Prevalence and associated factors of caesarean section in Ethiopia: systematic review and Meta-Analysis

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Abstract

Background Globally, maternal mortality is a serious public health concern. Caesarean section with reasonable medical indication reduces maternal mortality. In Ethiopia, a number of studies about prevalence and associated factors of C-section among mothers were conducted. The findings of these studies were inconsistently reported and more variable. Nationally, the prevalence of C-section isn't estimated. Therefore, the aim of this systematic review and meta-analysis was to estimate pooled prevalence of C-section and its associated factors among mothers in Ethiopia. Methods International (PubMed, MEDLINE, EMBASE, CINAHL, Google Scholar, Science Direct, and Google) and national (Ethiopian medical journal, Addis Ababa University Digital Library and Haramya University Digital Library) electronic databases were systematically searched from August 1 to October 1, 2019. All observational studies noted the prevalence of C-section and its associated factors among mothers in Ethiopia were included. Two authors (AG and AM) independently extracted all essential data using a standardized data extraction format. The extracted data were analyzed using STATA Version 14.1statistical software. We assessed heterogeneity among the included studies through the Cochrane Q test statistics and I 2 test. Lastly, a random effects meta-analysis model was fitted to estimate overall prevalence of C-section and its associated factors. Results Our search identified 573 studies amongst which 25 representing 53,381 participants were included for the final analysis stage. We found that the overall prevalence of C-section among mothers in Ethiopia was 29% (95%CI: 25, 32). Furthermore the subgroup analysis revealed that the highest pooled prevalence was observed in the Addis Ababa administrative city (35%) followed by Amhara (27%) and the smallest was observed in Oromia (25.6%). Mothers having a history of previous C-section (OR: 7.63, 95% CI: 3.29, 17.68) and delivery place (OR: 4.63, 95%CI: 2.06, 10.29) were statistically significant association with C-section. Conclusion In this study, the prevalence of C-section among mothers was 29% in Ethiopia which are high. This finding is twice higher than WHO recommendation, which not beyond 15%. Mothers' having history of previous C-section and delivery place was factors associated with C-section among mothers in Ethiopia. We recommend that the Minster of health should give intervention about C-section in a private institution.

Background

Maternal mortality is a serious public health concern in worldwide and Sub-Saharan Africa including Ethiopia (1). Maternal mortality due to obstructed labor/uterine rupture was 29% in Ethiopia (2). Caesarean section reduces maternal mortality when adequately apply with medical indication (3–5). However, there is a growing concern about unnecessary C-section leads to short term and long term risks of mothers and infants (6, 7).

In Ethiopia, the prevalence of C-section was beyond WHO recommendation, which is not more than 15% (7, 8). Despite of the fact that maternal mortality has not significantly changed (1). Maternal health remains a major concern, especially in developing countries like Ethiopia (9). A number of studies were conducted to determine the magnitude of C-section and its associated factors. These studies indicated that the prevalence increases recently and most of them revealed that the prevalence is above the optimal

range 15% (7, 10). But some studies reflected that it is below the cutoff point (11). According to the 2016 Ethiopia Demographic and Health Survey report, 1.9% of mothers undergoing to C-Sect. (9). However, the prevalence indicated in these studies have higher variation and inconsistent (11, 12). Therefore, policy maker and concerned bodies are confused to take action due to the variation of the prevalence in the country.

In addition to prevalence, identifying most associated risk factors is a critical step to take remedial. There is no study which assessing the prevalence and factors associated with C-section as a country level and it is a significant gap of the previous work. Therefore, the objective of this systematic review and meta-analysis was to estimate the pooled prevalence and associated factors of C-section using available literature in Ethiopia. The findings from this systematic review and meta-analysis will be used in assessing the prevalence and associated factors of C-section with implications to amend interventions, to reduce the prevalence and to protect an unnecessary C-section among reproductive age woman in the country.

Methods

Study setting and design

A systematic review and meta-analysis was conducted to determine the pooled prevalence and associated factors of C-section in Ethiopia. Ethiopia is found in East Africa and currently, the Ethiopian population is estimated to be 112,555,079.

Search strategies

This review was prepared according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) (13). To identify eligible articles, all-embracing search was performed with English language restriction from the following international electronics database: PubMed, MEDLINE, EMBASE, CINAHL, Google Scholar, and Science Direct. In addition to this, national database like an Ethiopian medical journal, Addis Ababa University Digital Library and Haramya University Digital Library were searched. Assuming that such language restriction does not alter the outcome of the systematic reviews and meta-analyses (14). Snow ball searching was done from the list of references of the eligible studies to included missed articles from our search strategy.

First, we have searched studies by writing a title “prevalence and associated/determinant factors of caesarean section in Ethiopia” from each database. For instance, we searched using the following keywords: “prevalence”, “associated factors”, “determinant factors”, “cesarean section”, “caesarean section”, “delivery”, “mothers” and “Ethiopia”. The search terms were used separately and in combination using Boolean operators like “OR” or “AND”. We have searched articles from the above electronic database between August 1, 2019 and October 1, 2019. All papers published until August 1, 2019 was included. After identifying potentially relevant studies using our search strategy, studies were retrieved and managed using Endnote X9 software.

