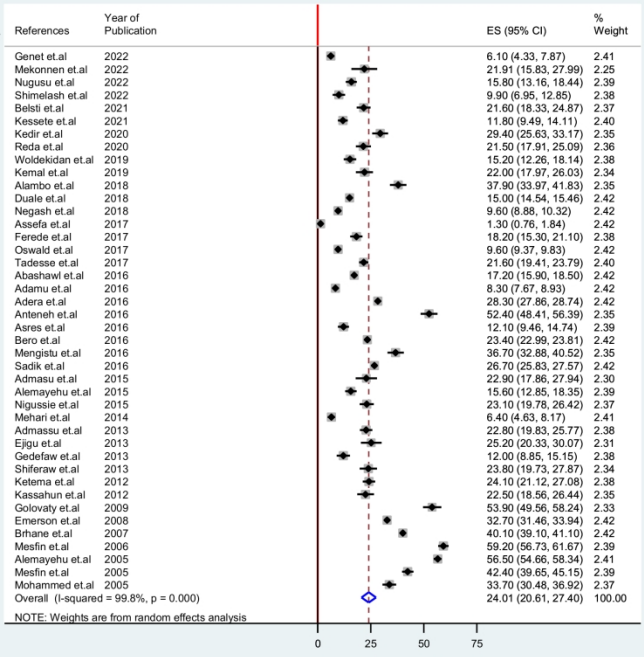


Figure 2 Forest plot depicting pooled prevalence of trachoma among 1-9 years of age children in Ethiopia,2023

Figure 2 Forest plot depicting pooled prevalence of trachoma among 1-9 years of age children in Ethiopia,2023

215x279mm (300 x 300 DPI)

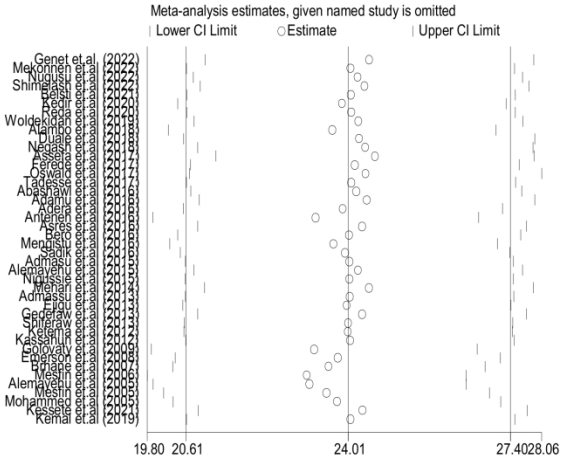


Figure 3. Leave-one sensitivity analysis on the studies included in pooled prevalence of trachoma among 1-9 years of age children in Ethiopia, 2023

Figure 3 Leave one sensitivity analysis on the studies included in the pooled prevalence of trachoma among 1-9 years of age children in Ethiopia,2023

215x279mm (300 x 300 DPI)

Supplemental Table 1: PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	3-4
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	6
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	7
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	6
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	6
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	7
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	7
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	7
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	7
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	7
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	15
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	8
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	7
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	7
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	9
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	15
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	16
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	15

Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	14

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	10
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	10
Study characteristics	17	Cite each included study and present its characteristics.	10
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	8
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	8
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	8
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	9
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	9
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	16
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	9
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	9
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	17
	23b	Discuss any limitations of the evidence included in the review.	18
	23c	Discuss any limitations of the review processes used.	18
	23d	Discuss implications of the results for practice, policy, and future research.	18
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	18
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	11
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	11
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	13
Competing interests	26	Declare any competing interests of review authors.	13
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	13

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

Supplemental Table 2: Full searching strategy by databases for the pooled prevalence of trachoma among 1-9 age years of children in Ethiopia, 2023

Medline searching strategy

1	exp trachoma infections
2	Trachoma
3	(Trachoma or trachoma infections).tw.
4	(Trachoma and children (prev* or magn*)).tw.
5	(Trachoma * or trachoma infections * or children).tw.
6	Or/1-5
7	Prevalence
8	(Trachoma infections * or children's*).tw.
9	Or/7-8
10	Ethiopia, sub-Saharan, Africa
11	(East* Africa* or "Horn of Africa*" or ethiopia* or Addis Ababa* or Afar* or Semera* or Amhara* or Bahir Dar* or Benishangul-Gumuz* or Asosa* or Dire Dawa* or Gambela* or Harar* or Oromia* or Somali* or Jijiga* or Hawassa* or Tigray* or Meke'ele* or "Southern Nations Nationalities and peoples region" or SNNPR).tw.
12	Or/10-11
13	6 and 9 and 12

Pub med searching strategy

1	((((Trachoma OR active Trachoma OR Trachoma Infections OR Prevalence OR Children))))
2	((east africa OR “Horn of Africa” OR ethiopia OR addis ababa OR afar OR semera OR amhara OR bahir dar OR benshangul gumz OR asosa OR dire dawa OR gambella OR harar OR oromiya OR Somali OR jijiga OR hawassa OR tigray OR meke’le OR “southern nations nationalities and peoples region) NOT Medline[sb])” LIMITED to English
3	1 AND 2

Web of Science searching strategy

1	((Trachoma or Active Trachoma or Trachoma Infection) AND ((Prevalence * or Children*) OR (Trachoma/1 (prev* or children*)))
2	(east* Africa* or "Horn of Africa*" or ethiopia* or Addis Ababa* or Afar* or Semera* or Amhara* or Bahir Dar* or Benishangul-Gumuz* or Asosa* or Dire Dawa* or Gambela* or Harar* or Oromia* or Somali* or Jijiga* or Hawassa* or Tigray* or Meke'ele* or "Southern Nations Nationalities and peoples region" or snnpr))
3	1 AND 2; Limited by language (English) and countries/territories (to Ethiopia)

Scopus searching strategy

1	ALL ((Trachoma* OR Active Trachoma* OR Trachoma Infections) OR (Trachoma W/1 (Preva* OR Children*)) OR Trachoma OR Active Trachoma OR “Trachoma infection”)
2	ALL (Prevalence* OR “Children*”)
3	ALL (ethiopia OR addis ababa OR oromiya OR afar OR tigray OR amhara OR afar OR harar OR benshangul gumz OR Somali OR OR gambella OR dire dawa OR “southern nations nationalities and peoples region OR snnpr)
4	1 AND 2 AND 3; Limited to country, Ethiopia AND Subject area medicine/sociology/psychology AND English

Supplemental Table 3: Methodological quality assessment of included studies using the Newcastle-Ottawa quality assessment scale

Study	Selection				Comparability	Outcome		
	Representativeness of the sample	Sample size	Non respondents	Ascertainment of the exposure (maximum score=2)	The subjects in different outcome groups are comparable, based on the study design or analysis. Confounding factors are controlled((maximum score=2))	Assessment of the outcome(maximum score=2)	Statistical test	Total(10)
Abashawl et.al[49]	1	0	0	1	0	2	2	6
Adamu et.al[50]	1	1	1	1	1	2	1	8
Adera et.al[31]	1	0	1	1	1	2	1	7
Admassu et.al[32]	1	0	1	2	1	2	1	8
Admasu et.al[33]	1	0	1	0	1	2	2	7
Alambo et.al[39]	1	0	1	1	1	2	1	7
Alemayehu et.al[52]	1	1	1	1	1	2	1	8

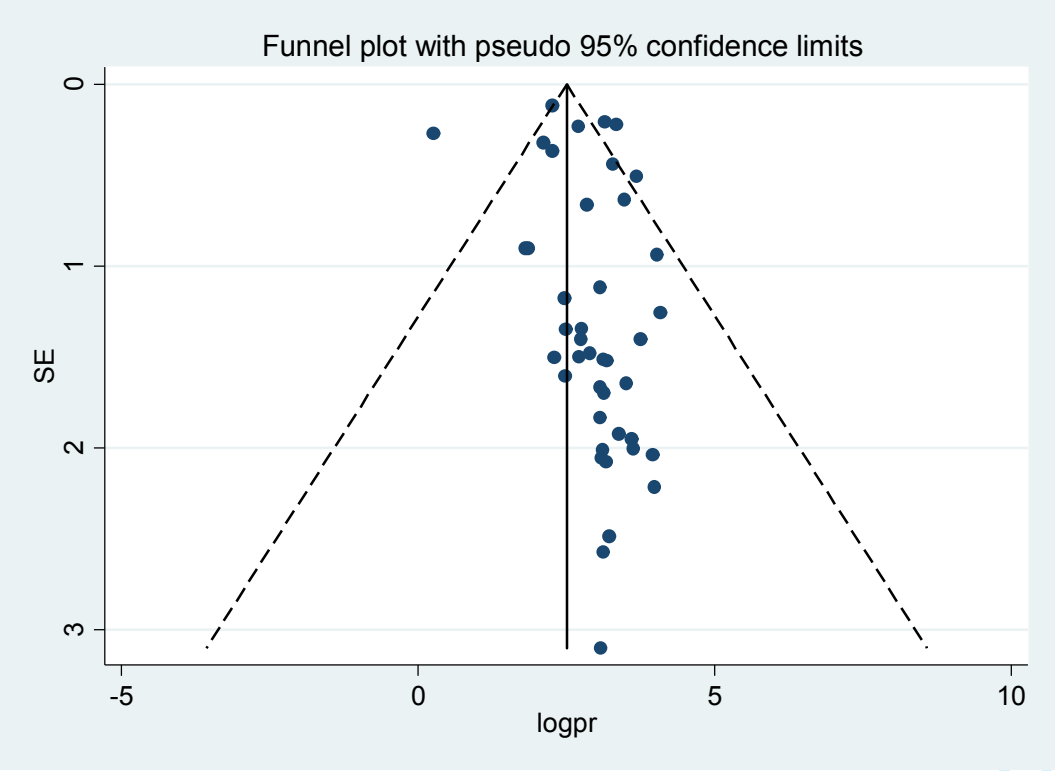
Alemayehu et.al [34]	1	1	1	1	1	2	2	9
Anteneh et.al[17]	1	0	1	1	0	2	2	7
Asres et.al[18]	1	1	1	1	1	2	1	8
Assefa et.al[48]	1	1	0	1	1	2	1	7
Belsti et.al[53]	1	1	1	1	1	2	1	8
Bero et.al[40]	1	0	1	1	1	2	2	8
Brhane et.al[51]	1	1	1	1	1	2	2	9
Duale et.al[47]	1	1	1	1	1	2	1	8
Ejigu et.al[54]	1	1	1	1	1	2	1	8
Emerson et.al[19]	1	0	1	1	1	2	1	7
Ferede et.al[20]	1	0	1	2	1	2	1	8
Gedefaw et.al[21]	1	0	1	0	1	2	2	7
Genet et.al [22]	1	0	1	1	1	2	1	7
Golovaty et.al[23]	1	1	1	1	1	2	1	8

Kassahun et.al[42]	1	1	1	1	1	2	2	9
Kedir et.al[35]	1	0	1	1	0	2	2	7
Kemal et.al[41]	1	1	1	1	1	2	1	8
Kessete et.al[30]	1	1	0	1	1	2	1	7
Ketema et.al[24]	1	0	1	1	1	2	1	7
Mehari et.al [36]	1	0	1	2	1	2	1	8
Mekonnen et.al[15]	1	0	1	1	0	2	2	7
Mengistu et.al[37]	1	1	1	1	1	2	1	8
Mesfin et.al[43]	1	1	0	1	1	2	1	7
Mesfin et.al[2]	1	1	1	1	1	2	1	8
Mohammed et.al[8]	1	0	1	1	1	2	2	8
Negash et.al[46]	1	1	1	1	1	2	2	9
Nigussie et.al[25]	1	1	1	1	1	2	1	8
Nigusu et.al[26]	1	1	1	1	1	2	1	8

Oswald et.al[16]	1	0	1	1	1	2	1	7
Reda et.al[44]	1	0	1	2	1	2	1	8
Sadik et.al[45]	1	0	1	0	1	2	2	7
Shiferaw et.al[27]	1	0	1	1	1	2	1	7
Shimelash et.al[28]	1	1	1	1	1	2	1	8
Tadesse et.al[29]	1	1	1	1	1	2	2	9
Woldekidan et.al[38]	1	0	1	1	0	2	2	7

Supplemental Table 4: Univariate meta-regression of factors related to the heterogeneity on the pooled prevalence of trachoma among 1-9 years of age children in Ethiopia, 2023

Variables	Coefficient	95% CI	P-value
Year of Publication	-1.83	-2.54 to -1.10	0.00
Region	1.23	-1.19-3.66	0.30
Sample Size	-.000	-.00 to 0.00	0.49



Supplemental Figure 1: Funnel plot depicting publication bias of studies reporting the pooled prevalence of trachoma among 1-9 years of age children in Ethiopia, 2023

BMJ Open

Prevalence of active trachoma among 1-9 years of age children in Ethiopia: a systematic review and meta-analysis

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2023-079623.R1
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Prevalence of active trachoma among 1-9 years of age children in Ethiopia: a systematic review and meta-analysis

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Keywords: Trachoma, Children, Systematic review, Meta-analysis, Ethiopia

Abstract

Objective: To determine the pooled prevalence of active trachoma among 1-9 years of children in Ethiopia.

Design: A systematic review and meta-analysis was employed in accordance with the Preferred Reporting Items for Systematic Reviews.

Data sources: Medline/PubMed, Scopus, web of science, African journal of online (AJOL) and Google scholar databases were systematically explored to find studies published in English until July 2023.

Eligibility criteria: The following criteria: (1) Condition (Co): Studies examined the prevalence of trachoma among children (1-9) years old; (2) Context (Co): Studies conducted in Ethiopia; (3) Population (Pop): Studies that were done among children (1-9 years); (4) Study type: Observational studies; (5) Language: Studies published in English.

Data extraction and synthesis: The data was extracted using a Microsoft Excel spreadsheet. DerSimonian-Laird Random effect model was used to estimate the pooled prevalence of active trachoma among 1-9 years of age children. Cochrane Q-test and I^2 statistics were used across studies to assess heterogeneity. To identify possible publication bias Egger's test was performed.

Primary outcome: Prevalence of active trachoma.

Results: Overall, a total of forty-two articles with 235,005 study participants were included in the final analysis. The estimated pooled prevalence of active trachoma using random effect model was 24% (95% CI: 20-27%). The sub-group analysis by region revealed the highest prevalence of trachoma was 36% (95% CI: 13-58%) in Tigray region and publication year revealed the prevalence of trachoma is decreasing from 32% to 19% after 2015.

Conclusion: In this review, the pooled prevalence of active trachoma was found to be high in Ethiopia compared to World health Organization (WHO) threshold level. This underscores the need for increased focus on high-risk age groups to decrease trachoma and to achieve elimination of trachoma from the country by 2030.

Strength and Limitations of this study

- ☞ It follows the recommended updated PRISMA guidelines
- ☞ We also rigorously searched the literature in different databases and identified eligible studies.
- ☞ One limitation of this systematic review and meta-analysis is that it only includes cross-sectional studies that report the proportion of trachoma cases.
- ☞ This review have not assessed for associated factors.

Word count: 3285

Introduction

Globally, trachoma is the leading infectious cause of blindness. Trachoma has been named one of 20 neglected tropical diseases (NTD) by the World Health Organization (WHO) [1, 2]. Children are the primary reservoirs of infection. Children aged 1 to 9 years are more likely to have an active trachoma [3]. Due to their tendency for close contact with others, children are frequently infected with *Chlamydia trachomatis* [4].

The poorest of the poor are primarily affected by trachoma [5]. The WHO 2021 report shows that trachoma is responsible for 1.9 million people with blindness and visual impairment, moreover, approximately 125 million people live in trachoma-endemic areas worldwide[1]. Around 3.8 million cases of blinding trachoma and 27.8 million cases of active trachoma have been reported in Africa which is one of the most affected continents [6]. Ethiopia has the world's highest trachoma burden, with 76.2 million people living in endemic areas at risk of contracting the disease. Among Ethiopian children active trachoma is ranged from 10.3%[7] to 74.3% [8] . For children aged 1-9 years living in endemic areas the prevalence of Trachomatous inflammation-follicular (TF) <5% is the elimination target set by WHO(3), However, the prevalence in Ethiopian children is higher than the target. If TF is > =5% among children aged 1-9 years SAFE strategy which includes Antibiotics, Face washing, and Environmental Improvement (A, F, and E) is recommended [9]. Globally an estimated US$ 8 billion in annual product loss is attributed to this disease [1].

Direct personal contact such as shared towels, flies, clothes, and fingers that interact with the infected person's eyes or nose is known for transmission of trachoma infection. The scarcity of safe drinking water access and sanitation systems has spread Chlamydia trachomatis infections. Corneal scarring and eyelid deformities can occur after inflammation and recurrent infections subsequently, if not treated and eyelid inversion (Entropion) and the lashes turn inward (trichiasis) occur as late complications. Trichiasis and permanent damage to the cornea frequently results in irreversible blindness [1].

