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Prevalence and predictors of pregnancy termination in Ethiopia: A systematic review and meta-analysis

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3 **Prevalence and predictors of pregnancy termination in Ethiopia: A systematic**
4 **review and meta-analysis**
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Abstract

Objectives: this systematic review and meta-analysis aimed to assess the prevalence of pregnancy termination and its predictors in Ethiopia.

Participants: A systematic review and meta-analysis of studies published from January 2004 to January 2023. PubMed, EMBASE, Medline, and other search engines were used to retrieve relevant articles. Thirty-three full articles were included in this review.

Primary and Secondary Measures: The p-value for I^2 statistics of 0.05 was used to determine the presence of heterogeneity. Publication bias was assessed using the Egger regression asymmetry test and the Duval and Tweedie nonparametric trim and fill analysis.

Results: The overall pooled prevalence of termination of pregnancy among women in Ethiopia was 21.52% (95% CI: 15.01, 28.03). The meta-analysis included studies with significant heterogeneity: $I^2 = 99.8\%$, $p = 0.000$. The Egger's regression asymmetry test also showed significant publication bias, a p-value 0.001. Sub-group analysis showed that the pooled prevalence of abortion was highest in the Oromia region (35.60%; 95% CI: 28.86, 42.34) and among gynecological admitted patients (60.60%; 95% CI: 59.47, 61.73). Women who were students who had their first sexual initiation before the age of 18, had irregular menstrual bleeding, and had multiple sexual partners were significantly associated with pregnancy termination, according to the pooled meta-analysis.

Conclusions: One in five women terminated their pregnancies, which is higher than in other sub-Saharan African countries. Being a student, irregular menstrual bleeding, early initiation of sexual intercourse, and multiple sexual partners were predictors of pregnancy termination.

Strength

- Both published and unpublished literature are included in this study.
- The authors extracted the whole literature separately to ensure data quality
- JBI implemented to ensure the quality of each literature to include in this review

Keywords: Pregnancy termination, Predictors, Systematic review and meta analysis, Ethiopia

Introduction

Pregnancy termination is a delicate and divisive topic having political, cultural, moral, and religious implications. Also, it is a problem for public health in many regions of the world(1). More than 60% of unintended pregnancies result in induced abortion, with the majority of those being unsafe, resulting in approximately 73 million induced abortions performed globally each year(2). Developing countries bear the burden of 97% of all unsafe abortions and contribute to 220 deaths per 100,000 live births(3).

Moreover, abortion imposes an additional burden on health institutions and individuals; 7 million women per year were treated in hospital facilities for complications of unsafe abortion in developing countries alone(4). It is estimated that health-care systems will spend \$553 million per year on post-abortion complications and will lose \$922 million in income due to long-term disability caused by unsafe termination(5). Additionally, a woman with a history of pregnancy termination has an increased risk of subsequent preterm birth, especially when performed by mechanical dilation and curettage or performed repeatedly (6).

Though the burden of pregnancy termination has significant causes of maternal mortality and morbidity in Ethiopia(7). Previous studies conducted in Ethiopia have shown that the prevalence of pregnancy termination and its negative consequences are increasing over time(8, 9), and repeated induced abortion also account significant amount (10-12). Several variables, including early age marriage, low level of education, early sexual intercourse initiation, violence/rape, emotional well-being, educational status, employment status, and resources, and sexual intercourse relationship, have been implicated as predictors of pregnancy termination in studies conducted across Ethiopia(13-16).

However, at the national level, illustrative evidence is lacking in Ethiopia regarding the level and underlying factors of pregnancy termination. Thus, this systematic review and meta-analysis aimed to assess the prevalence of pregnancy termination and its associated factors in Ethiopia. The findings of this study provide evidence for intervention to reduce the burden of pregnancy termination, its complications, and its economic impact in the country. Additionally, this study will help to design strategies and monitor the progress of programs aimed at achieving the maternal mortality reduction targets of the sustainable development goals.

Methods

Study design and search strategy

A search in PubMed, EMBASE, Medline, and reference lists was performed for relevant articles to assess the pooled prevalence and predictors of pregnancy termination in Ethiopia. Well-known PRISMA guidelines were strictly followed in doing this review. Similarly, the quality of our systematic review and meta-analysis was assessed using the Joanna Briggs Institute (JBI) critical appraisal checklist(17). The data extraction tool contains information on the author, title, year of publication, study area and region, study design and type, study population, sample size, the outcome measured, and the prevalence rate of pregnancy termination.

We used the search terms “(((((((Abortion) OR (termination of pregnancy)) OR (miscarriage)) AND (determinant factors)) OR (predictors)) OR (associated factors)) OR (influencing factors)) AND (Ethiopia)”.

Study selection and eligibility criteria

The study period for the review ranged from January 2004 to January 2023. MESH terms were pregnancy termination, abortion, and miscarriage. We included cross-sectional and case-control studies that showed the prevalence of or predictors of pregnancy termination or miscarriage. Case reports, case series, reviews, editorials, and studies published as abstracts only were excluded. The references of the selected articles were also screened to retrieve any additional articles that could be incorporated into this review.

Quality assessment and data extraction

Articles were screened using their titles, abstracts, and full paper reviews before being included in the meta-analysis. The quality of included studies was evaluated using the Joanna Briggs Institute (JBI) critical appraisal checklist(17). The quality scores of included studies were assessed and presented using the mean scores to designate them as high- or low-quality. The JBI tool for prevalence and predictor studies was used as a guideline for data extraction from the final selected articles. The data extraction tool contains information on the author and year of the study, the title, the year the study was conducted and the year of publication, the study area and

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3 region, the study design and type, the study population, the sample size, the response rate, the
4 outcome measured, and the prevalence and predictors of pregnancy termination. Moreover, all
5 authors independently reviewed the titles and abstracts of studies to be included in this
6 systematic review and meta-analysis. Agreements on the inclusion and exclusion of the articles
7 were reached with the participation of all authors.
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13 **Heterogeneity and publication Bias**

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15 The I^2 statistics were used to assess the heterogeneity of the studies that were included. The p-
16 value for I^2 statistics less than 0.05 was used to determine the presence of heterogeneity. Based
17 on the I^2 test statistics results, the heterogeneity is categorized as low (25%), moderate (50%),
18 and high (75%) (18). Moreover, the publication bias was assessed using the Egger regression
19 asymmetry test (19, 20). The presence of publication bias is declared when the Egger test result's
20 P-value is less than 0.05. The Duval and Tweedie nonparametric trim and fill analysis using the
21 random effect analysis was conducted to see the presence of publication bias(21).
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28 **Measurement of the outcome variable**

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31 In this study, pregnancy termination is the removal of pregnancy tissue, the products of
32 conception, or the fetus, and the placenta from the uterus. In general, the terms "fetus" and
33 "placenta" are used after eight weeks of pregnancy. Pregnancy tissue and products of conception
34 refer to tissue produced by the union of an egg and sperm before eight weeks. It is a deliberate
35 intervention to terminate a pregnancy, either by a health professional or the woman herself(22).
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40 **Patient and Public Involvement:** N/A

41 **Statistical methods and analysis**

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43 Data were entered into Microsoft Excel, and the meta-analysis was conducted using Stata 16
44 software. The prevalence of pregnancy termination in Ethiopia was shown by forest plots. Due to
45 its help in minimizing the heterogeneity of included studies, the random effect model of analysis
46 was used as a method of meta-analysis(18). Sub-group analysis was conducted by study setting,
47 population, and study period. Predictors of pregnancy termination were presented using odds
48 ratios (ORs) at a 95% confidence interval (CI).
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For peer review only

Result

Study selection

This systematic review and meta-analysis included published studies on the termination of pregnancy in Ethiopia. A total of 12,242 records were retrieved through electronic database searching, and only 33 articles were included in the final analysis (Figure 1).

Characteristics of included studies

Thirty-three studies conducted in different regions of Ethiopia were represented in this review. Of all the studies, 8 (24.24%) were from the Amhara Region(11, 12, 15, 16, 23-26), South Nations and Nationalities accounted for 9 (27.27%) of the total(13, 27-34), 1 was from Oromia (35), 5 (15.15%) from Addis Ababa city administration(10, 14, 36-38), 3 (9.09%) were from Harari region(39-41), 3 (9.09%) were from Tigray region(42-44), 1 (3.03%) was from Afar region(45), 3 (9.09) were from National data(46-48). Twenty-eight (84.85%) of the included studies were cross-sectional studies(10-13, 15, 23-31, 33-35, 37-42, 44-48), and remains five (15.15%) were case-control studies(14, 16, 32, 36, 43).

As well, twenty-seven of the studies were institution-based(10-16, 24, 27-33, 35-46), while six were community-based studies(23, 25, 26, 34, 47, 48). The sample size of the included studies ranged from a minimum of 124 in a study conducted in southwest Ethiopia(34) and to a maximum of 12,378 in a study conducted using DHS data(48). Lastly, this review included a total of 40,116 study participants.

Prevalence of pregnancy termination in Ethiopia

Based on the random effect model, the overall pooled prevalence of termination of pregnancy among women in Ethiopia was 21.52% (95% CI: 15.01–28.03). The meta-analysis included studies with significant heterogeneity: $I^2 = 99.8\%$, $p = 0.000$. Publication biases among the included studies were examined using funnel plots and Egger's regression test. The results of funnel plots showed an asymmetric shape, which indicates the presence of publication bias among those included studies. Additionally, the Duval and Tweedie nonparametric trim and fill analysis was applied to correct publication bias among the studies, but no trimming was performed since the data is unchanged (Figures 3 and 4).

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3 Objective assessments of publication bias by Egger's regression test also showed the presence of
4 publication bias across studies (p -value 0.001). After adjustment, the final pooled prevalence of
5 pregnancy termination in Ethiopia after the trim and fill analysis was 21.52% (95% CI: 15.01–
6 28.03) (Figure 2).
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10 **Subgroup analysis**

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13 We performed subgroup analysis based on the region, study population, and study setting of the
14 included studies. Table 1 shows the pooled prevalence was highest, 35.60% (95% CI: 28.86,
15 42.34) in the Oromia region, followed by 34.17% (95% CI: 17.67, 86.01) in the Tigray region,
16 24.63% (95% CI: 10.52, 37.75) in the South Nation and Nationalities People Region, and the
17 lowest was seen in three studies conducted using demographic health data, 12.10% (95% CI:
18 5.66, 18.50) (Figure 5).
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25 Furthermore, subgroup analysis reveals that the highest pooled prevalence of abortion was seen
26 among gynecological admitted patients, at 60.60% (95% CI: 59.47, 61.73), followed by 25.38%
27 (95% CI: 9.39, 41.32) among university/college students, and 27.90% (95% CI: 20.01, 35.79)
28 among insecurely housed women, with the lowest pooled prevalence being seen among pregnant
29 women and youth women. Additionally, subgroup analysis was conducted based on the year
30 before and after the Millennium Development Goals' implementation. The pooled prevalence of
31 pregnancy termination before and after MDGs was 20.55% (95% CI: 16.10–24.99) and 21.61%
32 (95% CI: 15.01–28.03), respectively (Figure 7).
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Table 1: Subgroup analysis for the prevalence of pregnancy termination in Ethiopia, 2004-2022

Subgroup	Number of studies	Total Sample	Prevalence (95%CI)	Heterogeneity	
				I ²	p-value
By region					
Addis Ababa	2	855	25.49(10.39, 40.09)	92.4	0.000
Amhara	6	2371	18.06(6.27, 29.85)	99.0	0.000
SNNP	8	3678	24.63(95% CI: 10.52, 37.75)	99.4	0.000
National Data	3	19854	12.10(5.70, 18.50)	99.7	0.000
Tigray	2	7463	34.17(17.6, 86.01)	99.9	0.000
Harari	2	1835	16.13(12.21, 20.05)	81.2	0.021
Oromia	1	194	35.60(28.86, 42.34)	.	.
Afar	1	509	8.80(6.34, 11.26)	.	.
By publication year					
2016 to 2022 (post MDG)	15	24234	20.55(16.10, 24.99)	99.3	0.000
Before MDG	10	12525	22.61(4.55, 40.66)	99.9	0.000
Study population					
Reproductive age	8	4426	17.03(8.55, 25.52)	99.0	0.000
Pregnant women	1	12378	8.90(8.40, 9.40)	.	.
Abortion care seeker	7	2990	21.19(14.65, 27.72)	95.3	0.000
University or college student	6	3237	25.36(9.39, 41.32)	99.5	0.000
Gynecological patient	1	7203	60.60(59.47, 61.73)	.	.
Youth women	1	6401	2.50(2.12, 2.88)	.	.
Insecurely household women	1	124	27.90(20.01, 35.79)	.	.
Total	25	36759	21.52(15.01, 28.03)	99.8	0.000

Predictors of pregnancy termination

Socio-demographic characteristics

The sociodemographic factors included in this analysis were the place of residence, age, marital, occupational, and educational status of the women. A separate analysis was conducted for each variable. Finally, a meta-analysis of (16, 39) two studies showed that being a student was significantly associated with pregnancy termination (OR: 4.85; 95% CI: 1.98, 11.91). There was moderate heterogeneity ($I^2 = 39\%$) (Figures 8 and 9).

Reproductive characteristics

A total of 5 articles (15, 24, 28, 43, 47) were included to assess the association between first sexual initiation before the age of 18 and pregnancy termination. The pooled meta-analysis found that women who had their first sexual experience before the age of 18 were twice as likely as those who had their first sexual experience after the age of 18 to have their pregnancy terminated (OR = 1.78; 95% CI = 1.13, 2.82). There was moderate heterogeneity ($I^2 = 41.6\%$). Moreover, two articles (11, 43) were also included to determine the association between irregular menstrual bleeding and pregnancy termination. The final pooled meta-analysis using data from the two articles found that pregnancy termination was nearly two times more likely to occur in women with irregular menstrual bleeding than in those who had regular menstrual bleeding, (OR = 1.86; 95% CI = 1.25, 2.77). Similarly, a meta-analysis of six studies (14, 15, 24, 32, 34, 43) showed that women who had multiple sexual partners were significantly associated with pregnancy termination (OR: 4.88; 95% CI: 3.43, 6.93). There was low heterogeneity ($I^2 = 13.4\%$) (Figure 10).

Discussion

Pregnancy termination is a major public health concern in Ethiopia (49). In this systematic review and meta-analysis, the overall magnitude of pregnancy termination was pooled from 25 published articles in Ethiopia, and significant predictors of pregnancy termination were identified using different articles. Being a student increased the rate of termination of pregnancy nearly five times. In addition, first sexual initiation before the age of 18, women with irregular menstrual bleeding, and multiple sexual partners were predictors of pregnancy termination in Ethiopia. The findings of this review revealed evidence to help reduce the impact of pregnancy termination in Ethiopia by aiming at the main predictors for pregnancy termination.

There are different studies conducted on this issue at community, health, and higher education institutions with different figures. This study found a higher prevalence of termination of pregnancy in Ethiopia compared to other low- and middle-income countries.

The pooled prevalence of termination of pregnancy in Ethiopia was 21.52%. This finding is lower compared to a study conducted in Ghana at 25% (50), higher than in Mozambique at 9 % ($\times 2.33$) (50), and in India at 1.7% ($\times 12$) (51). The difference might be due to the difference in the study population, study design, study area, socio-demographic characteristics, and the differences in health policies of the countries. That is, the current study was conducted using meta-analysis at the national level, which includes community or institutional studies, while the study in Ghana and Mozambique was conducted using demographic health data with a small sample size compared to the current study(50). Additionally, in our study, huge variations were seen across the regions. Moreover, a spatial analysis study conducted in Ethiopia using national DHS data also showed variation even within the regions of the country(48). Thus, acting according to the needs of the region and age-specific policy is important in national policy or guideline development.

