

Magnitude of Postpartum Hemorrhage and Its Associated Factors in Ethiopia: Systematic Review and Meta-analysis.

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Abstract

Background: Postpartum hemorrhage or postpartum bleeding (PPH) is often defined as loss of > 500 ml of blood after vaginal delivery or > 1,000 ml after cesarean delivery within 24 hrs. Postpartum hemorrhage is a leading direct cause of maternal morbidity and mortality in Ethiopia. Therefore, the main objective of this systematic review and meta-analysis was to estimate the pooled magnitude of postpartum hemorrhage and the pooled effect size of the associated factors in Ethiopia.

Methods: Primary studies were searched in PubMed / MEDLINE online, Science Direct and Hinari Cochrane Library, CINAHL, African Journals Online databases, Google and Google Scholars. The search for studies was not limited by time and all articles up to October 10/2021 were included. The data extraction format was prepared in Microsoft Excel. The data extracted from the Microsoft Excel format was exported to Stata Version 16.0 statistical software for analysis. A random effect meta-analysis model was used. Statistical heterogeneity was evaluated by the I^2 test and Egger's weighted regression test was used to assess publication bias.

Result: A total of 165 records from the electronic databases were excluded, but 145 records were excluded for different reasons, and finally 20 studies were included in this final analysis. The pooled magnitude of postpartum hemorrhage in Ethiopia was **8.18%** [95% CI; 6.996 - 9.363]. Older age [OR= 5.038 (95% CI; 2.774 - 9.151)], prolonged labor [OR = 4.054 (95% CI; 1.484 - 11.074)], absence of ANC visit [OR = 13.84 (95% CI; 5.57 - 34.346)] grand-multiparity, [OR = 6.584 (95% CI; 1.902 - 22.795)], and history of postpartum hemorrhage [OR = 4.355 (95% CI; 2.347 - 8.079)] were identified as factors for the occurrence of postpartum hemorrhage.

Conclusions: This study concludes that the magnitude of postpartum hemorrhage in Ethiopia was moderately high. The finding was strongly help different stakeholder working in maternal and child health to focus on the main contributors factors to reduce PPH. Health professionals attending delivery should emphasize high-risk groups of mothers. Encouraging ANC visit and prevent prolonged labor should be recommended to reduce the occurrence of postpartum hemorrhage.

Plain English Summary

Even though other complications are occurred during pregnancy, post-partum hemorrhage is one of the most complications and a frequent health problem during pregnancy and child birth. It can cause severe anemia, ARDS, ARF, coma, cardiac arrest leading to death. Uterine atony, retained tissue, genital tract tear, coagulation problem, and uterine rupture are the most causes of post-partum hemorrhage. In developing countries, PPH is one of the leading causes of maternal mortality, accounting for 25-43% of maternal death. Postpartum hemorrhage is a leading direct cause of maternal morbidity and mortality in Ethiopia. This systematic review and meta-analysis was performed in accordance with the preferred reporting items for systematic reviews and Meta-Analyses (PRISMA). Primary studies were searched from different databases. A random effect meta-analysis model was used, since it reduces heterogeneity among studies.

The current systematic review and meta-analysis included 20 primary studies with a total of 93,600 study participants. The pooled magnitude of postpartum hemorrhage in Ethiopia was **8.18%**. Advanced maternal age, prolonged labor, no antenatal care (ANC) visits, grand multi-parity, previous postpartum hemorrhage were significantly associated with postpartum hemorrhage. The finding of this systematic review and meta-analysis was strongly helping different stakeholders working in maternal and child health to focus on the main contributor factors to reduce PPH. If postpartum hemorrhage is reduced, maternal death will be greatly reduced since it is the main cause of maternal death.

Introduction

Postpartum hemorrhage or postpartum bleeding (PPH) is often defined as loss of > 500 ml of blood after vaginal delivery or > 1,000 ml after cesarean delivery within 24 hrs [1-3]. It is also defined as blood loss sufficient to cause hypovolemia, a 10% decrease in hematocrit or requiring transfusion of blood products regardless of the route of delivery [1, 4, 5].

Postpartum hemorrhage (PPH) is the most common complication of deliveries and its magnitude is reported to be 2 - 4% and 6% after vaginal and cesarean-sections (C/S) deliveries respectively [6, 7]. Uterine atony is responsible for more than 50% of PPH cases, followed by retained tissue, genital tract tear, coagulation problem, and uterine rupture [2, 7]. PPH has long- and short-term impacts such as chronic illness, disability, increased risk of death and/or poor growth and development of their children, hepatic dysfunction, adult respiratory distress syndrome and renal failure [8-11].

PPH occurs approximately 8.7 million times and causes 44,000 to 86,000 deaths per year, making it the leading cause of death during pregnancy worldwide [12, 13]. In developing countries, PPH is the leading cause of maternal mortality, accounting for 25-43% of maternal death, unlike those of developed countries in which pulmonary embolism is the leading cause of maternal mortality [6]. Postpartum hemorrhage is a serious problem even in metropolitan areas of sub-Saharan Africa [14]

Ethiopia is one of the countries with the highest maternal mortality rate (MMR) and almost all of these deaths were due to direct obstetric complications [15]. PPH is one of the leading direct causes of maternal morbidity and mortality in Ethiopia [15]. A study conducted in Jima revealed that 54% of maternal deaths were caused by postpartum hemorrhage. Similarly, 46.5% of maternal mortality in the kersa district was due to post-partum hemorrhage [9, 16].

Risk factors for PPH include; past history of PPH, multiple pregnancy, fetal macrosomia, primi-gravida, grand multi-parity, older age, preterm births, genital tract injuries, non-use of oxytocic's for PPH prophylaxis, ANC, labour induction, duration of labour, cesarean birth and intra-uterine fetal deaths [11, 17-21].

Postpartum hemorrhage is the most preventable and treatable problem through active management of the third stage of labor (AMTSL) [22]. However, the use of oxytocin is not feasible in many low-income settings, where most births take place at home with untrained birth attendants [21, 23]. The preference of mothers to deliver at home rather than in a health facility is the most important underlying cause of maternal mortality in Ethiopia [24].

Reducing maternal mortality is one of the hot agendas, globally and nationally. The Ethiopian government provides free maternal and pre-partum waiting services regardless of the social and economic status of the women. But with this effort, the maternal mortality rate is still high at the national level [15] and PPH continues to be the leading direct cause of maternal mortality in Ethiopia (23-26).

In Ethiopia, a variety of previous studies reported that the magnitude of postpartum hemorrhage ranged from 1.4% (Addis Ababa) [25] to 16.6% (South Nation Nationality People region) [26]. This showed the presence of large discrepancies among studies reports in the different geographical regions. Furthermore, there is no nationally representative pooled data on the magnitude of postpartum hemorrhage in Ethiopia. Therefore, reliable and summarized information is essential to refine government policies, strategies, and interventions. Therefore, the main objective of this systematic review and meta-analysis was to estimate the pooled magnitude of postpartum hemorrhage and the pooled effect size of associated factors in Ethiopia.

Research Questions

What is the pooled magnitude of postpartum hemorrhage among post-natal mothers in Ethiopia?

What is the pooled effect size of factors associated with postpartum hemorrhage among post-natal mothers in Ethiopia?

Methods

Information source

This systematic review and meta-analysis was performed in accordance with the preferred reporting items for systematic reviews and Meta-Analyses (PRISMA) [27] (Supplementary file one). These published and unpublished (Grey literature) researches report the magnitude or prevalence of postpartum hemorrhage and associated factors in Ethiopia were included in this review.

Eligibility criteria

This review included studies conducted on postpartum hemorrhage among postpartum mothers in Ethiopia and published up to October 10/2021. We include articles published in the English language. All studies conducted in the health institution or community were included. However, case reports, qualitative studies, and articles without full text were not included in the review.

Outcome of measurements

This systematic review and meta-analysis had two main outcomes. The first outcome had to estimate the pooled magnitude of postpartum hemorrhage in Ethiopia. Postpartum hemorrhage is defined as loss of > 500 ml of blood after vaginal delivery or > 1,000 ml after cesarean delivery within 24 h. The second objective was to determine the pooled effect size of associated factors for postpartum hemorrhage. The magnitude of postpartum hemorrhage was calculated by dividing the number of mothers who had postpartum hemorrhage by the total number of mothers who have been included in the study and multiplied by 100 (100). For the second outcome, the odds ratio was used to measure the level of association between postpartum hemorrhage and its associated factors. The odds ratio was calculated from primary studies using two by two tables.