Eliminating trachoma by 2020 through the implementation SAFE strategy (surgery for in-turned eyelashes, antibiotics to clear the infection, and facial cleanliness and environmental improvement to reduce infection transmission) was set by the WHO and

other concerned organizations[1]. Ethiopia intended to eliminate trachoma through the SAFE strategy by implementing a national trachoma action plan in 2012 and implementing a second master plan for 2016 to 2020 [10, 11]. Despite significant development, trachoma elimination was not met by December 2020 and it was pushed back to 2030 to align with the Sustainable Development Goals (SDGs) [1].

Despite the fact that numerous studies have been conducted in Ethiopian children (1-9 years) to assess the prevalence of trachoma and systematic review and meta-analysis in 2019 [12]; Our reason for undergoing this systematic review and meta-analysis is many studies have been published since then and our study aimed to address specific Stastical limitations in the previous studies. As a result, this study aimed to deliver a comprehensive updated nationwide prevalence of trachoma infection among children, and geographical locations, and to assess the ongoing preventive and control measures impact in the country.

Furthermore, the government and other concerned bodies may contribute by focusing on preventive measures such as improving access to water and sanitation specifically in areas of trachoma infection high prevalence.

Research Question: What is the pooled prevalence of trachoma infection among children (1-9yrs) old in Ethiopia?

Methods

Reporting

We performed our analyses according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement [13]. The article screening was based on the PRISMA 2020 statement, and the selection process has been shown using a PRISMA -P flow diagram. The finding is presented using the standard PRISMA checklist **(Supplemental Table 1).** The review protocol is not registered in PROSPERO.

Search Strategy and study identification

To estimate the prevalence of trachoma among children (1-9) years old in Ethiopia a systematic review and meta-analysis were performed. After an initial exploration of Google Scholar, MEDLINE, and SCOPUS with limited parameters, a follow-up search was conducted using all identified keywords and index terms across several databases including MEDLINE, PubMed, SCOPUS, Web of Science, and African journal online(AJOL). All studies conducted on trachoma Prevalence among children in Ethiopia were retrieved. The search included all articles published from database inception to July 31, 2023. English-language studies were only searched. Medical subject heading (MeSH) (((((("Magnitude") OR "prevalence" OR “burden”) AND "Trachoma") OR "Eye infection" OR “Trachomatous intense” OR “Trachomatous Follicular”)) AND Ethiopia) were used in various combinations as the primary search keywords (**Supplemental Table 2).** During the systematic review and meta-analysis, we followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [13].

Eligibility Criteria

We used condition, context, and population (CoCoPop) framework for the search and meta-analysis of eligibility criteria.

Inclusion Criteria

The following criteria were used to include studies in this systematic review and meta-analysis.

- Condition (Co): We include studies examined the prevalence of trachoma among children (1-9) years old.
- Context (Co): Studies conducted in Ethiopia were included.
- Population (Pop): Studies that were done among children (1-9 years).
- Study type: Observational studies
- Language: Studies published in English were included

Exclusion criteria

We excluded studies other than children (1-9 years) as well as with different outcome of interest, qualitative studies, case reports, case series, review paper, conference proceedings and abstracts.

Outcome measurement

This study aimed to gather and analyze data from various studies conducted in Ethiopia to determine the pooled prevalence of Trachoma among children (1-9 years). We used a systematic approach to identify the relevant studies and extract data from them. Then we employ Stastical methods to combine the data from different studies to estimate the overall pooled prevalence of Trachoma among children (1-9 years) in Ethiopia. Prevalence of trachoma defined here as trachomatous inflammation follicular or Trachomatous inflammation intense among children was the major outcome of this review. We calculated the prevalence of trachoma in children by adjusting for the proportion of each age group (1-year increments) with active trachoma (TF) based on the local population distribution of 1-9 year-olds from the latest census data.

Data extraction and quality assessment

The Endnote citation manager (Version X8, for Windows, Thomson Reuters, Philadelphia, PA, USA) was used to import the retrieved studies and then duplicates were removed. Two independent reviewers screened all the articles for eligibility criteria. Reviewers began by screening the abstracts and titles, followed by full-text screening. The quality of the articles was assessed by using Newcastle-Ottawa Quality Assessment Scale (adapted for cross-sectional studies) [14]. Disagreements were resolved by a third investigator. The articles were critically appraised by the following criteria from the tool: Representativeness of the sample (1 score maximum), sample size (1 score maximum), non-respondent (1 score maximum), ascertainment of exposure (2 score maximum), Comparability of outcome based on study design (2 score maximum), outcome assessment (2 score maximum) and Statistical analysis (1 score maximum). All the included studies assessed through the tool with a score of ≥5 were included in this systematic review and meta-analysis (**Supplemental Table 3).** After quality rating no study was dismissed. During our quality assessment nineteen studies score eight, seventeen studies score seven, five studies

score nine and one study score six out of ten. Overall, the distribution of scores in your quality assessment indicates that the majority of studies were of good to high quality, with only a few studies showing lower scores. Two investigators used a standardized extraction format prepared in Microsoft Excel. The excel spreadsheet includes the name of the first author, publication year, study design, region, study area, gender, sample size, number of cases and trachoma prevalence.

Statistical Analysis

Data was extracted in Microsoft Excel format and analyzed using STATA software version 16.0 (Stata Corp LLC, Texas, USA). We used forest plots to report the estimated pooled prevalence of the study with confidence interval (CI) to provide a visual summary of the data. Effect sizes were expressed as a proportion with 95% CI around the summary estimate. The data was first presented using narrative synthesis of the included studies. We assumed no, low, medium, and high heterogeneity across studies if the I^2 values were 0%, 25%, 50%, and 75%, respectively. A meta-analysis using a random effects model was performed to analyze the pooled prevalence with 95% confidence intervals (CI) since significant heterogeneity was detected between studies. The heterogeneity of each outcome measure was assessed using both X^2 and I^2 statistics to determine dispersion. Meta-regression analysis was performed to investigate the source of heterogeneity. A Funnel plot and Egger's regression test was conducted to assess publication bias. In addition, a leave one-out sensitivity analysis to evaluate small study effect by excluding each study one at a time, the analysis was performed to assess the effect of each study on the pooled prevalence of trachoma and subgroup analysis was performed to ensure consistency of pooled results. Statistical significance was considered at $p< 0.05$.

Patient and public involvement

The public/patient was not involved in the design, conduct, reporting, or dissemination plans of this review.

Results

Search results

Our searching strategy initially identified 453 Articles and 340 duplicates were excluded by using the endnotes citation manager. Finally, 68 Studies were further excluded after reviewing the title and abstract and then 45 articles full text was reviewed for necessary criteria. Excluding three articles as they were not reported outcomes of interest; finally, 42 studies that fulfilled the inclusion criteria were considered for the final analysis to estimate the overall pooled prevalence of trachoma among children (1-9 years) in Ethiopia. (Figure 1) illustrates the process of the literature review, screening, and eligibility assessment of the study articles.

Included studies characteristics

A total of forty-two cross-sectional studies (235,006 children) were included in this systematic review and meta-analysis (**Supplemental Table 5**). The spanned publication period was from 2005 to 2023. The sample size of the included studies ranges from 178 [15] to 62869[16]. With regard to study sites, sixteen of the primary studies included from Amhara region [2, 16-30], nine from SNNPR region [31-39] and six studies included from Oromia [15, 40-42], three from Tigray [43-45] respectively. However, one study each reported from Afar[46] , Somali[47], Harari[48],Diredawa [8], Gambela [49], BenshangulGumuz [50], and nationwide [51] (Table 1).

Table 1: Summary of 42 included studies on the pooled prevalence of trachoma among 1-9 years of age children in Ethiopia, 2023.

Author's	Publication year	Region	Study Area	Sample	Male(n)	Female (n)	No of cases(n)	Prevalence %
Abashawl et.al[49]	2016	Gambela	Region-wide	3238	NA	NA	557	17.2
Adamu et.al[50]	2016	Benishangul Gumuz	Region-wide	7417	3212	4205	618	8.3
Adera et.al[31]	2016	SNNP	Region-wide	41,155	NA	NA	11,647	28.3
Admassu et.al[32]	2013	SNNP	Guragie	768	386	382	175	22.8
Admasu et.al[33]	2015	SNNP	Dawro	267	113	154	61	22.9
Alambo et.al[39]	2018	SNNP	Areka	586	317	269	222	37.9
Alemayehu et.al[52]	2015	Amhara	Dera	671	351	320	105	15.6
Alemayehu et.al [34]	2005	SNNP	Guragie	2788	NA	NA	1561	56.5
Anteneh et.al[17]	2016	Amhara	Gazegibela	601	268	333	315	52.4
Asres et.al[18]	2016	Amhara	Gondar	586	285	301	71	12.1
Assefa et.al[48]	2017	Harari	Harari	1722	804	918	22	1.3
Belsti et.al[53]	2021	Southwest	Lare	610	283	327	132	21.6
Bero et.al[40]	2016	Oromia	Regionwide	41642	NA	NA	9744	23.4
Brhane et.al[51]	2007	Nationwide	Nationwide	9289	NA	NA	3725	40.1
Duale et.al[47]	2018	Somali	Region-wide	23620	11462	12158	3543	15
Ejigu et.al[54]	2013	Southwest	Kersa	305	154	151	77	25.2
Emerson et.al[19]	2008	Amhara	Region wide	5485	NA	NA	1794	32.7
Ferede et.al[20]	2017	Amhara	Dembia	681	NA	NA	121	18.2
Gedefaw et.al[21]	2013	Amhara	Dangila	409	215	194	49	12

Genet et.al [22]	2022	Amhara	Dangila	704	337	367	43	6.1
Golovaty et.al[23]	2009	Amhara	Ankober	507	219	288	275	53.9
Kassahun et.al[42]	2012	Oromia	Mojo	431	NA	NA	97	22.5
Kedir et.al[35]	2020	SNNP	Silte	561	279	282	165	29.4
Kemal et.al[41]	2019	Oromia	Medawalebu	406	215	191	89	22
Kessete et.al[30]	2021	Amhara	Metema	752	352	400	88	11.8
Ketema et.al[24]	2012	Amhara	Baso Liben	792	391	401	191	24.1
Mehari et.al [36]	2014	SNNP	Guragie	735	366	369	47	6.4
Mekonnen et.al[15]	2022	Oromia	Arsi Negele	178	93	85	39	21.91
Mengistu et.al[37]	2016	SNNP	Zala	611	286	325	224	36.7
Mesfin et.al[43]	2006	Tigray	Regionwide	1526	NA	NA	903	59.2
Mesfin et.al[2]	2005	Amhara	Ebinet	1244	601	643	527	42.4
Mohammed et.al[8]	2005	Diredawa	Goro	826	438	388	278	33.7
Negash et.al[46]	2018	Afar	Regionwide	6339	NA	NA	611	9.6
Nigussie et.al[25]	2015	Amhara	Gonji Kolella	618	353	265	143	23.1
Nigusu et.al[26]	2022	Amhara	Tarimaber	736	380	356	116	15.8
Oswald et.al[16]	2017	Amhara	Region wide	62869	NA	NA	6035	9.6
Reda et.al[44]	2020	Tigray	Deguatemben	502	257	245	108	21.5
Sadik et.al[45]	2016	Tigray	Regionwide	10023	NA	NA	2676	26.7
Shiferaw et.al[27]	2013	Amhara	Makisegnit	420	209	211	100	23.8
Shimelash et.al[28]	2022	Amhara	Debretabor	394	70	324	39	9.9
Tadesse et.al[29]	2017	Amhara	Wollo	1358	638	720	293	21.6
Woldekidan et.al[38]	2019	SNNP	Lemo	574	NA	NA	87	15.2

The pooled prevalence estimates of trachoma among children in Ethiopia

The pooled prevalence of trachoma among children (1-9 years) in Ethiopia was identified in 42 studies, from a total of 235,006 children, 45,711 children were infected with trachoma. Stastically significant heterogeneity was observed (I^2= 99.8%); p<0.0001). There we used random effect model to estimate the pooled prevalence of trachoma among children (1-9 years) which was 24.01 %(95% CI: 20.67-27.40%) (Figure 2).

Subgroup analysis

To identify the potential source of heterogeneity, a subgroup analysis was executed based on study area (region) and publication year. Based on the subgroup analysis by study are (region) of Ethiopia the highest prevalence of trachoma was reported in Tigray region 35.81 (95% CI: 13.84-57.78) and followed by SNNP where 28.98 (20.14-37.82). According to subgroup analysis by publication year the pooled prevalence of trachoma among children was significantly different 32.53% (95%CI: 24.32-40.76) and 19.93% (95% CI: 16.35-23.51) before 2015 and since 2015 (Table 2).

Table 2: Subgroup-analysis on the pooled prevalence of trachoma infection among children (1-9 years) in Ethiopia, 2023

Subgroups	Number of studies	Prevalence (95%CI)	I^2	P-value
Regions				
Amhara	16	23.02(16.7,29.31)	59.5	0.001
SNNPR	10	28.58 (20.14,37.82)	99.5	0.001
Oromia	6	23.36(22.96,23.75)	0.00	0.107
Tigray	3	35.81(13.84,57.78)	59.7	0.100
Others	7	15.29(7.33,23.26)	59.9	0.600
Over all	**42**	**24.01(20.61,27.40)**	**59.8**	**0.001**
Publication year				
>= 2015	28	19.71(16.27,23.15)	99.8	0.001
<2015	14	32.53(24.31,40.76)	99.5	0.001
Over all	**42**	**24.01(20.61,27.40)**	**59.8**	**0.001**

Publication bias assessment

The funnel plot was visually inspected to assess potential publication bias, which was statistically supported by Egger's test. The symmetrical distribution of the included publications in a large inverted funnel indicated the absence of a publication bias (**Supplemental Figure 1**). The Egger tests revealed no publication bias among the studies included to estimate the pooled prevalence of trachoma infection among children in Ethiopia, with p - values of (p = 0.260).

Meta-Regression

Meta-regression was used to identify factors associated with the pooled prevalence of trachoma among children (1-9 years) old. For the meta-regression, publication year,

region and sample size were considered. The analysis revealed a significant correlation between the pooled prevalence of trachoma among children (1-9 years) and publication year (P<0.001) but no significant correlation with sample size and region (**Supplemental Table 4**).

Sensitivity analysis

By excluding each study individually, a leave-out-one sensitivity analysis was used to determine the effect of a single study on pooled prevalence of trachoma among children (1-9 years) in Ethiopia. Our finding revealed no single study had a significant impact on the pooled prevalence of trachoma among children (1-9 years) in Ethiopia (Figure 3).

Discussion

The purpose of this systematic review and meta-analysis is to append national data on the prevalence of trachoma infection among Ethiopian children to eliminate the disease. Although different studies from different regions have been published in the country, the data on trachoma infections have to be organized and updated every time. Therefore, updating the information has the potential to inform and help develop different strategies by targeting highly endemic areas.

The pooled overall prevalence of Trachoma (24.01 %) observed in the current review is comparable with a study from Colombia [55], but higher than the study done in the Democratic Republic of Congo [56], Nigeria [57], Uganda [58], Brazil [59], Kenya [60]. This prevalence is lower than studies from South Sudan [61] and Guinea [62]. The disparity among the findings might be due to environmental factors such as the level of participants' hygiene, sanitation, Access to functional latrines, and clear water supply, and recent studies were included in our review that reported ongoing Sustainable water, sanitation, and hygiene (WASH) program and Mass drug administration (MDA) with Azithromycin which might reduce trachoma prevalence among children in Ethiopia, unlike the South Sudan study which lacks MDA and targeted SAFE strategy [61].

The Subgroup analysis of this review also shows a statistically significant (p=0.01) difference among regions. Trachoma was highly prevalent in Tigray and SNNP followed by Oromia and Amhara regions. Trachoma infection is related to inadequate hygiene, low standard of living, inadequate access to water, and inadequate access to sanitation use. In the Tigray region trachoma prevalence is high which might also be related to extreme climatic events which favor a decline in water availability during dry periods which affects personal hygiene. Another reason for the difference is attributed to baseline and intervention disparity in the communities. MDA with Azithromycin once yearly is needed based on review finding (24%) and Ethiopia is known to require intervention based on WHO 2021 report(1).

Though the decline is not statistically significant (p=0.30) our result from this review revealed studies conducted between 2005-2014 and 2015-2022 show decrement on the prevalence of trachoma from 32 to 19%. The expansion of MDA and WASH programs might be attributed to the decrease in the prevalence. This is review has an implication revealing the national burden of trachoma infection among children, who are a special population accounted for one third of the national population. Moreover, this large magnitude of trachoma infection show significant gap in the implementation of devised WHO and national elimination strategies. Last but not least, from research perspective we recommend to conduct operational studies on the topic.

This review adhered to the PRISMA guidelines and conducted a thorough literature search across multiple databases to identify relevant studies. While the meta-analytic methods employed were robust, caution is advised when interpreting the findings due to the study's limitations. Significant heterogeneity was observed in Trachoma prevalence across regions, potentially influenced by factors such as publication year and sample size.

