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Research article

Prevalence and associated factors of caesarean section among mothers who gave birth across Eastern Africa countries: Systematic review and meta-analysis study

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A B S T R A C T

Background: Caesarean section (CS) rate increased dramatically worldwide, exceeding the World Health Organization's benchmark (10–15 %) in many countries. This rate varies in different regions of the continent. Using various study designs, researchers from across East African countries investigated the prevalence of caesarean section and the factor associated with it but no study shows a pooled prevalence of caesarean section in the Eastern African region. Therefore, this review aimed to systematically summarize and estimate the pooled prevalence of caesarean section and its associated factors in Eastern Africa, 2023.

Methods: PubMed, Web of Science, EMBASE, Scopus and CINAHL were rigorously searched to find relevant studies. All identified observational studies reporting the prevalence of CS and its associated factors in East Africa published till August 2023 were considered. Heterogeneity across the studies was evaluated using the I^2 test. Publication bias was assessed by funnel plot and Egger's regression test. Finally, a random effect meta-analysis model was computed to estimate the pooled prevalence of CS and qualitative analysis was employed for associated factors. The study protocol was registered in PROSPERO.

Results: This review was assessed using twenty-six eligible studies from a total of 2223 articles with a total of 600,431 participants. In this meta-analysis, the pooled prevalence of caesarean section in Eastern Africa was 24.0 % (95%CI: 22–27 %). The highest pooled prevalence of caesarean section was in Ethiopia, 28.30 % (95%CI; 21.3–35.2 %), and the lowest was seen in Uganda, 11.9 % (95%CI; 7.9–15.9 %). Urban residency, having high level of wealth asset, education level college and above, advanced maternal age, big birth weight, history of previous caesarean section, private institution delivery, multiple pregnancies, pregnancy-induced hypertension, antepartum haemorrhage and fetal malpresentation were linked with a greater likelihood of having CS.

Conclusions: and recommendation: The overall pooled prevalence of CS in Eastern Africa was high compared to the WHO proposed recommended range. Therefore, the finding implies that each East African countries Ministry of Health and health care professionals shall be given particular emphasis made on strengthening antenatal care services and ensure more women have access to skilled healthcare professionals during childbirth. This can help in providing appropriate interventions, support to women and reducing the need for emergency and unnecessary CSs. The result of this research are a baseline data for future researchers to conduct further studies to better understand the reasons behind the high rates and identify potential interventions and solutions specific to the African context.

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1. Introduction

Caesarean section (CS) is defined as a fetal delivery through an open abdominal incision and an incision in the uterus. The first caesarean documented occurred in 1020 AD, and since then, the procedure has evolved tremendously [1,2].

Globally, the latest available data from 154 countries showed that 21.1 % of women gave birth by caesarean [3], World Health Organization(WHO) indicated that the ideal caesarean sections rate ranges from 10 % to 15 % [4]. Both very low and very high caesarean sections rates (CSRs) could be dangerous [5,6].

The global rate of this surgery has doubled in the past 10 years to 21 %, and increases the average annual rate by 3.7 % [7]. Caesarean section use varied greatly, from 5 % in the sub-Saharan Africa region (0.6 % in South Sudan) to 42·8 % in the Latin America and Caribbean region (55.5 % in Brazil) [3,8]. Projections showed that by the year 2030, an estimated 28.5 % of women worldwide will give birth by caesarean section (38 million caesareans of which 33.5 million in low and middle-income countries (LMIC) annually) ranging from 7.1 % in sub-Saharan Africa to 63.4 % in Eastern Asia [3].

The CS rate has increased worldwide in the past year and recently there has been a dramatic rise in developing countries [2,5]. The reasons for this increase in CS are multifactorial and include the increasing number of women with prior caesarean delivery, the increase in multifetal gestations, use of intrapartum electronic fetal monitoring, changes in obstetric training, medico-legal concerns, alterations in parental and social expectations of pregnancy outcome and maternal autonomy in decision – making regarding delivery mode [2,3,5,8,9].

The International Federation of Gynecologists and Obstetricians (FIGO), recommends physicians perform caesarean sections to improve the health and well-being of mothers and babies [10]. The most commonly documented indications for first-time caesarean deliveries are labor dystocia, abnormal fetal heart rate pattern, malpresentation of the fetus, multiple gestations, and suspected fetal macrosomia [9,11–15]. Overuse of caesarean section or performed without medically indicated reasons is associated with increased risk of harm for women and their babies, surgical complications during intra-operative and post-operative complications [16,17], and also affects subsequent pregnancy [5,18,19]. Evidence suggests that the majority of caesarean section is medically unnecessary and unjustified [5,20].

Conversely, underuse(less than 10 % prevalence) and lack of access to caesarean section, particularly among rural and disadvantaged communities in low-resource settings, can result in unnecessary birth complications and deaths of women and their babies [21,22]. The advantages of vaginal delivery compared to a caesarean section include: women's shorter physical and psychological recovery period after birth, increased likelihood of successful breastfeeding, natural physiological adaptation to the external environment and improved immunity of the baby, and support for the baby's longer-term growth, health and development [23].

The evidence from the reported prevalence estimate of caesarean section in developed and developing countries shows that the prevalence of caesarean section in the range of 23.5 %–63.27 % [24–30] and 2.1 %–29.55 % [31–37] respectively. Various studies undertaken in various sections of East African countries reveal varying in the prevalence of caesarean section such as: 14 % in Uganda [38], 15.6 % in Rwanda [39], 20.7 % in Zambia [40], 28.9 % in Tanzania [41] and 27.6 % in Ethiopia [42].