Our study observed that being a student was significantly associated with the termination of pregnancy. One of the possible explanations could be that students are likely to be adolescents, belonging to the younger age category. In addition, adolescent girls are remaining in school longer, which may factor into their decisions to postpone childbearing and terminate unintended

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3 pregnancies(52). Likewise, a study conducted in India shows the tendency for pregnancy
4 termination is high in this age category since the rate of unintended pregnancies and unmet needs
5 for family planning are high in this age group(53). The higher rate of pregnancy termination
6 could also be attributed to a failure to provide education about the risks of pregnancy termination
7 and the mechanisms in place to prevent unintended pregnancy. Contraception use aids in the
8 prevention of unintended pregnancy and unsafe abortions(54).
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14 Additionally, the idea supported by Van Rensburg that societal poverty, unemployment, and
15 other socio-demographic factors affect youth pregnancies and might lead to pregnancy
16 termination is also supported(55). In addition, a review from the late 1990s found that young
17 women often cited a desire to stay in school as a major reason for abortion(56). Moreover, many
18 adolescents continue to have difficulty accessing contraception, often as a result of stigma and/or
19 a lack of resources(57).
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26 The study from Nigeria indicated that 15–24-year old women are still being left behind on
27 reproductive health matters despite increasing global attention to prioritizing their health(58).
28 Studies found that educational programs aimed at reducing sexual risk behaviors and preventing
29 pregnancy among young people can effectively reduce pregnancy rates among teenagers(59).
30 Also, programs aimed at abstinence-centered sexuality education are effective in preventing
31 adolescent pregnancy (60). Thus, this implies a future focus on reproductive health issues
32 specific to students to address their needs. Additionally, future researchers should better focus on
33 possible interventions to reduce the risk of pregnancy and pregnancy termination among students.
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41 This review also assessed the association of selected variables with pregnancy termination.
42 Women under the age of 18 at first sex were significantly more likely to terminate their
43 pregnancy. This finding is consistent with studies conducted in Nigeria and Peru that reported a
44 higher rate of pregnancy termination among women who had their age at first sex before 18
45 years old (61-63). Studies also revealed that early sexual debuts are significantly associated with
46 adolescent pregnancies, which are usually unwanted (64, 65). In addition, a study conducted in
47 Ethiopia shown engaging in sex before the age of 18 years was found to have a higher odds of
48 experiencing repeat induced abortion (66).
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3 In many low income countries, rising ages at first marriage combined with increasing levels of
4 premarital sex continue to result in unintended pregnancies among adolescents(67). Thus,
5 improving the knowledge of adolescents about sexual and reproductive health issues, and
6 increasing contraceptive access and use among young people, are important to prevent unsafe
7 abortion or pregnancy termination(68). This necessitates the development of reproductive health
8 education specifically for adolescent girls. Future researchers should also address the gap in
9 studies on the needs of adolescent girls and possible interventions needed to reduce sexual
10 initiation before the age of 18 years.

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12 Furthermore, at the individual level, we found that pregnancy termination was significantly
13 associated with women who had multiple sexual partners. Likewise, a study conducted in Peru
14 indicated that as the number of sexual partners increased, the odds of getting a pregnancy
15 termination increased(69). Furthermore, studies in Cambodia, China, and the United Kingdom
16 have found that having multiple sexual partners is associated with a higher rate of repeated
17 pregnancy termination(54, 70, 71). The government shall be emphasized reproductive health
18 education, particularly for women regarding the risks of multiple sexual partners, the access
19 where, and how to get counseling on how to prevent pregnancy.

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21 This study also found that pregnancy termination was two times higher among women who had
22 menstrual irregularities compared to their counterparts. Lastly, this systematic review and meta-
23 analysis indicated that there was no statistically significant association between the termination
24 of pregnancy and rural residents, marital status, women's age, educational status, primiparous,
25 history of abortion, and wanted pregnancy.

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27 As a limitation, this finding might be prone to the risk of bias due to the significant heterogeneity
28 of articles included from a different region of Ethiopia. In addition, differences in the study
29 population, setting, and design within the included studies might influence the results of this
30 review. Moreover, studies conducted in health institutions, Colleges, or higher education might
31 affect the pooled estimates. Additionally, in this review, only published articles were included.
32 On the other hand, the fact that self-performed pregnancy termination is becoming common,
33 especially when performed early, makes it difficult to determine the true prevalence of
34 pregnancy termination. Abortifacients like misoprostol tablets are poorly restricted in many
35 African countries(72). Future research must explain the relationship between pregnancy
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3 termination and other predictors such as social, economic, substance use, peer pressure, alcohol
4 use, sexual or physical violence, and knowledge of sexual and reproductive health issues such as
5 family planning and fertility. Also, this review didn't include qualitative studies on the
6 explanations for pregnancy termination.
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10 11 **Conclusions**

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14 One in every five women had their pregnancies terminated, which is a high rate when compared
15 to other students in Sub-Saharan Africa. Being a student was significantly associated with the
16 termination of a pregnancy. In addition, irregular menstrual bleeding, early initiation of sexual
17 intercourse, and multiple sexual partners were important predictors of pregnancy termination
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22 **Abbreviations**

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25 OR: odds ratios; CI: confidence interval; JBI: Joanna Briggs Institute; MDG: Millennium
26 Development Goals'
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30 **Declarations**

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33 **Ethical approval:** Not required. This article is based on published articles.

34
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36
37 **Availability of data and materials:** The datasets used and analyzed during the current study are
38 available from the corresponding author upon reasonable request(lebezaa@gmail.com).
39

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41 **Competing interests:** None declared.

42
43 **Author contributions:** HK, MWA, AKA, EKM, TH, and LAT conducted the search and data
44 extraction. HK, LAT, EKM, and MWA. wrote the first draft of the manuscript. LAT, EKM,
45 MWA and HK conducted the statistical analyses and data interpretation. All authors read and
46 approved the final manuscript.
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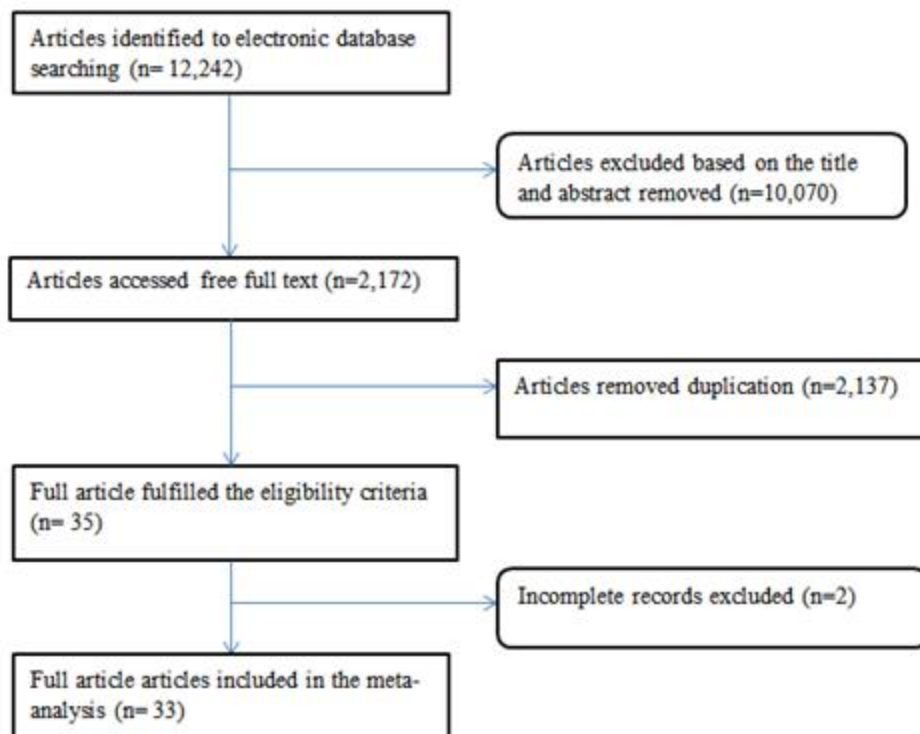


Figure 1. Flow chart of describing the selection of studies for the systematic review and meta-analysis of the prevalence of pregnancy termination and associated factors in Ethiopia, 2023

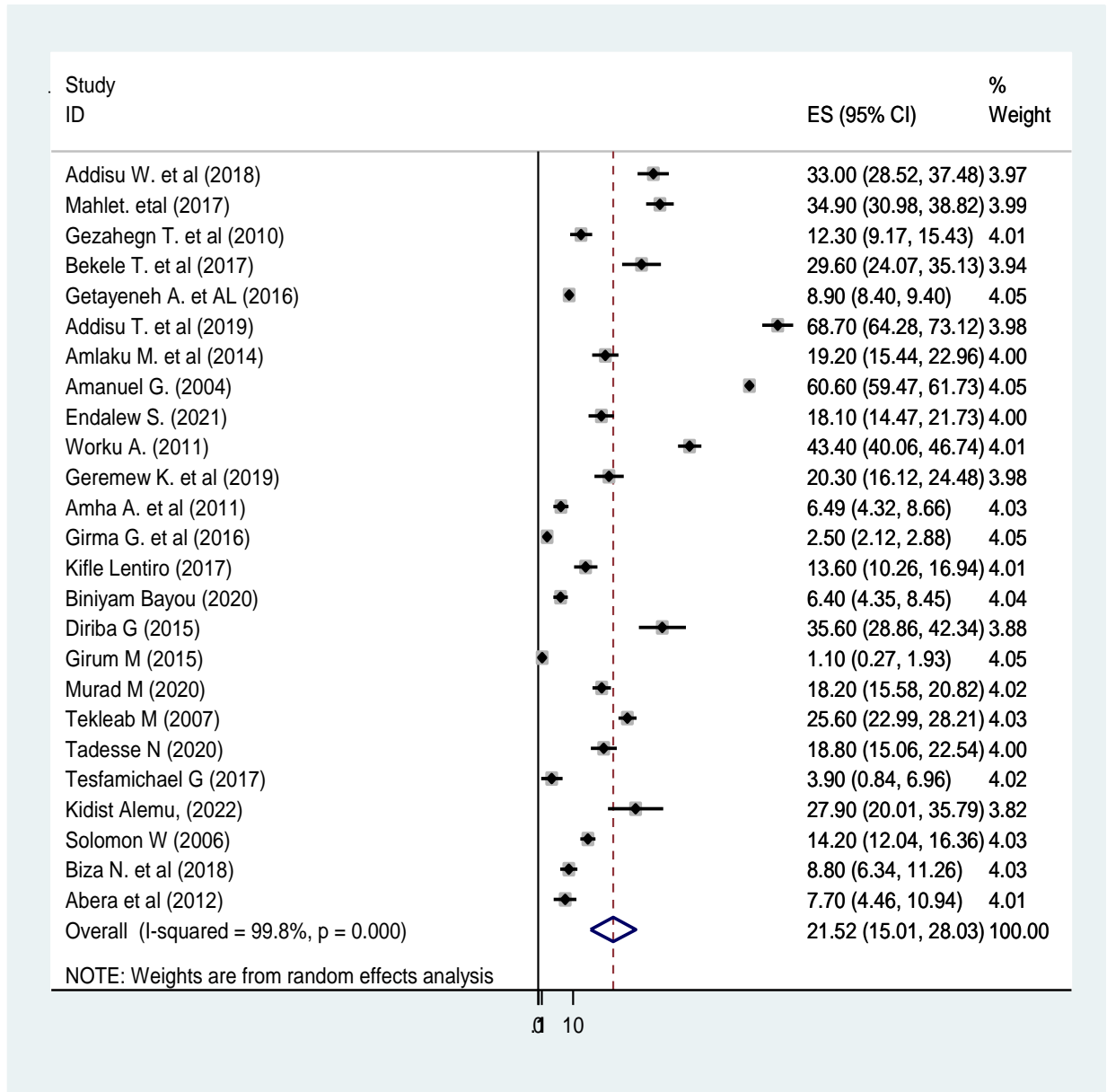


Figure-2: Forest plot of the pooled prevalence of pregnancy termination in Ethiopia, 2023

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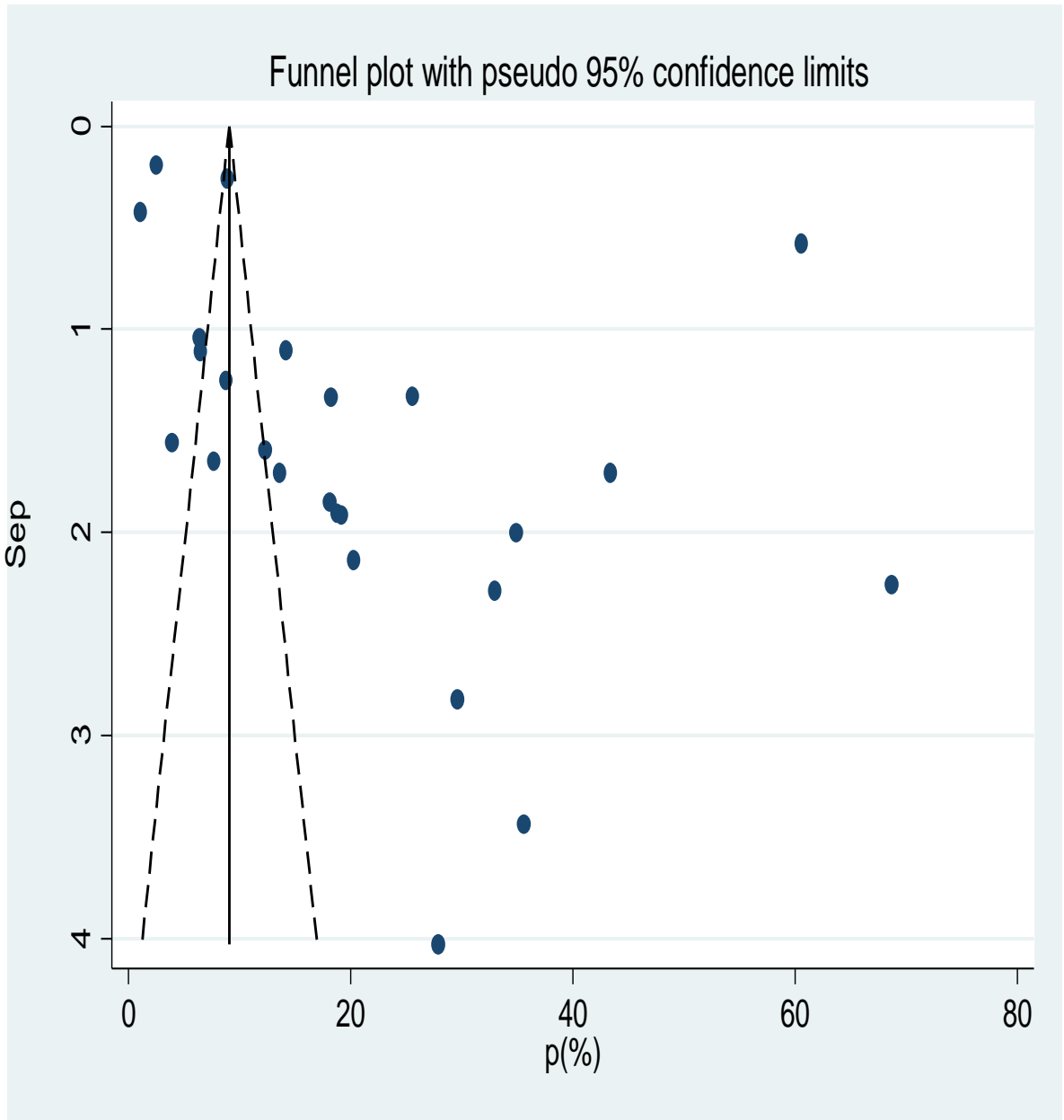


Figure-3: Funnel plot to test publication bias of pregnancy termination in Ethiopia, 2023

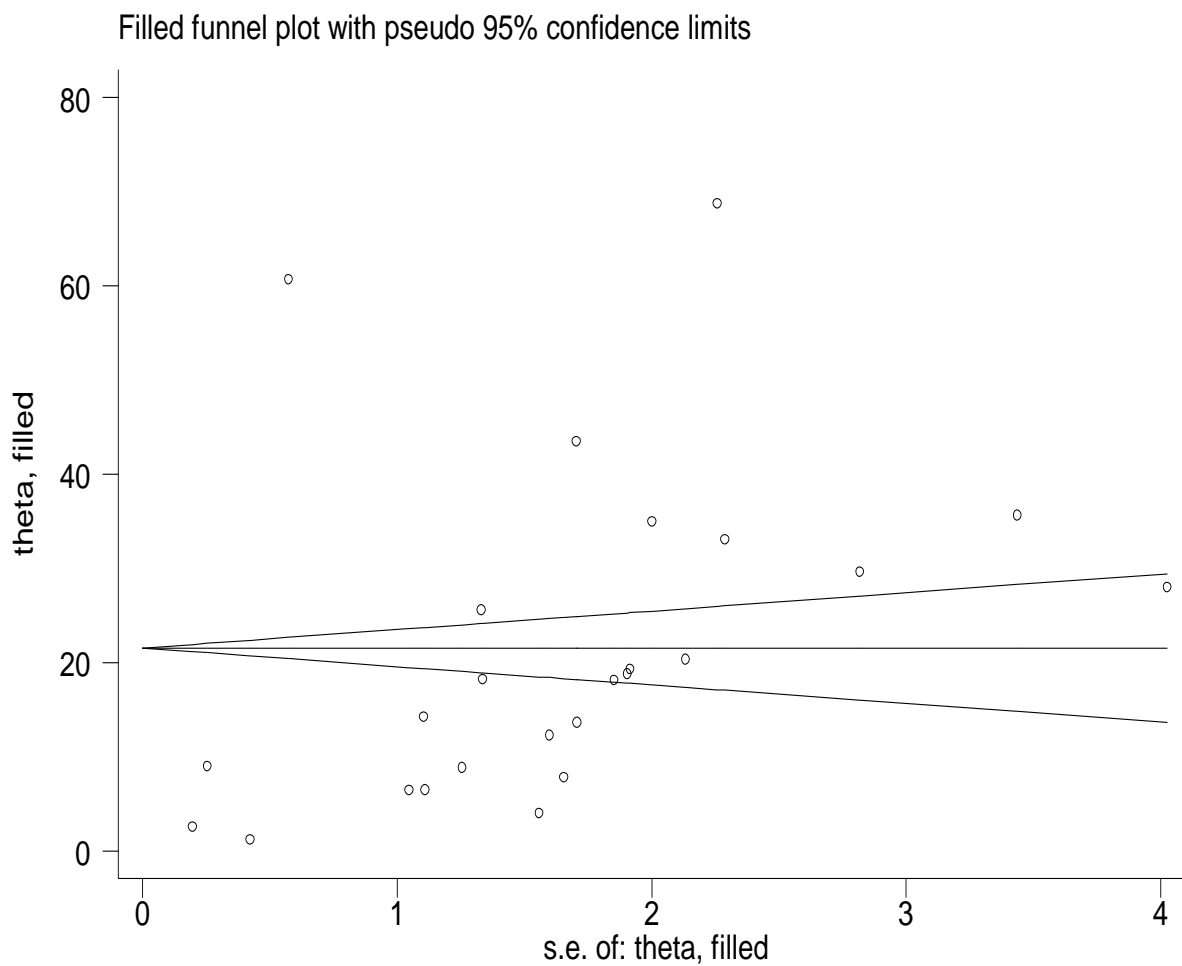


Figure-4: The Duval and Tweedie nonparametric trim and fill analysis of abortion among women in Ethiopia, 2023