Conclusions

An effort has been made to eliminate, trachoma infection is still highly prevalent across the Ethiopian regions. Even though the decline is not statistically significant we saw decreased trachoma prevalence in Ethiopian children. Trachoma is highly prevalent in Tigray followed by SNNP. Moreover, trachoma remains a significant public health concern among adults in Ethiopia. The prevalence of trachoma in this population is alarmingly high, highlighting the urgent need for continued efforts to improve access to clean water, sanitation, and hygiene practices. Despite the effort made by the country to eliminate Trachoma infection, According to WHO risk classification, it remains a public health problem in the country. The output of this review will offer valuable data to the Ministry of Health, policymakers, and concerned bodies which work on eliminating trachoma infection in the country. Trachoma infection is highly prevalent based on this review and it underlines the need for improved prevention and control strategies for one of the Neglected tropical diseases in Ethiopia.

List of Abbreviations CI: Confidence interval; NTD: Neglected tropical disease; PRISMA: Preferred reporting items for systematic review and meta-analysis; SAFE: Surgery for Trichiasis, Antibiotics, Face Washing and Environmental improvement strategy; SDG: Sustainable development goal; SNNPR: South Nation and Nationalities people; WHO: World Health Organization.

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Figure Legend

Figure 1- PRISMA flow diagram of screened articles and the selection process of studies on pooled prevalence of trachoma infection among 1-9 years of age children in Ethiopia 2023.

Figure 2- Forest plot depicting pooled prevalence of trachoma among 1-9 years of age children in Ethiopia 2023.

Figure 3- Leave-one sensitivity analysis on the studies included in the pooled prevalence of trachoma among 1-9 years of age children in Ethiopia 2023.

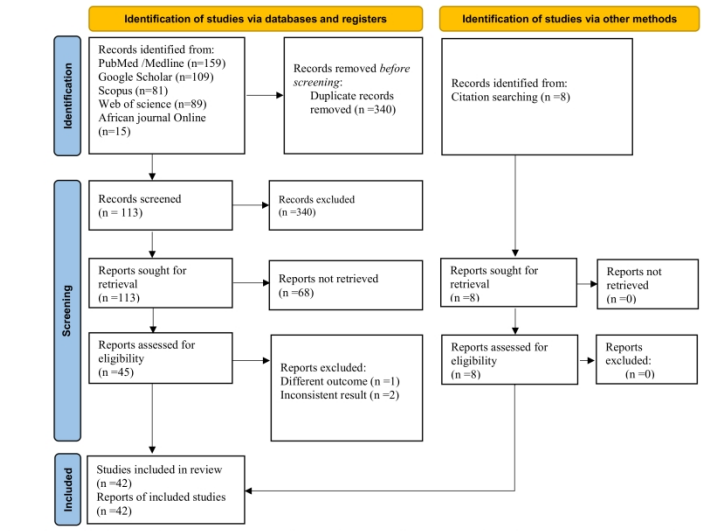
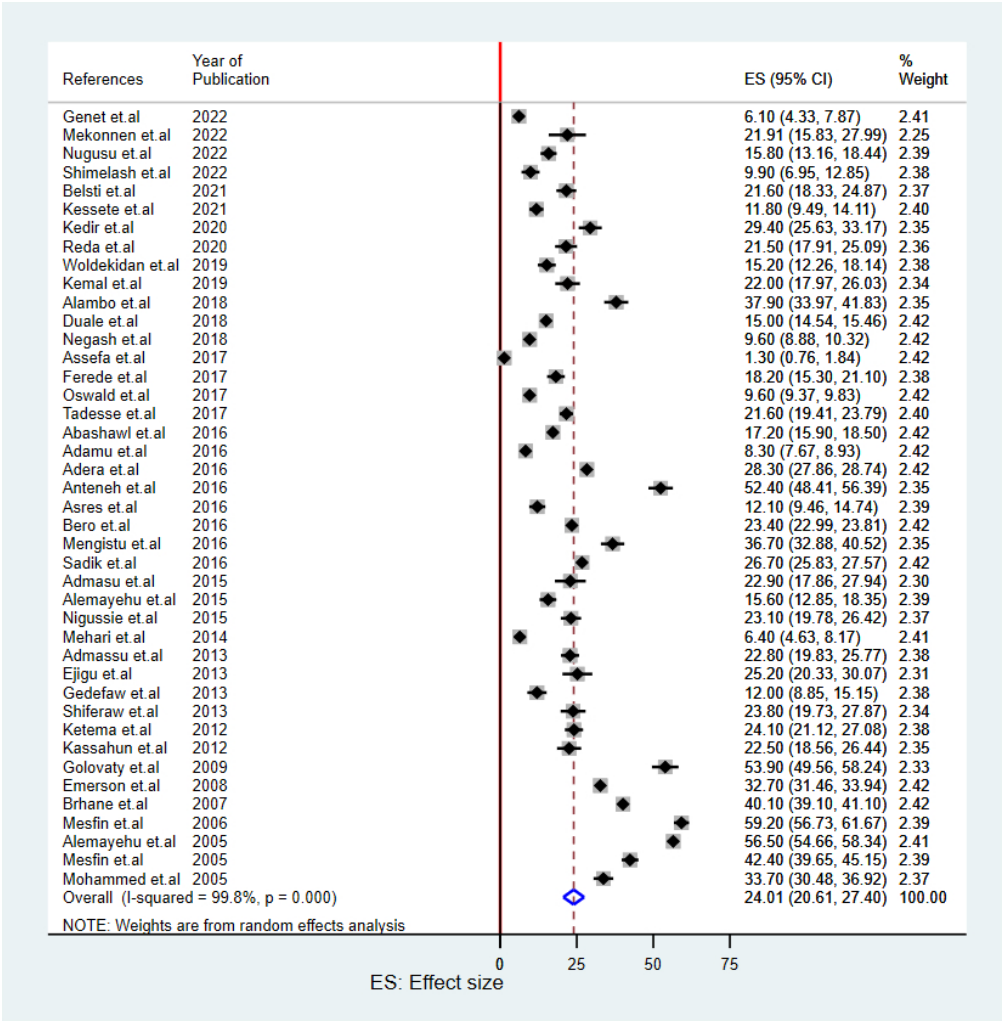


Figure 1 PRISMA flow diagram of screened articles and the selection process of studies on pooled prevalence of trachoma infection among 1-9 years of age children in Ethiopia,2023

Figure 1 PRISMA flow diagram of screened articles and the selection process of studies on the pooled prevalence of trachoma among 1-9 years of age children in Ethiopia,2023

297x210mm (300 x 300 DPI)



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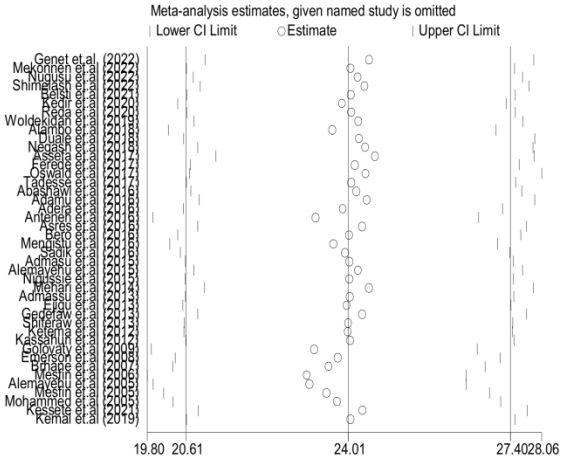

Figure 3. Leave-one sensitivity analysis on the studies included in pooled prevalence of trachoma among 1-9 years of age children in Ethiopia, 2023

Figure 3 Leave one sensitivity analysis on the studies included in the pooled prevalence of trachoma among 1-9 years of age children in Ethiopia,2023

215x279mm (300 x 300 DPI)

Supplemental Table 1: PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	3-4
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	6
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	7
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	6
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	6
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	7
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	7
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	7
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	7
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	7
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	15
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	8
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	7
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	7
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	9
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	15
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	16
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	15
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	14

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	10
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	10
Study characteristics	17	Cite each included study and present its characteristics.	10
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	8
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	8
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	8
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	9
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	9
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	16
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	9
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	9
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	17
	23b	Discuss any limitations of the evidence included in the review.	18
	23c	Discuss any limitations of the review processes used.	18
	23d	Discuss implications of the results for practice, policy, and future research.	18
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	18
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	11
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	11
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	13
Competing interests	26	Declare any competing interests of review authors.	13
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	13

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

Supplemental Table 2: Search Strategy Summary

Period search was conducted	20 May 2023 to 20 June 2023
Inclusion criteria	• Cross sectional study • Studies published until 31 July 2023 • Studies conducted in Ethiopia. • Children (1-9 years) • Published in the English Language. • Studies reported the prevalence of Trachoma
Exclusion criteria	• Case reports • case series • review articles • letters to editors
Libraries	Worldwide
Records identified from secondary databases, Google scholar	("magnitude"[All Fields] OR "magnitudes"[All Fields] OR ("epidemiology"[MeSH Subheading] OR "epidemiology"[All Fields] OR "prevalence"[All Fields] OR "prevalence"[MeSH Terms] OR "prevalance"[All Fields] OR "prevalences"[All Fields] OR "prevalence s"[All Fields] OR "prevalent"[All Fields] OR "prevalently"[All Fields] OR "prevalents"[All Fields]) OR ("burden"[All Fields] OR "burdened"[All Fields] OR "burdening"[All Fields] OR "burdens"[All Fields]) OR ("epidemiologies"[All Fields] OR "epidemiology"[MeSH Subheading] OR "epidemiology"[All Fields] OR "epidemiology"[MeSH Terms] OR "epidemiology s"[All Fields])) AND ("trachoma"[MeSH Terms] OR "trachoma"[All Fields] OR "trachomas"[All Fields] OR ("eye infections"[MeSH Terms] OR ("eye"[All Fields] AND "infections"[All Fields]) OR "eye infections"[All Fields] OR ("eye"[All Fields] AND "infection"[All Fields]) OR "eye infection"[All Fields]) OR ("Trachomatous"[All Fields] AND ("intense"[All Fields] OR "intense ly"[All Fields] OR "intensities"[All Fields] OR "intensity"[All Fields] OR "intensively"[All Fields])) OR ("Trachomatous"[All Fields] AND "follicular"[All Fields])) AND ("Ethiopia"[MeSH Terms] OR "Ethiopia"[All Fields] OR "Ethiopia s"[All Fields])

Supplemental Table 3: Methodological quality assessment of included studies using the Newcastle-Ottawa quality assessment scale

Study	Selection				Comparability	Outcome		
	Representativeness of the sample	Sample size	Non respondents	Ascertainment of the exposure (maximum score=2)	The subjects in different outcome groups are comparable, based on the study design or analysis. Confounding factors are controlled((maximum score=2))	Assessment of the outcome(maximum score=2)	Statistical test	Total(10)
Abashawl et.al[49]	1	0	0	1	0	2	2	6
Adamu et.al[50]	1	1	1	1	1	2	1	8
Adera et.al[31]	1	0	1	1	1	2	1	7
Admassu et.al[32]	1	0	1	2	1	2	1	8
Admasu et.al[33]	1	0	1	0	1	2	2	7
Alambo et.al[39]	1	0	1	1	1	2	1	7
Alemayehu et.al[52]	1	1	1	1	1	2	1	8
Alemayehu et.al [34]	1	1	1	1	1	2	2	9

Anteneh et.al[17]	1	0	1	1	0	2	2	7
Asres et.al[18]	1	1	1	1	1	2	1	8
Assefa et.al[48]	1	1	0	1	1	2	1	7
Belsti et.al[53]	1	1	1	1	1	2	1	8
Bero et.al[40]	1	0	1	1	1	2	1	8
Brhane et.al[51]	1	1	1	1	1	2	1	9
Duale et.al[47]	1	1	1	1	1	2	1	8
Ejigu et.al[54]	1	1	1	1	1	2	1	8
Emerson et.al[19]	1	0	1	1	1	2	1	7
Ferede et.al[20]	1	0	1	2	1	2	1	8
Gedefaw et.al[21]	1	0	1	0	1	2	2	7
Genet et.al [22]	1	0	1	1	1	2	1	7
Golovaty et.al[23]	1	1	1	1	1	2	1	8
Kassahun et.al[42]	1	1	1	1	1	2	2	9

Kedir et.al[35]	1	0	1	1	0	2	2	7
Kemal et.al[41]	1	1	1	1	1	2	1	8
Kessete et.al[30]	1	1	0	1	1	2	1	7
Ketema et.al[24]	1	0	1	1	1	2		7
Mehari et.al [36]	1	0	1	2	1	2		8
Mekonnen et.al[15]	1	0	1	1	0	2		7
Mengistu et.al[37]	1	1	1	1	1	2		8
Mesfin et.al[43]	1	1	0	1	1	2	1	7
Mesfin et.al[2]	1	1	1	1	1	2	1	8
Mohammed et.al[8]	1	0	1	1	1	2	2	8
Negash et.al[46]	1	1	1	1	1	2	2	9
Nigussie et.al[25]	1	1	1	1	1	2	1	8
Nigusu et.al[26]	1	1	1	1	1	2	1	8
Oswald et.al[16]	1	0	1	1	1	2	1	7

Reda et.al[44]	1	0	1	2	1	2	1	8
Sadik et.al[45]	1	0	1	0	1	2	2	7
Shiferaw et.al[27]	1	0	1	1	1	2	1	7
Shimelash et.al[28]	1	1	1	1	1	2	1	8
Tadesse et.al[29]	1	1	1	1	1	2	1	9
Woldekidan et.al[38]	1	0	1	1	0	2	1	7

Supplemental Table 4: Meta-regression of factors related to the heterogeneity on the pooled prevalence of trachoma among 1-9 years of age children in Ethiopia, 2023

Variables	Coefficient	95% CI	P-value
Year of Publication	-1.83	-2.54 to -1.10	0.00
Region	1.23	-1.19-3.66	0.30
Sample Size	-.000	-.00 to 0.00	0.49

Supplemental table 5: Study characteristics of included studies on the prevalence trachoma among children age 1-9 years; 2023

Author's	Year of Publication	Region	Study Area	Study Design	Sample Size	Male(n)	Female (n)	No of cases(n)	Prevalence %
Abashawl et.al[48]	2016	Gambela	Region-wide	CS	3238	NA	NA	557	17.2
Adamu et.al[49]	2016	Benishangul Gumuz	Region-wide	CS	7417	3212	4205	616	8.3
Adera et.al[30]	2016	SNNP	Region wide	CS	41,155	NA	NA	11,647	28.3
Admassu et.al[31]	2013	SNNP	Guragie	CS	768	386	382	175	22.8
Admasu et.al[32]	2015	SNNP	Dawro	CS	267	113	154	61	22.9
Alambo et.al[38]	2018	SNNP	Areka	CS	586	317	269	222	37.9
Alemayehu et.al[51]	2015	Diredawa	Dera	CS	671	351	320	105	15.6
Alemayehu et.al[33]	2005	SNNP	Guragie	CS	2788	NA	NA	1561	56.5
Anteneh et.al[16]	2016	Amhara	Gazegibela	CS	601	268	333	315	52.4
Asres et.al[17]	2016	Amhara	Gondar	CS	586	285	301	71	12.1
Assefa et.al[47]	2017	Harari	Harari	CS	1722	804	918	22	1.3
Belsti et.al[52]	2021	Southwest	Lare	CS	610	283	327	132	21.6
Bero et.al[39]	2016	Oromia	Region-wide	CS	41642	NA	NA	9744	23.4
Brhane et.al[50]	2007	Nationwide	Nation-wide	CS	9289	NA	NA	3725	40.1
Duale et.al[46]	2018	Somali	Region-wide	CS	23620	11462	12158	3543	15
Ejigu et.al[53]	2013	Southwest	Kersa	CS	305	154	151	77	25.2
Emerson et.al[18]	2008	Amhara	Region-wide	CS	5485	NA	NA	1794	32.7
Ferede et.al[19]	2017	Amhara	Dembia	CS	681	NA	NA	121	18.2
Gedefaw et.al[20]	2013	Amhara	Dangila	CS	409	215	194	49	12
Genet et.al [21]	2022	Amhara	Dangila	CS	704	337	367	43	6.1
Golovaty et.al[22]	2009	Amhara	Ankober	CS	507	219	288	275	53.9
Kassahun et.al[41]	2012	Oromia	Mojo	CS	431	NA	NA	97	22.5