A number of factors that were associated to an increased chance of having a CS have been identified by different epidemiological researches, including, urban residency, the highest level of wealth asset, the mother level of education collage and above, women age between 15 and 24 years and between 35 and 39 years, birth weight ≥4000 gm, women who had been augmentation, history of previous caesarean section, giving birth in a private health facility, unknown gestational age and had multiple pregnancies, women who had pregnancy-induced hypertension, women who had antepartum haemorrhage and fetal malpresentation [42–47].

Numerous studies have been carried out East African countries. However, there exists a significant discrepancy in the literature concerning the prevalence of caesarean section and the factors that influence it. Furthermore, it was found that the study design and measurement were inconsistent throughout the data. As far as the author is aware, no review of the literature has been done to show the cumulative prevalence of caesarean sections and the factors that contribute to it in the region. Therefore, the aim of this systematic review and meta-analysis is to determine the regional pooled prevalence of caesarean sections and associated factors.

2. Methods

2.1. Design and registration

This systematic review and meta-analysis were conducted based on the Preferred Reporting Items for Systematic and meta-analysis (PRISMA) guideline [48]. This review protocol was registered at the National Institute for Health Research; International Prospective Register of Systematic Reviews (PROSPERO), with registration number CRD42023440131: Available from https://www.crd.york.ac.uk/prospero/#recordDetails.

2.2. Search strategy

Initially, databases including MEDLINE (via PubMed), Google Scholar, EMBASE, Scopus, Web of Science, and CINAHL were systematically searched to identify relevant studies electronically. Besides, to identify additional relevant articles, manual search of grey literature available on local university institutional repository (Addis Ababa University Digital Library) and Google Scholar were used. The current review and meta-analysis included articles published. The keywords used for the review included "caesarean section", "prevalence", "associated factors" and "List of East African countries". To combine search terms Boolean operators such as "AND" and "OR" were used (Supplementary 1). Software called Mendeley reference manager is used to gather and arrange search results. Studies were imported into covidence which is web application for screening and data extraction [49].

2.3. Selection/screening process

Studies were imported to the web-based application Covidence for screening. ATH and MDM were involved in all steps of data screening process, EGS and HAN were involved in data extraction and quality assessment. Any disagreements at the time of data screening were reconciled by discussion and consensus.

2.4. Eligibility criteria

2.4.1. Inclusion criteria

Studies were eligible for inclusion in the review if they reported their outcome variable as the prevalence of caesarean section and associated factor. Other criteria were the research design was observational quantitative studies. Similarly, articles published in peer-reviewed journals and grey literature in the English language until August 3, 2023, were also included. Furthermore, the date of publication was no restriction; any article ever published in the topic of interest was used.

2.4.2. Exclusion criteria

Studies were excluded if: (1) those articles that were not fully accessible; (2) articles in which fail to estimate the outcome (caesarean section); (3) articles conducted in non-human subjects and (4) they have a poor quality score.

2.5. Quality assessment

The methodological quality of each included study was assessed using the Newcastle- Ottawa Scale for observational studies quality assessment of the studies which was included in the review and meta-analysis [50]. The quality assessment tool had a total of ten point score under three categories; Selection (5 points), Comparability (2 points) and Outcome (3 points) and articles assessed with a score of $\geq$6 out of 10 considered as achieving high quality. Finally, articles of medium and high quality were included for analysis. Furthermore, quality assurance checks were independently performed by two authors. Any disagreements of assessors were resolved by discussion and settled by taking the mean score of their assessment results.

2.6. Data extraction

After identifying articles for inclusion, two authors (EG and HA) performed data extraction. The data extraction was based on the study objectives, for the first objective (Prevalence of caesarean section) data regarding the names of the authors, year of publication, the name of the East Africa country; number of sample size, response rate, prevalence of caesarean section and sampling technique were used. For the second objective (association factors with caesarean section delivery), the data extraction format was prepared in the form of a two-by-two table for each statistically significant variables (P-value $<$0.05 on multivariable regression), plus the quality score of each study was ascertained for each article. Any disagreements at the time of data abstraction were reconciled by discussion and consensus.

2.7. Meta-analysis

Data were abstracted by using Microsoft™ Excel, and further analysis was performed using STATA™ Version 16 statistical software. The results of the meta-analysis were reported as the pooled prevalence of caesarean section and pooled adjusted odds ratio of associated factors with 95 % confidence intervals (CIs). Heterogeneity across the studies was evaluated using the I^2 statistics, within a value above 75 % interpreted as reflecting high heterogeneity. A random-effects model was performed due to anticipated heterogeneity among studies [51] and associated factors were analyzed qualitatively. To minimize the random variations between the point estimates of the primary study, subgroup analysis was performed based on the study setting, country and year of publication. Besides, to identify the possible sources of heterogeneity, meta-regression was undertaken considering sample size, response rate, study setting, publication year and country as covariates, response rate defined as the number of people who were interviewed divided by the total number of people in the sample who were eligible to participate and should have been interviewed. Moreover, we performed a sensitivity analysis to describe whether the pooled effect size was influenced by individual studies.

The study had two main objectives: The first were to determine the pooled prevalence of caesarean section in East Africa. It was calculated by dividing the total number of women delivered by caesarean section divided by the total number of women who gave birth included in the study (sample size) and multiplying by one hundred (100). The second objective were to estimate the pooled effects of each associated factor on caesarean section delivery and the odds ratio was calculated from the primary studies using Excel and STATA™ version 16 software.