Search strategies

Primary studies were searched from PubMed / MEDLINE online, Science Direct, Hinari, Cochrane Library, CINAHL and African Journals Online databases. Grey literature was also identified from Google and Google Scholars. The search for studies was not limited by time, and all articles up to October 10/2021 were included. We searched using controlled vocabulary variables such as postpartum hemorrhage, postpartum bleeding, birth outcome and complication. We used key terms to retrieve primary studies (magnitude OR prevalence AND postpartum hemorrhage OR bleeding AND Ethiopia. For factors associated with post-partum hemorrhage; ((factors OR determinants OR risk factors OR correlations AND postpartum hemorrhage) key terms were used. Two authors (JN &BG) searched the primary studies from different databases.

Study selection and quality appraisal

The principal investigator (JN) performed an initial review by title and abstract to eliminate articles that were visibly not important to this review. The full text articles were included if they reported the magnitude of postpartum hemorrhage and/or its associated factors. Two reviewers (BG and AM) independently screened the selected studies using pre-specified inclusion criteria. During the selection process, disagreements between the two authors were decided by mediation of other reviewers (TT, RT).

The authors used the Newcastle-Ottawa quality assessment scale to assess the qualities of the included studies [28]. The tool has three main parts. The first five components assess the methodological quality of each study. The second part

assesses the comparability of primary studies, and the final part of the tool measures the quality of the original articles with respect to their outcome and statistical analysis. All articles scored 7 and more can be considered as low risk and good to be included for the meta-analysis.

Data extraction

Data extraction format prepared in Microsoft Excel was used to extract the necessary data from each primary study. The extraction format contains the name of the first author, the publication year, the region where the studies were conducted, the sample size, the response rate, and the magnitude of postpartum hemorrhage for the first objective. For the second objective (factors associated with postpartum hemorrhage), the data extraction format was prepared in the form of two by two tables. Categorical variables (a, b, c, and d) with postpartum hemorrhage or bleeding were tabulated. Categorical variables (a, b, c, and d) were tabulated with outcome variables (magnitude of postpartum hemorrhage). The differences between the two authors during data extraction were solved by re-extracting the data of the primary article together. The other authors checked the accuracy of the extracted data.

Data Analysis and interpretation

The data extracted on the Microsoft Excel format was exported to Stata Version 16.0 statistical software for analysis. A random effect meta-analysis model was used, since it considers heterogeneity among studies. In this meta-analysis, the Forest plot was used to show the pooled estimate with a 95% confidence interval (CI). Statistical heterogeneity was evaluated by the I^2 test [29]. The heterogeneity of the included studies was interpreted as an I^2 value of 25%=low, 50%=moderate, and 75% and above= high. In case of high heterogeneity, a subgroup was performed to identify the possible source of this heterogeneity. Egger's weighted regression test was used to assess publication bias at a 5% significance level [30]. We also assessed publication bias by visual inspection of funnel plots. The size of the pooled effect of the factors associated with postpartum hemorrhage was estimated as an odds ratio. Finally, for all analyses, $P < 0.05$ was considered statistically significant.

Results

Search results

A total of 165 records from electronic databases such as MIDLINE/PubMed, Science Direct, Hinari, Cochrane Library, CINAHL, and African Journals Online, Google, and Google Scholar were searched; however 25 records were excluded due to duplication. We excluded 93 records because these articles were not related to our review after assessing their titles and abstracts. After assessing 47 full articles, 27 articles were further excluded for reasons (the outcome variables were not reported). Finally, 20 studies were included in this systematic review and meta-analysis (Figure 1).

Characteristics of the included articles

The current systematic review and meta-analysis included 20 primary studies with a total of 93,600 study participants. Of the total of 20 studies; 7 studies were conducted in Amhara region [10, 31-36], 5 studies in SNNP region [26, 37-40], 2 studies in Oromia region [9, 41], 2 studies in Addis Ababa city administration [25, 42], 1 study in Tigray region [43], 1 study in Dire Dawa city administration [44], 1 study in Harar region [45] and 1 study was conducted national-wide [46] (Table 1). Only 4 studies were conducted in the rural area, the rest 16 were conducted in the urban area. Among the 20 primary studies included in this meta-analysis, 18 studies were conducted in a health institution and only two studies were community-based. Three studies of a total of 20 studies were used in a case-control study design, and the rest were used in a cross-sectional study design. The sample size of the primary studies included in this systematic review and meta-

analysis ranged from 144 to 68,437 as reported by Debre tabor in the Amhara region and national-wide studies respectively [34, 46]. The highest magnitude of post-partum hemorrhage was 16.6% in SNNP region [26], and the lowest report was 1.4% in Addis Ababa [25].

Table 1

Summary of the studies included in the systematic review and meta-analysis of magnitude and associated factors of post-partum hemorrhage in Ethiopia 2020.

Authors	Publication year	Region	Sample size	Magnitude (%)	Study designs	Area	Study setting	Sampling technique
Mesfin et al [43]	2021	Harar	642	12.9	Cross-sectional	Urban	Institution-based	Simple random
Hamdela B. Et al [35]	2021	SNNPR	2517	2.9	Cross-sectional	Urban	Community-based	Simple random
Worku T. Et al [29]	2019	Amhara	384	11	Cross-sectional	Urban	Institution-based	Systematic random
Adere A. Et al [40]	2020	Addis Ababa	606	12.4	Case control	Urban	Institution-based	Systematic random
Abebaw A. Et al [30]	2020	Amhara	424	14.2	Cross-sectional	Urban	Institution-based	Systematic random
Sufian Jeilu., et al [42]	2021	Dire Dawa	239	13	Cross-sectional	Urban	Institution-based	Systematic random
Legesse et al [9].	2017	Oromia	600	7	Case control	Urban	Institution-based	Simple random
KEBEBUSH ABERA [23]	2014	Addis Ababa	12995	1.4	Cross-sectional	Urban	Institution-based	Consecutive sampling
Temesgen MA [31].	2017	Amhara	377	5.8	Cross-sectional	Urban	Institution-based	Systematic random
Kebede BA et al [24]	2019	SNNPR	422	16.6	Cross-sectional	Urban	Institution-based	Consecutive sampling
TESHAGER DERBEW[38]	2017	SNNPR	1786	5.9	Cross-sectional	Rural	Institution-based	Consecutive sampling
Harrison MS et al [37]	2021	SNNPR	998	2.2	Cross-sectional	Urban	Institution-based	Consecutive sampling
Abate T. Et al [10]	2014	Amhara	203	14.8	Cross-sectional	Urban	Institution-based	Sample random
Geleto et al [44]	2020	National	68437	4.2	Cross-sectional	Urban	Institution-based	Survey
Habitamu et al [32]	2019	Amhara	144	7.6	Cross-sectional	Urban	Institution-based	Systematic random
Gudeta TA et al [39]	2018	Oromia	200	9.7	Cross-sectional	Urban	Institution-based	Systematic random
Maeruf H, et al [41]	2020	Tigray	752	3.1	Cross-sectional	Urban	Institution-based	Systematic random
Zimmerman et a [36]	2019	SNNPR	321	12.5	Cross-sectional	Rural	Community-based	Survey
Tiruneh B et al [33].	2020	Amhara	1060	9	Cross-sectional	Rural	Institution-based	Systematic random

SNNPR- South Nation Nationality and People Region

Authors	Publication year	Region	Sample size	Magnitude (%)	Study designs	Area	Study setting	Sampling technique
Dagne AH et al [34].	2021	Amhara	493	13.6	Cross-sectional	Rural	Institution-based	Systematic random
SNNPR- South Nation Nationality and People Region								

Meta-analysis

A random effect model was used to estimate the pooled magnitude of postpartum hemorrhage and the factors associated with it in Ethiopia. The pooled magnitude of postpartum hemorrhage in Ethiopia was **8.18%** [(95% CI; 6.996 - 9.363), $I^2 = 97.9\%$, $P < 0.01$] (Figure 2). Significant publication bias was observed since the Egger's test result is significant ($P = 0.014$) at 95% CI. The Duval and Tweedie trim and fill methods were used to estimate the number of studies missed from a meta-analysis as a source of publication bias but the finding was not significant [47]. We also observed a symmetrical distribution of the funnel plot, indicating a significant publication bias was observed (Figure 3).