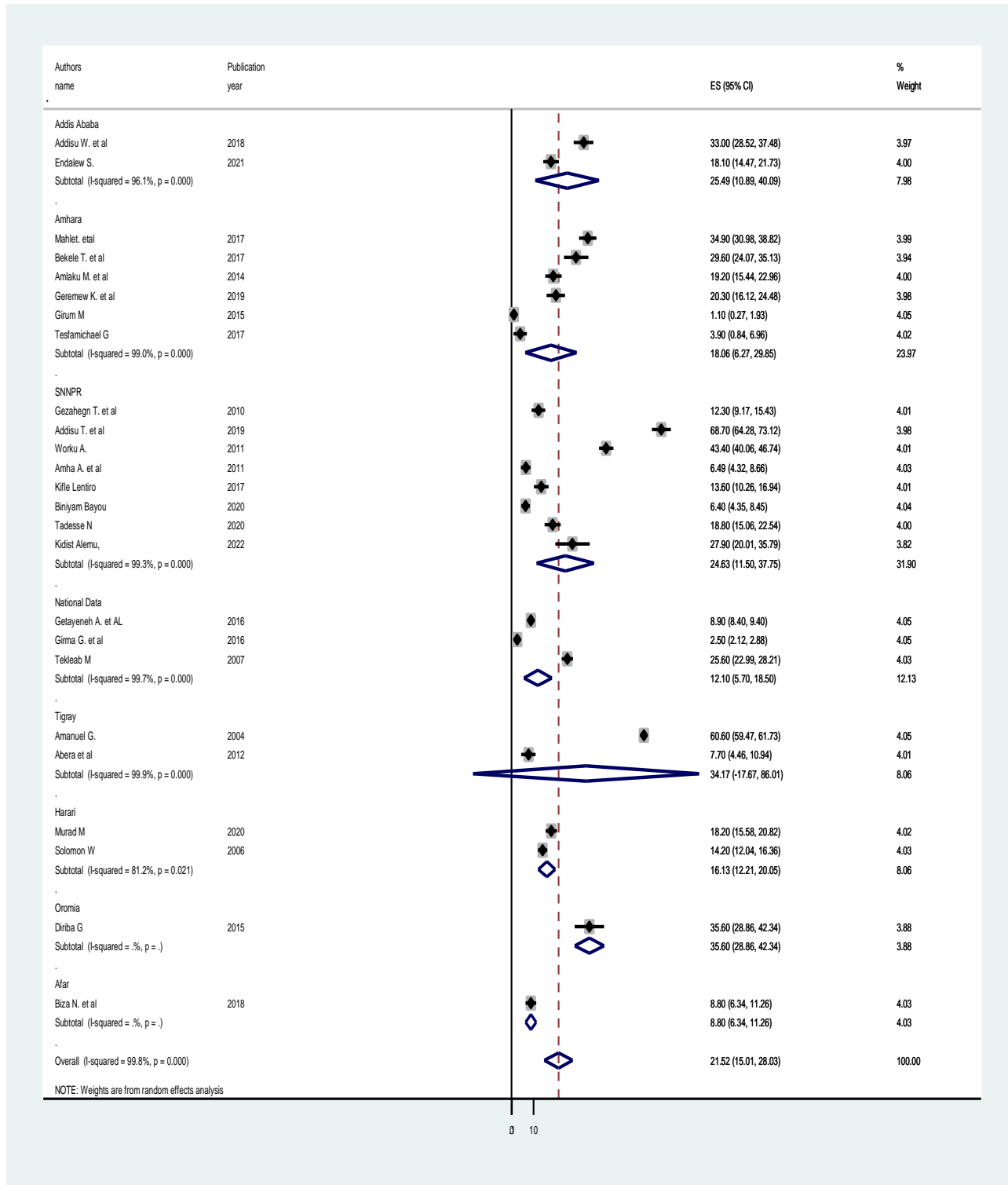


Figure-5: Subgroup analysis of the pregnancy termination based on regional distribution in Ethiopia, 2023



PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	3
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	3
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	4
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	4
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	4
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	4
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	6
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	4
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	5
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	5
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	5
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I ²) for each meta-analysis.	5



PRISMA 2009 Checklist

Page 1 of 2

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	5
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	5
RESULTS			6-7
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	6
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	6
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	6
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	6
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	6
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	6
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	7
DISCUSSION			10-12
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	10
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	11
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	13
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	13

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(6): e1000097. doi:10.1371/journal.pmed1000097

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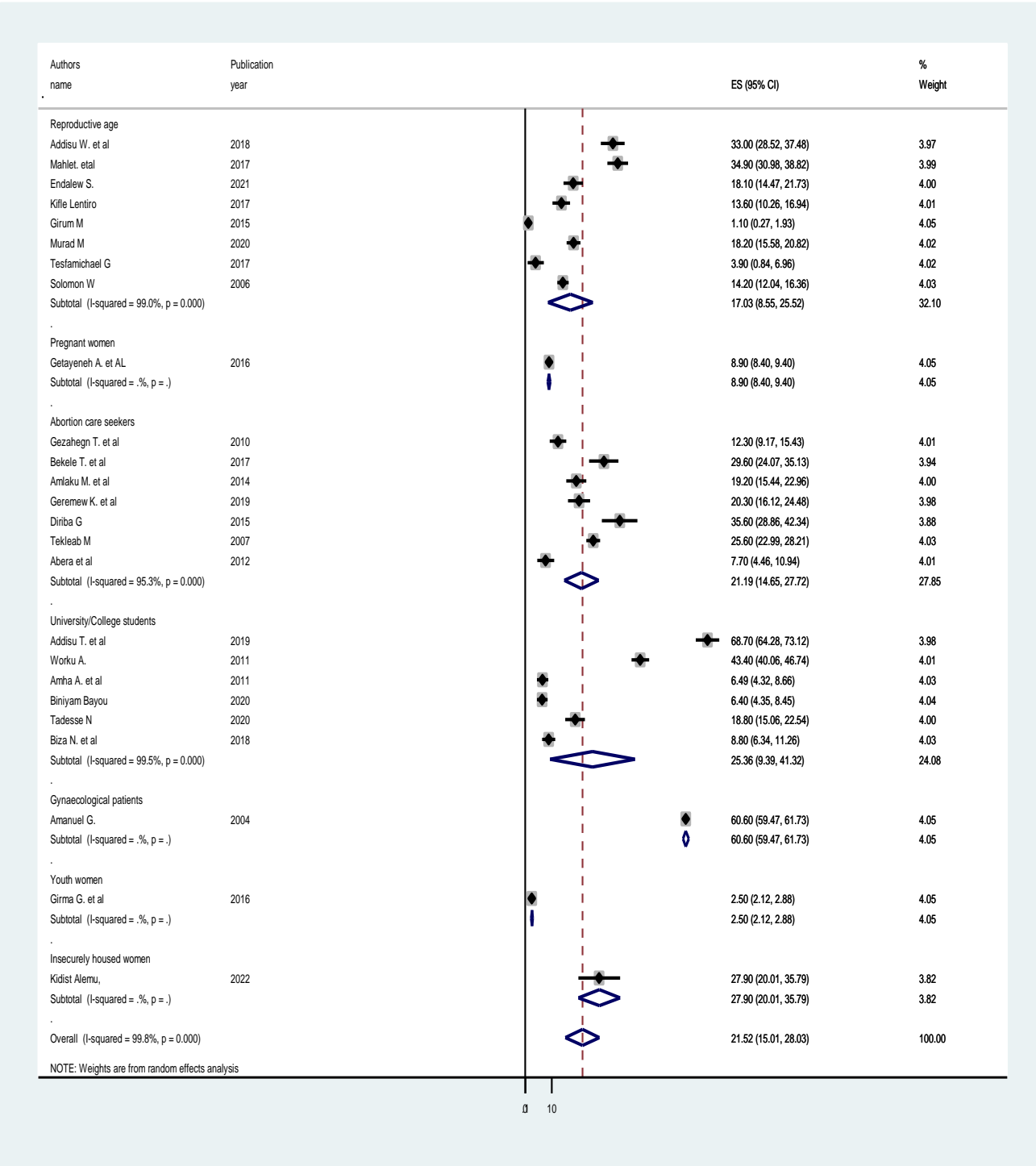


Figure-6: Subgroup analysis of the prevalence of pregnancy termination based on study population in Ethiopia, 2023

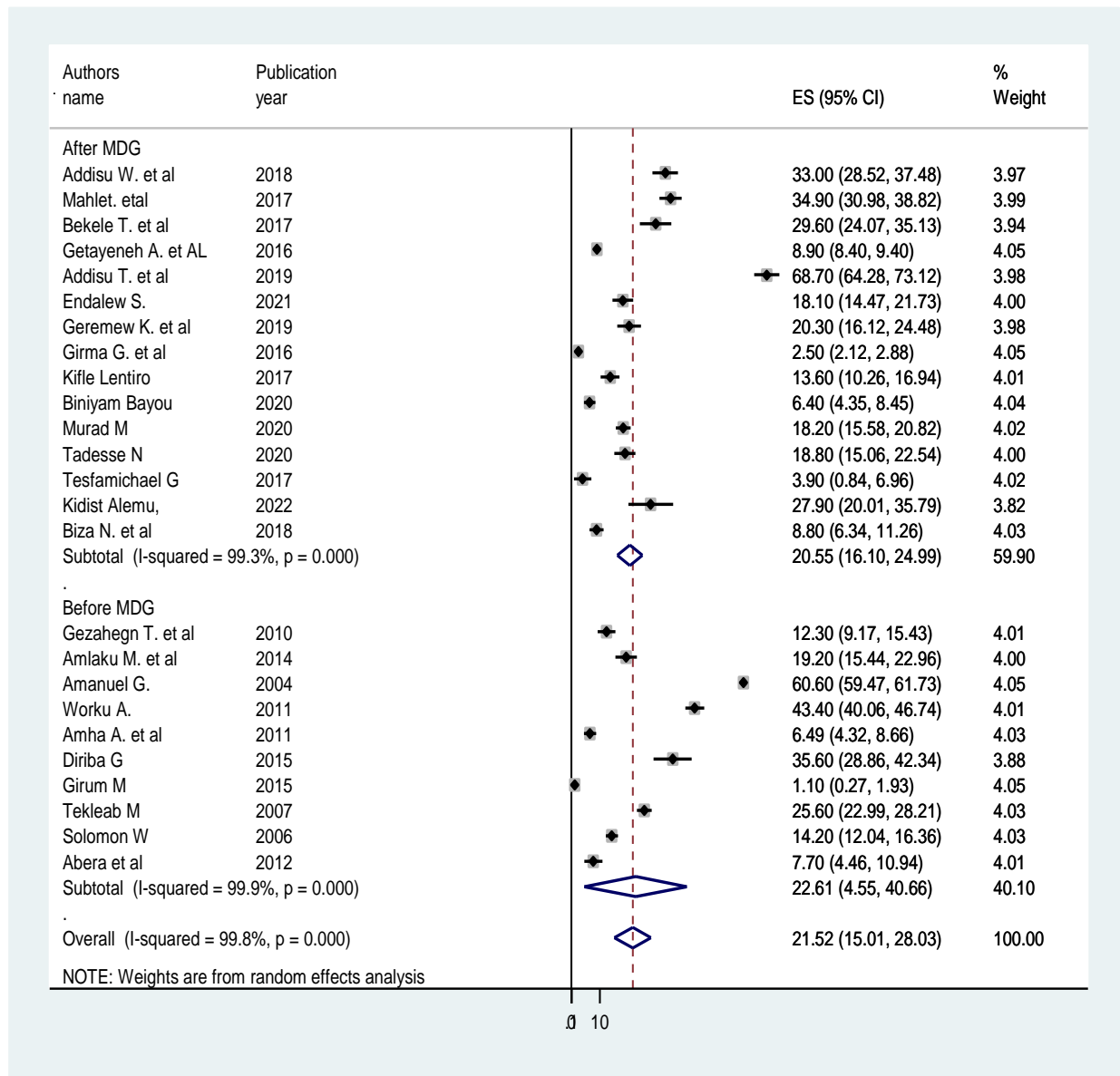


Figure-7: Subgroup analysis of the prevalence of pregnancy termination based on before and after MDG in Ethiopia, 2023

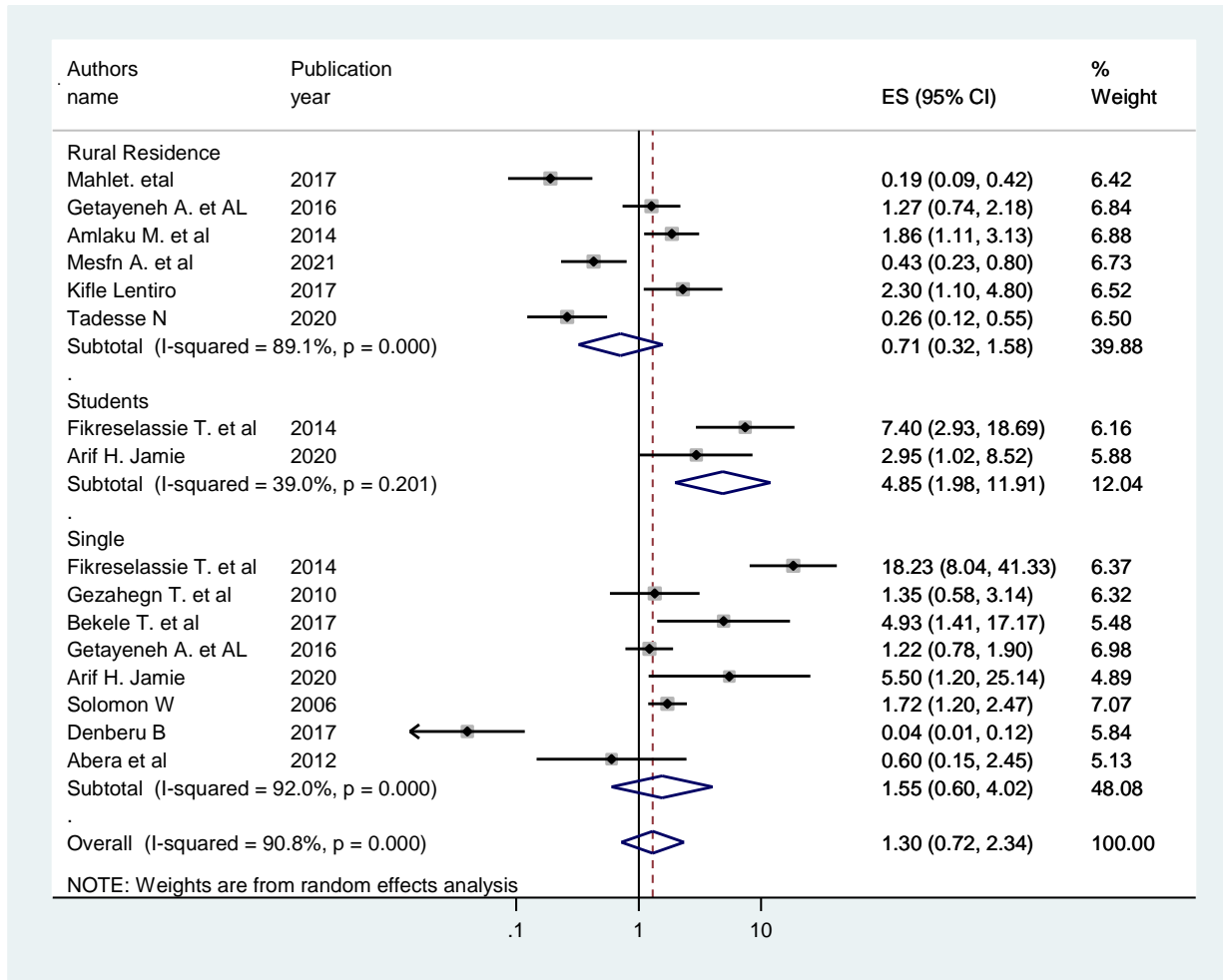


Figure-8: Forest plot of odds ratio for the association of selected socio-demographic characteristics and pregnancy termination in Ethiopia, 2023