2.8. Publication bias

Publication bias was checked using a funnel plot and Egger's statistical test. Based on the shape of the graph, a symmetrical graph was interpreted to suggest absence of publication bias, whereas an asymmetrical graph was interpreted to indicate presence of publication bias. Statistically significant Egger's test (P-value <0.05) indicates that the presence of a small study effect and handled by Duval and Tweedie non-parametric trim and fill analysis using the random effects model to formalize use of funnel plot, estimate number and outcome of missing studies, and adjust for theoretically missing studies [52].

3. Results

3.1. Study selection

A database search yielded a total of 2223 articles, of which 1421 were from PubMed, 437 from Web of Science, 271 from Scopus, 23 from CINAHL, 4 from EMBASE, and 67 from Google Scholar. 205 of these had duplicate records that were found and eliminated. After reading the titles and abstracts of the remaining 2018 articles in accordance with the predetermined inclusion criteria, 1986 items were eliminated. After that, 32 full-text papers were reviewed, and only 26 studies were subsequently included in the final analysis.

Overall, the preferred reporting item for systematic reviews and meta-analysis (PRISMA) flow diagram 2015 on Covidence workflow platform was used to guide the entire screening process (Fig. 1).

3.2. Baseline characteristics of the included studies

Twenty-six articles were included in this review [32,37–47,53–66]. Selected studies publication year's ranges were between 2014 and 2022 (8 year). The total of 26 studies were reviewed, from them 16 studies were from Ethiopia [32,37,43–47,55,57,59,61–65], four studies from Tanzania [41,54,58,60], two studies each from Rwanda [39,56] and Uganda [38,66]. One study each was identified from Mozambique [53] and Zambia [40].

All of the studies considered in the final analysis used a cross-sectional design. Six studies used community samples, whereas twenty studies used samples from the institution. Regarding the sampling method used, eight studies use systematic random sampling and two studies used convenience sampling technique. Table 1 summarizes the characteristics of included articles.

3.3. Quality of included studies

In this review quality evaluation, all the included studies were ranges between: 7 to 9 from a total of 10-point of Newcastle Ottawa Score (NOS) score. The investigators agreed that the risk of selection, ascertainment, and non-response bias was minimal. A moderate or substantial or perfect agreement was found between investigators regarding the level of bias for the included studies (Kappa statistic range 0.52–1 (Suplimentary-1).

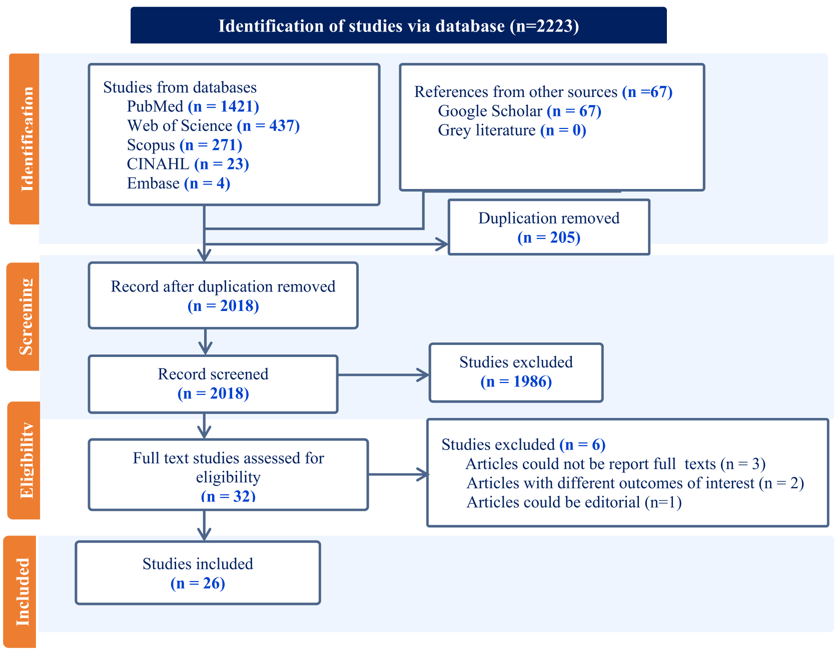

Fig. 1. PRISMA flow chart showing selection of primary studies for the systematic review and meta-analysis of prevalence of caesarean section and associated factor in East Africa.

Table 1
Distribution of studies on Prevalence of caesarean section included in analysis based on Author, year, setting, country, study design, sample size, response rate, and prevalence.