Eligibility criteria

Study area

Only studies conducted in Ethiopia.

Population

Only studies involving on mothers who have at least one birth.

Publication condition

Both published and unpublished full text accessible articles were included. Articles reported national survey or duplicated also excluded.

Study design

All observational prevalence study designs (i.e. cross-sectional, case-control and cohort) reporting the prevalence of C-section were eligible for this review.

Language

Only articles reported in the English language were considered.

Outcome measurements

This review considered two main outcomes. The primary outcome variable of this study was the prevalence of C-section. It is defined as a prevalence of C-section, cesarean section, Caesarean delivery. The second outcome of this study was to identify factors associated with C-section of mothers among a reproductive age. We determined the association between C-section and associated factors in the form of the log odds ratio. Three major factors, which assessed by each studies were selected to explore their association with C-section. For each factor, the odds ratio was calculated or extracted based on the data reported by each study. The factors assessed in this review were delivery place type (private or public), previous history of C-section (Yes versus no) and gestational age (< 37, ≥ 37 week).

Data extraction

All necessary data were extracted by all authors (AG and AM) independently using a standardized data extraction form, which was adapted from the JBI data extraction format (15). Any disagreements during data collection were resolved through discussion. For the prevalence outcome; primary author, publication year, regions where the study was conducted, study area, sample size, study design and prevalence with 95% confidence intervals were extracted. For the latter outcome, data were extracted in a format of the odds ratio for each factor was extracted on the reports of original studies.

Risk of bias assessment

All authors (AG and AM) independently assessed the quality of each original study using the quality assessment tool. Joanna Briggs Institute (JBI) critical appraisal checklist for prevalence study was used which have nine questions (15, 16). Quality assessment was done for included studies in this review. The quality of each study categorized into three categories as “low risk of bias” (the sum of quality score ≥ 6), “medium risk of bias” (sum of quality score between 3 and 5, inclusively) and “high risk of bias” (sum of quality score less than 3). All published and unpublished studies having greater or equal to five quality score was included. Any disagreement between the two authors was resolved through discussion.

Data processing and synthesis

After essential data extracted, it was entered to Microsoft Excel, and then it exported to STATA Version 14.1 Statistical software to analyze. The existence of heterogeneity was assessed using a Cochrane Q test and I^2 test statistics. For results with statistically significant heterogeneity ($I^2 \geq 50$, P−value < 0.05), Dersimonian and Liard random effect model was used (17). We used the Egger test statistics to assess publication bias. We used forest plot to present estimated value with the 95% confidence interval (CI). We conducted subgroup analyses by region, sample size, publication year, the risk of bias and study design. Additionally, association of C-section with previous history of C-section, place of delivery and gestational age was conducted.

Results

Studies Selection

Totally 573 titles and abstracts were searched using previously noted electronics databases. Among these potentially relevant articles, 306 studies were excluded due to duplication. Furthermore, 235 studies were excluded after detail reviewed their abstract as they did not report the prevalence and associated factors of C-section among woman. Therefore, the remaining 32 articles were satisfying the minimum criteria to be included and their full text articles were accessed. Of those fully accessed studies, three articles reported by national survey (11, 18, 19), three articles were inaccessible of their full text (20–22) and one article published twice in different journals were excluded (23). Finally, 25 studies were included in the final meta-analysis Fig. 1.

Characteristics of included studies

All studies included in this review published between 2012 and 2018. Of all the included studies, only two studies were used retrospective cohort study (24, 25) and the rest were used institutional based cross sectional study design (7, 10, 12, 26–44). From 25 studies, 53381 mothers participated to estimate the prevalence whereas, 11 studies were reported associated factors of C-section in Ethiopia. The number of participants in each study varies from 60 (37) to 17761(28). Regarding the prevalence of C-section, the smallest and highest prevalence was 11% and 63.7%, which reported in a study conducted in Amhara (45) and Private hospital Addis Abeba (38), respectively.

Only five Ethiopian regions, two in Ethiopian university hospitals and one administrative town were represented. Seven studies were from Addis Ababa, five from SNNP, three from Amhara, three from Oromia, three from Harerri, two from Ethiopia and Ethiopian university Hospitals, and the remaining from Tigray Table 1.

Prevalence of C-section in Ethiopia

The pooled prevalence of C-section among mothers in Ethiopia was 29.0% (95%CI: 25, 32) Fig. 2. The result of the included studies was heterogeneous ($I^2 = 98.7$, $p < 0.001$). Therefore, we used Dersimonian and Liard random effect model to estimate the pooled prevalence. We assessed possible sources of heterogeneity using variables sample size and publication year, but they haven't statistically significant relation with this heterogeneity in univariable meta-regression Table 2. We visualized the presence of publication bias using funnel plot.