Subgroup analysis

Subgroup analysis was performed to identify the source of heterogeneity since I^2 test ($I^2 = 97.9\%$, $P < 0.001$) shows the presence of significant heterogeneity. Therefore, subgroup analysis was done using the study area region and the study setting (urban vs rural) using random model effect analysis. Accordingly, the highest pooled magnitude of postpartum hemorrhage was in the Amhara region (10.6% (95% CI: 8.14-13.18), $I^2 = 80.2\%$) and the lowest was in Addis Ababa (6.8% (95% CI: 3.96-17.60), $I^2 = 98.5$) (Figure 4). The pooled magnitude of postpartum hemorrhage was slightly higher in rural areas 9.99% (95% CI; 6.53 -13.43), $I^2 = 91.2\%$) than in urban areas 7.69% (95% CI; 6.41-8.96), $I^2 = 98.1\%$) (Figure 5).

Factors associated with postpartum hemorrhage

This systematic review and meta-analysis identified different factors associated with postpartum hemorrhage in Ethiopia. Variables reported as statistically significant with the occurrence of postpartum hemorrhage in at least two primary studies were incorporated into this meta-analysis. Accordingly, age of the women, prolonged labor, antenatal care (ANC) visits, parity, previous postpartum hemorrhage were significantly associated with postpartum hemorrhage.

The age of the mother was significantly associated with postpartum hemorrhage among two primary studies included in this systematic review and meta-analysis [26, 34]. A total of 566 study participants were included to determine the association between the age of the mothers and the occurrence of post-partum hemorrhage. The pooled odds ratio showed that older mothers (>35 years) had 5 times more odds of developing postpartum hemorrhage than mothers younger than 35 years [OR = 5.038 (95% CI; 2.774 - 9.151), $I^2 = 0.0\%$, $P = 0.602$] (Figure 6).

Prolonged labor was reported as a factor associated with postpartum hemorrhage among two primary studies [33, 37]. To analyze the association between prolonged labor and the postpartum hemorrhage, 2,894 mothers were included in the meta-analysis. Accordingly, the odds of postpartum hemorrhage were 4 times higher in mothers who had prolonged labor compared to mothers whose labor had not been prolonged [OR = 4.054 (95% CI; 1.484 - 11.074) $I^2 = 70.8\%$, $P = 0.064$] (Figure 7).

Two primary studies have reported that antenatal care follow-up (ANC) reduces the occurrence of post-partum hemorrhage after birth [33, 34]. More than 500 postnatal mothers were included to show the association between antenatal care follow-up and postpartum hemorrhage. The pooled result showed that mothers who didn't had ANC follow-

up were 13.8 times more likely to develop postpartum hemorrhage than mothers who had ANC follow-up [OR = 13.84 (95% CI; 5.57 - 34.346) $I^2 = 21.9%$, $P = 0.258$] (Figure 8).

Parity was reported as a factor associated with postpartum hemorrhage among two primary articles included in this meta-analysis [33, 34]. A total of 521 mothers were included to analyze the association between parity and postpartum hemorrhage. The odds of postpartum hemorrhage among grand multipara mothers were 6.6 times higher than multi- and Primi-Para mothers [OR = 6.584 (95% CI; 1.902 - 22.795) $I^2 = 58.8%$, $P = 0.119$] (Figure 9).

Two primary studies included in this meta-analysis reported that previous postpartum hemorrhage was significantly associated with the occurrence of post-partum hemorrhage after birth [26, 34]. A total of 566 mothers were included to show the association between previous PPH and postpartum hemorrhage. According to the analysis, mothers who had postpartum hemorrhage in the previous delivery were 4 times the risk of developing postpartum hemorrhage than mothers who didn't have postpartum hemorrhage previously [OR = 4.355 (95% CI; 2.347 - 8.079) $I^2 = 0.0%$, $P = 0.457$] (Figure 10).

Discussion

Globally, postpartum hemorrhage is the leading cause of maternal morbidity and mortality that causes more than 25% of maternal death [48] and is a major cause of postpartum disability in sub-Saharan Africa [49]. Even if it is one of the leading causes of maternal mortality, most cases can be prevented through proper management, as it is one of the manageable cause of maternal death [49]. This review was carried out to estimate the pooled magnitude and associated factors of postpartum hemorrhage in Ethiopia.

This systematic review and meta-analysis revealed that the pooled magnitude of postpartum hemorrhage in Ethiopia was **8.18%** [(95% CI; 6.996 - 9.363), $I^2 = 97.9%$, $P < 0.01$]. This report was in line with studies conducted in Uganda 9% [50] and Japan 8.7% [51], but much lower than study reports from Pakistan 21.3% [52], Cameroon 23.6% [53], and Yemen 29.1% [54]. The discrepancy could be due to the difference in maternal health services utilization (prenatal, natal, and postnatal care) between the countries. The pooled magnitude of postpartum hemorrhage in this meta-analysis was greater than studies conducted in Senegal and Mali 5.4% [8], India 3.55% [55], Norway 2.5% [56] and Zimbabwe 1.6% [3]. The possible explanation for this variation could be due to geographic and sociocultural differences, as well as maternal health service utilization. The above difference might also be due to the nature of the studies between the primary studies and the meta-analysis.

This meta-analysis also determines the pooled effect of factors associated with postpartum hemorrhage among postnatal mothers. Accordingly, advanced age (>35 years), prolonged labor, of antenatal care (ANC) follow-up, grand-multiparty, and history of PPH were significantly associated with postpartum hemorrhage. The magnitude of postpartum hemorrhage was 5 times higher in mothers older than 35 years old compared to mothers younger than 35 years old. This finding is supported by study reports conducted in Uganda [50], Pakistan [52] and France [57]. The reason might be that obstetrics complications increase as the age of the mothers increases.

Mothers who had prolonged labor had 4 times higher odds of postpartum hemorrhage than their counterparts. A similar finding was reported from studies done in China [58], Pakistan [52], and Cameroon [53]. This could be due to the fact that prolonged labor causes uterine atony, which is a leading cause of postpartum hemorrhage. This meta-analysis also showed that the odds of developing postpartum hemorrhage among mothers who did not have ANC follow were 13.8 times higher compared to their counterparts. This could be due to the fact that mothers can obtain adequate information about institutional delivery as well as birth preparedness and complication redness during the ANC visit, which can reduce the risk of postpartum hemorrhage.

This study also revealed that grand multi-Para mothers had 6.6 times higher risk of developing postpartum hemorrhage as compared to multi-Para and prim-Para mothers. This finding is supported by studies done in Cameroon [53], Uganda [50] and Pakistan [52]. The reason might be that reduction in muscular strength of the uterus due to the loss of collagen fibres, resulting in reduced uterine contraction after birth leading to bleeding. The odds of postpartum hemorrhage were four times higher in mothers who had history of postpartum hemorrhage than mothers who hadn't history of postpartum hemorrhage. Similar study findings have been reported from studies conducted in Norway [56], China [58] and Cameroon [53]. The reason might be that once the mother developed PPH, the contraction of the myometrium has been reduced for the next birth, which easily develops postpartum hemorrhage. This review used a wide range of search strategies and two and more reviewers were involved in the whole review process through PRISMA guideline. The finding of this systematic review and meta-analysis was strongly helping different stakeholders working in maternal and child health to focus on the main contributor factors to reduce PPH. If postpartum hemorrhage is reduced, maternal death will be greatly reduced as it is the main cause of maternal death.

Limitation of the study

Almost all primary studies included in this systematic review and meta-analysis used a cross-sectional study design, making it difficult to establish cause-effect relationships, and the outcome variable may be affected by other confounding factors. The presence of significant heterogeneity between the primary studies is the other limitation of this study. Studies published other than English language not included in this meta-analysis is also considered as a limitation for this study.