Author, Year,(Reference)	Setting	Country	Study design	Sample size	Response rate	Prevalence	Sampling method
Abdo A. et al., 2020 [63],	HI	Ethiopia	Cross-sectional	4004	99.3 %	32.80 %	Census
Abebe F. et al., 2016 [64],	HI	Ethiopia	Cross-sectional	2967	96.9 %	25.40 %	Census
Abubeker F. et al., 2020 [65],	HI	Ethiopia	Cross-sectional	4200	100 %	34.70 %	Census
Alemu A. et al., 2020 [44],	HI	Ethiopia	Cross-sectional	422	94.8 %	20.20 %	Systematic random sampling
Atuheire E. et al., 2019 [66],	HI	Uganda	Cross-sectional	398,113	100 %	9.90 %	Multistage sampling
Ayalew M. et al., 2020 [45],	HI	Ethiopia	Cross-sectional	433	100 %	30.90 %	Systematic random sampling
Azene A. et al., 2019 [37],	Community	Ethiopia	Cross-sectional	7193	100 %	3.55 %	Multistage sampling
Chicumbe S. et al., 2022 [53],	HI	Mozambique	Cross-sectional	5066	100 %	19 %	Cluster sampling
Hailegebreal S. et al., 2021 [32],	Community	Ethiopia	Cross-sectional	5527	100 %	5.44 %	Multistage sampling
Hanson C. et al. (2019) [54],	Community	Tanzania	Cross-sectional	34,063	100 %	6.40 %	Cluster sampling
Harrison M. et al., 2021 [55],	HI	Ethiopia	Cross-sectional	1000	99.3 %	23.40 %	Convenience sampling
Kakoma J. et al., 2016 [56],	Community	Rwanda	Cross-sectional	152	100 %	21.05 %	Census
Kibe P. et al., 2022 [39],	Community	Rwanda	Cross-sectional	34,144	100 %	15.60 %	Multistage sampling
Melesse M. et al., 2020 [46],	HI	Ethiopia	Cross-sectional	724	97.8 %	41.80 %	Systematic random sampling
Moges A. et al., 2015 [57],	HI	Ethiopia	Cross-sectional	5611	100 %	27.60 %	Census
Mose A. et al., 2021 [43],	HI	Ethiopia	Cross-sectional	551	98 %	32.50 %	Systematic random sampling
Nilsen C et al., 2014 [41],	HI	Tanzania	Cross-sectional	29,752	100 %	28.90 %	Census
Nkhata E. et al., 2016 [40],	HI	Zambia	Cross-sectional	358	100 %	20.70 %	Systematic random sampling
Nyamtema A. et al., 2016 [58],	HI	Tanzania	Cross-sectional	58,751	100 %	10 %	Census
Shit S. et al., 2020 [59],	HI	Ethiopia	Cross-sectional	248	99.2 %	21 %	Systematic random sampling
Taye M. et al., 2021 [47],	HI	Ethiopia	Cross-sectional	351	91.2 %	39.10 %	Convenience sampling
Tognon F. et al., 2019 [60],	HI	Tanzania	Cross-sectional	3012	98.7 %	35.20 %	Census
Tsegaye H. et al., 2019 [42],	HI	Ethiopia	Cross-sectional	298	100 %	38.30 %	Systematic random sampling
Waniala I. et al., 2020 [38],	Community	Uganda	Cross-sectional	2573	100 %	14 %	Cluster sampling
Welay F. et al., 2021 [61],	HI	Ethiopia	Cross-sectional	398	100 %	28.90 %	Systematic random sampling
Wondie A. et al., 2019 [62],	HI	Ethiopia	Cross-sectional	520	98.4 %	47.60 %	Stratified sampling

Key; HI: Health institution.

3.4. Prevalence of caesarean section in East Africa

A lower prevalence (3.55 %) of caesarean section was recorded in the nation-based study in Ethiopia [37], whereas a higher prevalence (47.6 %) of caesarean section was also identified in the Ethiopian study [62]. The overall pooled prevalence of caesarean section in East Africa was 24.0 % (95 % CI: 22–27 %) (Fig. 2). We found a significant heterogeneity among the twenty six studies ($I^2 = 99.81$ %; $p < 0.001$). Therefore, we used Dersimonian and Liard random effect model to estimate the pooled prevalence [52,67].