Kedir et.al[34]	2020	SNNP	Silte	CS	561	279	282	165	29.4
Kemal et.al[40]	2019	Oromia	Medawalebu	CS	406	215	191	89	22
Kessete et.al[29]	2012	Amhara	Baso Liben	CS	792	391	401	191	24.1
Ketema et.al[23]	2014	SNNP	Guragie	CS	735	366	369	47	6.4
Mehari et.al [35]	2022	Oromia	Arsi Negele	CS	178	93	85	39	21.91
Mekonnen et.al[14]	2016	SNNP	Zala	CS	611	286	325	224	36.7
Mengistu et.al[36]	2006	Tigray	Region wide	CS	1526	NA	NA	903	59.2
Mesfin et.al[42]	2005	Amhara	Ebinet&East Belesa	CS	1244	601	643	527	42.4
Mesfin et.al[2]	2005	SNNP	Goro	CS	826	438	388	278	33.7
Mohammed et.al[8]	2018	Afar	Region-wide	CS	6399	NA	NA	611	9.6
Negash et.al[45]	2015	Amhara	Gonji Kolella	CS	618	353	265	143	23.1
Nigussie et.al[24]	2022	Amhara	Tarimaber	CS	736	380	356	116	15.8
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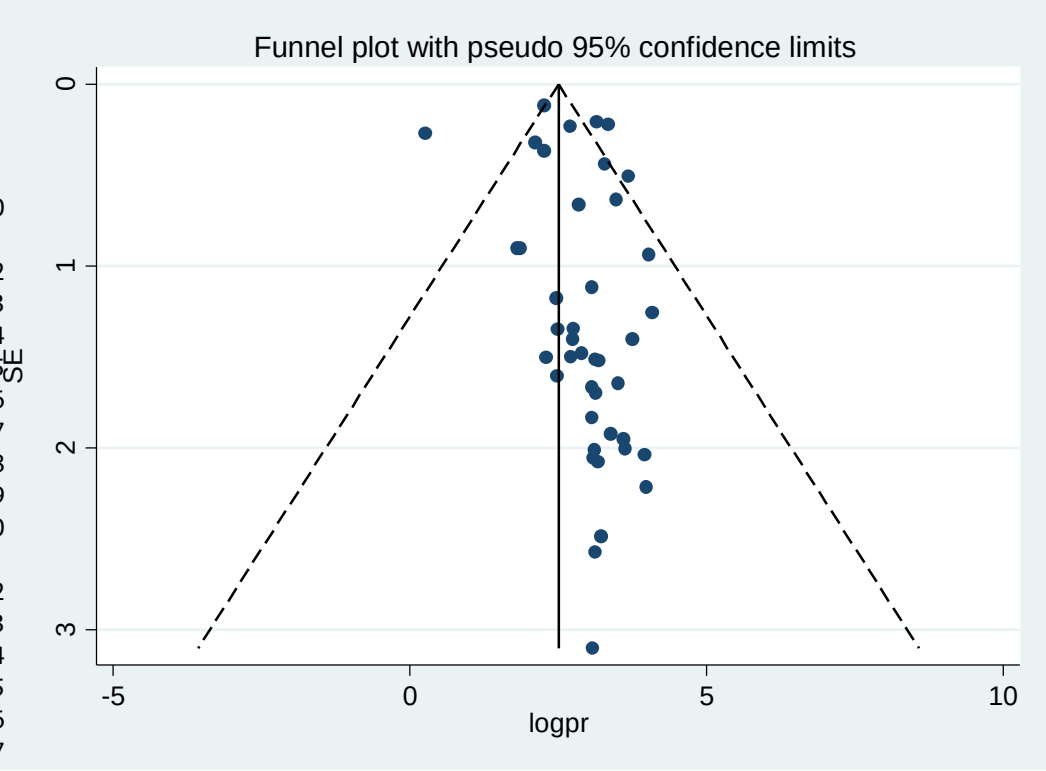
Shimelash et.al[27]	2017	Amhara	Wollo	CS	1358	638	720	293	21.6
Tadesse et.al[28]	2019	SNNP	Lemo	CS	574	NA	NA	87	15.2

CS: Cross-sectional study



Supplemental Figure 1: Funnel plot depicting publication bias of studies reporting the pooled prevalence of trachoma among 1-9 years of age children in Ethiopia, 2023

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Prevalence of active trachoma among 1-9 years of age children in Ethiopia: a systematic review and meta-analysis

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Prevalence of active trachoma among 1-9 years of age children in Ethiopia: a systematic review and meta-analysis

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Keywords: Trachoma, Children, Systematic review, Meta-analysis, Ethiopia

Abstract

Objective: To determine the pooled prevalence of active trachoma among 1-9 years of children in Ethiopia.

Design: A systematic review and meta-analysis was employed in accordance with the Preferred Reporting Items for Systematic Reviews.

Data sources: Medline/PubMed, Scopus, web of science, African journal of online (AJOL) and Google scholar databases were systematically explored to find studies published in English until July 2023.

Eligibility criteria: The following criteria: (1) Condition (Co): Studies examined the prevalence of trachoma among children (1-9) years old; (2) Context (Co): Studies conducted in Ethiopia; (3) Population (Pop): Studies that were done among children (1-9 years); (4) Study type: Observational studies; (5) Language: Studies published in English.

Data extraction and synthesis: The data was extracted using a Microsoft Excel spreadsheet. DerSimonian-Laird Random effect model was used to estimate the pooled prevalence of active trachoma among 1-9 years of age children. Cochrane Q-test and I^2 statistics were used across studies to assess heterogeneity. To identify possible publication bias Egger's test was performed.

Primary outcome: Prevalence of active trachoma.

Results: Overall, a total of forty-two articles with 235,005 study participants were included in the final analysis. The estimated pooled prevalence of active trachoma using random effect model was 24% (95% CI: 20-27%). The sub-group analysis by region revealed the highest prevalence of trachoma was 36% (95% CI: 13-58%) in Tigray region and publication year revealed the prevalence of trachoma is decreasing from 32% to 19% after 2015.

Conclusion: In this review, the pooled prevalence of active trachoma was found to be high in Ethiopia compared to World health Organization (WHO) threshold level. This underscores the need for increased focus on high-risk age groups to decrease trachoma and to achieve elimination of trachoma from the country by 2030.

Strength and Limitations of this study

- ☞ It follows the recommended updated PRISMA guidelines
- ☞ We also rigorously searched the literature in different databases and identified eligible studies.
- ☞ One limitation of this systematic review and meta-analysis is that it only includes cross-sectional studies that report the proportion of trachoma cases.
- ☞ This review have not assessed for associated factors.

Word count: 3285

Introduction

Globally, trachoma is the leading infectious cause of blindness. Trachoma has been named one of 20 neglected tropical diseases (NTD) by the World Health Organization (WHO) [1, 2]. Children are the primary reservoirs of infection. Children aged 1 to 9 years are more likely to have an active trachoma [3]. Due to their tendency for close contact with others, children are frequently infected with *Chlamydia trachomatis* [4].

The poorest of the poor are primarily affected by trachoma [5]. The WHO 2021 report shows that trachoma is responsible for 1.9 million people with blindness and visual impairment, moreover, approximately 125 million people live in trachoma-endemic areas worldwide[1]. Around 3.8 million cases of blinding trachoma and 27.8 million cases of active trachoma have been reported in Africa which is one of the most affected continents [6]. Ethiopia has the world's highest trachoma burden, with 76.2 million people living in endemic areas at risk of contracting the disease. Among Ethiopian children active trachoma is ranged from 10.3%[7] to 74.3% [8] . For children aged 1-9 years living in endemic areas the prevalence of Trachomatous inflammation-follicular (TF) <5% is the elimination target set by WHO(3), However, the prevalence in Ethiopian children is higher than the target. If TF is > =5% among children aged 1-9 years SAFE strategy which includes Antibiotics, Face washing, and Environmental Improvement (A, F, and E) is recommended [9]. Globally an estimated US$ 8 billion in annual product loss is attributed to this disease [1].

Direct personal contact such as shared towels, flies, clothes, and fingers that interact with the infected person's eyes or nose is known for transmission of trachoma infection. The scarcity of safe drinking water access and sanitation systems has spread Chlamydia trachomatis infections. Corneal scarring and eyelid deformities can occur after inflammation and recurrent infections subsequently, if not treated and eyelid inversion (Entropion) and the lashes turn inward (trichiasis) occur as late complications. Trichiasis and permanent damage to the cornea frequently results in irreversible blindness [1].

Eliminating trachoma by 2020 through the implementation SAFE strategy (surgery for in-turned eyelashes, antibiotics to clear the infection, and facial cleanliness and environmental improvement to reduce infection transmission) was set by the WHO and

other concerned organizations[1]. Ethiopia intended to eliminate trachoma through the SAFE strategy by implementing a national trachoma action plan in 2012 and implementing a second master plan for 2016 to 2020 [10, 11]. Despite significant development, trachoma elimination was not met by December 2020 and it was pushed back to 2030 to align with the Sustainable Development Goals (SDGs) [1].

Despite the fact that numerous studies have been conducted in Ethiopian children (1-9 years) to assess the prevalence of trachoma and systematic review and meta-analysis in 2019 [12]; Our reason for undergoing this systematic review and meta-analysis is many studies have been published since then and our study aimed to address specific Stastical limitations in the previous studies. As a result, this study aimed to deliver a comprehensive updated nationwide prevalence of trachoma infection among children, and geographical locations, and to assess the ongoing preventive and control measures impact in the country.

Furthermore, the government and other concerned bodies may contribute by focusing on preventive measures such as improving access to water and sanitation specifically in areas of trachoma infection high prevalence.

Research Question: What is the pooled prevalence of trachoma infection among children (1-9yrs) old in Ethiopia?

Methods

Reporting

We performed our analyses according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement [13]. The article screening was based on the PRISMA 2020 statement, and the selection process has been shown using a PRISMA -P flow diagram. The finding is presented using the standard PRISMA checklist **(Supplemental Table 1).** The review protocol is not registered in PROSPERO.

Search Strategy and study identification

To estimate the prevalence of trachoma among children (1-9) years old in Ethiopia a systematic review and meta-analysis were performed. After an initial exploration of Google Scholar, MEDLINE, and SCOPUS with limited parameters, a follow-up search was conducted using all identified keywords and index terms across several databases including MEDLINE, PubMed, SCOPUS, Web of Science, and African journal online(AJOL). All studies conducted on trachoma Prevalence among children in Ethiopia were retrieved. The search included all articles published from database inception to July 31, 2023. English-language studies were only searched. Medical subject heading (MeSH) (((((("Magnitude") OR "prevalence" OR “burden”) AND "Trachoma") OR "Eye infection" OR “Trachomatous intense” OR “Trachomatous Follicular”)) AND Ethiopia) were used in various combinations as the primary search keywords (**Supplemental Table 2).** During the systematic review and meta-analysis, we followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [13].

Eligibility Criteria

We used condition, context, and population (CoCoPop) framework for the search and meta-analysis of eligibility criteria.

Inclusion Criteria

The following criteria were used to include studies in this systematic review and meta-analysis.

- Condition (Co): We include studies examined the prevalence of trachoma among children (1-9) years old.
- Context (Co): Studies conducted in Ethiopia were included.
- Population (Pop): Studies that were done among children (1-9 years).
- Study type: Observational studies
- Language: Studies published in English were included

Exclusion criteria

We excluded studies other than children (1-9 years) as well as with different outcome of interest, qualitative studies, case reports, case series, review paper, conference proceedings and abstracts.

Outcome measurement

This study aimed to gather and analyze data from various studies conducted in Ethiopia to determine the pooled prevalence of Trachoma among children (1-9 years). We used a systematic approach to identify the relevant studies and extract data from them. Then we employ Stastical methods to combine the data from different studies to estimate the overall pooled prevalence of Trachoma among children (1-9 years) in Ethiopia. Prevalence of trachoma defined here as trachomatous inflammation follicular or Trachomatous inflammation intense among children was the major outcome of this review. We calculated the prevalence of trachoma in children by adjusting for the proportion of each age group (1-year increments) with active trachoma (TF) based on the local population distribution of 1-9 year-olds from the latest census data.

Data extraction and quality assessment

The Endnote citation manager (Version X8, for Windows, Thomson Reuters, Philadelphia, PA, USA) was used to import the retrieved studies and then duplicates were removed. Two independent reviewers screened all the articles for eligibility criteria. Reviewers began by screening the abstracts and titles, followed by full-text screening. The quality of the articles was assessed by using Newcastle-Ottawa Quality Assessment Scale (adapted for cross-sectional studies) [14]. Disagreements were resolved by a third investigator. The articles were critically appraised by the following criteria from the tool: Representativeness of the sample (1 score maximum), sample size (1 score maximum), non-respondent (1 score maximum), ascertainment of exposure (2 score maximum), Comparability of outcome based on study design (2 score maximum), outcome assessment (2 score maximum) and Statistical analysis (1 score maximum). All the included studies assessed through the tool with a score of ≥5 were included in this systematic review and meta-analysis (**Supplemental Table 3).** After quality rating no study was dismissed. During our quality assessment nineteen studies score eight, seventeen studies score seven, five studies

score nine and one study score six out of ten. Overall, the distribution of scores in your quality assessment indicates that the majority of studies were of good to high quality, with only a few studies showing lower scores. Two investigators used a standardized extraction format prepared in Microsoft Excel. The excel spreadsheet includes the name of the first author, publication year, study design, region, study area, gender, sample size, number of cases and trachoma prevalence.

Statistical Analysis

Data was extracted in Microsoft Excel format and analyzed using STATA software version 16.0 (Stata Corp LLC, Texas, USA). We used forest plots to report the estimated pooled prevalence of the study with confidence interval (CI) to provide a visual summary of the data. Effect sizes were expressed as a proportion with 95% CI around the summary estimate. The data was first presented using narrative synthesis of the included studies. We assumed no, low, medium, and high heterogeneity across studies if the I^2 values were 0%, 25%, 50%, and 75%, respectively. A meta-analysis using a random effects model was performed to analyze the pooled prevalence with 95% confidence intervals (CI) since significant heterogeneity was detected between studies. The heterogeneity of each outcome measure was assessed using both X^2 and I^2 statistics to determine dispersion. Meta-regression analysis was performed to investigate the source of heterogeneity. A Funnel plot and Egger's regression test was conducted to assess publication bias. In addition, a leave one-out sensitivity analysis to evaluate small study effect by excluding each study one at a time, the analysis was performed to assess the effect of each study on the pooled prevalence of trachoma and subgroup analysis was performed to ensure consistency of pooled results. Statistical significance was considered at $p< 0.05$.

Patient and public involvement

The public/patient was not involved in the design, conduct, reporting, or dissemination plans of this review.

Results

Search results

Our searching strategy initially identified 453 Articles and 340 duplicates were excluded by using the endnotes citation manager. Finally, 68 Studies were further excluded after reviewing the title and abstract and then 45 articles full text was reviewed for necessary criteria. Excluding three articles as they were not reported outcomes of interest; finally, 42 studies that fulfilled the inclusion criteria were considered for the final analysis to estimate the overall pooled prevalence of trachoma among children (1-9 years) in Ethiopia. (Figure 1) illustrates the process of the literature review, screening, and eligibility assessment of the study articles.

Included studies characteristics

A total of forty-two cross-sectional studies (235,006 children) were included in this systematic review and meta-analysis (**Supplemental Table 4**). The spanned publication period was from 2005 to 2023. The sample size of the included studies ranges from 178 [15] to 62869[16]. With regard to study sites, sixteen of the primary studies included from Amhara region [2, 16-30], nine from SNNPR region [31-39] and six studies included from Oromia [15, 40-42], three from Tigray [43-45] respectively. However, one study each reported from Afar[46] , Somali[47], Harari[48],Diredawa [8], Gambela [49], BenshangulGumuz [50], and nationwide [51] (Table 1).

Table 1: Summary of 42 included studies on the pooled prevalence of trachoma among 1-9 years of age children in Ethiopia, 2023.

Author's	Publication year	Region	Study Area	Sample	Male(n)	Female (n)	No of cases(n)	Prevalence %
Abashawl et.al[49]	2016	Gambela	Region-wide	3238	NA	NA	5[illegible]	17.2
Adamu et.al[50]	2016	Benishangul Gumuz	Region-wide	7417	3212	4205	6[illegible]	8.3
Adera et.al[31]	2016	SNNP	Region-wide	41,155	NA	NA	1[illegible]3	28.3
Admassu et.al[32]	2013	SNNP	Guragie	768	386	382	1[illegible]2	22.8
Admasu et.al[33]	2015	SNNP	Dawro	267	113	154	6[illegible]	22.9
Alambo et.al[39]	2018	SNNP	Areka	586	317	269	2[illegible]2	37.9
Alemayehu et.al[52]	2015	Amhara	Dera	671	351	320	1[illegible]5	15.6
Alemayehu et.al [34]	2005	SNNP	Guragie	2788	NA	NA	1561	56.5
Anteneh et.al[17]	2016	Amhara	Gazegibela	601	268	333	3[illegible]5	52.4
Asres et.al[18]	2016	Amhara	Gondar	586	285	301	7[illegible]	12.1
Assefa et.al[48]	2017	Harari	Harari	1722	804	918	2[illegible]2	1.3
Belsti et.al[53]	2021	Southwest	Lare	610	283	327	1[illegible]2	21.6
Bero et.al[40]	2016	Oromia	Regionwide	41642	NA	NA	9744	23.4
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Mekonnen et.al[15]	2022	Oromia	Arsi Negele	178	93	85	39	21.91
Mengistu et.al[37]	2016	SNNP	Zala	611	286	325	224	36.7
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Nigussie et.al[25]	2015	Amhara	Gonji Kolella	618	353	265	143	23.1
Nigusu et.al[26]	2022	Amhara	Tarimaber	736	380	356	116	15.8
Oswald et.al[16]	2017	Amhara	Region wide	62869	NA	NA	6035	9.6
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Woldekidan et.al[38]	2019	SNNP	Lemo	574	NA	NA	87	15.2

The pooled prevalence estimates of trachoma among children in Ethiopia

The pooled prevalence of trachoma among children (1-9 years) in Ethiopia was identified in 42 studies, from a total of 235,006 children, 45,711 children were infected with trachoma. Stastically significant heterogeneity was observed (I^2= 99.8%); p<0.0001). There we used random effect model to estimate the pooled prevalence of trachoma among children (1-9 years) which was 24.01 %(95% CI: 20.67-27.40%) (Figure 2).