Conclusion

This systematic review and meta-analysis conclude that the magnitude of postpartum hemorrhage in Ethiopia was moderately high. Older age, prolonged labor, absence of ANC visit, grand multiparty, and history of postpartum hemorrhage were identified as factors for the occurrence post-partum hemorrhage. Health professionals attending labor should emphasize the mother of the high-risk group (older age, grand-multi parity and history of PPH) during delivery. Encouraging ANC visit and prevent prolonged labor should be recommended to reduce the occurrence of postpartum hemorrhage.

Abbreviations

ANC- Antenatal care, MMR - Maternal mortality rate, PPH- post-partum hemorrhage, WHO- World health organization, SEA- South East Asian, SSA- Sub-Saharan African, EDHS- Ethiopia demographic health survey, CSA- central statistical agency, PRISMA - preferred reporting items for systematic reviews and meta-analysis.

Declarations

Ethics approval and consent to participate

Not applicable

Consent for publication

Not applicable

Availability of data and materials

The data set analysed during the current study is available from the cross-pondering author on reasonable request.

Competing Interests

All authors declare that they have no competing interests.

Authors' contributions

JN and BG conceived the idea and participated in data extraction, analysis, and draft writing. AM and MM participated in the analysis, preparation of the manuscript, and revision. All authors read and approved the final version of the manuscript to be considered for publication.

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Figures



PRISMA 2009 Flow Diagram

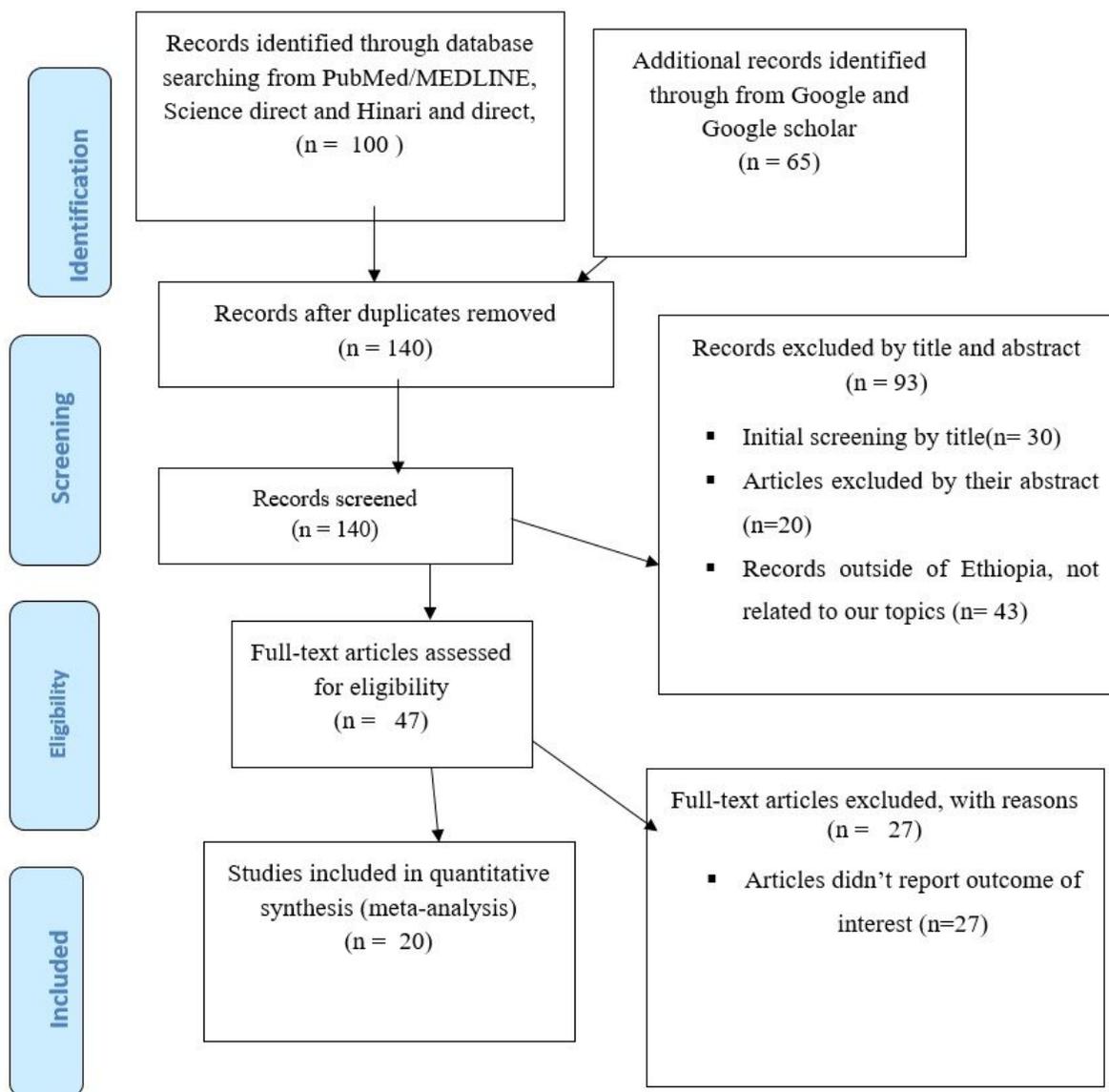


Figure 1

PRISMA Flow chart during the selection process for the studies included in the analysis.

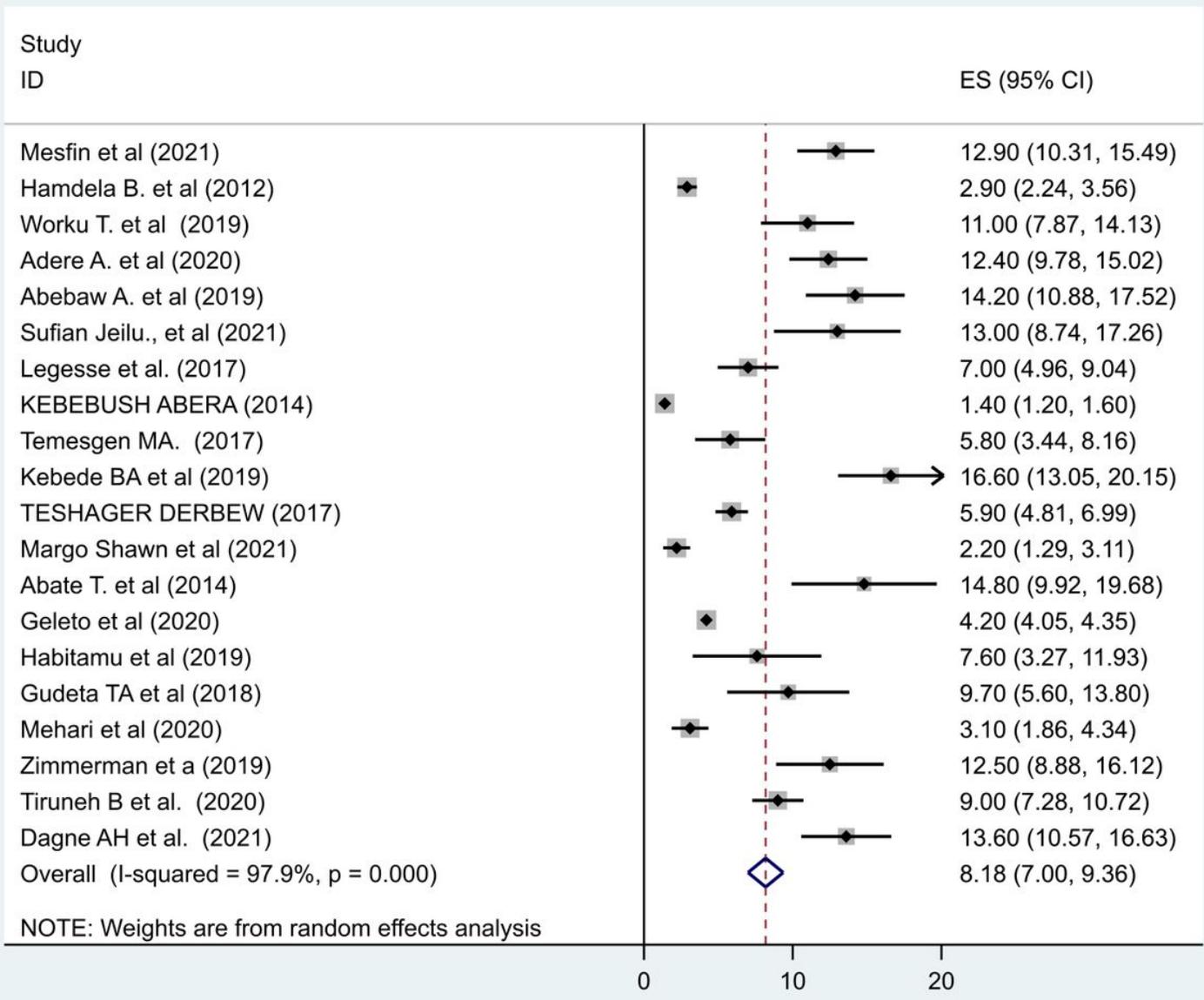


Figure 2

Forest plot for the pooled magnitude of postpartum hemorrhage in Ethiopia, 2021.