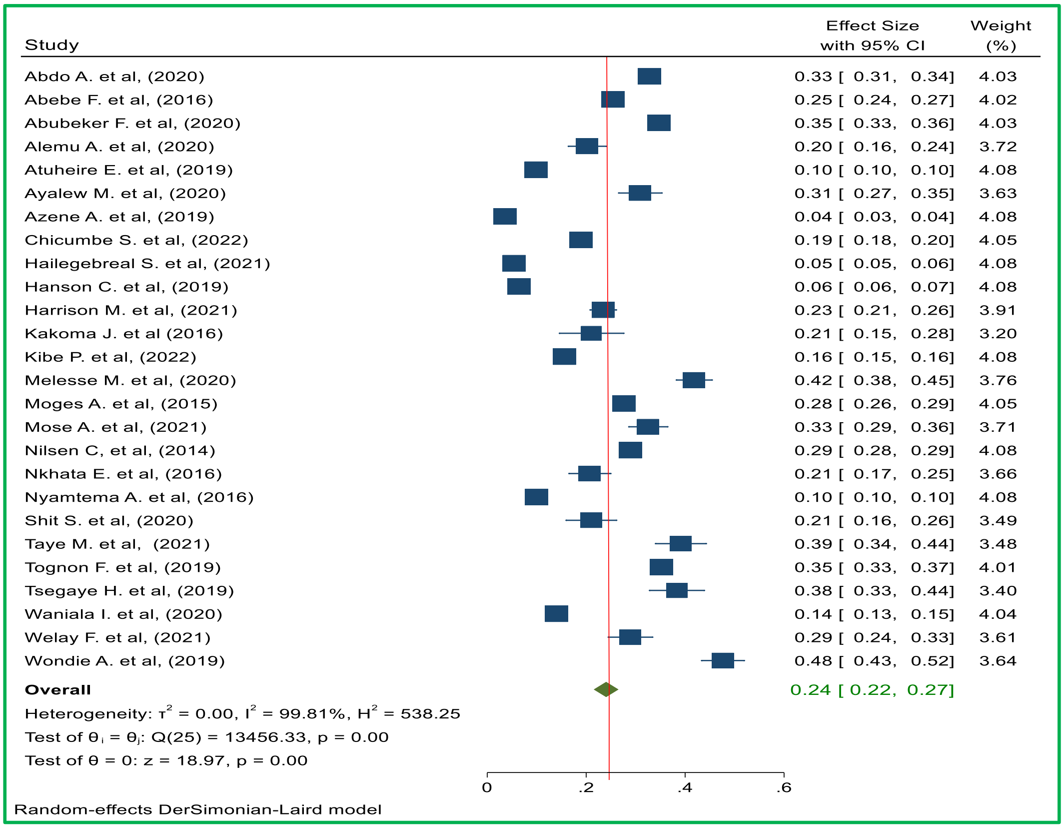

Fig. 2. Forest plot shows overall pooled prevalence of caesarean section among women's who gave birth in Eastern Africa.

3.5. Subgroup analysis

3.5.1. Subgroup analysis by country

The subgroup analyses prevalence of caesarean section among different countries. We carried out a subgroup analysis of studies that reported the prevalence of caesarean section in each country. From all the included studies, sixteen studies assessed the prevalence of caesarean section in Ethiopia, four studies in Tanzania, two studies each in Rwanda and Uganda, one studies each in Zambia and Mozambique. The subgroup analysis revealed that the highest pooled prevalence of caesarean sections was in Ethiopia; it was 28.30 % (95%CI; 21.3–35.2 %) and lowest pooled prevalence seen in Uganda, 11.9 % (95%CI; 7.9–15.9 %).

We observed a significant heterogeneity. ($I^2 = 63.06$ %; $P = 0.100$), ($I^2 = 99.73$ %; $P < 0.001$), ($I^2 = 99.96$ %; $P < 0.001$) and ($I^2 = 97.20$ %; $P < 0.001$) for studies in Rwanda, Ethiopia, Tanzania and Uganda respectively (Table 2).

Table 2
Subgroup analysis of the prevalence of caesarean section in East Africa using random effect analysis.

Subgroup	Number of studies	Estimates		Heterogeneity across studies		Heterogeneity between groups (P value)
		Prevalence (%)	95 % Confidence interval	I^2 (%)	P value	
Country						
Ethiopia	16	28.3	0.213–0.352	99.73	$P < 0.001$	$P = 0.001$
Mozambique	1	19.0	0.179–0.201	–	–	
Rwanda	2	17.3	0.124–0.223	63.06	$P = 0.100$	
Tanzania	4	20.1	0.112–0.289	99.96	$P < 0.001$	
Uganda	2	11.9	0.079–0.159	97.20	$P < 0.001$	
Zambia	1	20.7	0.165–0.249	–	–	
Setting						
Community based	6	10.5	0.061–0.149	99.78	$P < 0.001$	$P < 0.001$
Institution based	20	28.2	0.247–0.318	99.82	$P < 0.001$	
Year of publication						
Before 2018	6	22.3	0.121–0.325	99.90	$P < 0.001$	$P = 0.688$
After 2018	20	24.4	0.219–0.270	99.73	$P < 0.001$	

3.5.2. Subgroup analysis by setting

We also performed a subgroup analysis on the basis of the study setting. The pooled prevalence estimates for caesarean section were 10.5 % (95 % CI; 6.1–14.9 %) for studies conducted in the community and 28.2 % (95 % CI; 24.7–31.8 %) for studies conducted in institutions. Significant heterogeneity was seen in both community and institutional settings, (I^2 = 99.78 %, P < 0.001) and (I^2 = 99.82 %, P < 0.001) respectively (Table 2).

3.5.3. Subgroup analysis by publication year

Lastly, we conducted a subgroup analysis based on publication year. The pooled prevalence estimates for caesarean section were 22.3 % (95%CI; 12.1–32.5 %) for the studies conducted before a year 2018 and 24.4 % (95%CI; 21.9–27.0 %) for the studies conducted after 2018. Significant heterogeneity was seen in both studies conducted before and after 2018, (I^2 = 99.90 %, P < 0.001) and (I^2 = 99.73 %, P < 0.001) respectively (Table 2).

3.6. Publication bias

The results of this systematic review and meta-analysis were heterogeneous. To understand the cause of heterogeneity publication bias was assessed. The graphic asymmetry test of the funnel plot which shows asymmetrical distribution, which shows the presence of possible publication bias (Fig. 3) and Egger's regression tests (B = 6.81, SE = 1.172, P = 0.001) (Supplementary 1). This bias is possibly related to the missing of unpublished studies in the country. Other causes could be the inclusion of articles with various methodologies and outcomes of interest for assessing risk factors for caesarean section.

3.7. Sensitivity analysis

We employed a leave-one-out sensitivity analysis to identify the potential source of heterogeneity in the analysis of the prevalence of caesarean section in East Africa. This sensitivity analysis showed that our findings were robust and not dependent on a single study. Our pooled estimated prevalence of caesarean section varied between 23.1 % (20.6–25.6 %) and 24.2 % (21.7–26.8 %) after deleting a single study (Table 3).