Subgroup analysis

To identify the potential source of heterogeneity, a subgroup analysis was executed based on study area (region) and publication year. Based on the subgroup analysis by study are (region) of Ethiopia the highest prevalence of trachoma was reported in Tigray region 35.81 (95% CI: 13.84-57.78) and followed by SNNP where 28.98 (20.14-37.82). Subgroup analysis by publication year was performed to overlook the trends over ten years on the pooled prevalence of trachoma among children in Ethiopia. The results of the subgroup analysis revealed a significant difference in the pooled prevalence of trachoma among children, with rates of 32.53% (95% CI: 24.32-40.76) before 2015 and 19.93% (95% CI: 16.35-23.51) since 2015 (Table 2).

Table 2: Subgroup-analysis on the pooled prevalence of trachoma infection among children (1-9 years) in Ethiopia, 2023

Subgroups	Number of studies	Prevalence (95%CI)	I^2	P-value
Regions				
Amhara	16	23.02(16.7,29.31)	59.5	0.001
SNNPR	10	28.58 (20.14,37.82)	99.5	0.001
Oromia	6	23.36(22.96,23.75)	0.00	0.107
Tigray	3	35.81(13.84,57.78)	59.7	0.100
Others	7	15.29(7.33,23.26)	59.9	0.600
Over all	**42**	**24.01(20.61,27.40)**	**59.8**	**0.001**
Publication year				
>= 2015	28	19.71(16.27,23.15)	99.8	0.001
<2015	14	32.53(24.31,40.76)	99.5	0.001
Over all	**42**	**24.01(20.61,27.40)**	**59.8**	**0.001**

Publication bias assessment

The funnel plot was visually inspected to assess potential publication bias, which was statistically supported by Egger's test. The symmetrical distribution of the included publications in a large inverted funnel indicated the absence of a publication bias (**Supplemental Figure 1**). The Egger tests revealed no publication bias among the studies included to estimate the pooled prevalence of trachoma infection among children in Ethiopia, with p - values of (p = 0.260).

Meta-Regression

Meta-regression was used to identify factors associated with the pooled prevalence of trachoma among children (1-9 years) old. For the meta-regression, publication year, region and sample size were considered. The analysis revealed a significant correlation between the pooled prevalence of trachoma among children (1-9 years) and publication year (P<0.001) but no significant correlation with sample size and region (**Supplemental Table 5**).

Sensitivity analysis

By excluding each study individually, a leave-out-one sensitivity analysis was used to determine the effect of a single study on pooled prevalence of trachoma among children (1-9 years) in Ethiopia. Our finding revealed no single study had a significant impact on the pooled prevalence of trachoma among children (1-9 years) in Ethiopia (Figure 3).

Discussion

The purpose of this systematic review and meta-analysis is to append national data on the prevalence of trachoma infection among Ethiopian children to eliminate the disease. Although different studies from different regions have been published in the country, the data on trachoma infections have to be organized and updated every time. Therefore, updating the information has the potential to inform and help develop different strategies by targeting highly endemic areas.

The pooled overall prevalence of Trachoma (24.01 %) observed in the current review is comparable with a study from Colombia [55], but higher than the study done in the Democratic Republic of Congo [56], Nigeria [57], Uganda [58], Brazil [59], Kenya [60]. This prevalence is lower than studies from South Sudan [61] and Guinea [62]. The disparity among the findings might be due to environmental factors such as the level of participants' hygiene, sanitation, Access to functional latrines, and clear water supply, and recent studies were included in our review that reported ongoing Sustainable water, sanitation, and hygiene (WASH) program and Mass drug administration (MDA)

with Azithromycin which might reduce trachoma prevalence among children in Ethiopia, unlike the South Sudan study which lacks MDA and targeted SAFE strategy [61].

The Subgroup analysis of this review also shows a statistically significant (p=0.01) difference among regions. Trachoma was highly prevalent in Tigray and SNNP followed by Oromia and Amhara regions. Trachoma infection is related to inadequate hygiene, low standard of living, inadequate access to water, and inadequate access to sanitation use. In the Tigray region trachoma prevalence is high which might also be related to extreme climatic events which favor a decline in water availability during dry periods which affects personal hygiene. Another reason for the difference is attributed to baseline and intervention disparity in the communities. MDA with Azithromycin once yearly is needed based on review finding (24%) and Ethiopia is known to require intervention based on WHO 2021 report(1).

Though the decline is not statistically significant (p=0.30) our result from this review revealed studies conducted between 2005-2014 and 2015-2022 show decrement on the prevalence of trachoma from 32 to 19%. The expansion of MDA and WASH programs might be attributed to the decrease in the prevalence. This is review has an implication revealing the national burden of trachoma infection among children, who are a special population accounted for one third of the national population. Moreover, this large magnitude of trachoma infection show significant gap in the implementation of devised WHO and national elimination strategies. Last but not least, from research perspective we recommend to conduct operational studies on the topic.

Strength and limitations of the study

The current meta-analysis has several strengths. It provides a comprehensive overview of trachoma among Ethiopian children in accordance with the most recent PRISMA guidelines. We conducted a thorough search of the literature using multiple databases and found eligible studies. Although the meta-analytic techniques used in this study were strong, the results should be interpreted with caution due to the study's limitations. First, there was significant heterogeneity in trachoma prevalence in Ethiopia. However, this heterogeneity can be attributed to factors such as publication year and sample size.

Conclusions

An effort has been made to eliminate, trachoma infection is still highly prevalent across the Ethiopian regions. Even though the decline is not statistically significant we saw decreased trachoma prevalence in Ethiopian children. Trachoma is highly prevalent in Tigray followed by SNNP. Moreover, trachoma remains a significant public health concern among adults in Ethiopia. The prevalence of trachoma in this population is alarmingly high, highlighting the urgent need for continued efforts to improve access to clean water, sanitation, and hygiene practices. Despite the effort made by the country to eliminate Trachoma infection, According to WHO risk classification, it remains a public health problem in the country. The output of this review will offer valuable data to the Ministry of Health, policymakers, and concerned bodies which work on eliminating trachoma infection in the country. Trachoma infection is highly prevalent based on this review and it underlines the need for improved prevention and control strategies for one of the Neglected tropical diseases in Ethiopia.

List of Abbreviations CI: Confidence interval; NTD: Neglected tropical disease; PRISMA: Preferred reporting items for systematic review and meta-analysis; SAFE: Surgery for Trichiasis, Antibiotics, Face Washing and Environmental improvement strategy; SDG: Sustainable development goal; SNNPR: South Nation and Nationalities people; WHO: World Health Organization.

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Patient consent for publication: Not applicable

Ethical approval: Not applicable

Data Availability: All associated data and supporting information are included in this systematic review and meta-analysis.

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Figure Legend

Figure 1- PRISMA flow diagram of screened articles and the selection process of studies on pooled prevalence of trachoma infection among 1-9 years of age children in Ethiopia 2023.

Figure 2- Forest plot depicting pooled prevalence of trachoma among 1-9 years of age children in Ethiopia 2023.

Figure 3- Leave-one sensitivity analysis on the studies included in the pooled prevalence of trachoma among 1-9 years of age children in Ethiopia 2023.

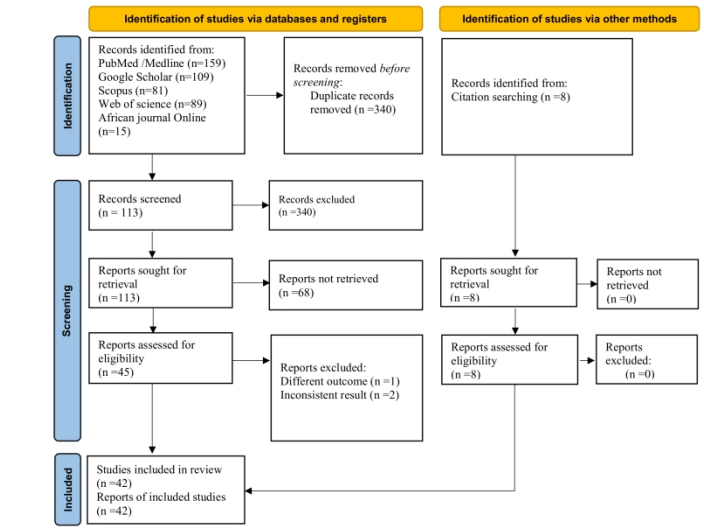
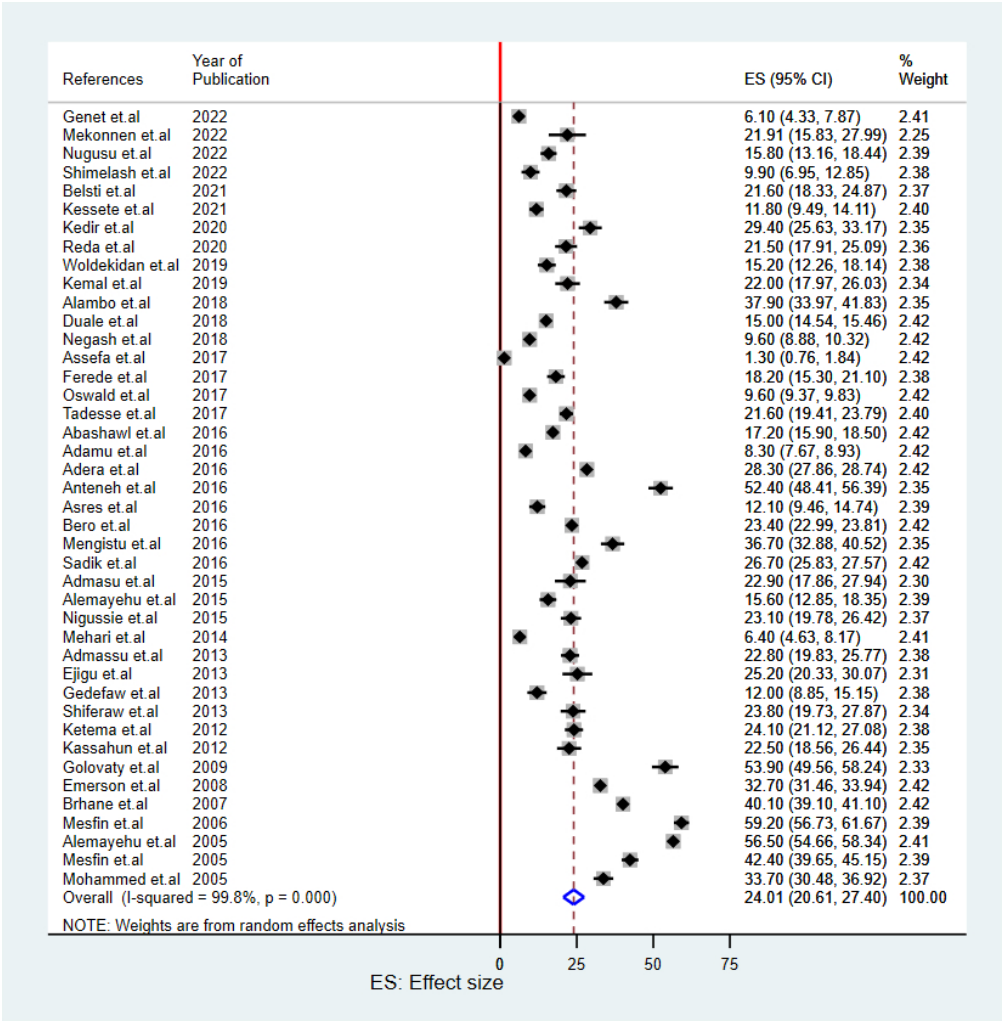


Figure 1 PRISMA flow diagram of screened articles and the selection process of studies on pooled prevalence of trachoma infection among 1-9 years of age children in Ethiopia,2023

Figure 1 PRISMA flow diagram of screened articles and the selection process of studies on the pooled prevalence of trachoma among 1-9 years of age children in Ethiopia,2023

297x210mm (300 x 300 DPI)



290x295mm (72 x 72 DPI)

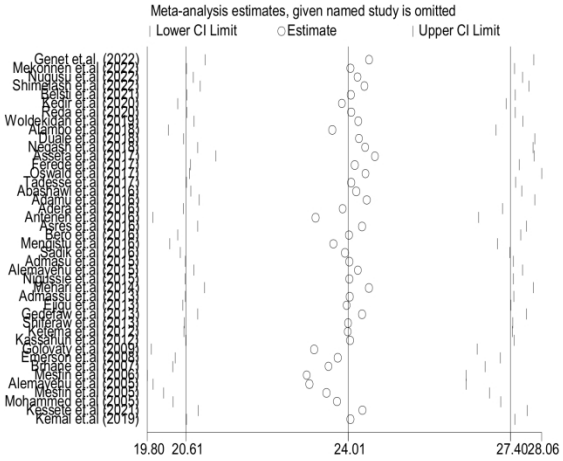


Figure 3. Leave-one sensitivity analysis on the studies included in pooled prevalence of trachoma among 1-9 years of age children in Ethiopia, 2023

Figure 3 Leave one sensitivity analysis on the studies included in the pooled prevalence of trachoma among 1-9 years of age children in Ethiopia,2023

215x279mm (300 x 300 DPI)

Supplemental Table 1: PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	3-4
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	6
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	7
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	6
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	6
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	7
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	7
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	7
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	7
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	7
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	15
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	8
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	7
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	7
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	9
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	15
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	16
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	15
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	14

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	10
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	10
Study characteristics	17	Cite each included study and present its characteristics.	10
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	8
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	8
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	8
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	9
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	9
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	16
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	9
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	9
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	17
	23b	Discuss any limitations of the evidence included in the review.	18
	23c	Discuss any limitations of the review processes used.	18
	23d	Discuss implications of the results for practice, policy, and future research.	18
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	18
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	11
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	11
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	13
Competing interests	26	Declare any competing interests of review authors.	13
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	13

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

Supplemental Table 2: Search Strategy Summary

Period search was conducted	20 May 2023 to 20 June 2023
Inclusion criteria	• Cross sectional study • Studies published until 31 July 2023 • Studies conducted in Ethiopia. • Children (1-9 years) • Published in the English Language. • Studies reported the prevalence of Trachoma
Exclusion criteria	• Case reports • case series • review articles • letters to editors
Libraries	Worldwide
Records identified from secondary databases, Google scholar	("magnitude"[All Fields] OR "magnitudes"[All Fields] OR ("epidemiology"[MeSH Subheading] OR "epidemiology"[All Fields] OR "prevalence"[All Fields] OR "prevalence"[MeSH Terms] OR "prevalance"[All Fields] OR "prevalences"[All Fields] OR "prevalence s"[All Fields] OR "prevalent"[All Fields] OR "prevalently"[All Fields] OR "prevalents"[All Fields]) OR ("burden"[All Fields] OR "burdened"[All Fields] OR "burdening"[All Fields] OR "burdens"[All Fields]) OR ("epidemiologies"[All Fields] OR "epidemiology"[MeSH Subheading] OR "epidemiology"[All Fields] OR "epidemiology"[MeSH Terms] OR "epidemiology s"[All Fields])) AND ("trachoma"[MeSH Terms] OR "trachoma"[All Fields] OR "trachomas"[All Fields] OR ("eye infections"[MeSH Terms] OR ("eye"[All Fields] AND "infections"[All Fields]) OR "eye infections"[All Fields] OR ("eye"[All Fields] AND "infection"[All Fields]) OR "eye infection"[All Fields]) OR ("Trachomatous"[All Fields] AND ("intense"[All Fields] OR "intense ly"[All Fields] OR "intensities"[All Fields] OR "intensity"[All Fields] OR "intensively"[All Fields])) OR ("Trachomatous"[All Fields] AND "follicular"[All Fields])) AND ("Ethiopia"[MeSH Terms] OR "Ethiopia"[All Fields] OR "Ethiopia s"[All Fields])

Supplemental Table 3: Methodological quality assessment of included studies using the Newcastle-Ottawa quality assessment scale

Study	Selection				Comparability	Outcome		
	Representativeness of the sample	Sample size	Non respondents	Ascertainment of the exposure (maximum score=2)	The subjects in different outcome groups are comparable, based on the study design or analysis. Confounding factors are controlled((maximum score=2))	Assessment of the outcome(maximum score=2)	Statistical test	Total(10)
Abashawl et.al[49]	1	0	0	1	0	2	2	6
Adamu et.al[50]	1	1	1	1	1	2	1	8
Adera et.al[31]	1	0	1	1	1	2	1	7
Admassu et.al[32]	1	0	1	2	1	2	1	8
Admasu et.al[33]	1	0	1	0	1	2	2	7
Alambo et.al[39]	1	0	1	1	1	2	1	7
Alemayehu et.al[52]	1	1	1	1	1	2	1	8
Alemayehu et.al [34]	1	1	1	1	1	2	2	9