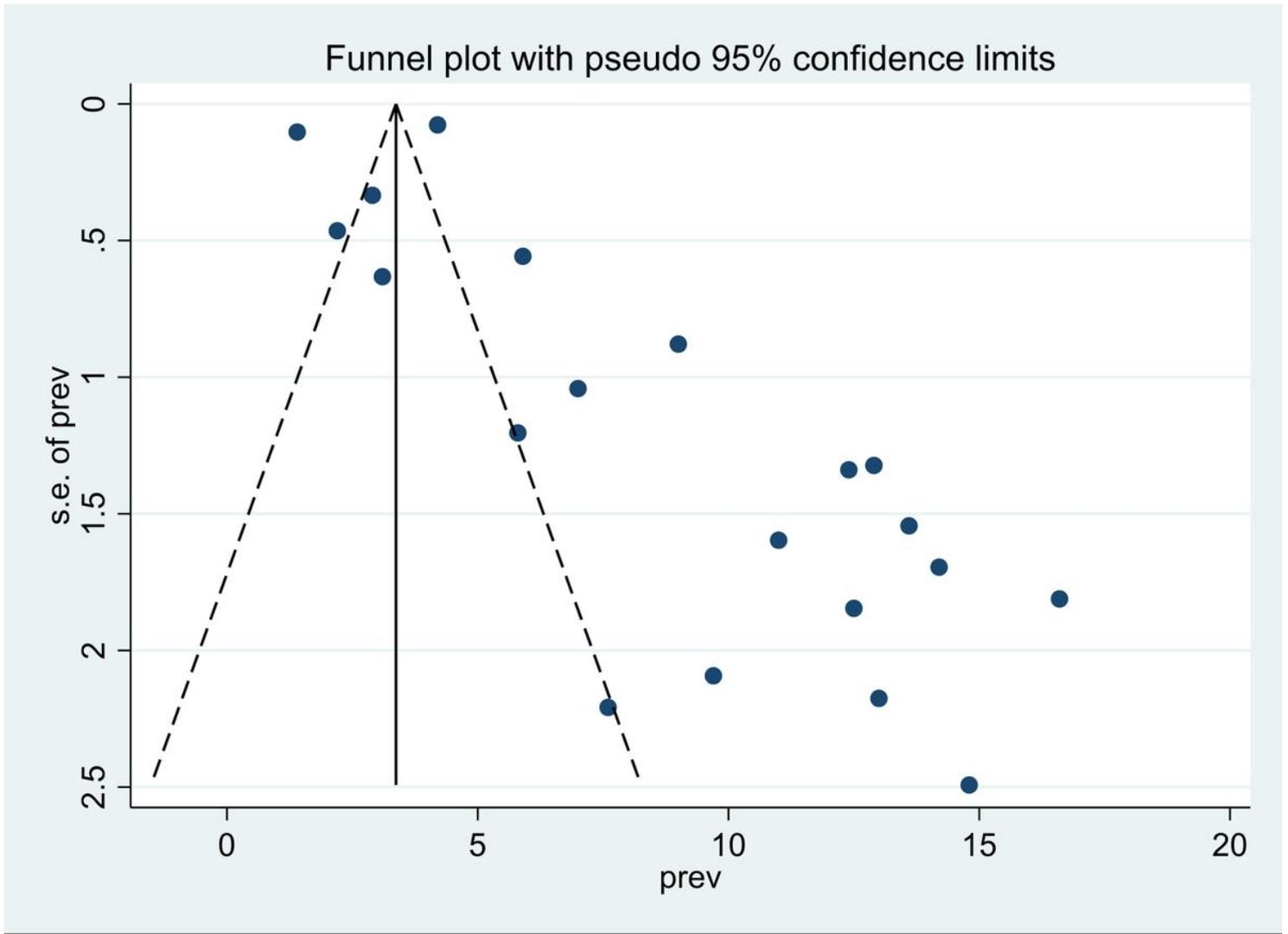


Figure 3

Funnel plot showing symmetric distribution of articles on magnitude of post-partum hemorrhage in Ethiopia, 2021.

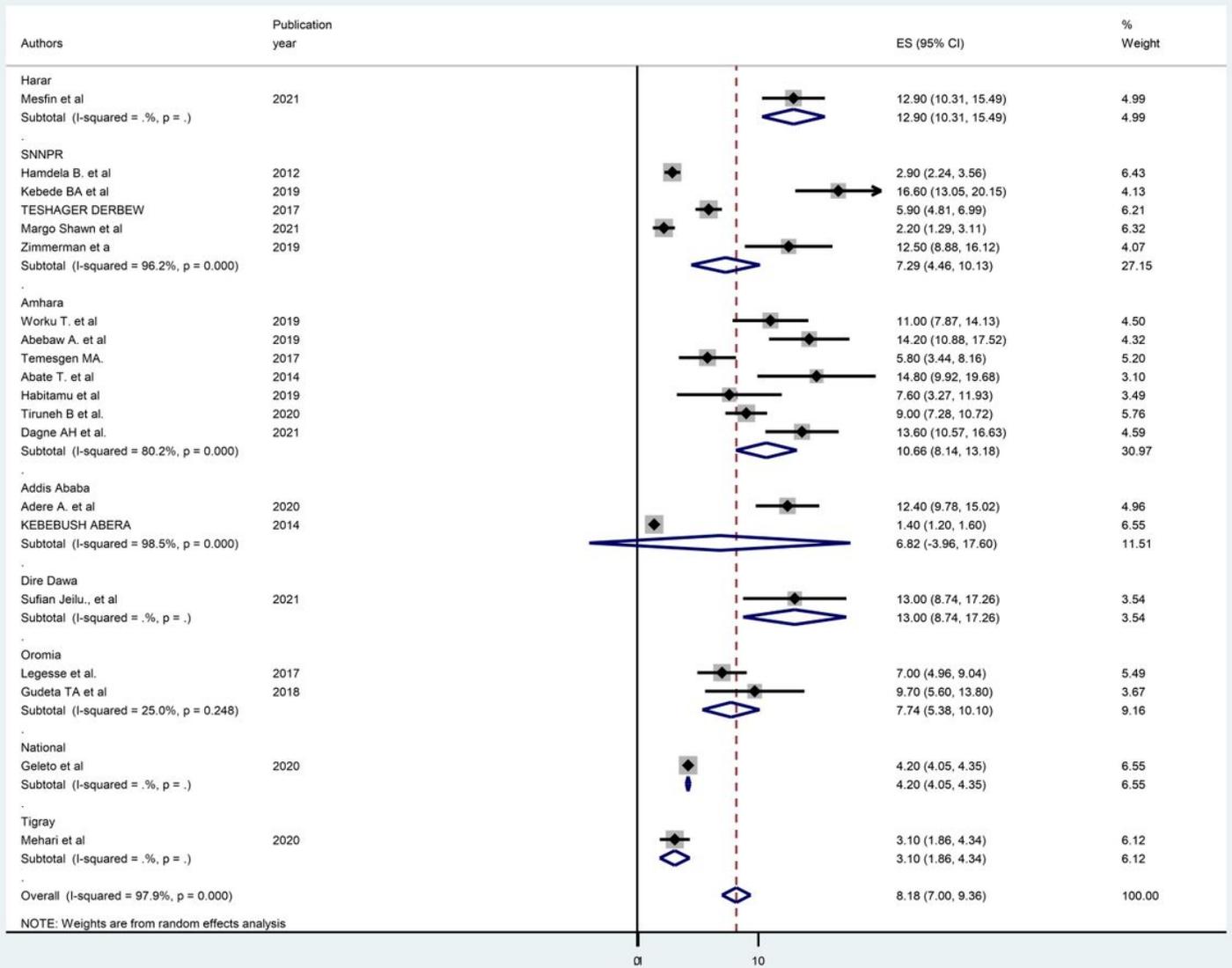


Figure 4

Sub-group analysis of magnitude of post-partum hemorrhage by using study setting (regions).