3.8. Meta regression

Univariate meta-regression analysis using sample size, response rate, study setting, publication year and country was used as a study variable. A final meta-regression revealed that the study setting with prevalence of caesarean section was statistically significant. Being an institution based study increases the likelihood of caesarean section by a factor of 0.174 times (β = 0.174, 95 % CI: 0.09, 0.26); with a total proportion of caesarean section explain by the covariate study setting by 38.63 % (adjusted R^2 = 38.63). Besides, the pooled prevalence of caesarean section was higher in Ethiopia than in Zambia (β = 0.075, 95 % CI: 0.16, 0.31), summarized in Table 4.

3.9. Factors associated with caesarean section

In this portion of the study, we qualitatively analyzed the factors that were associated with an increased prevalence of caesarean section in Eastern Africa using narration method form the included studies [42–47,59,61,62,64] summarized in Table 5. Overall, we found that the level of adjustment for the potential confounding factors that are responsible for a higher risk of caesarean section was inconsistent in Eastern Africa articles. For instance, in this review we assessed the association between giving birth in private health facility and caesarean section only by two studies [42,62]. Similarly, only two studies examined the relationship between caesarean delivery and the highest level of wealth assets [46,47], and the mother's educational status was college and above [42,47]. In addition, only three studies measured the link between caesarean section and urban residency [43,45,46], and fetal malpresentation [43,45,46]. Additionally, the relationship between caesarean section and other characteristics was examined inconsistently (i.e. in each study, a

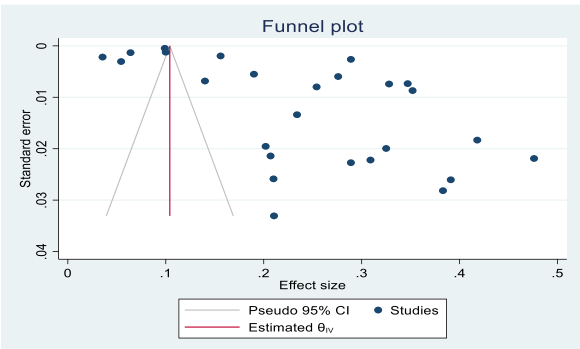

Fig. 3. Funnel plot asymmetry for testing publication bias on studies of caesarean section in Eastern Africa.

Table 3
Sensitivity analysis of prevalence for each study deleted at a time: Prevalence and 95 % confidence interval of caesarean section in Eastern Africa.

Excluded study	Prevalence (%)	95 % Confidence Interval
Abdo A. et al., 2020 [63],	23.6	21.2–26.1
Abebe F. et al., 2016 [64],	24.0	21.5–26.5
Abubeker F. et al., 2020 [65],	23.6	21.1–26.0
Alemu A. et al., 2020 [44],	24.2	21.6–26.7
Atuheire E. et al., 2019 [66],	24.8	21.3–28.3
Ayalew M. et al., 2020 [45],	23.8	21.2–26.3
Azene A. et al., 2019 [37],	24.9	22.4–27.5
Chicumbe S. et al., 2022 [53],	24.2	21.7–26.8
Hailegebreal S. et al., 2021 [32],	24.8	22.3–27.4
Hanson C. et al. (2019) [54],	24.8	22.1–27.6
Harrison M. et al., 202 [55],	24.1	21.5–26.6
Kakoma J. et al., 2016 [56],	24.1	21.6–26.7
Kibe P. et al., 2022 [39],	24.4	21.8–27.0
Melesse M. et al., 2020 [46],	23.3	20.8–25.8
Moges A. et al., 2015 [57],	23.9	21.4–26.3
Mose A. et al., 2021 [43],	23.7	21.2–26.2
Nilsen C et al., 2014 [41],	23.6	21.6–25.7
Nkhata E. et al., 2016 [40],	24.2	21.6–26.7
Nyamtema A. et al., 2016 [58],	24.7	21.8–27.7
Shit S. et al., 2020 [59],	24.1	21.6–26.7
Taye M. et al., 2021 [47],	23.5	21.0–26.0
Tognon F. et al., 2019 [60],	23.5	21.1–26.0
Tsegaye H. et al., 2019 [42],	23.5	21.0–26.0
Waniala I. et al., 2020 [38],	24.5	21.9–27.0
Welay F. et al., 2021 [61],	23.8	21.3–26.4
Wondie A. et al., 2019 [62],	23.1	20.6–25.6

Table 4
Univariate meta-regression analysis of the prevalence of caesarean section in East Africa using random effect analysis.

Study level variable		Adjusted R^2 (%)	Standard error	Coefficient (95 %)	P-value	I^2 (%)
Sample size		6.97	2.92	−4.93(-1.07, 7.88)	0.091	99.89
Response rate		10.09	0.011	−0.022(-0.04, 0.003)	0.054	99.94
Study setting	Community	1	1	1	1	1
	Institution	38.63	0.043	0.174(0.09, 0.26)	<0.0001[a]	99.88
Publication year	Before 2018	1	1	1	1	1
	After 2018	0	0.033	0.023(-0.042, 0.088)	0.488	99,80
Country	Zambia	1	1	1	1	1
	Ethiopia	3.97	0.12	0.075(-0.16, 0.31)	0.534	99.87
	Mozambique		0.164	−0.017(−0.34, 0.31)	0.918	
	Rwanda		0.144	−0.025(-0.31, 0.26)	0.863	
	Tanzania		0.131	−0.006(-0.26, 0.25)	0.964	
	Uganda		0.143	−0.088(−0.38, 0.19)	0.540	

NB.
[a] Statistically significant at 5 % level, **CI:** Confidence interval.

number of characteristics are measured as potential predisposing factors for caesarean delivery).