Table 1
, Descriptive summery of 24 studies included in meta-analysis of C-section in Ethiopia. 2019

Author	Publication year	Region	Study area	Sample size	Study design	Prevalence (%)
Abebe, et al (10)	2015	Amhara	FHRH	2967	IBCS	25.4
Tsega, et al (41)	2015	Harer	Harer tawon	630	IBCS	34.3
Aman. et al (28)	2014	A.A	A.A	17761	IBCS	36.16
Bayu YT, et al (32)	2016	A.A	A.A	835	IBCS	19.2
Marye, et al (36)	2018	A.A	T.Ambessa	1713	IBCS	32.5
Melkie, et al (37)	2012	A.A	T.Ambessa	60	IBCS	28.3
Sinishaw (39)	2018	Oromia	Gelemso G.H	333	IBCS	28.2
Amin A.(29)	2016	Harer	Gelemso G.H	2080	IBCS	24.65
Olanipekun. (38)	2017	A.A	A.A privet hospital	411	IBCS	63.7
Kuzma (24)	2016	Ethiopia	Ethiopian National	1383	RC	32.8
Wae, et al (25)	2017	SNNP	Arba Minch	1980	RC	24.64
Gutema, et al. (35)	2014	SNNP	Mizan Aman	342	IBCS	21.1
Tura AK. et al (43)	2017	Ethiopia University	Eastern Ethiopia	4758	IBCS	25.7
Bago (31)	2018	SNNP	Hawassa	414	IBCS	35.4
Alemayehu et al (27)	2015	Oromia	Mattu karl hospital	3346	IBCS	21.73
Hiwot Tesfaye (42)	2017	A.A	A.A hospital	298	IBCS	38.3
Ayano and Guto (30)	2017	A.A	st Paulos hospital	2345	IBCS	24.8
Wondie et al (7)	2013	Amhara	Dessie tawon	512	IBCS	47.6

IBCS = Institutional based cross-sectional, RC = retrospective cohort, A.A = Addis Ababa

Author	Publication year	Region	Study area	Sample size	Study design	Prevalence (%)
Eyowas, et al (12)	2016	Amhara	FHRH	3003	IBCS	25.31
w/gebriel et al (33)	2018	SNNP	Mizan and bonga	727	IBCS	25.07
Akki SJ, et al (26)	2015	SNNP	Attat hospital	3722	IBCS	27.6
Gebre et al (34)	2017	Tigray	West tigray	749	IBCS	13.2
Yohanes T. (44)	2016	Hareri	Hiwot Fana	407	IBCS	25.1
Taye, et al (40)	2015	Oromia	Jimma University	338	IBCS	28.1
Yenit, et al (45)	2016	Amhara	Fnoteselam	2267	IBCS	11.0
IBCS = Institutional based cross-sectional, RC = retrospective cohort, A.A = Addis Ababa						

However, Egger's test statistics assured that there is no statistically significant publication bias (p = 0.77).

Table 2
Univariable meta regression model factors related with heterogeneity with caesarean section in meta-analysis in Ethiopia

Variables	Coefficient	I^2(%)	P-value
Sample size	7.98-07	98.01	0.899
Year of publication	-0.003	98.43	0.815

Subgroup analysis

In this study, addition to univariable meta-regression, we conducted subgroup analyses to identify potential source of heterogeneity and the distribution of C-section using region of the country where the study was conducted, sample size, year of publication and study design. As a result; the highest pooled prevalence was 35% in the Addis Ababa administrative city followed by Amhara region (27%), whereas the smallest prevalence observed in Oromia region (25.6%). Heterogeneity test between region was statistically significant (p-value < 0.001). The subgroup analyses based on sample size also showed a study which has a sample size less than 750 participant mothers highest (32%) than a study having a sample size greater than 750 (26%) but the difference between groups was not statistically significant (p-value = 0.05). This result indicated that the finding is robust over sample size. Moreover, the pooled prevalence of C-section was 27% and 31% for a studies conducted before and after 2017, respectively. We

found a significant heterogeneity difference between an article published before and after 2017 (p-value < 0.001) Table 3.

Table 3
Subgroup analysis of the prevalence of caesarean section in Ethiopia, 2019

Variables	Subgroup	No Studies	Prevalence (%)	I^2 (%)	P-value	Heterogeneity p-value
Region	Amhara	4	0.27(0.17, 0.38)	99.52	< 0001	< 0.001
	Addis Abeba	7	0.35(0.28, 0.42)	98.58	< 0001	
	SNNP	5	0.27(0.24, 0.30)	85.22	< 0001	
	Harerr	3	0.28(0.22, 0.34)	90.58	< 0.001	
	Oromia	3	0.25(0.21, 0.31)	82.91	0.003	
	Other	3	0.25(0.15, 0.33)	98.46	< 0.001	
Sample Size	≤ 750	12	0.32(0.24, 0.40)	97.78	< 0.001	0.054
	> 750	13	0.26(0.21, 0.30)	99.14	< 0.001	
Publication year	Before 2017	15	0.27(0.22, 0.32)	99.04	< 0.001	< 0.001
	After 2017	10	0.31(0.26, 0.36)	97.92	< 0.001	
Study Design	RC	2	0.29(0.21, 0.37)	89.40	< 0.001	0.992
	IBCS	23	0.29(0.24, 0.32)	98.82	< 0.001	
Risk of bias	Low risk	19	0.29(0.25, 0.35)	98.30	< 0.001	< 0.001
	Medium risk	6	0.29(0.23, 0.34)	98.40	< 0.001	

Risk of bias assessments of included studies

We assessed the quality of each study included in this review based on the JBI appraisal tool. Of the included studies, 19 (76%) are low risk of bias, 6 (24%) studies were medium risk of bias and no studies which is a high risk of bias. We found the prevalence of C-section was 29% for both low risk bias and

medium risk studies, although the difference between group is significant (p-value = < 0.001) Table 3. This result same as the overall prevalence of C-section (29%) since all the included studies were good in quality.