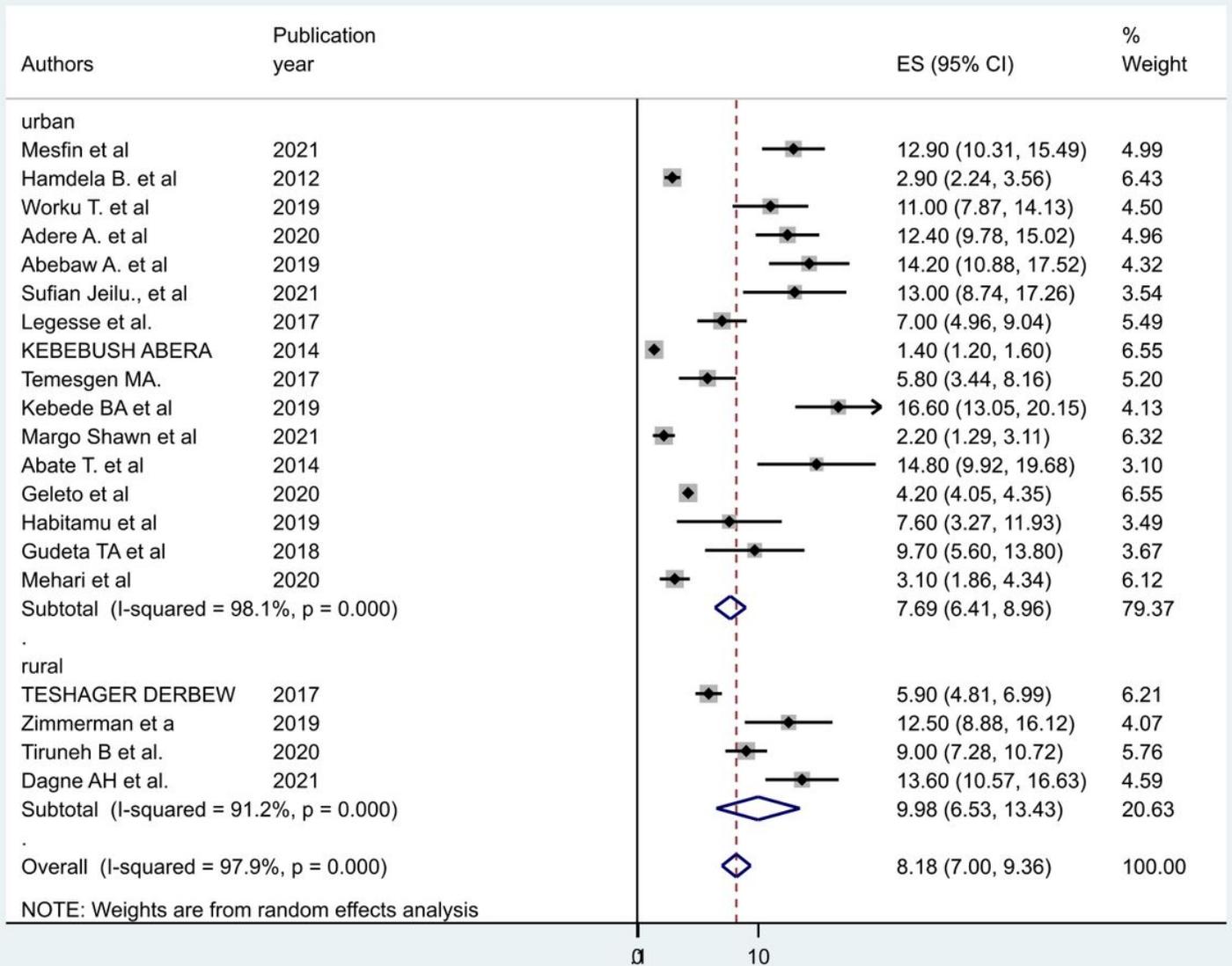


Figure 5

Sub-group analysis of magnitude of post-partum hemorrhage by using study setting.

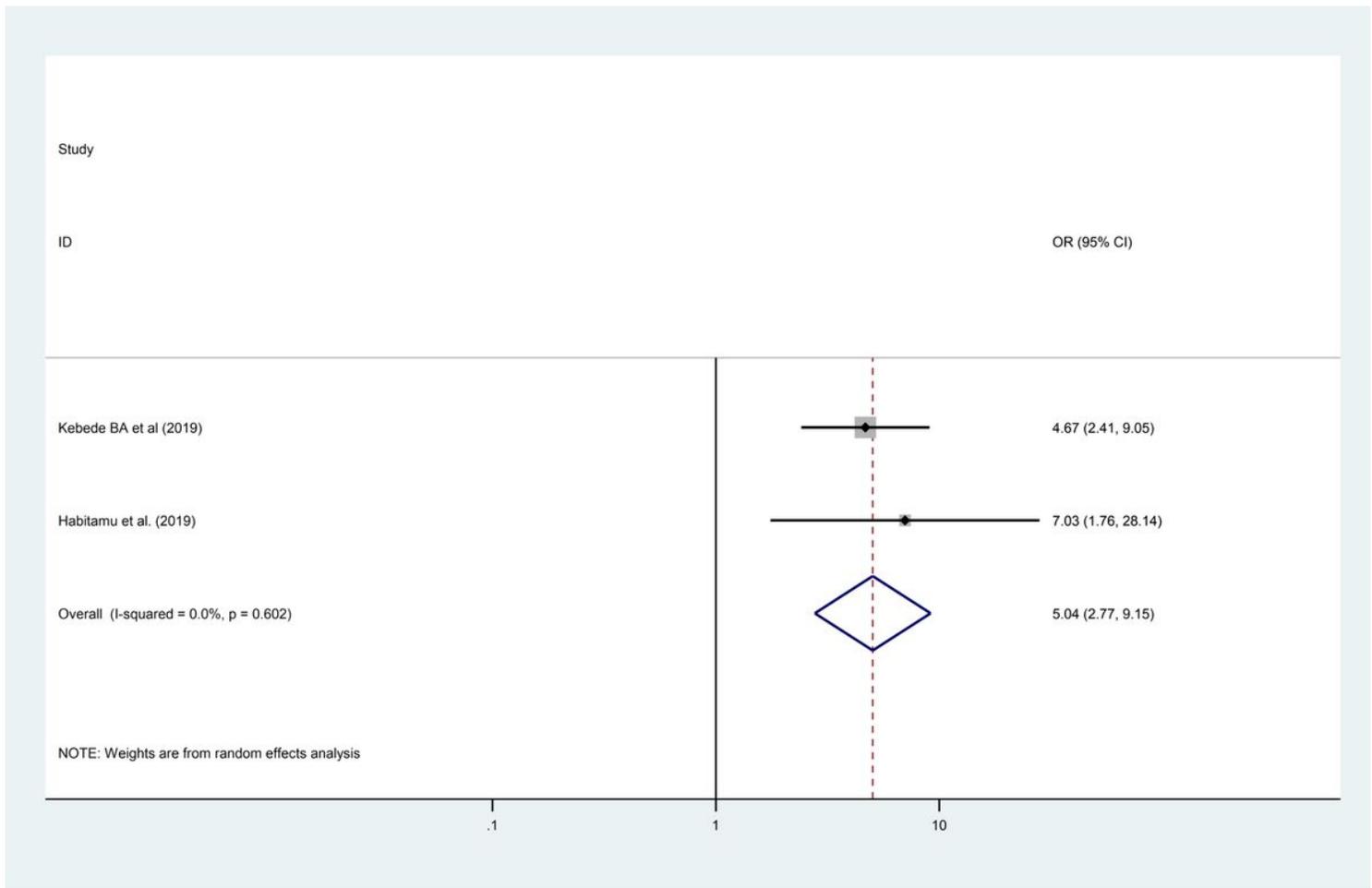


Figure 6

The pooled odds ratio of the association between age of the mother and post-partum hemorrhage in Ethiopia.