As a result, it was challenging to integrate and present the pooled mean effect of covariates associated with caesarean section in East Africa. In this study, the determinants of caesarean section were divided into three categories: socioeconomic factors (four), obstetric-related factors (seven), and reasons for decision and other factors (three).

3.9.1. Sociodemographic factors

Four sociodemographic factors were found to significantly increase the chance of caesarean section [42,45–47]. The sociodemographic factors significantly associated with caesarean section included women residing in urban areas (AOR: 4.04; 95%CI: 2.19–7.45) [45], the highest level of wealth asset(AOR: 5.39; 95%CI:1.0–26.8) [46], mother who had collage and above(AOR: 3.46; 95%CI: 1.2–10.76) [42], and women aged between 15 and 24 years (AOR: 0.2; 95%CI: 0.07–0.52) [46]. Furthermore, those aged between 35 and 39 years (AOR: 5.3; 95%CI: 1.43–19.62) [47] were associated with caesarean section delivery (Table 5).

3.9.2. Obstetric-related factors

Seven obstetric-related predictors were significantly and positively associated with a higher risk of caesarean section in Eastern Africa [42–45]. Women who gave birth to new-borns weighting ≥4000 gm (AOR: 11; 95%CI: 2.30–57.5) [44], and had been augmentation (AOR: 3.14; 95%CI: 1.49–6.57) [44] were at a greater risk of caesarean section. Likewise, women who had history of

Table 5
Characteristics of factors associated with caesarean section in East Africa.

Factors	AOR	95 % CI	Strength of association	Author, (Year) (Reference)
Mothers age between 15 and 19	0.63	0.43–0.93	Moderate, Negative	Abebe F. et al. (2016) [64]
Women who had been augmentation	3.14	1.49–6.57	Strong, Positive	Alemu A. et al. (2020) [44]
Pregnancy induced hypertension	3.1	1.23–7.83	Strong, Positive	Alemu A. et al. (2020) [44]
Women who gave birth of ≥4000 gm	11	2.30–57.5	Strong, Positive	Alemu A. et al. (2020) [44]
Women with unknown gestational age	5.83	2.37–14.31	Strong, Positive	Alemu A. et al. (2020) [44]
Women in urban resident	4.04	2.19–7.45	Strong, Positive	Ayalew M. et al. (2020) [45]
Fetal malpresentation	2.56	1.29–5.05	Moderate, Positive	Ayalew M. et al. (2020) [45]
Previous caesarean section	9.11	3.77–22.01	Strong, Positive	Ayalew M. et al. (2020) [45]
Antepartum haemorrhage	8.65	3.82–19.56	Strong, Positive	Ayalew M. et al. (2020) [45]
Breech presentation	3.64	1.49–8.89	Strong, Positive	Melesse M. et al. (2020) [46]
Urban residence	6.54	2.59–16.48	Strong, Positive	Melesse M. et al. (2020) [46]
Women age between 15 and 24 years	0.2	0.07–0.52	Strong, Negative	Melesse M. et al. (2020) [46]
Para two	3.88	1.15–13.08	Strong, Positive	Melesse M. et al. (2020) [46]
Highest level of wealth asset	5.39	1.08–26.8	Strong, Positive	Melesse M. et al. (2020) [46]
Urban Residence	2.58	1.66–4.01	Moderate, Positive	Mose A. et al. (2021) [43]
Multiple pregnancies	3.15	1.89–5.23	Strong, Positive	Mose A. et al. (2021) [43]
Malpresentation	3.05	1.77–5.24	Strong, Positive	Mose A. et al. (2021) [43]
Previous history of caesarean section	3.55	2.23–5.64	Strong, Positive	Mose A. et al. (2021) [43]
Fetal weight between 2500 and 4000g	5.54	1.72–17.84	Strong, Positive	Shit S. et al. (2020) [59]
Mothers with ages of 35–39 years	5.3	1.43–19.62	Strong, Positive	Taye M. et al. (2021) [47]
Previous history of C/S	3.4	1.64–7.03	Strong, Positive	Taye M. et al. (2021) [47]
Educational status was college & above	3.43	1.33–8.81	Strong, Positive	Taye M. et al. (2021) [47]
Monthly income of >6000 Eth. birrs	2.43	1.20–4.94	Moderate, Positive	Taye M. et al. (2021) [47]
Mother who had collage and above	3.46	1.2–10.76	Strong, Positive	Tsegaye H. et al. (2019) [42]
Giving birth in private health facility	1.48	1.84–2.59	Moderate, Positive	Tsegaye H. et al. (2019) [42]
Young age	12.9	0.23–7.1	Strong, Positive	Welay F. et al. (2021) [61]
Previous caesarean delivery	2. 86	1.64–5.01	Moderate, Positive	Wondie A. et al. (2019) [62]
Being a private hospital delivery	6. 79	4.18–11.01	Strong, Positive	Wondie A. et al. (2019) [62]

NB: AOR: Adjusted odds ratio, **CI:** Confidence interval.

previous caesarean section (AOR: 9.11; 95%CI: 3.77–22.01) [45] and those who giving birth in private health facility (AOR: 1.48; 95% CI: 1.84–2.59) [42]. In addition, those women with unknown gestational age (AOR: 5.83; 95%CI: 2.37–14.31) [44] and had multiple pregnancies (AOR: 3.15; 95%CI: 1.89–5.23) [43] were associated with a higher risk of caesarean section(Table 5).