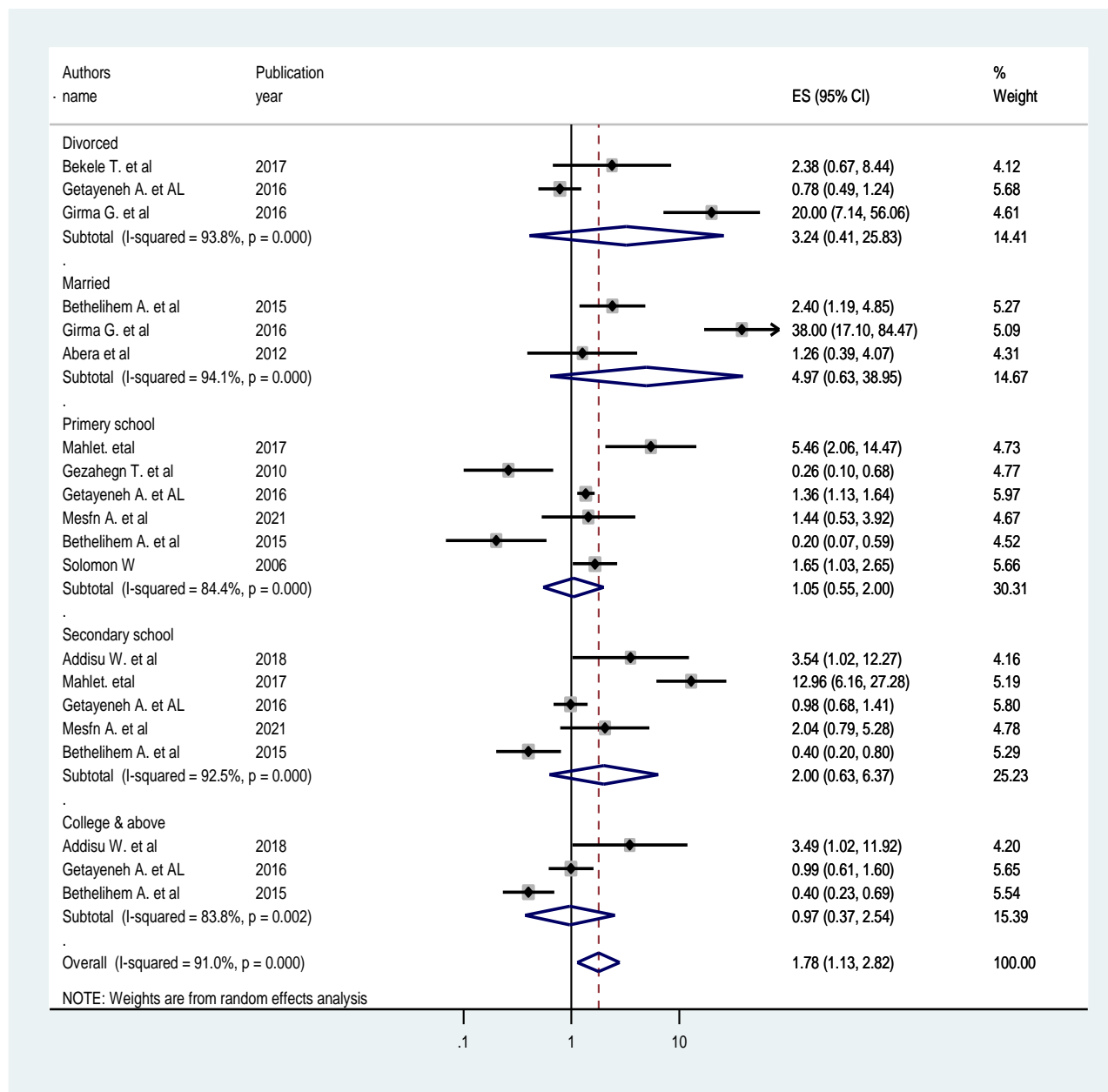


Figure-9: Forest plot of odds ratio for the association of selected socio-demographic characteristics and pregnancy termination in Ethiopia, 2023

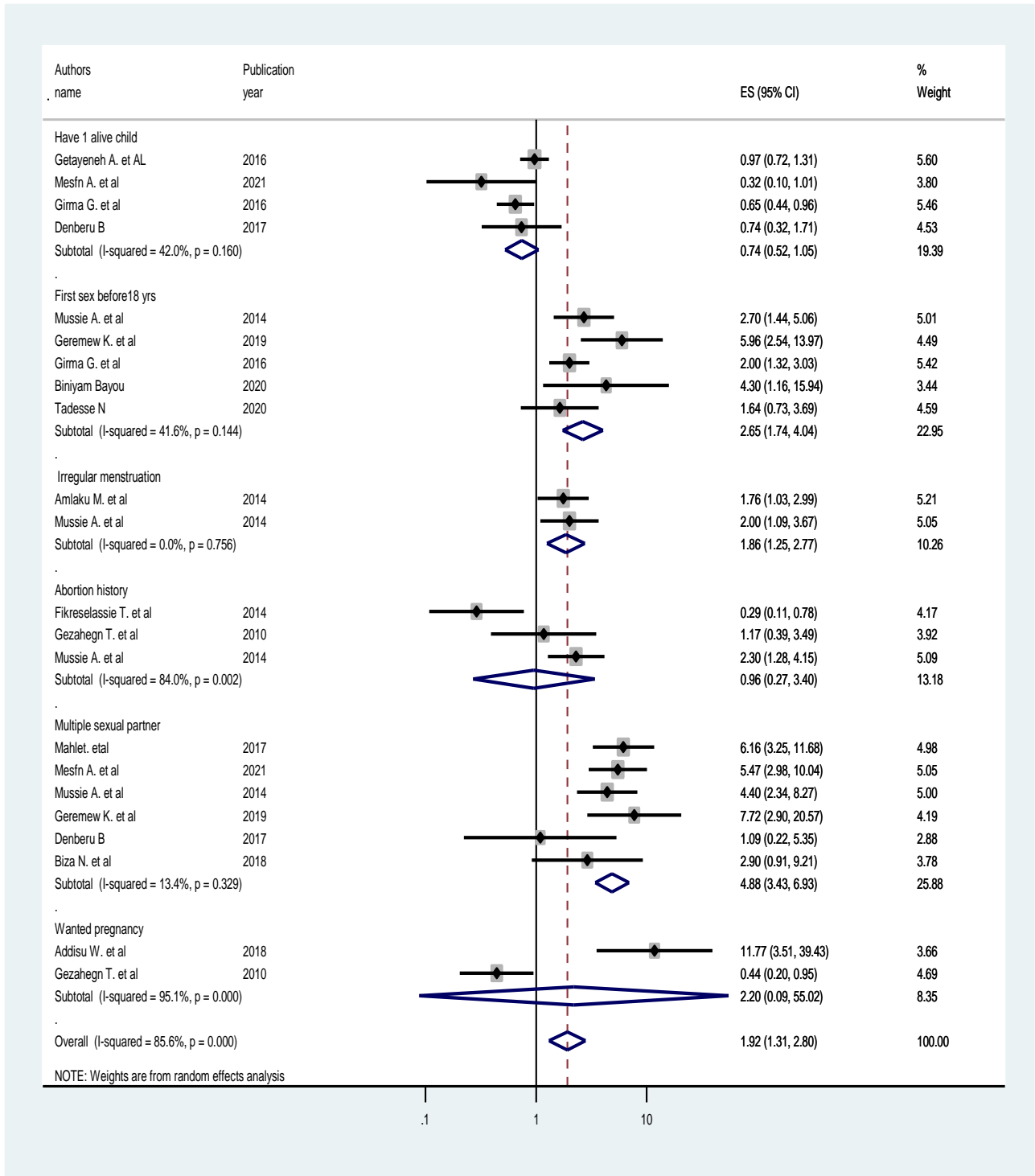


Figure-10: Forest plot of odds ratio for the association of selected reproductive characteristics and pregnancy termination in Ethiopia, 2023

BMJ Open

Prevalence and determinants of pregnancy termination in Ethiopia: A systematic review and meta-analysis

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Manuscript ID	bmjopen-2023-073799.R1
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Date Submitted by the Author:	03-Oct-2023
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Primary Subject Heading:	Obstetrics and gynaecology
Secondary Subject Heading:	Sexual health, Reproductive medicine, Public health
Keywords:	Adolescent, Public health < INFECTIOUS DISEASES, Sexual and Gender Minorities

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3 **Prevalence and determinants of pregnancy termination in Ethiopia: A systematic review**
4 **and meta-analysis**
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Abstract

Objective: This review aims to determine the prevalence of pregnancy termination and its determinant factors in Ethiopia.

Data sources: Relevant articles were retrieved from PubMed, EMBASE, Medline, and other search engines.

Eligibility criteria for selecting studies: The research design for this study had no restrictions, allowing for the inclusion of cross-sectional and case-control studies that examined the prevalence or determinants of pregnancy termination. However, case reports, case series, reviews, editorials, and studies published as abstracts only were excluded from the analysis.

Data extraction and synthesis: The review precisely in accordance with PRISMA criteria, and the quality of the review was assessed using the Joanna Briggs Institute critical appraisal checklist. Heterogeneity was indicated by the p-value for I2 statistics less than 0.05. Data were entered into Microsoft Excel, and the analysis was conducted using Stata 16.

Results: The pooled prevalence pregnancy termination in Ethiopia was 21.52% (95% CI: 15.01, 28.03). Women who had their first sexual initiation before the age of 18 (OR = 1.78; 95% CI = 1.13, 2.82, P=0.144), had irregular menstrual bleeding (OR = 1.86; 95% CI = 1.25, 2.77, P=0.756), being a student (OR: 4.85; 95% CI: 1.98, 11.91, P=0.201), and had multiple sexual partners (OR: 4.88; 95% CI: 3.43, 6.93, P=0.329) were significantly associated with pregnancy termination.

Conclusions: One in five women terminated their pregnancies, which is higher than in other sub-Saharan countries. Being a student, irregular menstrual bleeding, early initiation of sexual intercourse, and multiple sexual partners were determinants of pregnancy termination. Special attention is needed in avoiding early sexual initiation and in reducing sexual risk behaviors.

Strength and limitation of this review:

- Both published and unpublished literature are included in this study.
- The authors extracted the whole literature separately to ensure data quality
- The review includes only observational studies

Keywords: Pregnancy termination, Determinantss, Systematic review and meta analysis, Ethiopia

Introduction

Pregnancy termination is a delicate and divisive determinants topic having political, cultural, moral, and religious implications. Also, it presents a significant public health concern in developing countries (1). Above 60% of unintended pregnancies result in pregnancy termination, with the majority of those being unsafe (2). Developing countries bear the burden of 97% of all unsafe abortions which contributes to 220 deaths per 100,000 live births (3).

Moreover, pregnancy termination imposes an additional burden on health institutions and individuals; in developing countries alone, each year an estimated 7 million women seek treatment in health facilities for the complication of pregnancy termination (4). It is estimated that health-care systems will spend \$553 million per year on post-abortion complications and will lose \$922 million in income due to long-term disability caused by unsafe termination (5). Additionally, a woman who undergo pregnancy termination, particularly through methods such as mechanical dilation and curettage, face an increased risk of experiencing preterm birth and repeated pregnancy loss (6).

Though the burden of pregnancy termination in Ethiopia is a significant contributor to maternal mortality and morbidity (7). Previous studies conducted in Ethiopia have shown that the prevalence of pregnancy termination and its negative consequences are increasing over time (8, 9), and repeated pregnancy termination also accounts significant amount (10-12). Several variables, including early age marriage, low level of education, early sexual intercourse initiation, violence/rape, emotional well-being, educational status, employment status, and resources, and sexual intercourse relationship, have been implicated as factors of pregnancy termination in studies conducted across Ethiopia (13-16).

However, at the national level, illustrative evidence is lacking in Ethiopia regarding the level and underlying factors of pregnancy termination. Thus, this systematic review and meta-analysis aimed to assess the prevalence of pregnancy termination and its determinant factors in Ethiopia. The findings of this study provide evidence for intervention to reduce the burden of pregnancy termination, its complications, and its economic impact in the country. Additionally, this study will help to design strategies and monitor the progress of programs aimed at achieving the maternal mortality reduction targets of the sustainable development goals.

Methods

Study design and setting

This systematic review and meta-analysis included cross sectional, and case control studies which has been conducted in Ethiopia. Systematic review and meta-analysis using computerized databases; searches were performed to estimate the prevalence and identify the determinants of pregnancy termination in Ethiopia.

Search strategy

For this review, a comprehensive search was conducted using various searching strategies to identify relevant articles. Published articles were searched in well-known online databases including EMBASE, Medline, Google, PubMed, Google Scholar, African Journal Online, and Science Direct databases. Additionally, the search was expanded by examining the reference lists of eligible articles to retrieve and extract potential articles. This systematic review was conducted using the preferred reporting items for systematic Reviews and Meta-Analyses PRISMA guidelines. Similarly, the quality of our systematic review and meta-analysis was assessed using the Joanna Briggs Institute (JBI) critical appraisal checklist (17).

Searching was done by using Medical Subject Heading (MeSH) terms related with determinants of pregnancy termination. MeSH terms enables us to select related research articles. We conducted the search for terms using Boolean operators "AND" and "OR," both separately and in combinations. We used the search terms “((((((Abortion) OR (termination of pregnancy)) OR (miscarriage)) AND (determinant factors)) OR (determinants)) OR (associated factors)) OR (influencing factors)) AND (Amhara) OR (Oromia) OR (Tigray) OR (Southern nation, nationalities and people’s) OR (Afar) OR (Benshagul gumuz) OR (Gamabella) OR (Somali) OR (Dire dawa) OR (Addis Ababa) OR (Hareri) OR (Ethiopia)”.

Eligibility criteria

Inclusion criteria

There were no restrictions on research design. We included cross-sectional and case-control studies that showed the prevalence of or determinants of pregnancy termination. Additionally, Only articles reported in the English language and conducted studies until February 2023 were included.

Exclusion criteria

Case reports, case series, reviews, editorials, and studies published as abstracts only were excluded. Agreements on the inclusion and exclusion of the articles were held through the participation of all authors.

Quality assessment and data extraction

Articles were screened using their titles, abstracts, and full paper reviews before being included in the meta-analysis. The quality of included studies was evaluated using the Joanna Briggs Institute (JBI) critical appraisal checklist (17). The quality scores of included studies were assessed and presented using the mean scores to designate them as high- or low-quality. The JBI tool for prevalence and determinat studies was used as a guideline for data extraction from the final selected articles. The data extraction tool contains information on the author and year of the study, the title, the year the study was conducted and the year of publication, the study area and region, the study design and type, the study population, the sample size, the response rate, the outcome measured, and the prevalence and determinats of pregnancy termination. Moreover, all authors independently reviewed the titles and abstracts of studies to be included in this systematic review and meta-analysis. Agreements on the inclusion and exclusion of the articles were reached with the participation of all authors.

Measurement of the outcome variable

In this study, termination of pregnancy is the removal of pregnancy tissue, conception products, or fetus, and placenta from the uterus. The term 'fetus' and 'placenta' is commonly used after eight weeks of pregnancy. Pregnancy tissue and products of conception are the tissues that are produced by the union of an egg and sperm before eight weeks. Terminating a pregnancy is a deliberate action taken by a health professional or the woman herself (18).

Registration and protocol

This review has not previously registered or prepared a protocol. As a result, no adjustments have been made.

Patient and Public Involvement: not applicable

Statistical methods and analysis

The meta-analysis was conducted using Stata 16 software after entering data into Microsoft Excel. Forest plots were used to demonstrate the prevalence of pregnancy termination in Ethiopia. The random effect model of analysis was utilized as a method of meta-analysis to minimize the heterogeneity of included studies (19). The study setting, population, and study period were used to conduct sub-group analysis. The presentation of pregnancy termination determinants was based on odds ratios (ORs) with a 95% confidence interval(CI).

The heterogeneity of the studies included was assessed using the I² statistics. The presence of heterogeneity was determined by using a p-value for I² statistics that was less than 0.05. Based on the I² test statistics results, the heterogeneity is categorized as low (25%), moderate (50%), and high (75%) (19). Furthermore, the Egger regression asymmetry test was used to evaluate the publication bias (20, 21). When the Egger test result's P-value is less than 0.05, there is a declaration of publication bias. The Duval and Tweedie nonparametric trim and fill analysis using the random effect analysis was conducted to detect the presence of publication bias (22).

Result

Study selection

This systematic review and meta-analysis included published studies on the termination of pregnancy in Ethiopia. A total of 12,242 records were retrieved through electronic database searching, and only 33 articles were included in the final analysis (Figure 1).