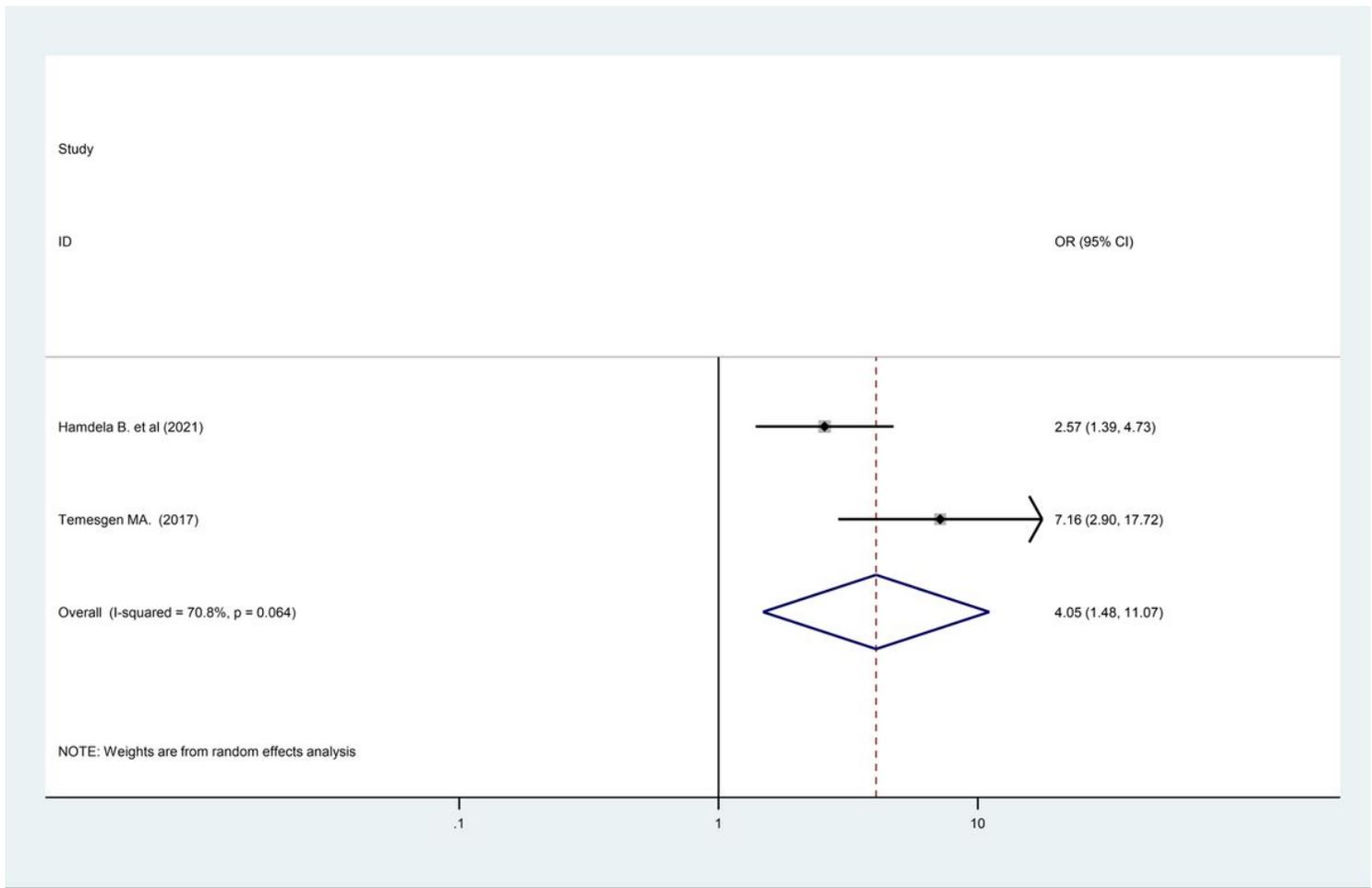


Figure 7

The pooled odds ratio of the association between prolonged labor and post-partum hemorrhage in Ethiopia.

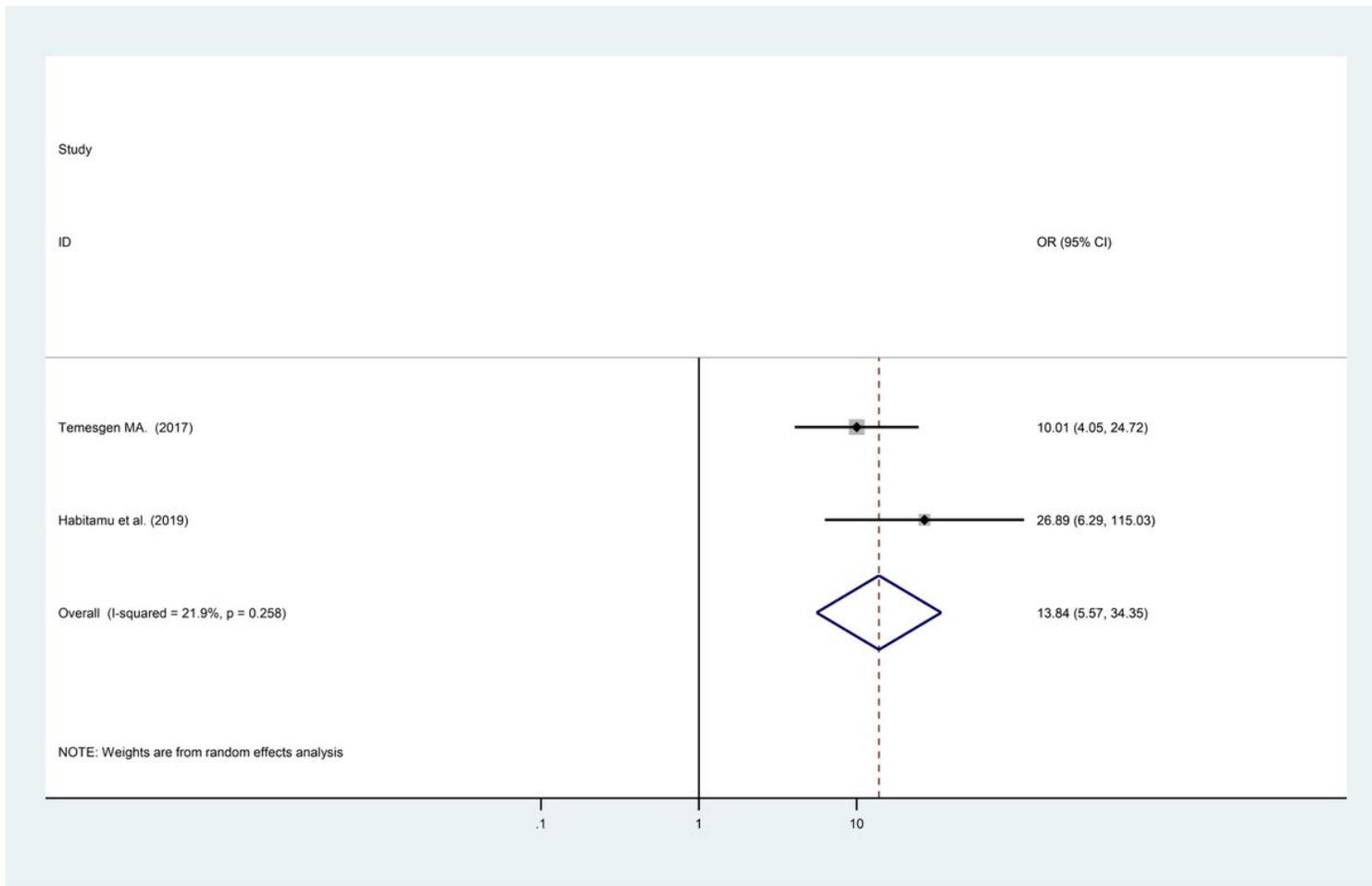


Figure 8

The pooled odds ratio of the association between ant-natal care (ANC) follow-up and post-partum hemorrhage in Ethiopia.