3.9.3. Reason for decision and other factors

Three reasons for decision and other factors were associated to an increased incidence of caesarean section in Eastern Africa [43–45]. Women who had pregnancy induced hypertension (AOR: 3.1; 95%CI: 1.23–7.83) [44] and had antepartum haemorrhage (AOR: 8.65; 95%CI: 3.82–19.56) [45] were associated with a significantly increased risk of caesarean section. Moreover, those who have fetal malpresentation (AOR: 3.05; 95%CI: 1.77–5.24) [43] were more likely to have caesarean section.

4. Discussion

In the present meta-analysis revealed that the pooled prevalence of caesarean section in this study was 24.0 % (95%CI: (20–27 %)). This finding was consistent with the results of a prior systematic review and meta-analysis, which revealed pooled estimates for caesarean section in Sub-Saharan African countries 19 % [33], 27.2 % in Brazil [68] and 29.55 % in Ethiopia [36].

The results of the present meta-analysis were higher than meta-analysis results from the studies conducted in 9 developing countries in South East Asia which is 13 % [69] and another two systematic review and meta-analysis from Africa: 17.6 % in Nigeria [70] and 9.9 % in Cameron [71]. However, lower than a systematic review and meta-analysis conducted in Iran found 48 % prevalence of caesarean section [72]. These differences could be attributed to the socioeconomic and cultural variations across the countries. The other possible reasons for the observed variation may be increasing electronic fetal monitoring availability and accessibility in referral and general hospitals. Furthermore, another evident reason for the differences could be sample size, data collected from various study settings and study periods.

In this review, we found factors with strong scientific evidence as determining factors for caesarean section in various studies, such as residency, level of wealth asset, level of education, woman's age, birth weight of new-born, augmentation of labor, history of previous caesarean section, place of delivery, unknown gestational age, multiple pregnancies, pregnancy induced hypertension, antepartum haemorrhage and fetal malpresentation were either not assessed or included in the model as confounding factors in each of the five included studies [42–47].

Furthermore, we found that the level of adjustment for the potential confounding factors responsible for a higher risk of caesarean section was inconsistent in Eastern African studies. For instance, in this review, we observed that the association between the giving birth in private health facility and caesarean section was assessed only by two studies [42,62]. Likewise, only two studies measured the relationship between caesarean section and highest level of wealth asset [46,47], and mothers educational status were college and above [42,47]. In addition, only three studies measured the link between caesarean section and urban residency [43,45,46], and fetal malpresentation [43,45,46].

5. Limitations of the study

This meta-analysis has its own limitations. The first limitation of this study was almost all studies included in this study were used retrospective cross-sectional study design as a result; the outcome variable might be affected by other confounding variables. In addition, this review study having a small sample size was included, which may influence the estimated pooled prevalence reported. Moreover, there was significant variability among the studies; due to inconsistent adjustment and inclusion of factors estimating caesarean section, we carried out only a qualitative analysis for associated factors of caesarean section.

6. Conclusion and recommendations

The overall pooled prevalence of caesarean section in this study was high compared to WHO proposed recommended range (10–15 %). There were variations in pooled prevalence of CS within the country; highest prevalence was seen on Ethiopia (higher than WHO recommended range) and lowest on Uganda (between WHO recommended range).

Therefore, the finding implies that each East African countries Ministry of Health and health care professionals shall be given particular emphasis made on strengthening antenatal care services can help in identifying high-risk pregnancies, ensure more women have access to skilled healthcare professionals during childbirth and encourage healthcare providers to offer and women to consider vaginal birth after caesarean section (VBAC) if they meet certain criteria and it is safe to do so. This can help in providing appropriate interventions and support to women and reducing the need for emergency and unnecessary caesarean sections.

The result of this research are a baseline data for future researchers to conduct further studies to better understand the reasons behind the high rates and identify potential interventions and solutions specific to the African context.

In this review, we found that the level of adjustment for the possible confounding factors responsible for a higher risk of having a caesarean section was inconsistent in Eastern African studies. Studies on the prevalence of caesarean section and associated factors in each country with adequate sample sizes, as well as studies focused on scientifically reasonable and consistent factors on cesarean section, are encouraged.

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data and materials

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request (Abrham Tesfaye, abrhamtesfaye95@gmail.com)

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Data availability statement

The data associated with this study have not been deposited into a publicly available repository. It is important to note that sharing research before publication opens it up to critique, which can be useful for improvement. However, during the under review phase, research undergoes rigorous peer review, and revisions are often made based on reviewer feedback. Sharing unfinished work could result in dissemination of incorrect or incomplete information, potentially damaging the researcher's reputation or credibility. However, the necessary data of this review will be provided upon request.

CRediT authorship contribution statement

Abrham Tesfaye Habteyes: Methodology, Formal analysis, Conceptualization. **Mihret Debebe Mekuria:** Data curation, Conceptualization. **Haweni Adugna Negeri:** Writing – review & editing, Validation, Data curation. **Roza Teshome Kassa:** Supervision, Software, Resources, Methodology. **Leul Kitaw Deribe:** Writing – original draft, Methodology, Formal analysis. **Endalew Gemechu Sendo:** Writing – review & editing, Validation, Software.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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List of abbreviations

CS Caesarean section
CSR Caesarean sections rate
PROSPERO International Protocol Registration of Systematic reviews
PRISMA Preferred Reporting Items for Systematic and meta-analysis
WHO World Health Organization

Ethics declarations.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2024.e32511.

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