Characteristics of included studies

This review included Thirty-three studies conducted in various regions of Ethiopia. Of all the studies, 8 (24.24%) were from the Amhara Region (11, 12, 15, 16, 23-26), South Nations and Nationalities Peoples accounted for 9 (27.27%) of the total (13, 27-34), 1 was from Oromia (35), 5 (15.15%) from Addis Ababa city administration (10, 14, 36-38), 3 (9.09%) were from Harari region (39-41), 3 (9.09%) were from Tigray region (42-44), 1 (3.03%) was from Afar region (45), 3 (9.09) were from National data (46-48). Twenty-eight (84.85%) of the included articles were cross-sectional studies (10-13, 15, 23-31, 33-35, 37-42, 44-48), and remains five (15.15%) were case-control studies(14, 16, 32, 36, 43) (**supplementary material 1**).

As well, twenty-seven of the studies were institution-based (10-16, 24, 27-33, 35-46), while six were community-based studies(23, 25, 26, 34, 47, 48). The sample size of the included studies ranged from a minimum of 124 in a study conducted in southwest Ethiopia (34) and and to a maximum of 12,378 in a study conducted using DHS data (48). Overall, a total of 40,116 study participants were included in this review.

Prevalence of pregnancy termination in Ethiopia

Based on the random effect model, the overall pooled prevalence of termination of pregnancy among women in Ethiopia was 21.52% (95% CI: 15.01–28.03). The meta-analysis included studies with significant heterogeneity: I² value of 99.8%, $p < 0.000$. Publication biases among the included studies were examined using funnel plots and Egger's regression test. The results of funnel plots showed an asymmetric shape, which indicates the presence of publication bias among those included studies. Additionally, the Duval and Tweedie nonparametric trim and fill analysis was applied to correct publication bias among the studies, but no trimming was performed since the data is unchanged (**supplementary material 2**).

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6 Objective assessments of publication bias by Egger's regression test also showed the presence of
7 publication bias across studies (p -value < 0.001). After conducting the trim and fill analysis to
8 address publication bias, the final pooled prevalence of pregnancy termination in Ethiopia was
9 adjusted to 21.52% (95% CI: 15.01–28.03) (**supplementary material 2**).

12 13 **Subgroup analysis**

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15 We performed subgroup analysis based on the region, study population, and study setting of the
16 included studies. Table 1 shows the pooled prevalence was highest, 35.60% (95% CI: 28.86,
17 42.34) in the Oromia region, followed by 34.17% (95% CI: 17.67, 86.01) in the Tigray region,
18 24.63% (95% CI: 10.52, 37.75) in the South Nation and Nationalities People Region, and the
19 lowest was seen in three studies conducted using demographic health data, 12.10% (95% CI:
20 5.66, 18.50) (**supplementary material 2**).

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22 Furthermore, subgroup analysis reveals that the highest pooled prevalence of abortion was seen
23 among gynecological admitted patients, at 60.60% (95% CI: 59.47, 61.73), followed by 25.38%
24 (95% CI: 9.39, 41.32) among university/college students, and 27.90% (95% CI: 20.01, 35.79)
25 among insecurely housed women, with the lowest pooled prevalence being seen among pregnant
26 women and youth women. Additionally, subgroup analysis was conducted based on the year
27 before and after the Millennium Development Goals' implementation. The pooled prevalence of
28 pregnancy termination before and after MDGs was 20.55% (95% CI: 16.10–24.99) and 21.61%
29 (95% CI: 15.01–28.03), respectively (**supplementary material 2**).

Table 1: Subgroup analysis for the prevalence of pregnancy termination in Ethiopia, 2004-2022

Subgroup	Number of studies	Total Sample	Prevalence (95%CI)	Heterogeneity	
				I ²	p-value
By region					
Addis Ababa	2	855	25.49(10.39, 40.09)	92.4	< 0.001
Amhara	6	2371	18.06(6.27, 29.85)	99.0	< 0.001
SNNP	8	3678	24.63(95% CI: 10.52, 37.75)	99.4	< 0.001
National Data	3	19854	12.10(5.70, 18.50)	99.7	< 0.001
Tigray	2	7463	34.17(17.6, 86.01)	99.9	< 0.001
Harari	2	1835	16.13(12.21, 20.05)	81.2	< 0.001
Oromia	1	194	35.60(28.86, 42.34)	.	.
Afar	1	509	8.80(6.34, 11.26)	.	.
By publication year					
2016 to 2022 (post MDG)	15	24234	20.55(16.10, 24.99)	99.3	< 0.001
Before MDG	10	12525	22.61(4.55, 40.66)	99.9	< 0.001
Study population					
Reproductive age	8	4426	17.03(8.55, 25.52)	99.0	< 0.001
Pregnant women	1	12378	8.90(8.40, 9.40)	.	.
Abortion care seeker	7	2990	21.19(14.65, 27.72)	95.3	< 0.001
University or college student	6	3237	25.36(9.39, 41.32)	99.5	< 0.001
Gynecological patient	1	7203	60.60(59.47, 61.73)	.	.
Youth women	1	6401	2.50(2.12, 2.88)	.	.
Insecurely housed women*	1	124	27.90(20.01, 35.79)	.	.
Total	25	36759	21.52(15.01, 28.03)	99.8	< 0.001

*Insecurely household women: it means women who live or spend their time on the street.

Determinants of pregnancy termination

Socio-demographic characteristics

The sociodemographic factors included in this analysis were the place of residence, age, marital, occupational, and educational status of the women. A separate analysis was conducted for each variable. Finally, a meta-analysis of (16, 39) two studies showed that being a student was significantly associated with pregnancy termination (OR: 4.85; 95% CI: 1.98, 11.91). There was moderate heterogeneity ($I^2 = 39\%$) (**supplementary material 2**).

Reproductive characteristics

A total of 5 articles (15, 24, 28, 43, 47) were included to assess the association between first sexual initiation before the age of 18 and pregnancy termination. The pooled meta-analysis found that women who had their first sexual experience before the age of 18 were twice as likely as those who had their first sexual experience after the age of 18 to have their pregnancy terminated (OR = 1.78; 95% CI = 1.13, 2.82). There was moderate heterogeneity ($I^2 = 41.6\%$). Moreover, two articles (11, 43) were also included to determine the association between irregular menstrual bleeding and pregnancy termination. The final pooled meta-analysis using data from the two articles found that pregnancy termination was nearly two times more likely to occur in women with irregular menstrual bleeding than in those who had regular menstrual bleeding, (OR = 1.86; 95% CI = 1.25, 2.77). Similarly, a meta-analysis of six studies (14, 15, 24, 32, 34, 43) showed that women who had multiple sexual partners were significantly associated with pregnancy termination (OR: 4.88; 95% CI: 3.43, 6.93). There was low heterogeneity ($I^2 = 13.4\%$) (**supplementary material 2**).

Discussion

Pregnancy termination is a major public health concern in Ethiopia (49). In this systematic review and meta-analysis, the overall magnitude of pregnancy termination was pooled from 25 published articles in Ethiopia, and significant determinants of pregnancy termination were identified using different articles. Being a student increased the rate of termination of pregnancy nearly five times. In addition, first sexual initiation before the age of 18, women with irregular menstrual bleeding, and multiple sexual partners were determinants of pregnancy termination in Ethiopia. The findings of this review revealed evidence to help reduce the impact of pregnancy termination in Ethiopia by aiming at the main determinants for pregnancy termination.

In Ethiopia various studies have been conducted on the issue of pregnancy termination, involving different settings such as the community, healthcare institutions, and higher education institutions. These studies have yielded varying figures regarding the prevalence of pregnancy termination in the country. However, this particular study revealed Ethiopia has a higher prevalence of pregnancy termination compared to other low- and middle-income countries.

The study found that the pooled prevalence of termination of pregnancy in Ethiopia was 21.52%. This finding is lower compared to a study done in Ghana at 25% (50), higher than in Mozambique at 9 % ($\times 2.33$) (50), and in India at 1.7% ($\times 12$) (51). The difference could be attributed to various factors like; study population, study design, study area, socio-demographic characteristics, and the differences in health policies of the countries. Additionally, the current study utilized a meta-analysis approach at the national level, incorporating community or institutional studies, while the study in Ghana and Mozambique was conducted using demographic health data with a small sample size compared to the current study (50). Additionally, in our study, huge variations were seen across the regions. A spatial analysis study conducted in Ethiopia using national DHS data also also showed variation even within the regions of the country (48). Thus, acting according to the needs of the region and age-specific policy is important during national policy or guideline development.

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3 Our study observed that being a student was significantly associated with the termination of
4 pregnancy. One of the possible explanations could be that students are likely to be adolescents,
5 belonging to the younger age category. In addition, adolescent girls are remaining in school
6 longer, which may factor into their decisions to postpone childbearing and terminate unintended
7 pregnancies (52). Likewise, a study conducted in India shows the tendency for pregnancy
8 termination is high in this age category since the rate of unintended pregnancies and unmet needs
9 for family planning are high in this age group (53). The higher rate of pregnancy termination
10 could also be attributed to a failure to provide education about the risks of pregnancy termination
11 and ways of prevention for unintended pregnancy (54).
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19 Additionally, the idea supported by Van Rensburg that societal poverty, unemployment, and
20 other socio-demographic factors affect youth pregnancies and it might prone to pregnancy
21 termination (55). In addition, a review from the late 1990s found that young women often cited a
22 desire to stay in school as a major reason for pregnancy termination (56). Moreover, many
23 adolescents continue to have difficulty accessing contraception, often as a result of stigma and/or
24 a lack of resources (57).
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30 The study from Nigeria indicated that 15–24-year old women are still being left behind on
31 reproductive health matters despite increasing global attention to prioritizing their health (58).
32 Studies found that educational programs aimed at reducing sexual risk behaviors and preventing
33 pregnancy among young people can effectively reduce pregnancy rates among teenagers (59).
34 Also, programs aimed at abstinence-centered sexuality education are effective in preventing
35 adolescent pregnancy (60). Thus, this implies a future focus on reproductive health issues
36 specific to students to address their needs. Additionally, future researchers should better focus on
37 possible interventions to reduce the risk of pregnancy and pregnancy termination among students.
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45 This review also assessed the association of selected variables with pregnancy termination.
46 Women under the age of 18 at first sex were significantly more likely to terminate their
47 pregnancy. This finding is consistent with studies conducted in Nigeria and Peru that reported a
48 higher rate of pregnancy termination among women who had their age at first sex before 18
49 years old (61-63). Studies also revealed that early sexual debuts are significantly associated with
50 adolescent pregnancies, which are usually unwanted (64, 65). As well, a study conducted in
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3 Ethiopia shown initiation of sexual intercourse before the age of 18 years was found significant
4 association with repeated pregnancy termination (66).
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7 In many low income countries, rising ages at first marriage combined with increasing levels of
8 premarital sex continue to result in unintended pregnancies among adolescents (67). Thus,
9 improving the knowledge of adolescents about sexual and reproductive health issues, and
10 increasing contraceptive access and use among young people, are important to prevent unsafe
11 abortion or pregnancy termination (68). This necessitates the development of reproductive health
12 education specifically for adolescent girls. Future researchers should also address the gap in
13 studies on the needs of adolescent girls and possible interventions needed to reduce sexual
14 initiation before the age of 18 years.
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17 Furthermore, at the individual level, we found that pregnancy termination was significantly
18 associated with women who had multiple sexual partners. Likewise, a study conducted in Peru
19 indicated that as the number of sexual partners increased, the odds of getting a pregnancy
20 termination increased (69). Studies conducted in Cambodia, China, and the United Kingdom also
21 have found that having multiple sexual partners is associated with a higher rate of repeated
22 pregnancy termination. (54, 70, 71). The government shall be emphasized reproductive health
23 education, particularly for women regarding the risks of multiple sexual partners, the access
24 where, and how to get counseling on how to prevent pregnancy.
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27 This study also found that pregnancy termination was two times higher among women who had
28 menstrual irregularities compared to their counterparts. Lastly, this systematic review and meta-
29 analysis indicated that there were no statistical association between the termination of pregnancy
30 and rural residents, marital status, women's age, educational status, primiparous, history of
31 abortion, and wanted pregnancy.
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34 As a limitation, this finding might be prone to the risk of bias due to the significant heterogeneity
35 of articles included from a different region of Ethiopia. In addition, differences in the study
36 population, setting, and design within the included studies might influence the results of this
37 review. Moreover, studies conducted in health institutions, Colleges, or higher education might
38 affect the pooled estimates. Additionally, in this review, only published articles were included.
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3 Also, this review didn't include qualitative studies on the explanations for pregnancy
4 termination.
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8 Future research must explain the relationship between pregnancy termination and other
9 determinants such as social, economic, substance use, peer pressure, alcohol use, sexual or
10 physical violence, and knowledge of sexual and reproductive health issues such as family
11 planning and fertility.
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15 16 **Conclusions**

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18 One in every five women had their pregnancies terminated, which is a high rate when compared
19 to Sub-Saharan countries. Being a student was significantly associated with the termination of a
20 pregnancy. In addition, irregular menstrual bleeding, early initiation of sexual intercourse, and
21 multiple sexual partners were important determinants of pregnancy termination.
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27 **Abbreviations:** OR: odds ratios; CI: confidence interval; JBI: Joanna Briggs Institute; MDG:
28 Millennium Development Goals'
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31 32 **Declarations**

33 **Ethical approval:** This article was conducted using published articles. Therefore, it don't
34 required ethical approval.
35

36 **Funding:** No funding was used in this study.
37

38 **Availability of data and materials:** The datasets used and analyzed during the review are
39 available from the corresponding author upon reasonable request.
40
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42 **Competing interests:** None declared.

43 **Author contributions:** HK, MWA, AB, EM, TH, and LAT conducted the data curation and
44 extraction. HK, LAT, EM, and MWA. wrote the original and final draft of the research. LAT, EM,
45 MWA and HK were conducted formal analyses and data interpretation. All authors read and
46 approved the final manuscript.
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51 **Supplementary file :** The supplementary file contains the data extraction sheet for the study
52 included in the review.
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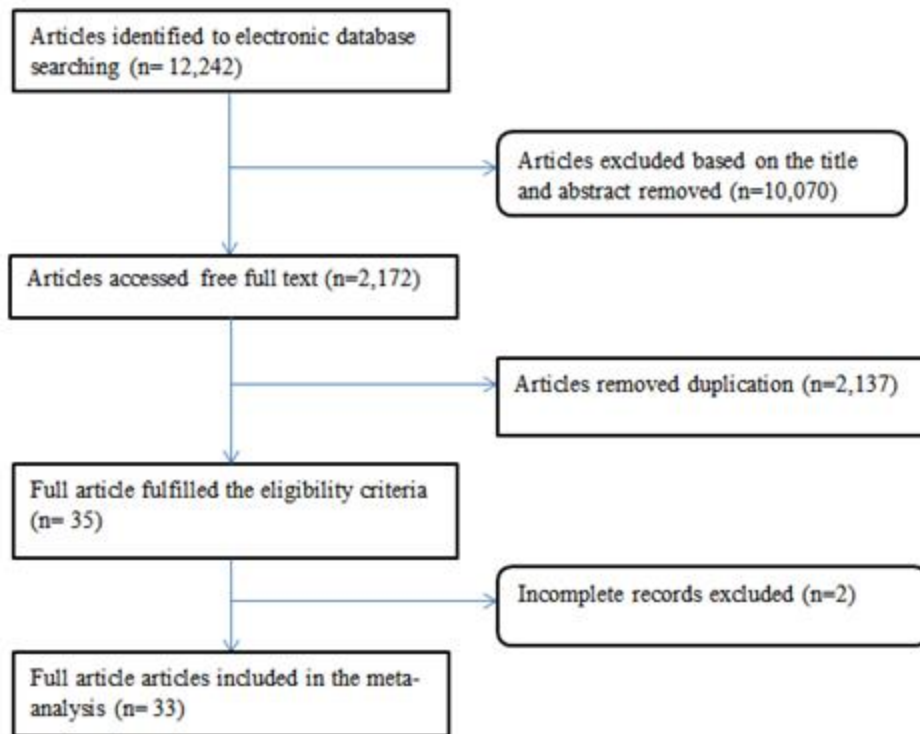


Figure 1. Flow chart of describing the selection of studies for the systematic review and meta-analysis of the prevalence of pregnancy termination and associated factors in Ethiopia, 2023

Table 2: Characteristics of the studies for the prevalence of pregnancy termination in Ethiopia, 2004-2022