Anteneh et.al[17]	1	0	1	1	0	2	2	7
Asres et.al[18]	1	1	1	1	1	2	1	8
Assefa et.al[48]	1	1	0	1	1	2	1	7
Belsti et.al[53]	1	1	1	1	1	2	1	8
Bero et.al[40]	1	0	1	1	1	2	1	8
Brhane et.al[51]	1	1	1	1	1	2	1	9
Duale et.al[47]	1	1	1	1	1	2	1	8
Ejigu et.al[54]	1	1	1	1	1	2	1	8
Emerson et.al[19]	1	0	1	1	1	2	1	7
Ferede et.al[20]	1	0	1	2	1	2	1	8
Gedefaw et.al[21]	1	0	1	0	1	2	2	7
Genet et.al [22]	1	0	1	1	1	2	1	7
Golovaty et.al[23]	1	1	1	1	1	2	1	8
Kassahun et.al[42]	1	1	1	1	1	2	2	9

Kedir et.al[35]	1	0	1	1	0	2	2	7
Kemal et.al[41]	1	1	1	1	1	2	1	8
Kessete et.al[30]	1	1	0	1	1	2	1	7
Ketema et.al[24]	1	0	1	1	1	2		7
Mehari et.al [36]	1	0	1	2	1	2		8
Mekonnen et.al[15]	1	0	1	1	0	2		7
Mengistu et.al[37]	1	1	1	1	1	2		8
Mesfin et.al[43]	1	1	0	1	1	2	1	7
Mesfin et.al[2]	1	1	1	1	1	2	1	8
Mohammed et.al[8]	1	0	1	1	1	2	2	8
Negash et.al[46]	1	1	1	1	1	2	2	9
Nigussie et.al[25]	1	1	1	1	1	2	1	8
Nigusu et.al[26]	1	1	1	1	1	2	1	8
Oswald et.al[16]	1	0	1	1	1	2	1	7

Reda et.al[44]	1	0	1	2	1	2	1	8
Sadik et.al[45]	1	0	1	0	1	2	2	7
Shiferaw et.al[27]	1	0	1	1	1	2	1	7
Shimelash et.al[28]	1	1	1	1	1	2	2	8
Tadesse et.al[29]	1	1	1	1	1	2	2	9
Woldekidan et.al[38]	1	0	1	1	0	2	2	7

Supplemental Table 4: Study characteristics of included studies on the prevalence trachoma among children age 1-9 years; 2023

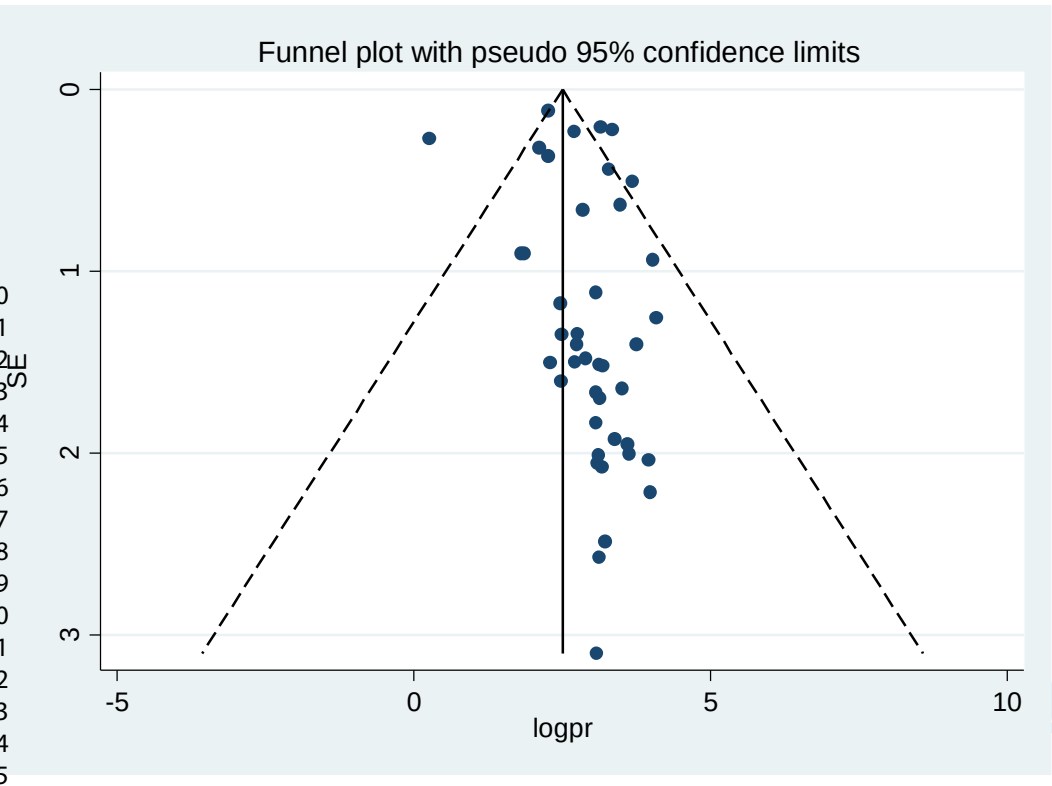
Author's	Year of Publication	Region	Study Area	Study Design	Sample Size	Male(n)	Female (n)	No of cases(n)	Prevalence %
Abashawl et.al[48]	2016	Gambela	Region-wide	CS	3238	NA	NA	557	17.2
Adamu et.al[49]	2016	Benishangul Gumuz	Region-wide	CS	7417	3212	4205	616	8.3
Adera et.al[30]	2016	SNNP	Region wide	CS	41,155	NA	NA	11,647	28.3
Admassu et.al[31]	2013	SNNP	Guragie	CS	768	386	382	175	22.8
Admasu et.al[32]	2015	SNNP	Dawro	CS	267	113	154	61	22.9
Alambo et.al[38]	2018	SNNP	Areka	CS	586	317	269	222	37.9
Alemayehu et.al[51]	2015	Diredawa	Dera	CS	671	351	320	105	15.6
Alemayehu et.al [33]	2005	SNNP	Guragie	CS	2788	NA	NA	1561	56.5
Anteneh et.al[16]	2016	Amhara	Gazegibela	CS	601	268	333	315	52.4
Asres et.al[17]	2016	Amhara	Gondar	CS	586	285	301	71	12.1
Assefa et.al[47]	2017	Harari	Harari	CS	1722	804	918	22	1.3
Belsti et.al[52]	2021	Southwest	Lare	CS	610	283	327	132	21.6
Bero et.al[39]	2016	Oromia	Region-wide	CS	41642	NA	NA	9744	23.4
Brhane et.al[50]	2007	Nationwide	Nation-wide	CS	9289	NA	NA	3725	40.1
Duale et.al[46]	2018	Somali	Region-wide	CS	23620	11462	12158	3543	15
Ejigu et.al[53]	2013	Southwest	Kersa	CS	305	154	151	77	25.2
Emerson et.al[18]	2008	Amhara	Region-wide	CS	5485	NA	NA	1794	32.7
Ferede et.al[19]	2017	Amhara	Dembia	CS	681	NA	NA	121	18.2
Gedefaw et.al[20]	2013	Amhara	Dangila	CS	409	215	194	49	12
Genet et.al [21]	2022	Amhara	Dangila	CS	704	337	367	43	6.1
Golovaty et.al[22]	2009	Amhara	Ankober	CS	507	219	288	275	53.9
Kassahun et.al[41]	2012	Oromia	Mojo	CS	431	NA	NA	97	22.5
Kedir et.al[34]	2020	SNNP	Silte	CS	561	279	282	165	29.4

Kemal et.al[40]	2019	Oromia	Medawalebu	CS	406	215	191	89	22
Kessete et.al[29]	2012	Amhara	Baso Liben	CS	792	391	401	191	24.1
Ketema et.al[23]	2014	SNNP	Guragie	CS	735	366	369	47	6.4
Mehari et.al [35]	2022	Oromia	Arsi Negele	CS	178	93	85	39	21.91
Mekonnen et.al[14]	2016	SNNP	Zala	CS	611	286	325	224	36.7
Mengistu et.al[36]	2006	Tigray	Region wide	CS	1526	NA	NA	903	59.2
Mesfin et.al[42]	2005	Amhara	Ebinet&East Belesa	CS	1244	601	643	527	42.4
Mesfin et.al[2]	2005	SNNP	Goro	CS	826	438	388	278	33.7
Mohammed et.al[8]	2018	Afar	Region-wide	CS	6399	NA	NA	611	9.6
Negash et.al[45]	2015	Amhara	Gonji Kolella	CS	618	353	265	143	23.1
Nigussie et.al[24]	2022	Amhara	Tarimaber	CS	736	380	356	116	15.8
Nigusu et.al[25]	2017	Amhara	Region wide	CS	62869	NA	NA	6035	9.6
Oswald et.al[15]	2020	Tigray	Deguatemben	CS	502	257	245	108	21.5
Reda et.al[43]	2016	Tigray	Region-wide	CS	10023	NA	NA	2676	26.7
Sadik et.al[44]	2013	Amhara	Makisegnit	CS	420	209	211	100	23.8
Shiferaw et.al[26]	2022	Amhara	Debretabor	CS	394	70	324	39	9.9
Shimelash et.al[27]	2017	Amhara	Wollo	CS	1358	638	720	293	21.6
Tadesse et.al[28]	2019	SNNP	Lemo	CS	574	NA	NA	87	15.2

CS: Cross-sectional study

Supplemental Table 5: Meta-regression of factors related to the heterogeneity on the pooled prevalence of trachoma among 1-9 years of age children in Ethiopia, 2023

Variables	Coefficient	95% CI	P-value
Year of Publication	-1.83	-2.54 to -1.10	0.00
Region	1.23	-1.19-3.66	0.30
Sample Size	-.000	-.00 to 0.00	0.49



Supplemental Figure 1: Funnel plot depicting publication bias of studies reporting the pooled prevalence of trachoma among 1-9 years of age children in Ethiopia, 2023

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Prevalence of active trachoma among 1-9 years of age children in Ethiopia: a systematic review and meta-analysis

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Prevalence of active trachoma among 1-9 years of age children in Ethiopia: a systematic review and meta-analysis

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Keywords: Trachoma, Children, Systematic review, Meta-analysis, Ethiopia

Abstract

Objective: To determine the pooled prevalence of active trachoma among 1-9 year old children in Ethiopia.

Design: A systematic review and meta-analysis were employed in accordance with the Preferred Reporting Items for Systematic Reviews.

Data sources: Medline/PubMed, Scopus, Web of Science, African Journal of Online (AJOL), and Google scholar databases were systematically explored to find studies published in English until July 2023.

Eligibility criteria: The following criteria apply: (1) Condition (Co): Studies examined the prevalence of trachoma among children (1-9) years old; (2) Context (Co): Studies conducted in Ethiopia; (3) Population (Pop): Studies that were done among children (1-9) years old; (4) Study type: observational studies; (5) Language: Studies published in English.

Data extraction and synthesis: The data was extracted using a Microsoft Excel spreadsheet. DerSimonian-Laird random effect model was used to estimate the pooled prevalence of active trachoma among 1-9 years old children. Cochrane Q-tests and I^2 statistics were used across studies to assess heterogeneity. To identify possible publication bias, Egger's test was performed.

Primary outcome: Prevalence of active trachoma.

Results: Overall, a total of forty-two articles with 235,005 study participants were included in the final analysis. The estimated pooled prevalence of active trachoma using random effect model was 24% (95% CI: 20%-27%). The sub-group analysis by region revealed the highest prevalence of trachoma was 36% (95% CI: 13%-58%) in the Tigray region, and publication year revealed the prevalence of trachoma was decreasing from 32% to 19% after 2015.

Conclusion: In this review, the pooled prevalence of active trachoma was found to be high in Ethiopia compared to World health Organization (WHO) threshold level. This

underscores the need for increased focus on high-risk age groups to decrease trachoma and to achieve the elimination of trachoma from the country by 2030.

Strength and Limitations of this study

- ☞ It follows the recommended updated PRISMA guidelines.
- ☞ We also rigorously searched the literature in different databases and identified eligible studies.
- ☞ One limitation of this systematic review and meta-analysis is that it only includes cross-sectional studies that report the proportion of trachoma cases.
- ☞ This review has not assessed associated factors.

Word count: 3285

Introduction

Globally, trachoma is the leading infectious cause of blindness. Trachoma has been named one of 20 neglected tropical diseases (NTDs) by the World Health Organization (WHO) [1, 2]. Children are the primary reservoirs of infection. Children aged 1 to 9 years are more likely to have an active trachoma [3]. Due to their tendency for close contact with others, children are frequently infected with *Chlamydia trachomatis* [4].

The poorest of the poor are primarily affected by trachoma [5]. The WHO 2021 report shows that trachoma is responsible for 1.9 million people with blindness and visual impairment; moreover, approximately 125 million people live in trachoma-endemic areas worldwide [1]. Around 3.8 million cases of blinding trachoma and 27.8 million cases of active trachoma have been reported in Africa, which is one of the most affected continents [6]. Ethiopia has the world's highest trachoma burden, with 76.2 million people living in endemic areas at risk of contracting the disease. Among Ethiopian children, active trachoma is ranged from 10.3% [7] to 74.3% [8] . For children aged 1-9 years living in endemic areas the prevalence of Trachomatous inflammation-follicular (TF) <5% is the elimination target set by WHO , However, the prevalence in Ethiopian children is higher than the target. If TF is > =5% among children aged 1-9 years, a SAFE strategy which includes Antibiotics, Face washing, and Environmental Improvement (A, F, and E) is recommended [9]. Globally, an estimated 8 billion US$ in annual product loss is attributed to this disease [1].

Direct personal contact such as shared towels, flies, clothes, and fingers that interact with the infected person's eyes or nose is known for transmission of trachoma infection. The scarcity of safe drinking water access and sanitation systems has spread Chlamydia trachomatis infections. Corneal scarring and eyelid deformities can occur after inflammation and recurrent infections; if not treated, eyelid inversion (entropion) and the lashes turning inward (trichiasis) occur as late complications. Trichiasis and permanent damage to the cornea frequently result in irreversible blindness [1].

Eliminating trachoma by 2020 through the implementation of the SAFE strategy (surgery for in-turned eyelashes, antibiotics to clear the infection, and facial cleanliness and environmental improvement to reduce infection transmission) was set by the WHO and

other concerned organizations [1]. Ethiopia intended to eliminate trachoma through the SAFE strategy by implementing a national trachoma action plan in 2012 and a second master plan for 2016 to 2020 [10, 11]. Despite significant development, trachoma elimination was not met by December 2020 and it was pushed back to 2030 to align with the Sustainable Development Goals (SDGs) [1].

Despite the fact that numerous studies have been conducted in Ethiopian children (1-9 years) to assess the prevalence of trachoma and systematic review and meta-analysis in 2019 [12], Our reason for undergoing this systematic review and meta-analysis is that many studies have been published since then, and our study aimed to address specific stastical limitations in the previous studies. As a result, this study aimed to deliver a comprehensive updated nationwide prevalence of trachoma infection among children and geographical locationsand to assess the ongoing preventive and control measures impact in the country.

Furthermore, the government and other concerned bodies may contribute by focusing on preventive measures such as improving access to water and sanitation, specifically in areas of high trachoma infection prevalence.

Research Question: What is the pooled prevalence of trachoma infection among children (1-9 years old) in Ethiopia?

Methods

Reporting

We performed our analyses according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement [13]. The article screening was based

on the PRISMA 2020 statement, and the selection process has been shown using a PRISMA P flow diagram. The finding is presented using the standard PRISMA checklist **(Supplemental Table 1).** The review protocol is not registered in PROSPERO.

Search Strategy and study identification

To estimate the prevalence of trachoma among children (1–9) years old in Ethiopia, a systematic review and meta-analysis were performed. After an initial exploration of Google Scholar, MEDLINE, and SCOPUS with limited parameters, a follow-up search was conducted using all identified keywords and index terms across several databases, including MEDLINE, PubMed, SCOPUS, Web of Science, and African Journal Online (AJOL). All studies conducted on trachoma prevalence among children in Ethiopia were retrieved. The search included all articles published from database inception to July 31, 2023. English-language studies were only searched. Medical subject headings (MeSH) (((((("Magnitude") OR "prevalence" OR “burden”) AND "Trachoma") OR "Eye infection" OR “Trachomatous intense” OR “Trachomatous follicular")) AND Ethiopia) were used in various combinations as the primary search keywords (**Supplemental Table 2).** During the systematic review and meta-analysis, we followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

[13].

Eligibility Criteria

We used the condition, context, and population (CoCoPop) framework for the search and meta-analysis of eligibility criteria.

Inclusion Criteria

The following criteria were used to include studies in this systematic review and meta-analysis.

- Condition (Co): we include studies that examine the prevalence of trachoma among children (1-9) years old.
- Context (Co): studies conducted in Ethiopia were included.
- Population (Pop): studies that were done among children (1-9 years).