Factors associated with C-section

In this systematic review and meta-analysis, we assessed factors associated with C-section. A separate analysis was conducted for each factor of previous history of C-section, place of delivery and gestational age. Six studies reported the association between previous history of C-section and C-section. We found a total of 5191 mothers participated to assess the association between those variables from the six studies. As we see from Fig. 3, there is a statistically significant association between previous history of C-section and C-section. The pooled odds ratio showed that the odds of undergoing to C-section was 7.63 times higher mothers' who had a previous history of C-section compared to who hadn't previous history counterparts (OR: 7.63, 95% CI: 3.29, 17.68).

Additionally, Two studies were assessed the association between mother's place of delivery and C-section(7, 41). Using 1142 mothers, the pooled odds ratio of indicated that mothers were delivered in private institution were 4.63 times more likely undergoing to C-section as compared to those mothers delivered in public institutions (OR: 4.63, 95%CI: 2.06, 10.29) Fig. 4. Finally, three studies were examined the association of gestational age with C-section. All of those studies reported that gestational age significantly associated with C-section. Of those studies, we have got 4471 mothers who participated to estimate the pooled odds ratio. Consequently, the results of the random effect model of this study revealed that gestational age had no statistically significant association with C-section (OR: 0.71, 95%CI: 0.17, 3.03) Fig. 5.

Discussion

Maternal mortality and morbidity is one of the major problems due to delivery in Ethiopia. Ethiopian demographic, health survey 2016 reported that, maternal mortality due to pregnancy related cause was 25% (9). Estimating the pooled prevalence of C-section and its associated factors in the country may contribute to informing policy makers to take remedial. As far as our knowledge this is the first systematic review and meta-analysis study to determine the overall prevalence of C-section and its associated factors among mothers in our country.

This meta-analysis revealed that 29% (95% CI: 25, 32) of mothers experiencing C-section in Ethiopia. This finding is inconsistent much higher with the 2016 Ethiopian DHS report, which indicated that 1.9% of mothers undergoing to C-Sect. (9). The possible reason for the above difference could be the methodological difference in the assessment of prevalence. In addition, this finding is much smaller than a study conducted in Iran using systematic review and meta-analysis, which shows that almost half of Iran, mothers delivered by C-section (48%) (46). The possible reason could be educational variation, cultural difference and their attitude difference attributed this difference.

We found that the overall prevalence of C-section in Addis Ababa is higher than the other regions from the subgroup analysis (34.1% (95% CI: 33.5, 34.7). The lowest prevalence was observed in Oromia with 22.7% (95% CI: 21.4, 23.9). This finding almost agrees with the 2016 Ethiopian DHS, which reported that the prevalence of C-section at Addis Ababa City is almost one in five (21.4%) (9). The possible explanations for this variation might be due to the difference in basic data collection method. In addition to this, the highest prevalence may be related with the awareness of mothers about C-section at Addis Ababa is good than other regions in the country.

In this study, we found that factors having a history of previous C-section and place of delivery statistically significantlly associated with C-section among woman in Ethiopia. As a result, a finding of this study revealed that mothers who had a previous history of C-section more likely experiencing C-section than compared to who hadn't previous history counterparts. The finding of this study is supported by a study done in Iran, which reported that 42.5% of mothers delivered by C-section had history of previous C-Sect. (46).

These studies reported that the odds of undergoing to C-section were higher among mothers who had delivered in private institutions than government. This finding also supported by a study conducted in Egypt (6). The possible reason could be related to access of C-section in health institutions and due to business oriented professional recommendation.

Limitations Of The Study

This meta-analysis has several own limitations. The first limitation of this study was English articles were considered solely to estimate the pooled prevalence in Ethiopia. In addition, all most 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 this review study having a small sample size was included, which may have an effect on the estimated pooled prevalence reported. Therefore, this result might be affected social desirability bias. Furthermore, in this meta-analysis five regions and one administrative city were represented solely, which may reflect non representation due to the limited number of articles included.

Conclusion

In this study, the prevalence of C-section among mothers in Ethiopia was significantly high. We found that history of previous C-section and place of delivery were significantly associated with C-section. In addition, gestational age was not significantly associated with CS. This prevalence was much higher than WHO recommendation, it is essential to reduce it. Therefore, Ethiopian Ministry of Health shall be given particular emphasis to private health institutions for unjustified C-section. Moreover, health educations about the uses and side effect of C-section are recommended.

Abbreviations

CI: Confidence Interval; C-section (CS): caesarean section; EDHS: Ethiopian Demographic and Health Survey; G.H: Generalized hospital; JBI-MAStARI: Joanna Briggs Institute Meta-analysis of Statistics Assessment and Review Instrument; OR: Odds ratio; PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analysis; SE: Standard Error;S.H: specialized hospital; SNNPR: Southern Nations, Nationalities, and Peoples' Region of Ethiopia; WHO: World Health Organization

Declarations

Ethics approval and consent to participate

Not applicable

Consent for publication

Not applicable

Availability of data and materials

All data will be accessible form the correspondence author for a reasonable request.