Authors name	Publication year	Study area	Region	Study design	Study setting	Study population	Sample size
Addisu W. et al	2018	Addis Ababa	Addis Ababa	Cross-sectional	Institutional	Reproductive age group	423
Mahlet T. et al.	2017	Debre Markos	Amhara	Cross-sectional	Institutional	Reproductive age group	567
Fikreselassie T. et al.	2014	Bahr Dar	Amhara	Case-control	Institutional	Pregnant women	175
Gezahegn T. et al.	2010	Guraghe Zone	SNNP	Cross-sectional	Institutional	Abortion care service seekers	422
Bekele T. et al.	2017	Debre Markos	Amhara	Cross-sectional	Institutional	Abortion care service seekers	262
Getayeneh A. et al.	2016	Ethiopia	National data	Cross-sectional	Community	Pregnant women	12378
Addisu T. et al.	2019	Hawassa	SNNP	Cross-sectional	Institutional	University/College students	422
Amlaku M. et al.	2014	Amhara region referral hospitals	Amhara	Cross-sectional	Institutional	Abortion care service seekers	422
Birye D. et al.	2019	Gondar	Amhara	Cross-sectional	Institutional	University/College students	648
Amanuel G. et al.	2004	Adigrat	Tigray	Cross-sectional	Institutional	Women with Gynecologic problem	7203
Endalew S. et al.	2021	Addis Ababa	Addis Ababa	Cross-sectional	Institutional	Reproductive age	432
Worku A. et al.	2011	Arba Minch	SNNP	Cross-sectional	Institutional	University/College students	845
Mesfn A. et al.	2021	Arba minch & Wolayita Sodo town	SNNP	Case control	Institutional	Reproductive age group	413
Bethelihem A. et al.	2015	Addis Ababa	Addis Ababa	Cross-sectional	Institutional	Abortion care service seekers	429
Mussie A. et al.	2014	Tigray region health hospitals	Tigray	Case control	Institutional	Abortion care service seekers	309

Geremew K. et al.	2019	Debre Berhan town health institutions	Amhara	Cross-sectional	Institutional	Abortion care service seekers	355
Amha A. et al.	2011	Hawassa University	SNNP*	Cross-sectional	Institutional	University/College students	493
Girma G. et al.	2016	Ethiopia	National data	Cross-sectional	Community	Youth women	6401
Kifle L. et al.	2017	Guraghe zone	SNNP	Cross-sectional	Institutional	Reproductive age	404
Arif H. et al.	2020	Harari	Harari	Cross-sectional	Institutional	Reproductive age group	611
Biniyam B. et al.	2020	Dilla University	SNNPR	Cross-sectional	Institutional	University/College students	548
Denberu B. et al	2017	Addis Ababa	Addis Ababa	Case control	Institutional	Youth women	330
Diriba G. et al.	2015	Jimma	Oromia	Cross-sectional	Institutional	Abortion care service seekers	194
Girum M. et al.	2015	Gonji Kollela District	Amhara	Cross-sectional	Community	Reproductive age group	611
Murad M. et al.	2020	Harar	Harari	Cross-sectional	Institutional	Reproductive age group	835
Tekleab M. et al.	2007	Ethiopia	National data	Cross-sectional	Institutional	Abortion care service seekers	1075
Tadesse N. et al.	2020	Mizan Tepi University	SNNP	Cross-sectional	Institutional	University/College students	420
Tesfamichael G. et al.	2017	Gondar	Amhara	Cross-sectional	Community	Reproductive age	154
Kidist A. et al	2022	Jimma, Bonga, and Mizan-Aman	SNNPR	Cross-sectional	Community	Insecurely housed women	124
Solomon W. et al	2006	Harer	Harari	Cross-sectional	Community	Reproductive age	1000
Biza N. et al.	2018	Semera	Afar	Cross-sectional	Institutional	University/College students	509
Abera et al.	2012	Mekelle	Tigray	Cross-sectional	Institutional	Abortion care seekers	260

*SNNP: South Nations and Nationalities Peoples

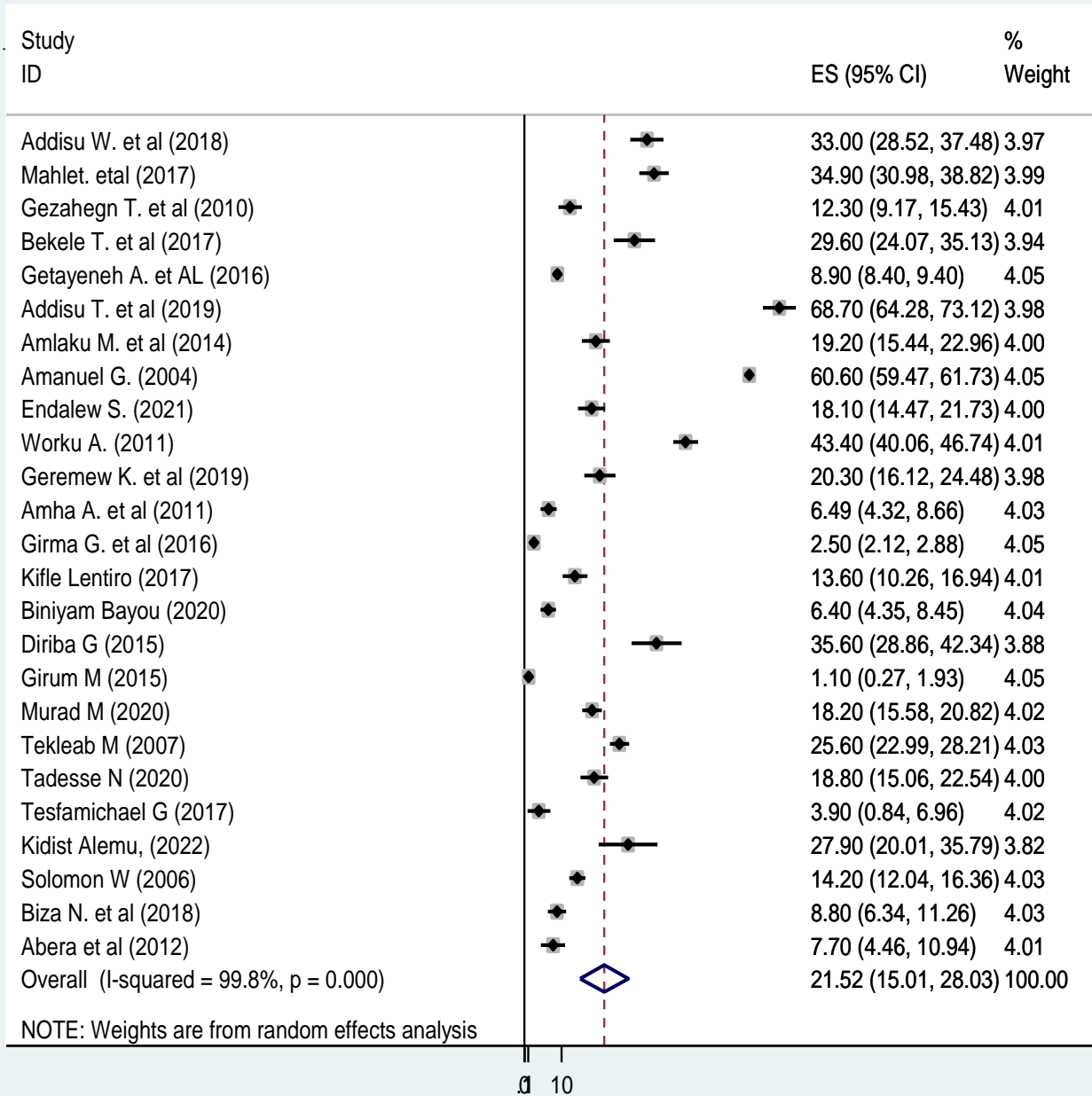


Figure-1: Forest plot of the pooled prevalence of pregnancy termination in Ethiopia, 2023

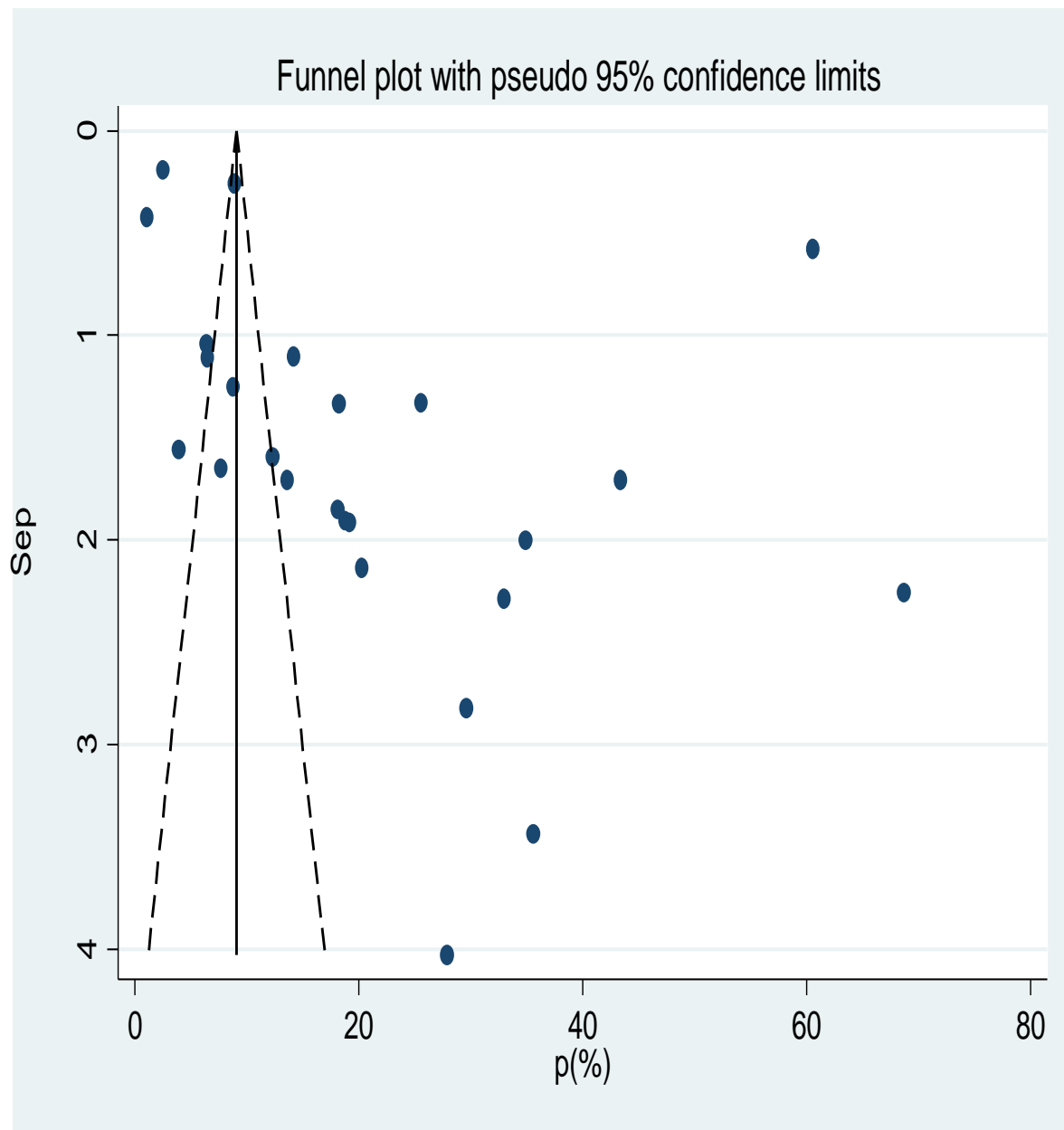


Figure-2: Funnel plot to test publication bias of pregnancy termination in Ethiopia, 2023

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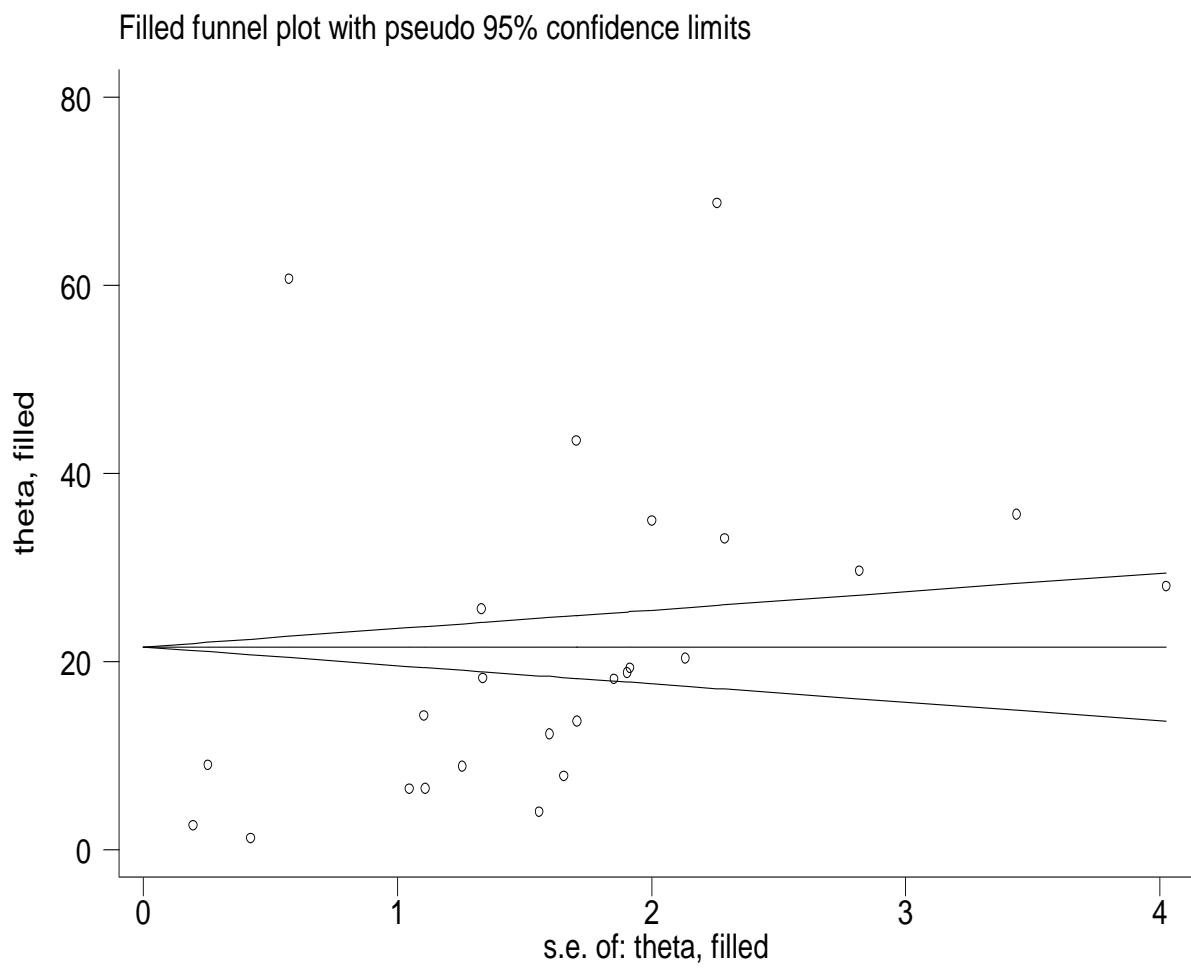


Figure-3: The Duval and Tweedie nonparametric trim and fill analysis of abortion among women in Ethiopia, 2023

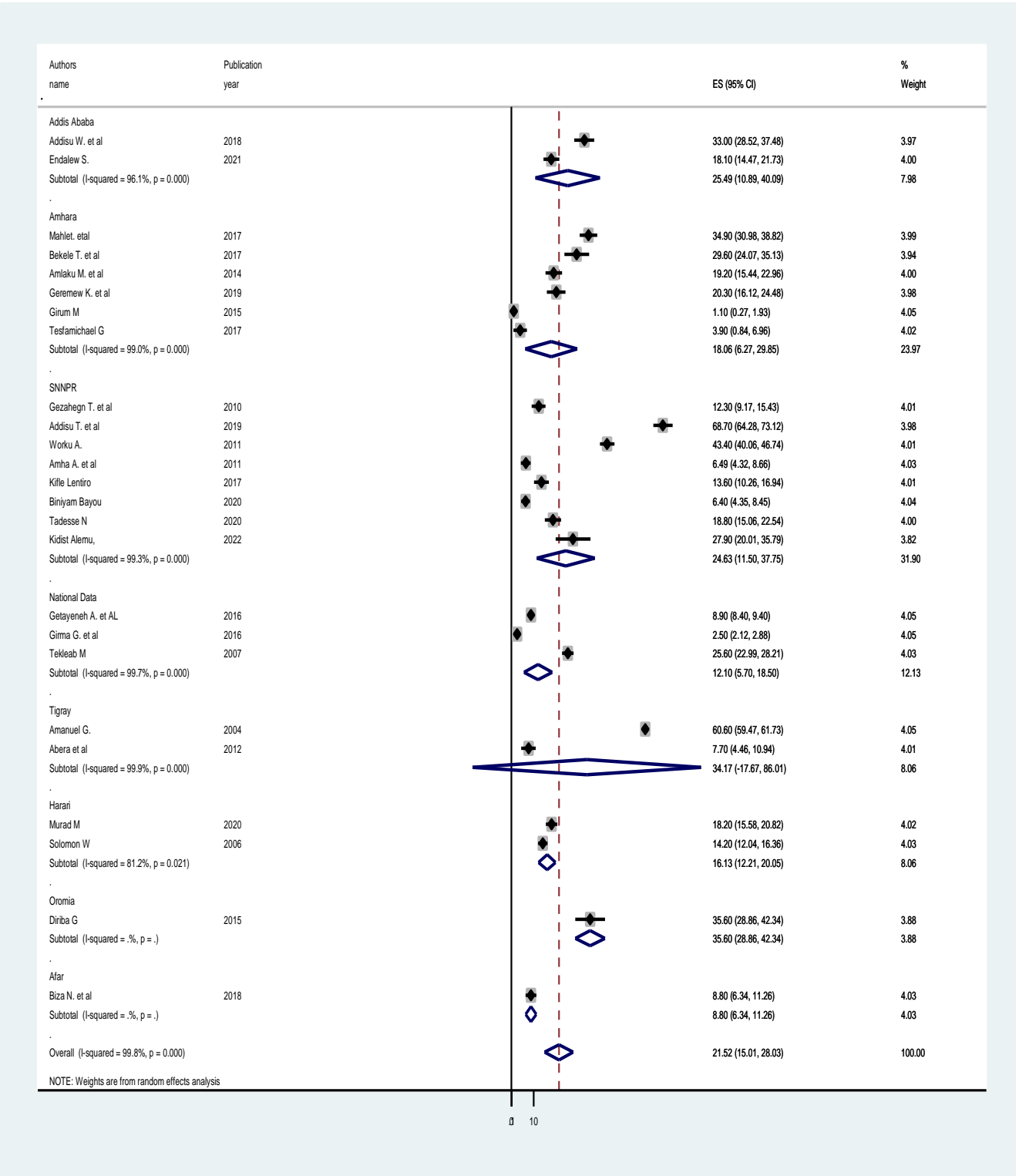


Figure-4: Subgroup analysis of the pregnancy termination based on regional distribution in Ethiopia, 2023