- Study type: observational studies
- Language: studies published in English were included

Exclusion criteria

We excluded studies other than children (1-9 years) as well as those with different outcomes of interest, qualitative studies, case reports, case series, review papers, conference proceedings, and abstracts.

Outcome measurement

This study aimed to gather and analyze data from various studies conducted in Ethiopia to determine the pooled prevalence of trachoma among children aged 1-9 years. We used a systematic approach to identify the relevant studies and extract data from them. Then we employ stastical methods to combine the data from different studies to estimate the overall pooled prevalence of trachoma among children (1-9 years old) in Ethiopia. The prevalence of trachoma, defined here as trachomatous inflammation follicular or trachomatous inflammation intense, among children was the major outcome of this review. We calculated the prevalence of trachoma in children by adjusting for the proportion of each age group (1-year increments) with active trachoma (TF) based on the local population distribution of 1-9 year-olds from the latest census data.

Data extraction and quality assessment

The Endnote citation manager (Version X8, for Windows, Thomson Reuters, Philadelphia, PA, USA) was used to import the retrieved studies, and then duplicates were removed. Two independent reviewers screened all the articles for eligibility criteria. The reviewers began by screening the abstracts and titles, followed by full-text screening. The quality of the articles was assessed using the Newcastle-Ottawa Quality Assessment Scale (adapted for cross- sectional studies) [14]. Disagreements were resolved by a third investigator. The articles were critically appraised by the following criteria from the tool: representativeness of the sample (1 score maximum), sample size (1 score maximum), non-respondent (1 score maximum), ascertainment of exposure (2 score maximum), comparability of outcome based on study design (2 score maximum), outcome assessment (2 score maximum) and statistical analysis (1 score maximum). All the included studies

assessed through the tool with a score of ≥5 were included in this systematic review and meta-analysis (**Supplemental Table 3).** After quality rating, no study was dismissed. During our quality assessment, nineteen studies score eight, seventeen studies score seven, five studies score nine and one study score six out of ten. Overall, the distribution of scores in the quality assessment indicates that the majority of studies were of good to high quality, with only a few studies showing lower scores. Two investigators used a standardized extraction format prepared in Microsoft Excel. The excel spreadsheet includes the name of the first author, publication year, study design, region, study area, gender, sample size, number of cases and trachoma prevalence.

Statistical Analysis

Data was extracted in Microsoft Excel format and analyzed using STATA software version 16.0 (Stata Corp., LLC, Texas, USA). We used forest plots to report the estimated pooled prevalence of the study with a confidence interval (CI) to provide a visual summary of the data. Effect sizes were expressed as a proportion with 95% CI around the summary estimate. The data was first presented using a narrative synthesis of the included studies. We assumed no, low, medium, and high heterogeneity across studies if the I^2 values were 0%, 25%, 50%, and 75%, respectively. A meta-analysis using a random effects model was performed to analyze the pooled prevalence with 95% confidence intervals (CI) since significant heterogeneity was detected between studies. The heterogeneity of each outcome measure was assessed using both X^2 and I^2 statistics to determine dispersion. A meta-regression analysis was performed to investigate the source of heterogeneity. A funnel plot and Egger's regression test was conducted to assess publication bias. In addition, a leave-one-out sensitivity analysis was performed to evaluate the small study effect by excluding each study one at a time. The analysis was performed to assess the effect of each study on the pooled prevalence of trachoma, and subgroup analysis was performed to ensure consistency of the pooled results. Statistical significance was considered at $p< 0.05$.

Patient and public involvement

The public or patient were not involved in the design, conduct, reporting, or dissemination plans of this review.

Results

Search results

Our searching strategy initially identified 453 articles, and 340 duplicates were excluded by using the endnotes citation manager. Finally, 68 studies were further excluded after reviewing the title and abstract, and then the full text of 45 articles was reviewed for the necessary criteria. Excluding three articles as they were not reported outcomes of interest, finally, 42 studies that fulfilled the inclusion criteria were considered for the final analysis to estimate the overall pooled prevalence of trachoma among children (1–9 years) in Ethiopia. (Figure 1) illustrates the process of the literature review, screening, and eligibility assessment of the study articles.

Included studies characteristics

A total of forty-two cross-sectional studies (235,006 children) were included in this systematic review and meta-analysis (**Supplemental Table 4**). The spanned publication period was from 2005 to 2023. The sample size of the included studies ranges from 178 [15] to 62869[16]. With regard to study sites, sixteen of the primary studies included from the Amhara region [2, 16-30], nine from the SNNPR region [31-39] and six studies were included from Oromia [15, 40-42], and three from Tigray [43-45], respectively. However, one study each reported from Afar [46] , Somali [47], Harari[48],Diredawa [8], Gambela [49], BenshangulGumuz [50], and nationwide [51] (Table 1).

Table 1: Summary of 42 included studies on the pooled prevalence of trachoma among 1-9 years of age children in Ethiopia, 2023.

Author's	Publication year	Region	Study Area	Sample	Male(n)	Female (n)	No of cases(n)	Prevalence %
Abashawl et.al[49]	2016	Gambela	Region-wide	3238	NA	NA	557	17.2
Adamu et.al[50]	2016	Benishangul Gumuz	Region-wide	7417	3212	4205	618	8.3
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Emerson et.al[19]	2008	Amhara	Region wide	5485	NA	NA	1794	32.7
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Kemal et.al[41]	2019	Oromia	Medawalebu	406	215	191	89	22
Kessete et.al[30]	2021	Amhara	Metema	752	352	400	88	11.8
Ketema et.al[24]	2012	Amhara	Baso Liben	792	391	401	191	24.1
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Mekonnen et.al[15]	2022	Oromia	Arsi Negele	178	93	85	39	21.91
Mengistu et.al[37]	2016	SNNP	Zala	611	286	325	224	36.7
Mesfin et.al[43]	2006	Tigray	Regionwide	1526	NA	NA	903	59.2
Mesfin et.al[2]	2005	Amhara	Ebinet	1244	601	643	527	42.4
Mohammed et.al[8]	2005	Diredawa	Goro	826	438	388	278	33.7
Negash et.al[46]	2018	Afar	Regionwide	6339	NA	NA	611	9.6
Nigussie et.al[25]	2015	Amhara	Gonji Kolella	618	353	265	143	23.1
Nigusu et.al[26]	2022	Amhara	Tarimaber	736	380	356	116	15.8
Oswald et.al[16]	2017	Amhara	Region wide	62869	NA	NA	6035	9.6
Reda et.al[44]	2020	Tigray	Deguatemben	502	257	245	108	21.5
Sadik et.al[45]	2016	Tigray	Regionwide	10023	NA	NA	2676	26.7
Shiferaw et.al[27]	2013	Amhara	Makisegnit	420	209	211	100	23.8
Shimelash et.al[28]	2022	Amhara	Debretabor	394	70	324	39	9.9
Tadesse et.al[29]	2017	Amhara	Wollo	1358	638	720	293	21.6
Woldekidan et.al[38]	2019	SNNP	Lemo	574	NA	NA	87	15.2

The pooled prevalence estimates of trachoma among children in Ethiopia

The pooled prevalence of trachoma among children (1–9 years old) in Ethiopia was identified in 42 studies. Of a total of 235,006 children, 45,711 were infected with trachoma. Stastically significant heterogeneity was observed (I2 = 99.8%; p<0.0001). We used a random effect model to estimate the pooled prevalence of trachoma among children (1–9 years), which was 24.1% (995% CI: 20.67–27.40%) (Figure 2).

Subgroup analysis

To identify the potential source of heterogeneity, a subgroup analysis was executed based on the study area (region) and publication year. Based on the subgroup analysis by the study, in the region of Ethiopia, the highest prevalence of trachoma was reported in Tigray at 35.81 (95% CI: 13.84–57.78), followed by SNNP at 28.98 (20.14–37.82). Subgroup analysis by publication year was performed to overlook the trends over ten years in the pooled prevalence of trachoma among children in Ethiopia. The results of the subgroup analysis revealed a significant difference in the pooled prevalence of trachoma among children, with rates of 32.53% (95% CI: 24.32-40.76) before 2015 and 19.93% (95% CI: 16.35-23.51) since 2015 (Table 2).

Table 2: Subgroup-analysis on the pooled prevalence of trachoma infection among children (1-9 years) in Ethiopia, 2023

Subgroups	Number of studies	Prevalence (95%CI)	I^2	P-value
Regions				
Amhara	16	23.02(16.7,29.31)	59.5	0.001
SNNPR	10	28.58 (20.14,37.82)	99.5	0.001
Oromia	6	23.36(22.96,23.75)	0.00	0.107
Tigray	3	35.81(13.84,57.78)	59.7	0.100

Others	7	15.29(7.33,23.26)	59.9	0.600
Over all	**42**	**24.01(20.61,27.40)**	**59.8**	**0.001**
Publication year				
>= 2015	28	19.71(16.27,23.15)	99.8	0.001
<2015	14	32.53(24.31,40.76)	99.5	0.001
Over all	**42**	**24.01(20.61,27.40)**	**59.8**	**0.001**

Publication bias assessment

The funnel plot was visually inspected to assess potential publication bias, which was statistically supported by Egger's test. The symmetrical distribution of the included publications in a large inverted funnel indicated the absence of a publication bias (**Supplemental Figure 1**). The Egger tests revealed no publication bias among the studies included to estimate the pooled prevalence of trachoma infection among children in Ethiopia, with p -values of (p = 0.260).

Meta-Regression

Meta-regression was used to identify factors associated with the pooled prevalence of trachoma among children (1–9 years old). For the meta-regression, publication year, region, and sample size were considered. The analysis revealed a significant correlation between the pooled prevalence of trachoma among children (1–9 years) and publication year (P<0.001) but no significant correlation with sample size or region (**Supplemental Table 5**).

Sensitivity analysis

By excluding each study individually, a leave-out-one sensitivity analysis was used to determine the effect of a single study on the pooled prevalence of trachoma among children (1–9 years) in Ethiopia. Our finding revealed that no single study had a

significant impact on the pooled prevalence of trachoma among children (1–9 years) in Ethiopia (Figure 3).

Discussion

The purpose of this systematic review and meta-analysis is to add national data on the prevalence of trachoma infection among Ethiopian children to eliminate the disease. Although different studies from different regions have been published in the country, the data on trachoma infections has to be organized and updated every time. Therefore, updating the information has the potential to inform and help develop different strategies by targeting highly endemic areas.

The pooled overall prevalence of Trachoma (24.01%) observed in the current review is comparable with a study from Colombia [55], but higher than the study done in the Democratic Republic of Congo[56], Nigeria [57], Uganda [58], Brazil [59], and Kenya [60]. This prevalence is lower than studies from South Sudan [61] and Guinea [62]. The disparity among the findings might be due to environmental factors such as the level of participants' hygiene, sanitation, access to functional latrines, and clear water supply, and recent studies were included in our review that reported an ongoing sustainable water, sanitation, and hygiene (WASH) program and mass drug administration (MDA) with azithromycin which might reduce trachoma prevalence among children in Ethiopia, unlike the South Sudan study, which lacks MDA and targets SAFE strategy [61].

The subgroup analysis of this review also shows a statistically significant (p = 0.01) difference among regions. Trachoma was highly prevalent in Tigray and SNNP, followed by Oromia and the Amhara regions. Trachoma infection is related to inadequate hygiene, a low standard of living, inadequate access to water, and inadequate access to sanitation . In the Tigray region, trachoma prevalence is high ,which might also be related to extreme climatic events that favor a decline in water availability during dry periods, which affects personal hygiene. Another reason for the difference is attributed to baseline and intervention disparities in the communities. MDA

with azithromycin once a year is needed based on the review findings (24%), and Ethiopia is known to require intervention based on the WHO 2021 report (1).

Though the decline is not statistically significant (p = 0.30), our results from this review revealed studies conducted between 2005-2014 and 2015-2022, which show a decrease in the prevalence of trachoma from 32% to 19%. The expansion of MDA and WASH programs might be attributed to the decrease in prevalence. This review has the implication of revealing the national burden of trachoma infection among children, who are a special population and account for one-third of the national population. Moreover, this large magnitude of trachoma infection shows a significant gap in the implementation of WHO designed and national elimination strategies. Last but not least, from a research perspective, we recommend conducting operational studies on the topic.

Strength and limitations of the study

The current meta-analysis has several strengths. It provides a comprehensive overview of trachoma among Ethiopian children in accordance with the most recent PRISMA guidelines. We conducted a thorough search of the literature using multiple databases and found eligible studies. Although the meta-analytic techniques used in this study were strong, the results should be interpreted with caution due to the study's limitations. First, there was significant heterogeneity in trachoma prevalence in Ethiopia. However, this heterogeneity can be attributed to factors such as publication year and sample size. Secondly, all the included studies were cross-sectional, which, owing to the nature of the study design, makes it challenging to demonstrate a cause-and-effect relationship. Moreover, this systematic review and meta-analysis has not assessed associated factors of trachoma among children in Ethiopia.

Conclusions

An effort has been made to eliminate trachoma infection, which is still highly prevalent across the Ethiopian regions. Even though the decline is not statistically significant, we saw decreased trachoma prevalence in Ethiopian children. Trachoma is highly prevalent

in Tigray, followed by SNNPR. Moreover, trachoma remains a significant public health concern among adults in Ethiopia. The prevalence of trachoma in this population is alarmingly high, highlighting the urgent need for continued efforts to improve access to clean water, sanitation, and hygiene practices. Despite the effort made by the country to eliminate trachoma infection, according to the WHO risk classification, it remains a public health problem in the country. The output of this review will offer valuable data to the Ministry of Health, policymakers, and concerned bodies that work on eliminating trachoma infection in the country. Trachoma infection is highly prevalent based on this review, and it underlines the need for improved prevention and control strategies for one of the neglected tropical diseases in Ethiopia.

List of Abbreviations CI: Confidence interval; NTDs: Neglected tropical disease; PRISMA: Preferred reporting items for systematic review and meta-analysis; SAFE: Surgery for Trichiasis, Antibiotics, Face Washing and Environmental improvement strategy; SDG: Sustainable development goal; SNNPR: South Nation and Nationalities people; WHO: World Health Organization.

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Ethical approval: Not applicable

Data Availability: All associated data and supporting information are included in this systematic review and meta-analysis.

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Figure Legend

Figure 1- PRISMA flow diagram of screened articles and the selection process of studies on pooled prevalence of trachoma infection among 1-9 years of age children in Ethiopia 2023.

Figure 2- Forest plot depicting pooled prevalence of trachoma among 1-9 years of age children in Ethiopia 2023.

Figure 3- Leave-one sensitivity analysis on the studies included in the pooled prevalence of trachoma among 1-9 years of age children in Ethiopia 2023.