Competing interests

The authors declare that they have no competing interest.

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Authors' contribution

Author A.G involved in the design stage and title specification. Both authors A.G. and A.M. involved in selection of articles, data extraction, statistical analysis and manuscript writing. All authors have read and approved the final draft of the manuscript.

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Figures

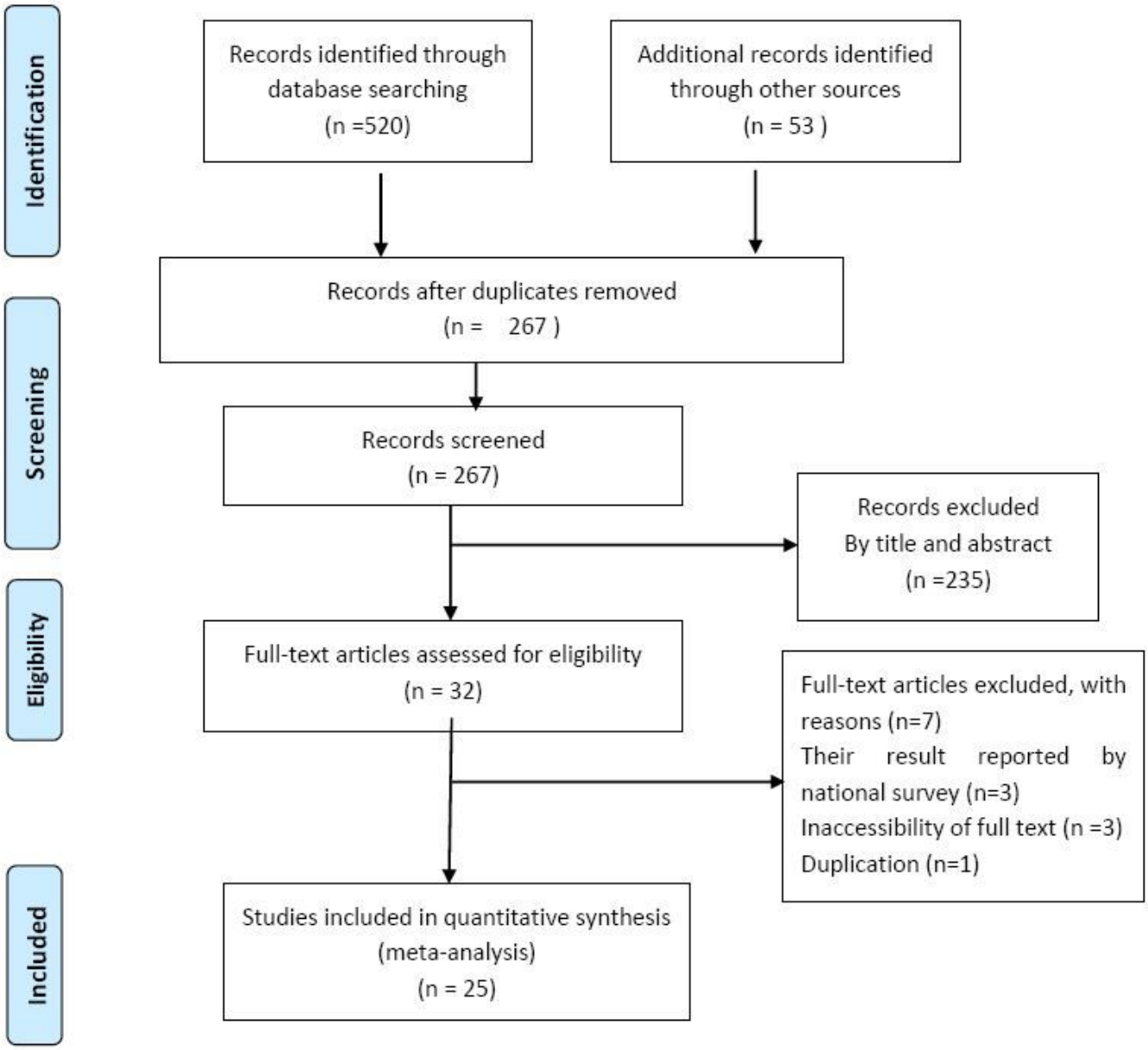

Figure 1

Flow diagram of studies included in Meta analysis

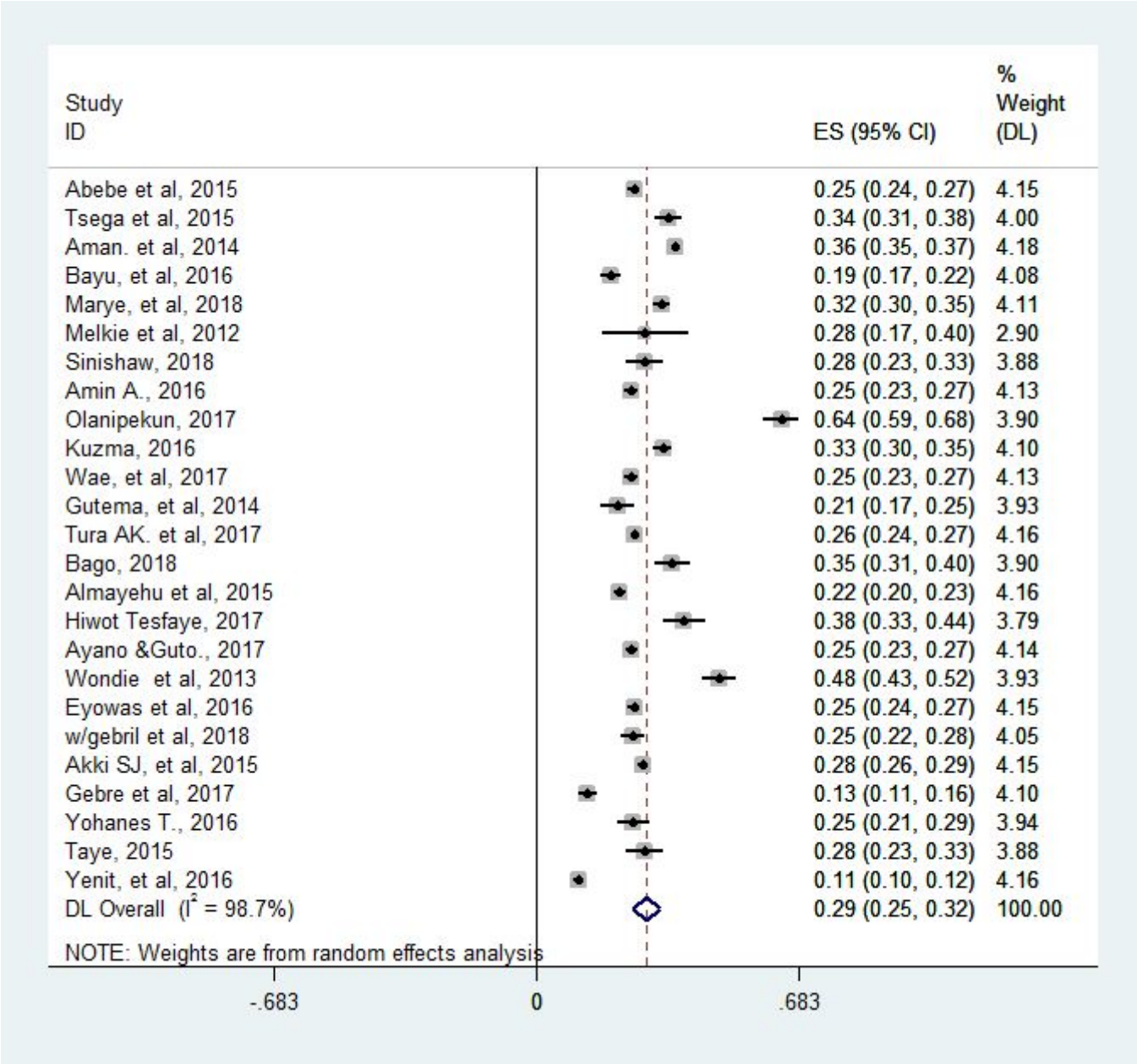

Figure 2

Forest plot the prevalence of C-section in Ethiopia, 2019

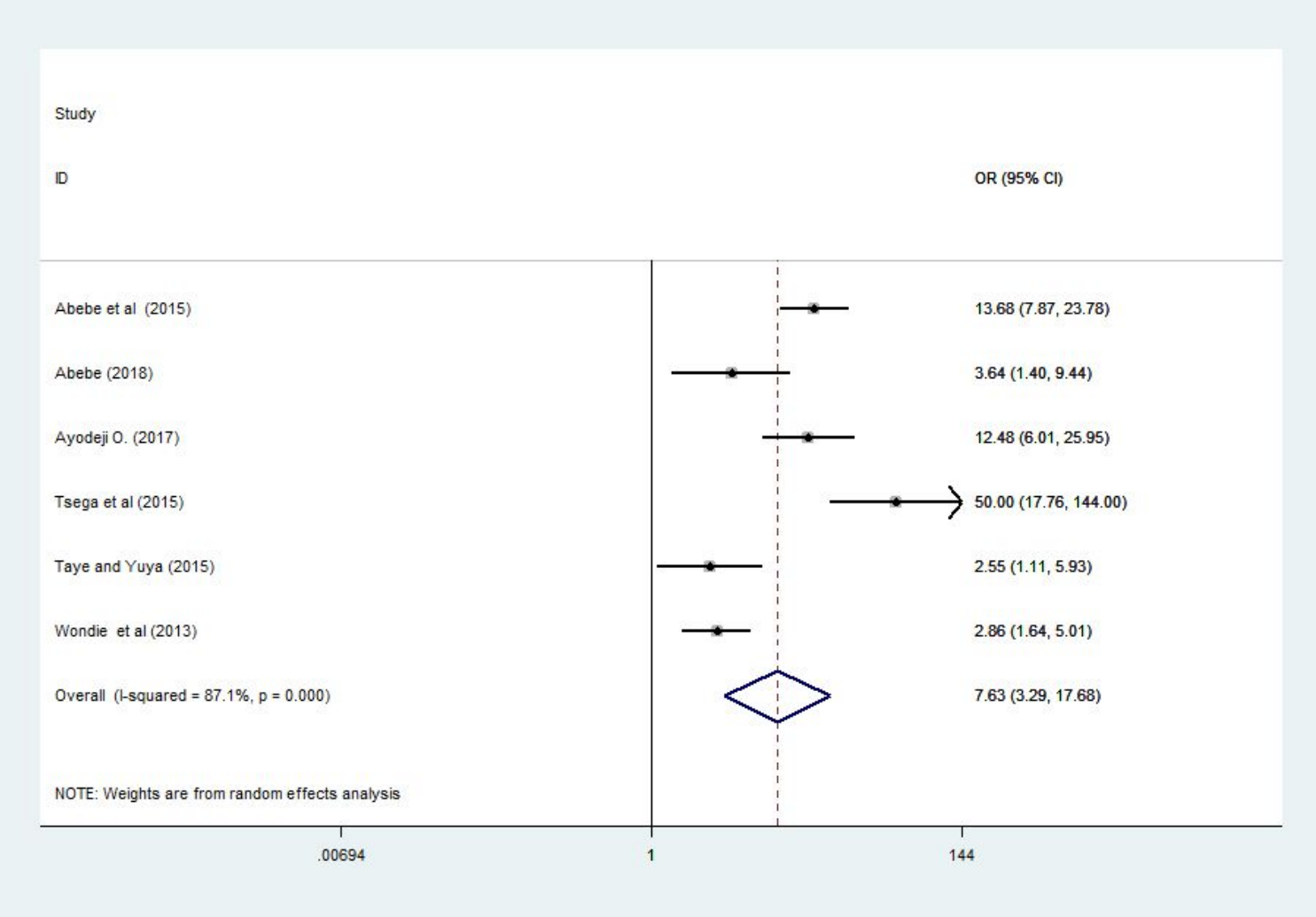

Figure 3

The pooled odds ratio of the association between previous history of CS and CS in Ethiopia