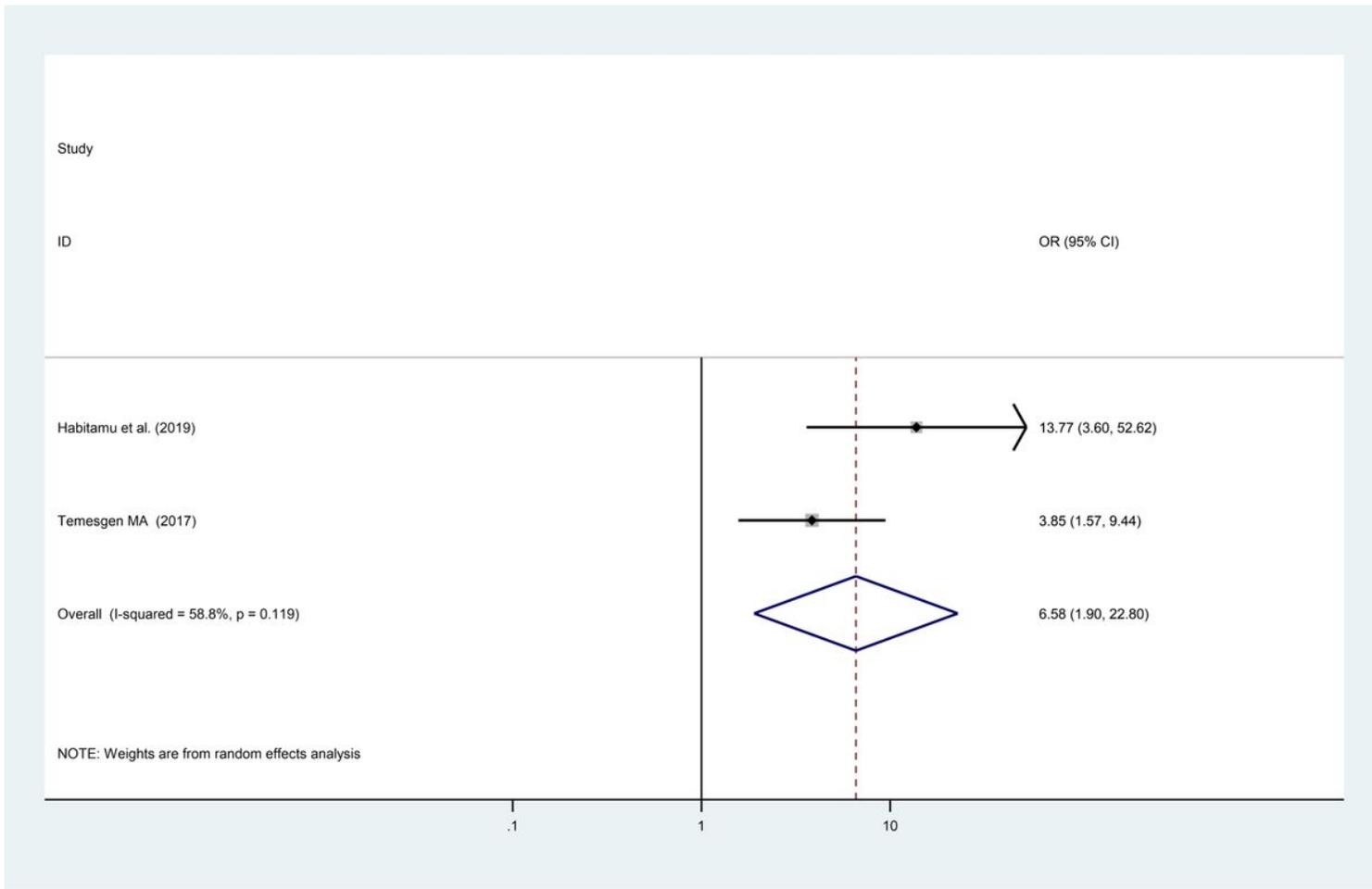


Figure 9

The pooled odds ratio of the association between parity and post-partum hemorrhage in Ethiopia.

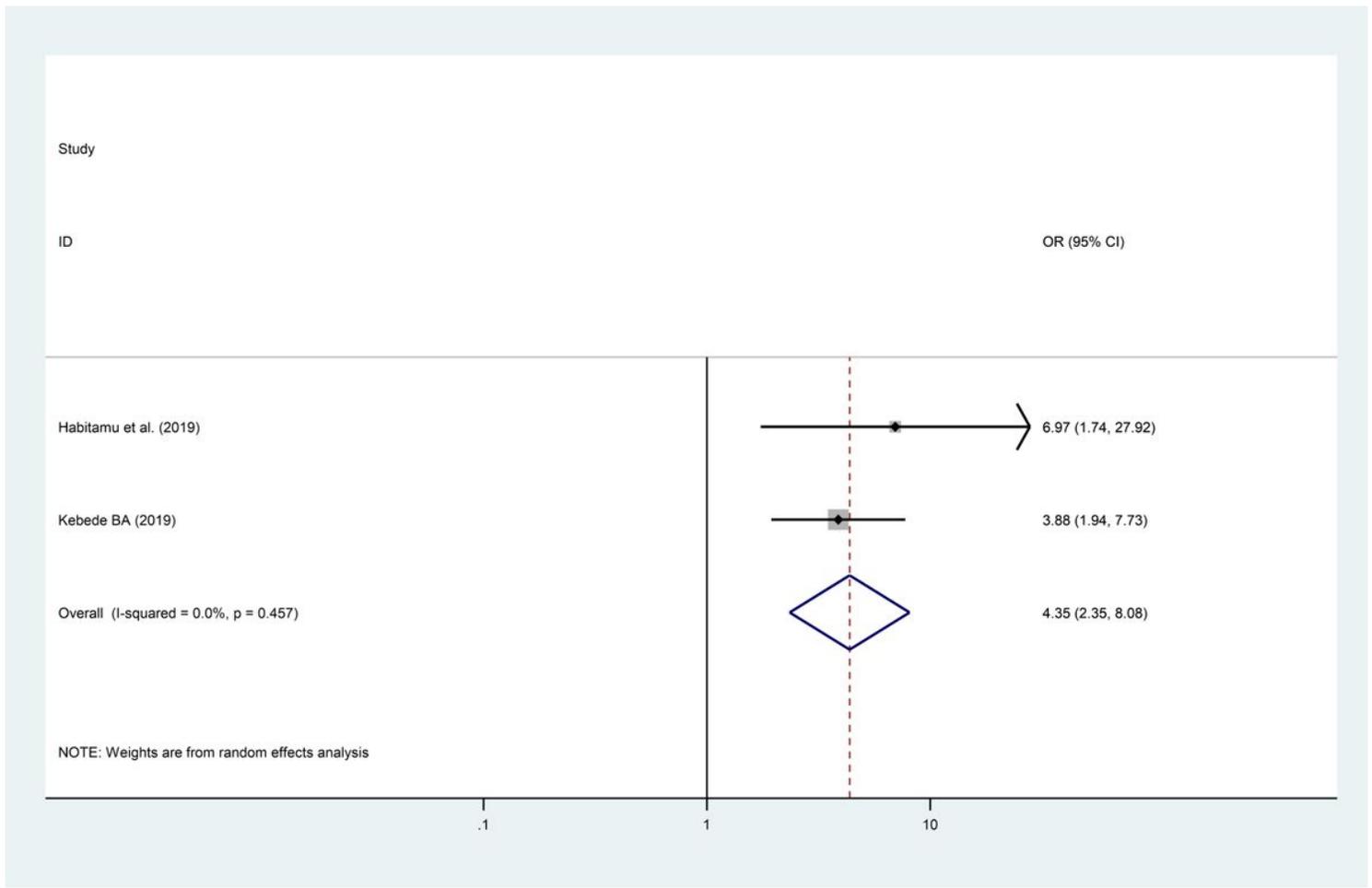


Figure 10

The pooled odds ratio of the association between history of previous PPH and post-partum hemorrhage in Ethiopia.

Supplementary Files

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