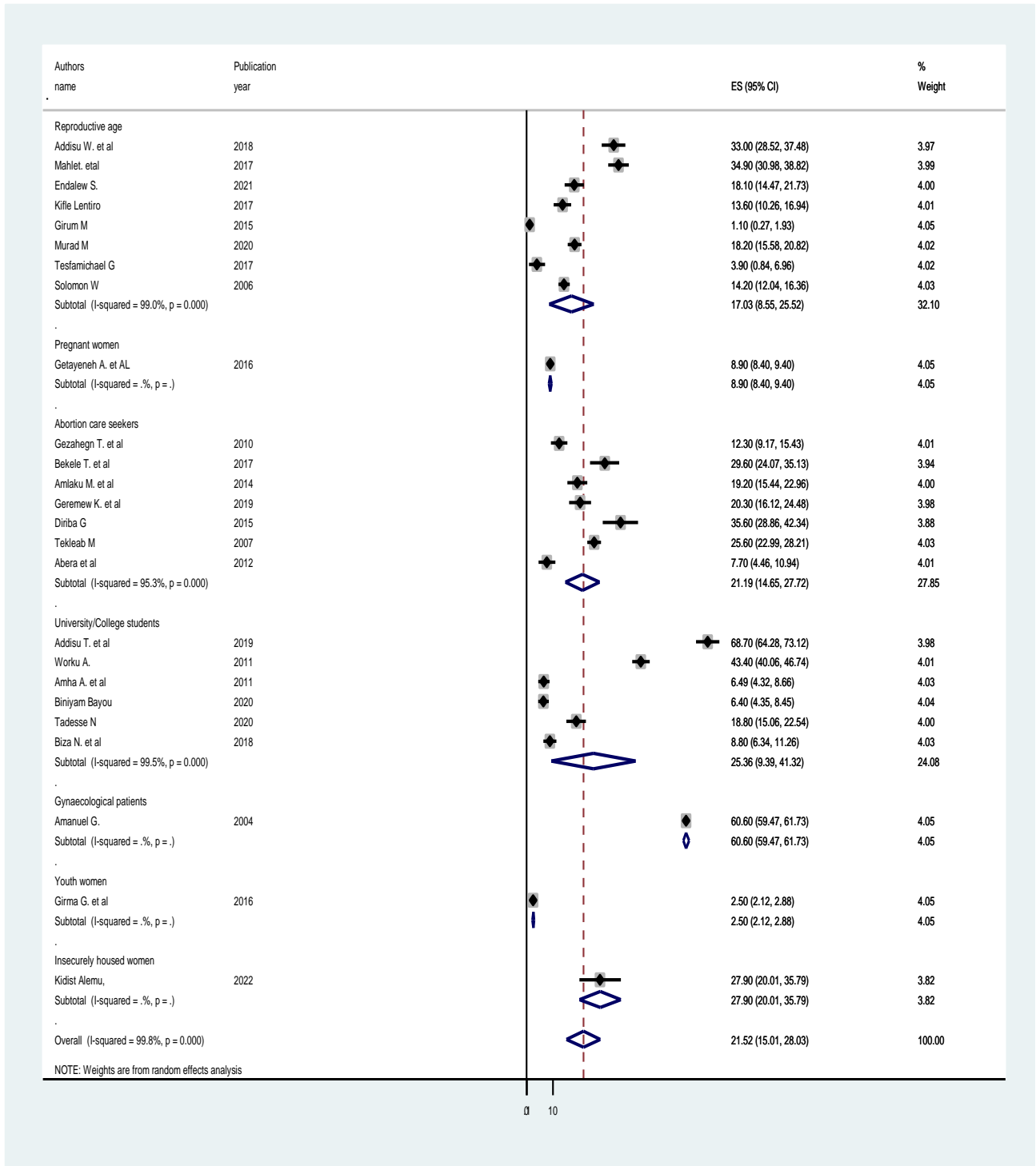


Figure-5: Subgroup analysis of the prevalence of pregnancy termination based on study population in Ethiopia, 2022

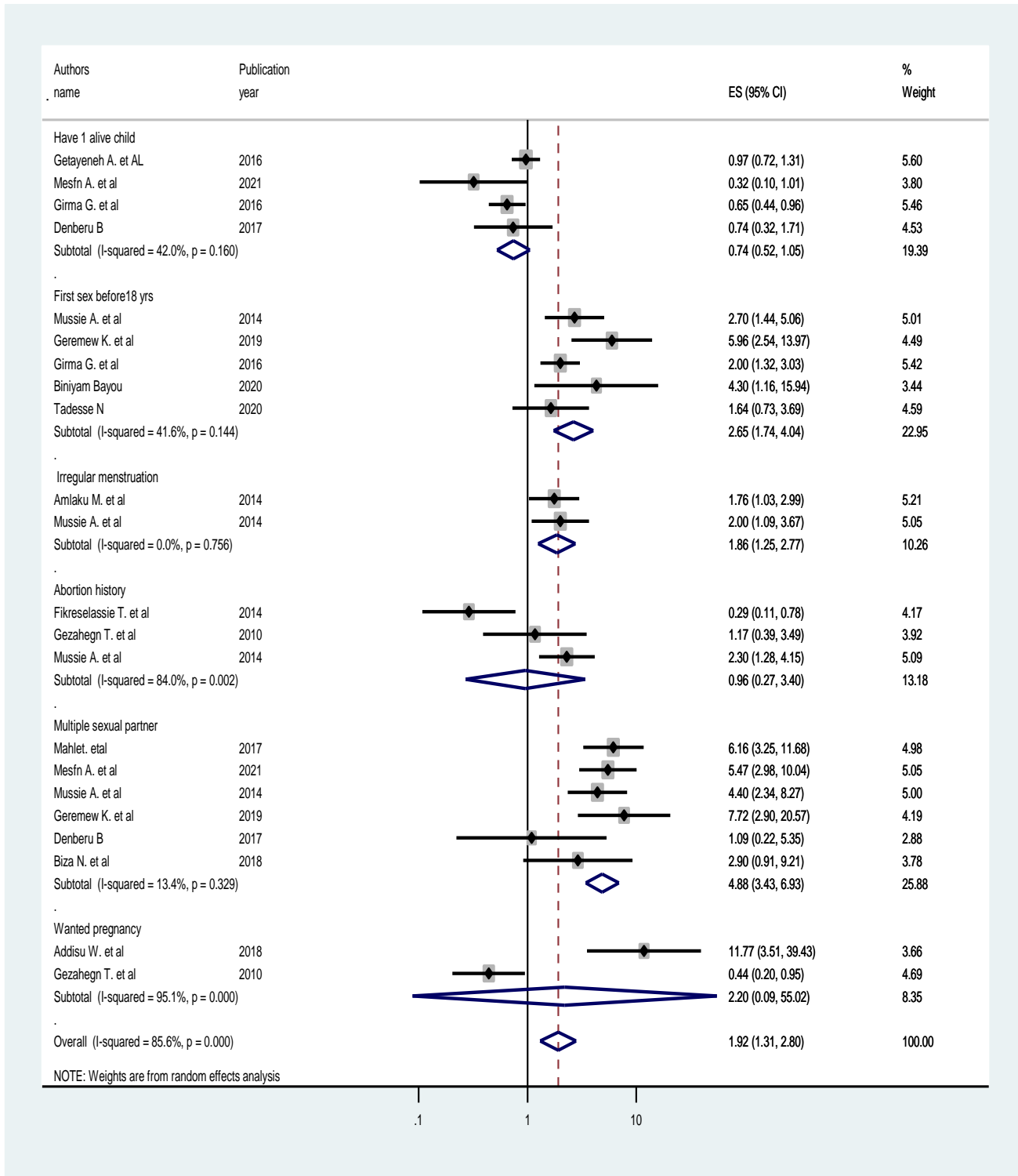


Figure-6: Subgroup analysis of the prevalence of pregnancy termination based on before and after MDG in Ethiopia, 2023

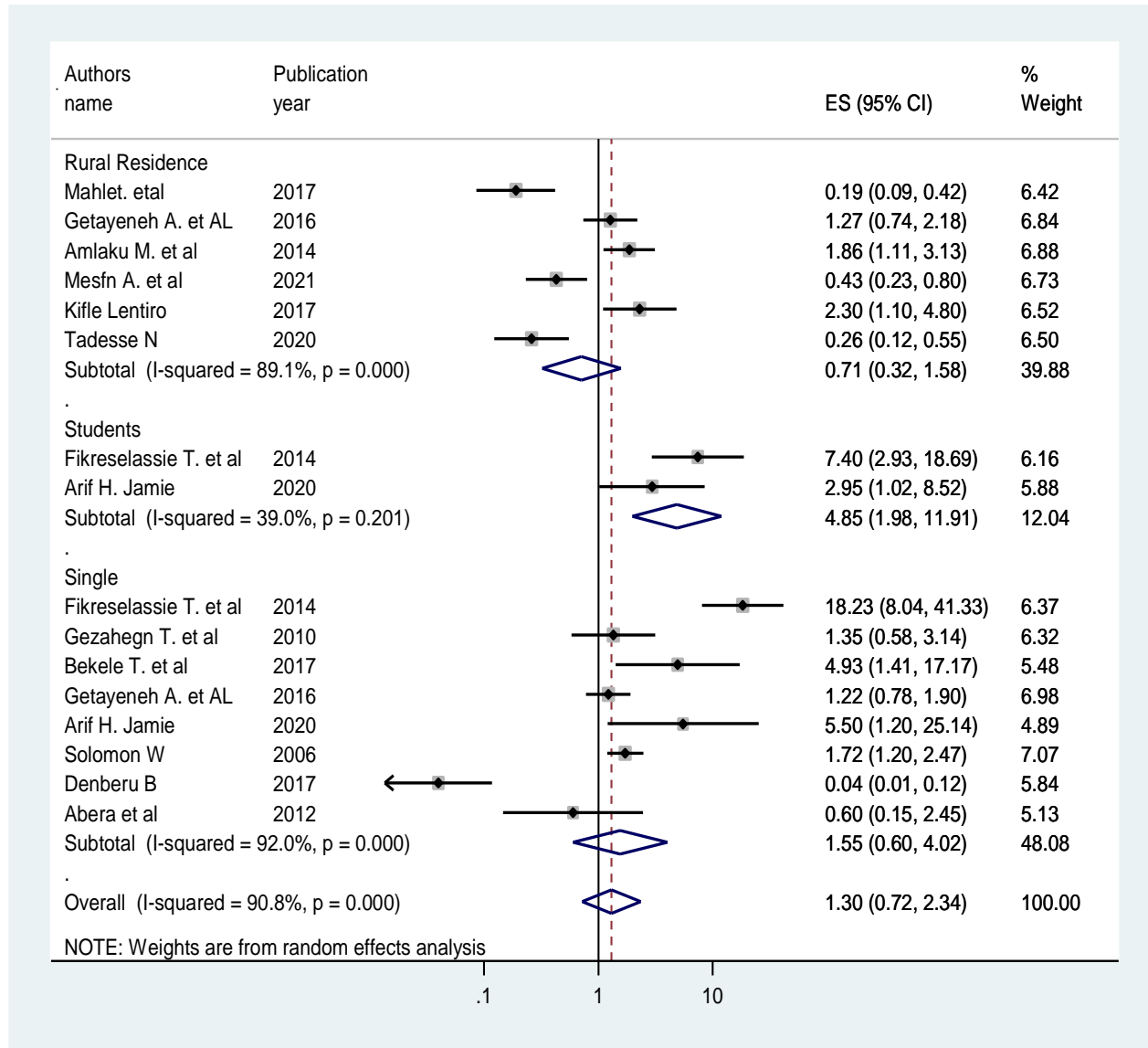


Figure-7: Forest plot of odds ratio for the association of selected socio-demographic characteristics and pregnancy termination in Ethiopia, 2023

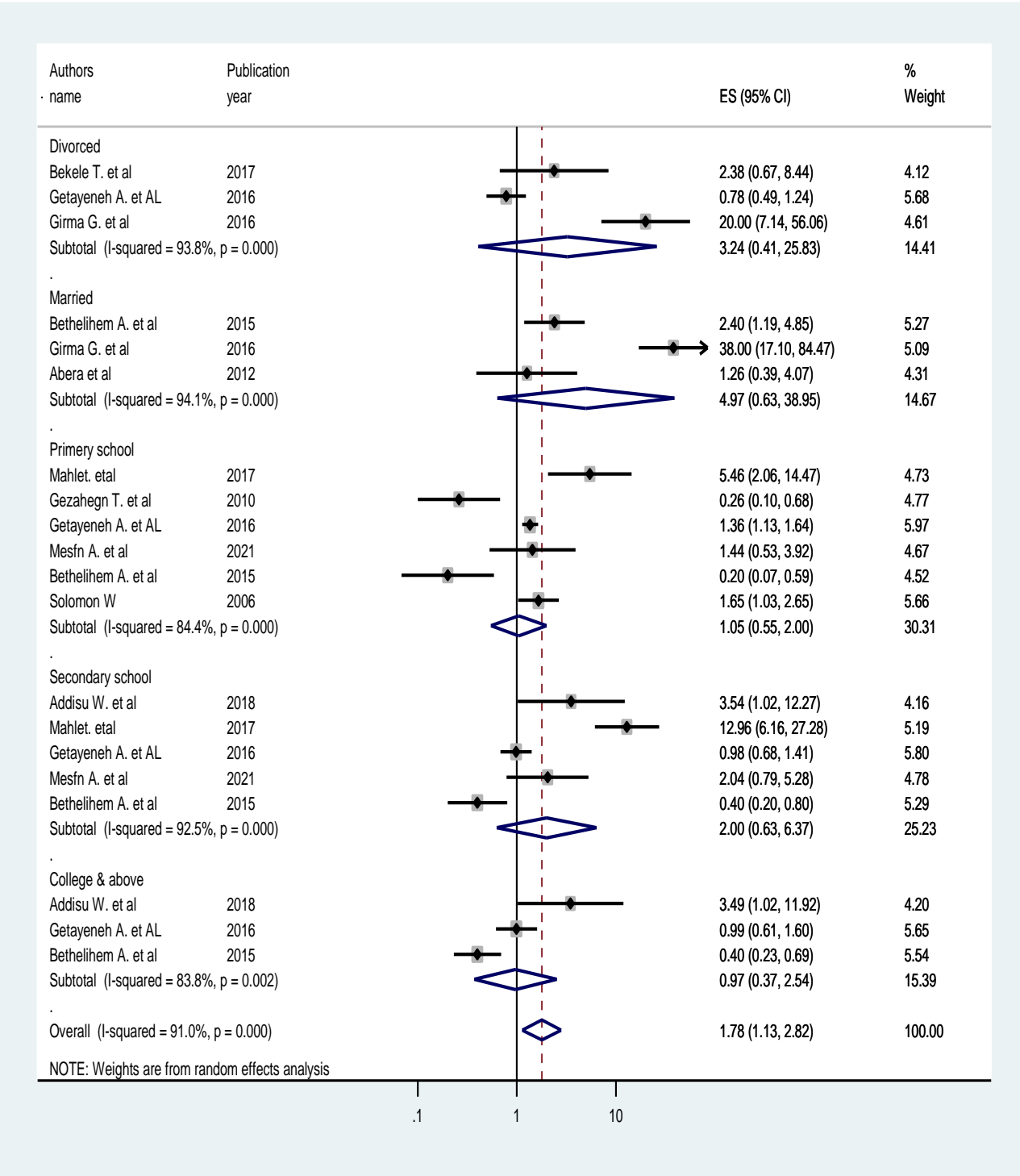


Figure-8: Forest plot of odds ratio for the association of selected socio-demographic characteristics and pregnancy termination in Ethiopia, 2023