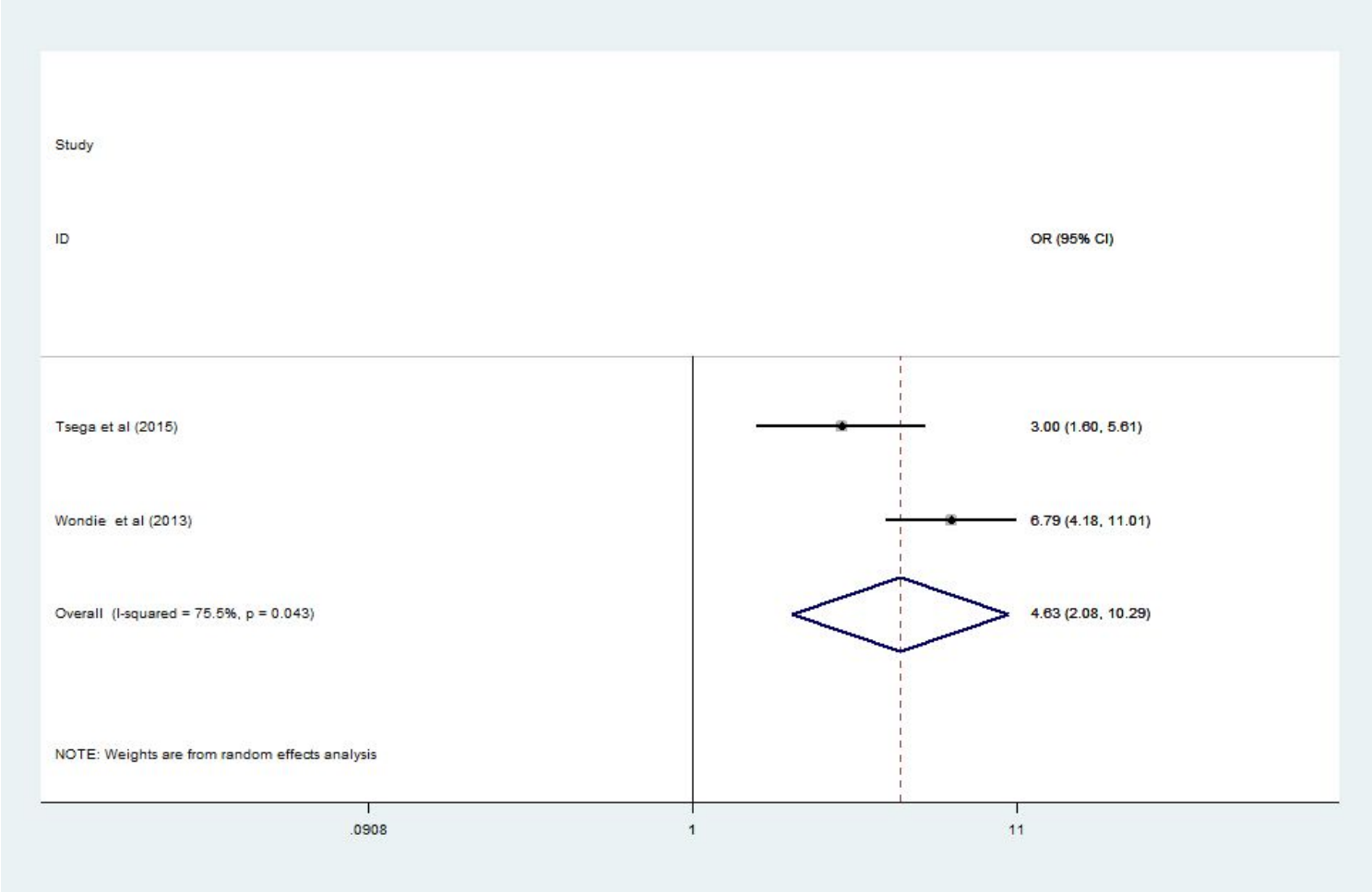

Figure 4

The pooled odds ratio of the association between place of delivery and CS in Ethiopia

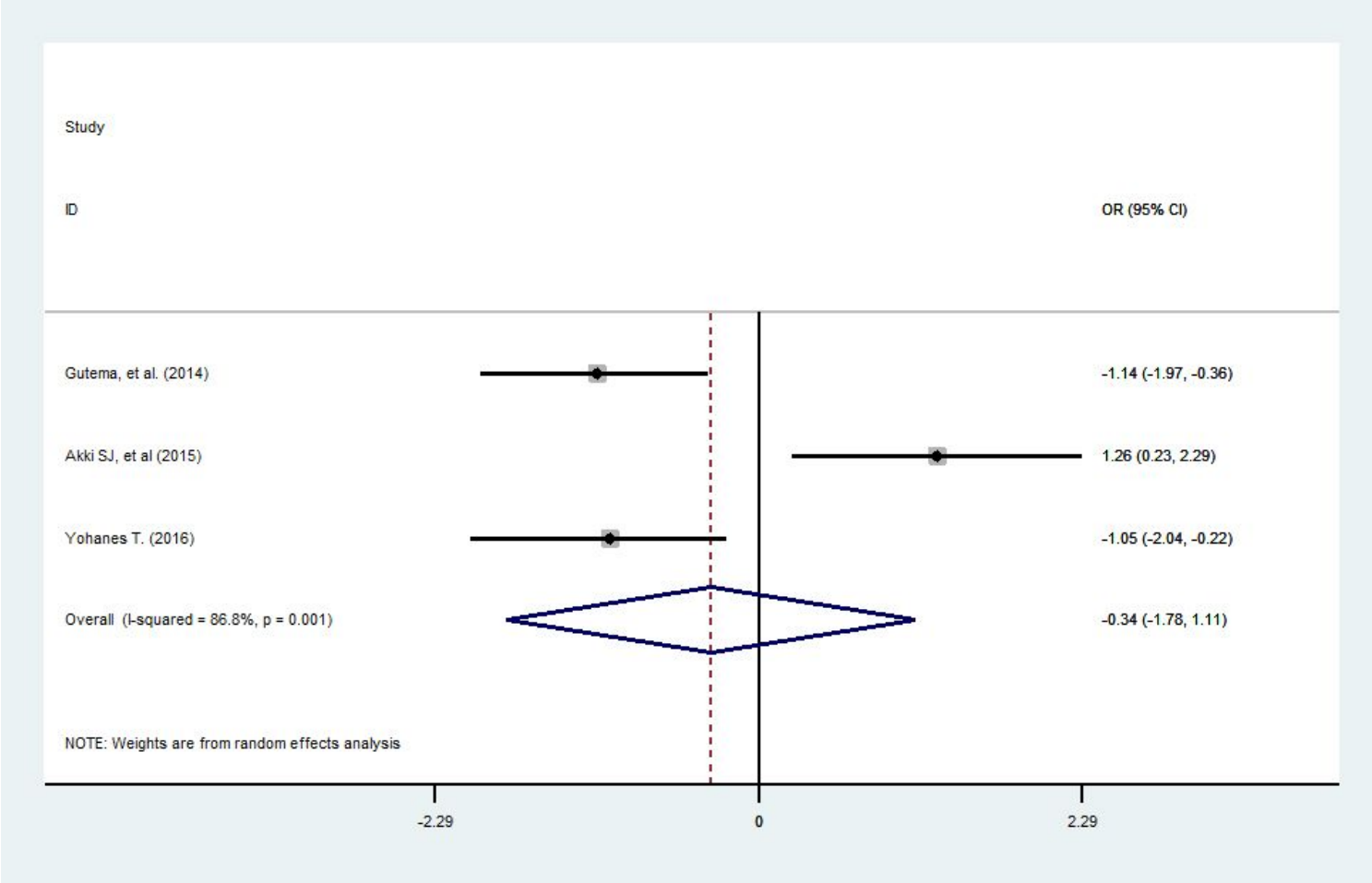

Figure 5

The pooled odds ratio of the association between gestational age and CS in Ethiopia

Supplementary Files

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- PRISMAchecklist.doc