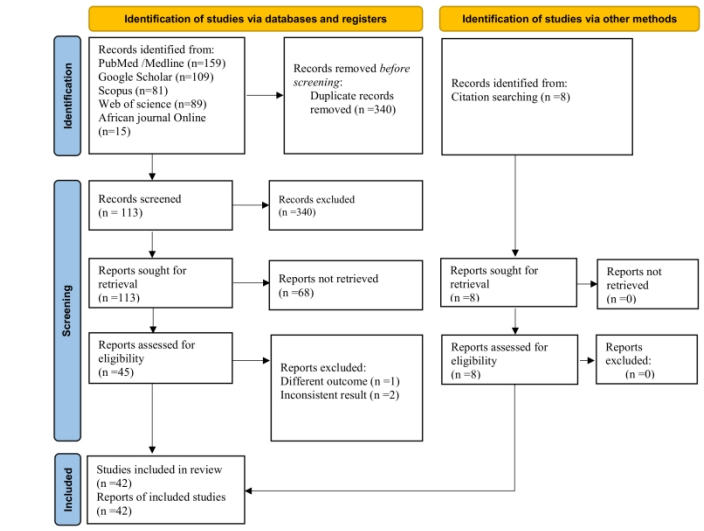
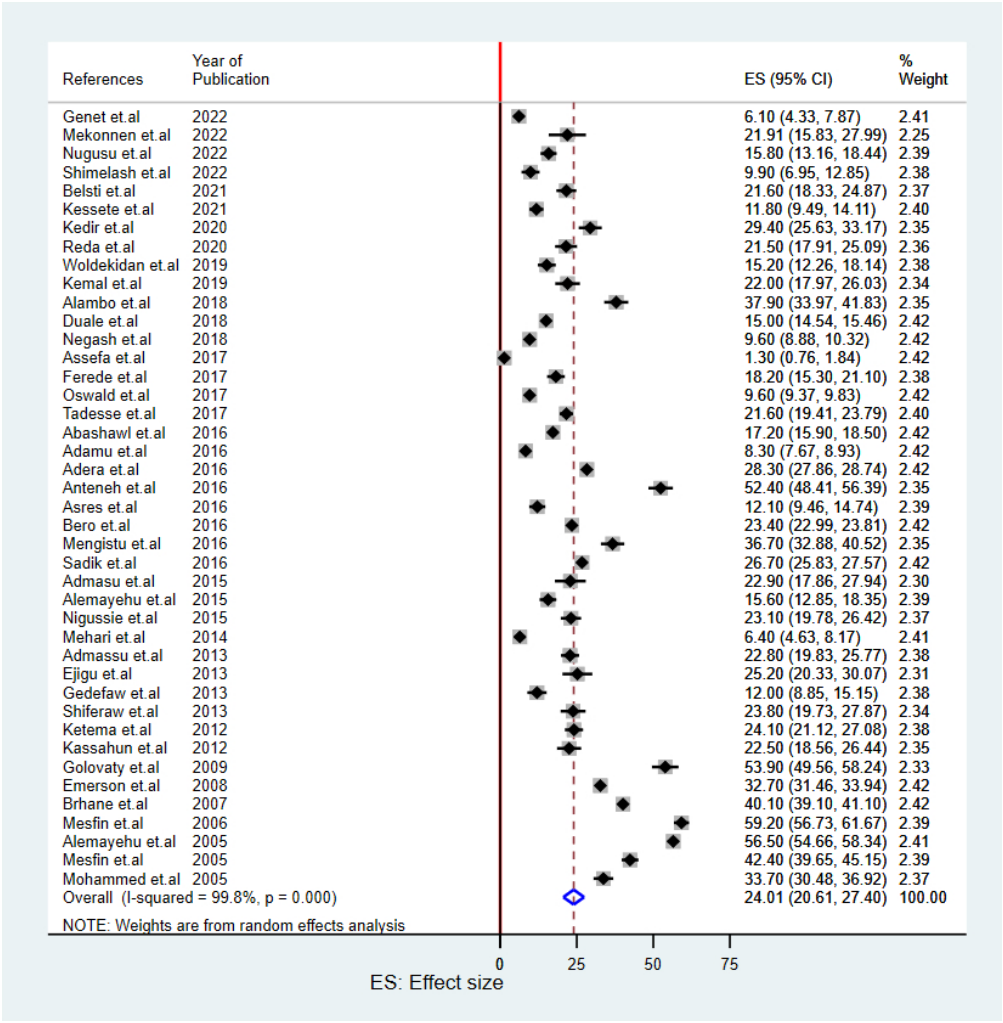


Figure 1 PRISMA flow diagram of screened articles and the selection process of studies on pooled prevalence of trachoma infection among 1-9 years of age children in Ethiopia,2023

Figure 1 PRISMA flow diagram of screened articles and the selection process of studies on the pooled prevalence of trachoma among 1-9 years of age children in Ethiopia,2023

297x210mm (300 x 300 DPI)



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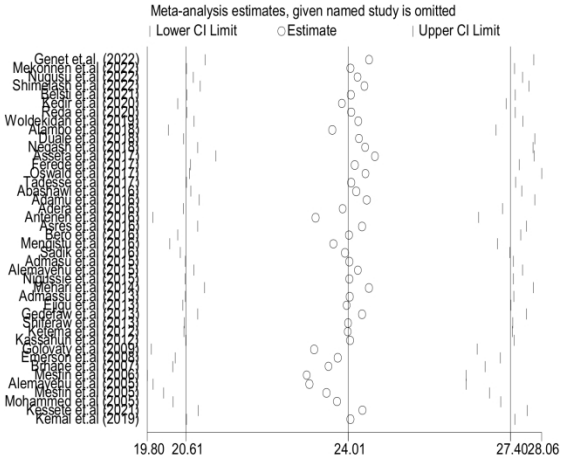


Figure 3. Leave-one sensitivity analysis on the studies included in pooled prevalence of trachoma among 1-9 years of age children in Ethiopia, 2023

Figure 3 Leave one sensitivity analysis on the studies included in the pooled prevalence of trachoma among 1-9 years of age children in Ethiopia,2023

215x279mm (300 x 300 DPI)

Supplemental Table 1: PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	3-4
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	6
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	7
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	6
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	6
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	7
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	7
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	7
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	7
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	7
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	15
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	8
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	7
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	7
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	9
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	15
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	16
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	15
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	14

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	10
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	10
Study characteristics	17	Cite each included study and present its characteristics.	10
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	8
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	8
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	8
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	9
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	9
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	16
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	9
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	9
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	17
	23b	Discuss any limitations of the evidence included in the review.	18
	23c	Discuss any limitations of the review processes used.	18
	23d	Discuss implications of the results for practice, policy, and future research.	18
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	18
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	11
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	11
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	13
Competing interests	26	Declare any competing interests of review authors.	13
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	13

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

Supplemental Table 2: Search Strategy Summary

Period search was conducted	20 May 2023 to 20 June 2023
Inclusion criteria	• Cross sectional study • Studies published until 31 July 2023 • Studies conducted in Ethiopia. • Children (1-9 years) • Published in the English Language. • Studies reported the prevalence of Trachoma
Exclusion criteria	• Case reports • case series • review articles • letters to editors
Libraries	Worldwide
Records identified from secondary databases, Google scholar	("magnitude"[All Fields] OR "magnitudes"[All Fields] OR ("epidemiology"[MeSH Subheading] OR "epidemiology"[All Fields] OR "prevalence"[All Fields] OR "prevalence"[MeSH Terms] OR "prevalance"[All Fields] OR "prevalences"[All Fields] OR "prevalence s"[All Fields] OR "prevalent"[All Fields] OR "prevalently"[All Fields] OR "prevalents"[All Fields]) OR ("burden"[All Fields] OR "burdened"[All Fields] OR "burdening"[All Fields] OR "burdens"[All Fields]) OR ("epidemiologies"[All Fields] OR "epidemiology"[MeSH Subheading] OR "epidemiology"[All Fields] OR "epidemiology"[MeSH Terms] OR "epidemiology s"[All Fields])) AND ("trachoma"[MeSH Terms] OR "trachoma"[All Fields] OR "trachomas"[All Fields] OR ("eye infections"[MeSH Terms] OR ("eye"[All Fields] AND "infections"[All Fields]) OR "eye infections"[All Fields] OR ("eye"[All Fields] AND "infection"[All Fields]) OR "eye infection"[All Fields]) OR ("Trachomatous"[All Fields] AND ("intense"[All Fields] OR "intense ly"[All Fields] OR "intensities"[All Fields] OR "intensity"[All Fields] OR "intensively"[All Fields])) OR ("Trachomatous"[All Fields] AND "follicular"[All Fields])) AND ("Ethiopia"[MeSH Terms] OR "Ethiopia"[All Fields] OR "Ethiopia s"[All Fields])

Supplemental Table 3: Methodological quality assessment of included studies using the Newcastle-Ottawa quality assessment scale

Study	Selection				Comparability	Outcome		
	Representativeness of the sample	Sample size	Non respondents	Ascertainment of the exposure (maximum score=2)	The subjects in different outcome groups are comparable, based on the study design or analysis. Confounding factors are controlled((maximum score=2))	Assessment of the outcome(maximum score=2)	Statistical test	Total(10)
Abashawl et.al[49]	1	0	0	1	0	2	2	6
Adamu et.al[50]	1	1	1	1	1	2	1	8
Adera et.al[31]	1	0	1	1	1	2	1	7
Admassu et.al[32]	1	0	1	2	1	2	1	8
Admasu et.al[33]	1	0	1	0	1	2	2	7
Alambo et.al[39]	1	0	1	1	1	2	1	7
Alemayehu et.al[52]	1	1	1	1	1	2	1	8
Alemayehu et.al [34]	1	1	1	1	1	2	2	9

Anteneh et.al[17]	1	0	1	1	0	2	2	7
Asres et.al[18]	1	1	1	1	1	2	1	8
Assefa et.al[48]	1	1	0	1	1	2	1	7
Belsti et.al[53]	1	1	1	1	1	2	1	8
Bero et.al[40]	1	0	1	1	1	2	1	8
Brhane et.al[51]	1	1	1	1	1	2	1	9
Duale et.al[47]	1	1	1	1	1	2	1	8
Ejigu et.al[54]	1	1	1	1	1	2	1	8
Emerson et.al[19]	1	0	1	1	1	2	1	7
Ferede et.al[20]	1	0	1	2	1	2	1	8
Gedefaw et.al[21]	1	0	1	0	1	2	2	7
Genet et.al [22]	1	0	1	1	1	2	1	7
Golovaty et.al[23]	1	1	1	1	1	2	1	8
Kassahun et.al[42]	1	1	1	1	1	2	2	9

Kedir et.al[35]	1	0	1	1	0	2	2	7
Kemal et.al[41]	1	1	1	1	1	2	1	8
Kessete et.al[30]	1	1	0	1	1	2	1	7
Ketema et.al[24]	1	0	1	1	1	2		7
Mehari et.al [36]	1	0	1	2	1	2		8
Mekonnen et.al[15]	1	0	1	1	0	2		7
Mengistu et.al[37]	1	1	1	1	1	2		8
Mesfin et.al[43]	1	1	0	1	1	2	1	7
Mesfin et.al[2]	1	1	1	1	1	2	1	8
Mohammed et.al[8]	1	0	1	1	1	2	2	8
Negash et.al[46]	1	1	1	1	1	2	2	9
Nigussie et.al[25]	1	1	1	1	1	2	1	8
Nigusu et.al[26]	1	1	1	1	1	2	1	8
Oswald et.al[16]	1	0	1	1	1	2	1	7

Reda et.al[44]	1	0	1	2	1	2	1	8
Sadik et.al[45]	1	0	1	0	1	2	2	7
Shiferaw et.al[27]	1	0	1	1	1	2	1	7
Shimelash et.al[28]	1	1	1	1	1	2	2	8
Tadesse et.al[29]	1	1	1	1	1	2	2	9
Woldekidan et.al[38]	1	0	1	1	0	2	2	7

Supplemental Table 4: Study characteristics of included studies on the prevalence trachoma among children age 1-9 years; 2023

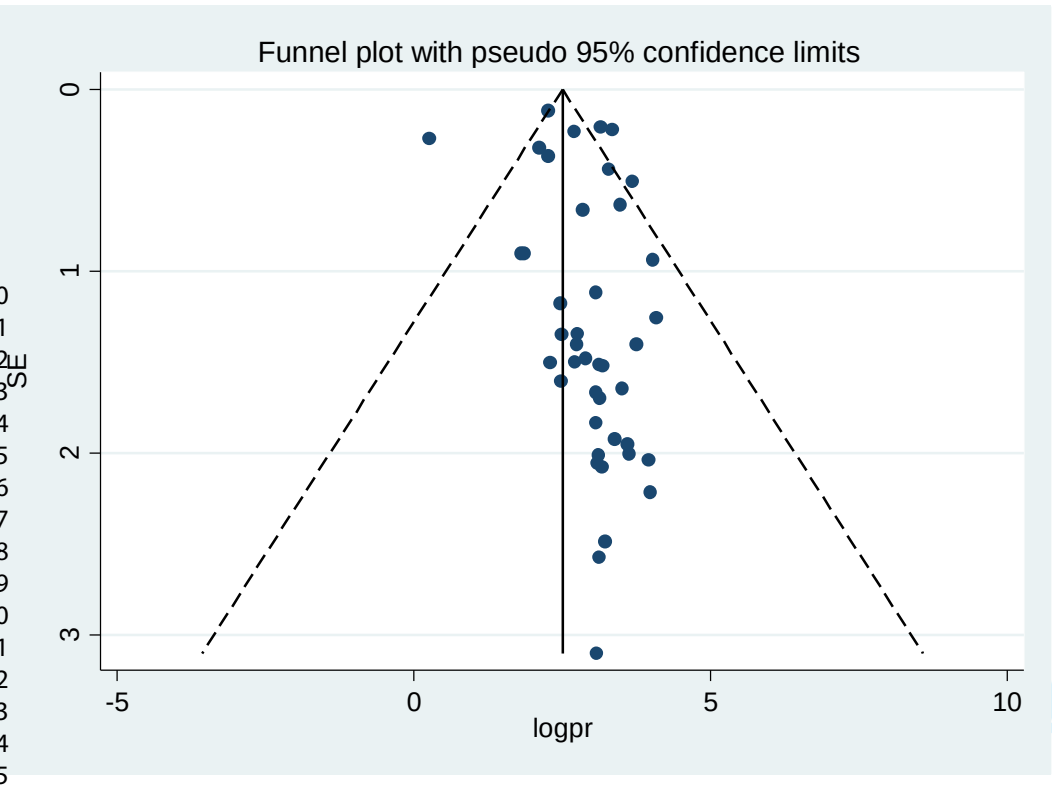
Author's	Year of Publication	Region	Study Area	Study Design	Sample Size	Male(n)	Female (n)	No of cases(n)	Prevalence %
Abashawl et.al[48]	2016	Gambela	Region-wide	CS	3238	NA	NA	557	17.2
Adamu et.al[49]	2016	Benishangul Gumuz	Region-wide	CS	7417	3212	4205	616	8.3
Adera et.al[30]	2016	SNNP	Region wide	CS	41,155	NA	NA	11,647	28.3
Admassu et.al[31]	2013	SNNP	Guragie	CS	768	386	382	175	22.8
Admasu et.al[32]	2015	SNNP	Dawro	CS	267	113	154	61	22.9
Alambo et.al[38]	2018	SNNP	Areka	CS	586	317	269	222	37.9
Alemayehu et.al[51]	2015	Diredawa	Dera	CS	671	351	320	105	15.6
Alemayehu et.al [33]	2005	SNNP	Guragie	CS	2788	NA	NA	1561	56.5
Anteneh et.al[16]	2016	Amhara	Gazegibela	CS	601	268	333	315	52.4
Asres et.al[17]	2016	Amhara	Gondar	CS	586	285	301	71	12.1
Assefa et.al[47]	2017	Harari	Harari	CS	1722	804	918	22	1.3
Belsti et.al[52]	2021	Southwest	Lare	CS	610	283	327	132	21.6
Bero et.al[39]	2016	Oromia	Region-wide	CS	41642	NA	NA	9744	23.4
Brhane et.al[50]	2007	Nationwide	Nation-wide	CS	9289	NA	NA	3725	40.1
Duale et.al[46]	2018	Somali	Region-wide	CS	23620	11462	12158	3543	15
Ejigu et.al[53]	2013	Southwest	Kersa	CS	305	154	151	77	25.2
Emerson et.al[18]	2008	Amhara	Region-wide	CS	5485	NA	NA	1794	32.7
Ferede et.al[19]	2017	Amhara	Dembia	CS	681	NA	NA	121	18.2
Gedefaw et.al[20]	2013	Amhara	Dangila	CS	409	215	194	49	12
Genet et.al [21]	2022	Amhara	Dangila	CS	704	337	367	43	6.1
Golovaty et.al[22]	2009	Amhara	Ankober	CS	507	219	288	275	53.9
Kassahun et.al[41]	2012	Oromia	Mojo	CS	431	NA	NA	97	22.5
Kedir et.al[34]	2020	SNNP	Silte	CS	561	279	282	165	29.4

Kemal et.al[40]	2019	Oromia	Medawalebu	CS	406	215	191	89	22
Kessete et.al[29]	2012	Amhara	Baso Liben	CS	792	391	401	191	24.1
Ketema et.al[23]	2014	SNNP	Guragie	CS	735	366	369	47	6.4
Mehari et.al [35]	2022	Oromia	Arsi Negele	CS	178	93	85	39	21.91
Mekonnen et.al[14]	2016	SNNP	Zala	CS	611	286	325	224	36.7
Mengistu et.al[36]	2006	Tigray	Region wide	CS	1526	NA	NA	903	59.2
Mesfin et.al[42]	2005	Amhara	Ebinet&East Belesa	CS	1244	601	643	527	42.4
Mesfin et.al[2]	2005	SNNP	Goro	CS	826	438	388	278	33.7
Mohammed et.al[8]	2018	Afar	Region-wide	CS	6399	NA	NA	611	9.6
Negash et.al[45]	2015	Amhara	Gonji Kolella	CS	618	353	265	143	23.1
Nigussie et.al[24]	2022	Amhara	Tarimaber	CS	736	380	356	116	15.8
Nigusu et.al[25]	2017	Amhara	Region wide	CS	62869	NA	NA	6035	9.6
Oswald et.al[15]	2020	Tigray	Deguatemben	CS	502	257	245	108	21.5
Reda et.al[43]	2016	Tigray	Region-wide	CS	10023	NA	NA	2676	26.7
Sadik et.al[44]	2013	Amhara	Makisegnit	CS	420	209	211	100	23.8
Shiferaw et.al[26]	2022	Amhara	Debretabor	CS	394	70	324	39	9.9
Shimelash et.al[27]	2017	Amhara	Wollo	CS	1358	638	720	293	21.6
Tadesse et.al[28]	2019	SNNP	Lemo	CS	574	NA	NA	87	15.2

CS: Cross-sectional study

Supplemental Table 5: Meta-regression of factors related to the heterogeneity on the pooled prevalence of trachoma among 1-9 years of age children in Ethiopia, 2023

Variables	Coefficient	95% CI	P-value
Year of Publication	-1.83	-2.54 to -1.10	0.00
Region	1.23	-1.19-3.66	0.30
Sample Size	-.000	-.00 to 0.00	0.49



Supplemental Figure 1: Funnel plot depicting publication bias of studies reporting the pooled prevalence of trachoma among 1-9 years of age children in Ethiopia, 2023