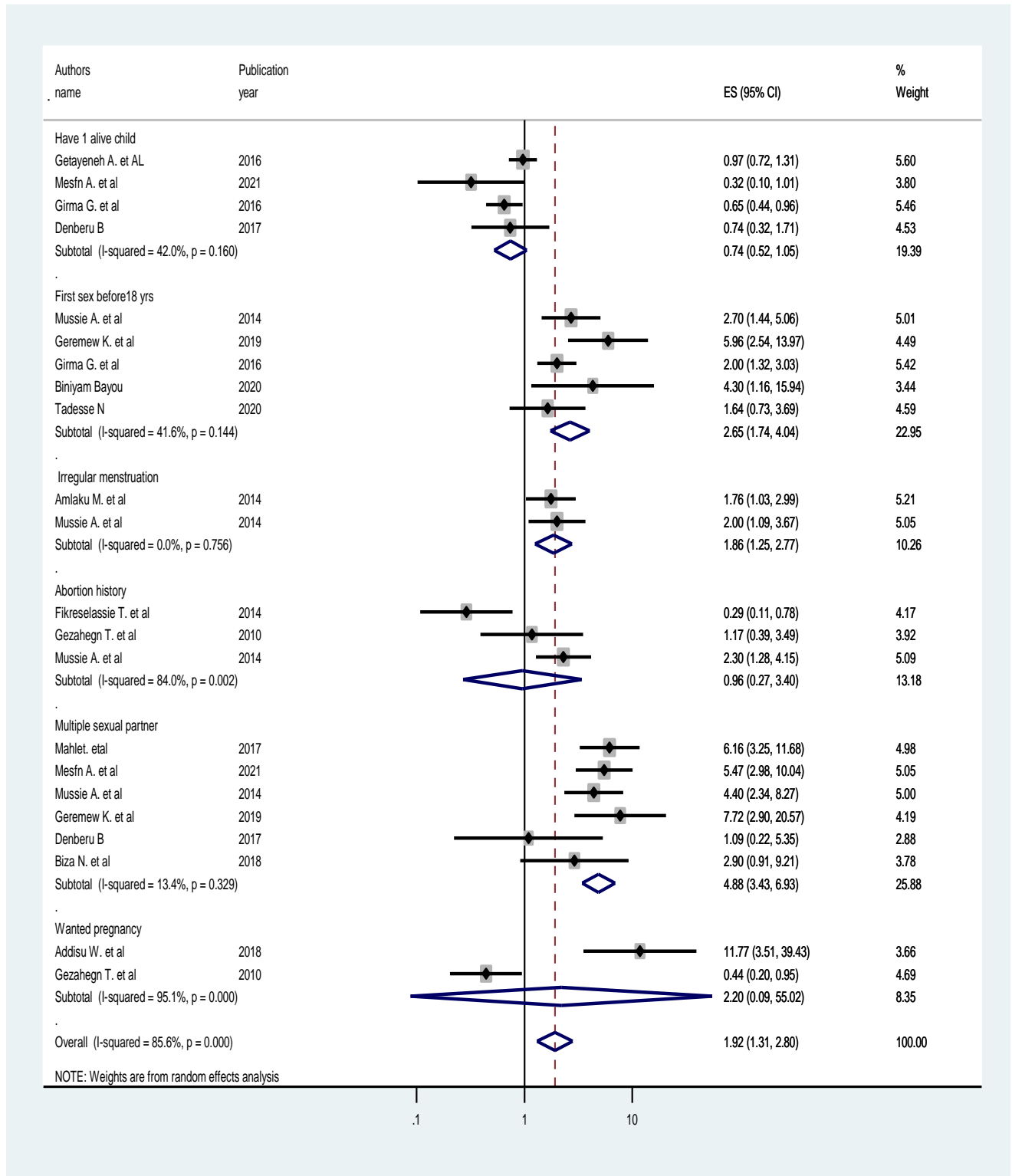


Figure-9: Forest plot of odds ratio for the association of selected reproductive characteristics and pregnancy termination in Ethiopia, 2023



PRISMA 2020 Checklist

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



PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
assessment			
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	7
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	7
Study characteristics	17	Cite each included study and present its characteristics.	7
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	7
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	7-9
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	7-9 & 14
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	7-9 & 14
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	7-9 & 14
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	7-9 & 14
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	7-9
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	7-9
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	11-13
	23b	Discuss any limitations of the evidence included in the review.	11-13
	23c	Discuss any limitations of the review processes used.	13
	23d	Discuss implications of the results for practice, policy, and future research.	111-13
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	5
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	5
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	5
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	14
Competing interests	26	Declare any competing interests of review authors.	14
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	14



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Prevalence and determinants of pregnancy termination in Ethiopia: A systematic review and meta-analysis

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Date Submitted by the Author:	08-Dec-2023
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Primary Subject Heading:	Obstetrics and gynaecology
Secondary Subject Heading:	Sexual health, Reproductive medicine, Public health
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3 **Prevalence and determinants of pregnancy termination in Ethiopia: A systematic review**
4 **and meta-analysis**
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7 Henok Kumsa¹, Esuyawkal Mislu¹, Mulugeta Wodaje Arage¹, Atitegeb Abera², Tilahun Hailu²,
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Abstract

Objective: This review aims to determine the prevalence of pregnancy termination and its determinant factors in Ethiopia.

Design: Systematic review and meta-analysis

Data sources: Relevant articles were retrieved from databases such as PubMed, EMBASE, Medline, and other search engines.

Eligibility criteria for selecting studies: The research design for this study had no restrictions, allowing for the inclusion of cross-sectional and case-control studies that examined the prevalence or determinants of pregnancy termination. However, case reports, case series, reviews, editorials, and studies published as abstracts only were excluded from the analysis.

Data extraction and synthesis: The review precisely in accordance with PRISMA criteria, and the quality of the review was assessed using the Joanna Briggs Institute critical appraisal checklist. Heterogeneity was indicated by the p-value for I^2 statistics less than 0.05. Data were entered into Microsoft Excel, and the analysis was conducted using Stata 16.

Results: The pooled prevalence pregnancy termination in Ethiopia was 21.52% (95% CI: 15.01, 28.03). Women who had their first sexual initiation before the age of 18 (OR = 1.78; 95% CI = 1.13, 2.82, P=0.144), had irregular menstrual bleeding (OR = 1.86; 95% CI = 1.25, 2.77, P=0.756), being a student (OR: 4.85; 95% CI: 1.98, 11.91, P=0.201), and had multiple sexual partners (OR: 4.88; 95% CI: 3.43, 6.93, P=0.329) were significantly associated with pregnancy termination.

Conclusions: One in five women terminated their pregnancies, which is higher than in other sub-Saharan countries. Being a student, irregular menstrual bleeding, early initiation of sexual intercourse, and multiple sexual partners were determinants of pregnancy termination. Special attention is needed in avoiding early sexual initiation and in reducing sexual risk behaviors.

Keywords: Pregnancy termination, Determinantss, Systematic review and meta analysis, Ethiopia

Introduction

Pregnancy termination is a sensitive and contentious issue with religious, moral, cultural, and political dimensions. Also, it presents a significant public health concern in developing countries (1). Above 60% of unintended pregnancies result in pregnancy termination, with the majority of those being unsafe (2). Developing countries bear the burden of 97% of all unsafe abortions which contributes to 220 deaths per 100,000 live births (3).

Moreover, pregnancy termination imposes an additional burden on health institutions and individuals; in developing countries alone, each year an estimated 7 million women seek treatment in health facilities for the complication of pregnancy termination (4). It is estimated that health-care systems will spend \$553 million per year on post-abortion complications and will lose \$922 million in income due to long-term disability caused by unsafe termination (5). Additionally, a woman who undergo pregnancy termination, particularly through methods such as mechanical dilation and curettage, face an increased a risk of experiencing preterm birth and repeated pregnancy loss (6).

Though the burden of pregnancy termination in Ethiopia is a significant contributor to maternal mortality and morbidity (7). Previous studies conducted in Ethiopia have shown that the prevalence of pregnancy termination and its negative consequences are increasing over time (8, 9), and repeated pregnancy termination also accounts significant amount (10-12). Several variables, including early age marriage, low level of education, early sexual intercourse initiation, violence/rape, emotional well-being, educational status, employment status, and resources, and sexual intercourse relationship, have been implicated as factors of pregnancy termination in studies conducted across Ethiopia (13-16).

However, at the national level, illustrative evidence is lacking in Ethiopia regarding the level and underlying factors of pregnancy termination. Thus, this systematic review and meta-analysis aimed to assess the prevalence of pregnancy termination and its determinant factors in Ethiopia. The findings of this study provide evidence for intervention to reduce the burden of pregnancy termination, its complications, and its economic impact in the country. Additionally, this study will help to design strategies and monitor the progress of programs aimed at achieving the maternal mortality reduction targets of the sustainable development goals.

Methods

Study design and setting

This systematic review and meta-analysis included cross sectional, and case control studies which has been conducted in Ethiopia. Systematic review and meta-analysis using computerized databases; searches were performed to estimate the prevalence and identify the determinants of pregnancy termination in Ethiopia.

Search strategy

For this review, a comprehensive search was conducted using various searching strategies to identify relevant articles. Published articles were searched in well-known online databases including EMBASE, Medline, Google, PubMed, Google Scholar, African Journal Online, and Science Direct databases. Additionally, the search was expanded by examining the reference lists of eligible articles to retrieve and extract potential articles. This systematic review was conducted using the preferred reporting items for systematic Reviews and Meta-Analyses PRISMA guidelines. Similarly, the quality of our systematic review and meta-analysis was assessed using the Joanna Briggs Institute (JBI) critical appraisal checklist (17).

Searching was done by using Medical Subject Heading (MeSH) terms related with determinants of pregnancy termination. MeSH terms enables us to select related research articles. We conducted the search for terms using Boolean operators "AND" and "OR," both separately and in combinations. We used the search terms “(((((((Abortion) OR (termination of pregnancy)) OR (miscarriage)) AND (determinant factors)) OR (determinants)) OR (associated factors)) OR (influencing factors)) AND (Amhara) OR (Oromia) OR (Tigray) OR (Southern nation, nationalities and people’s) OR (Afar) OR (Benshagul gumuz) OR (Gamabella) OR (Somali) OR (Dire dawa) OR (Addis Ababa) OR (Hareri) OR (Ethiopia)”.

Eligibility criteria

Inclusion criteria

There were no restrictions on research design. We included cross-sectional and case-control studies that showed the prevalence of or determinants of pregnancy termination. Additionally,

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3 Only articles reported in the English language and conducted studies until February 2023 were
4 included.
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6 7 **Exclusion criteria** 8

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10 Case reports, case series, reviews, editorials, and studies published as abstracts only were
11 excluded. Agreements on the inclusion and exclusion of the articles were held through the
12 participation of all authors.
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15 16 **Quality assessment and data extraction** 17

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19 Articles were screened using their titles, abstracts, and full paper reviews before being included
20 in the meta-analysis. The quality of included studies was evaluated using the Joanna Briggs
21 Institute (JBI) critical appraisal checklist (17). The quality scores of included studies were
22 assessed and presented using the mean scores to designate them as high- or low-quality. The JBI
23 tool for prevalence and determinat studies was used as a guideline for data extraction from the
24 final selected articles. The extraction sheet contains name of authors, study year, publication
25 year, region of study, study design, sample size, prevalence in percentage or proportion, odd
26 ratio of factors, confidence intervals both the upper and lower bound of each corresponding odds
27 ratio. The odd ratio of each factors are transformed as log (OR). The lower and upper
28 confidence intervals are log transformed as log (upper confidence interval), and log (lower
29 confidence interval). The standard error for the proportion was also created as: Standard error =
30 $\sqrt{\frac{p(1-p)}{n}}$. And then the standard error of the confidence intervals were also estimated using the
31 log transformed upper and lower limits which is calculated as $SE = (\log UCL - \log LCL) / 3.92$.
32 Finally for pooled prevalence estimation, the proportion and its corresponding standard errors
33 were used. For factors, the log transformed odd ratios and the standard error of their
34 corresponding confidence intervals were used to estimate the effect sizes. Moreover, all authors
35 independently reviewed the titles and abstracts of studies to be included in this systematic review
36 and meta-analysis. Agreements on the inclusion and exclusion of the articles were reached with
37 the participation of all authors.
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Measurement of the outcome variable

In this study, termination of pregnancy is the removal of pregnancy tissue, conception products, or fetus, and placenta from the uterus. The term 'fetus' and 'placenta' is commonly used after eight weeks of pregnancy. Pregnancy tissue and products of conception are the tissues that are produced by the union of an egg and sperm before eight weeks. Terminating a pregnancy is a deliberate action taken by a health professional or the woman herself (18).

Registration and protocol

This review has not previously registered or prepared a protocol. As a result, no adjustments have been made.

Patient and Public Involvement: not applicable

Statistical methods and analysis

The meta-analysis was conducted using Stata 16 software after entering data into Microsoft Excel. Forest plots were used to demonstrate the prevalence of pregnancy termination in Ethiopia. The random effect model of analysis was utilized as a method of meta-analysis to minimize the heterogeneity of included studies (19). The study setting, population, and study period were used to conduct sub-group analysis. The presentation of pregnancy termination determinants was based on odds ratios (ORs) with a 95% confidence interval(CI).

The heterogeneity of the studies included was assessed using the I^2 statistics. The presence of heterogeneity was determined by using a p-value for I^2 statistics that was less than 0.05. Based on the I^2 test statistics results, the heterogeneity is categorized as low (25%), moderate (50%), and high (75%) (19). Furthermore, the Egger regression asymmetry test was used to evaluate the publication bias (20, 21). When the Egger test result's P-value is less than 0.05, there is a declaration of publication bias. The Duval and Tweedie nonparametric trim and fill analysis using the random effect analysis was conducted to detect the presence of publication bias (22).

Result

Study selection

This systematic review and meta-analysis included published studies on the termination of pregnancy in Ethiopia. A total of 12,242 records were retrieved through electronic database searching, and only 33 articles were included in the final analysis (supplementary figure 1).

Characteristics of included studies

This review included Thirty-three studies conducted in various regions of Ethiopia. Of all the studies, 8 (24.24%) were from the Amhara Region (11, 12, 15, 16, 23-26), South Nations and Nationalities Peoples accounted for 9 (27.27%) of the total (13, 27-34), 1 was from Oromia (35), 5 (15.15%) from Addis Ababa city administration (10, 14, 36-38), 3 (9.09%) were from Harari region (39-41), 3 (9.09%) were from Tigray region (42-44), 1 (3.03%) was from Afar region (45), 3 (9.09) were from National data (46-48). Twenty-eight (84.85%) of the included articles were cross-sectional studies (10-13, 15, 23-31, 33-35, 37-42, 44-48), and remains five (15.15%) were case-control studies(14, 16, 32, 36, 43).

As well, twenty-seven of the studies were institution-based (10-16, 24, 27-33, 35-46), while six were community-based studies(23, 25, 26, 34, 47, 48). The sample size of the included studies ranged from a minimum of 124 in a study conducted in southwest Ethiopia (34) and to a maximum of 12,378 in a study conducted using DHS data (48). Overall, a total of 40,116 study participants were included in this review detail is available in supplementary table 1.

Prevalence of pregnancy termination in Ethiopia

Based on the random effect model, the overall pooled prevalence of termination of pregnancy among women in Ethiopia was 21.52% (95% CI: 15.01–28.03) (supplementary figure 2). The meta-analysis included studies with significant heterogeneity: I^2 value of 99.8%, $p < 0.000$. Publication biases among the included studies were examined using funnel plots and Egger's regression test. The results of funnel plots showed an asymmetric shape, which indicates the presence of publication bias among those included studies. Additionally, the Duval and Tweedie nonparametric trim and fill analysis was applied to correct publication bias among the studies, but no trimming was performed since the data is unchanged (supplementary figures 3 and 4).

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6 Objective assessments of publication bias by Egger's regression test also showed the presence of
7 publication bias across studies (p -value < 0.001). After conducting the trim and fill analysis to
8 address publication bias, the final pooled prevalence of pregnancy termination in Ethiopia was
9 adjusted to 21.52% (95% CI: 15.01–28.03).
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12 **Subgroup analysis**

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15 We performed subgroup analysis based on the region, study population, and study setting of the
16 included studies. Table 1 shows the pooled prevalence was highest, 35.60% (95% CI: 28.86,
17 42.34) in the Oromia region, followed by 34.17% (95% CI: 17.67, 86.01) in the Tigray region,
18 24.63% (95% CI: 10.52, 37.75) in the South Nation and Nationalities People Region, and the
19 lowest was seen in three studies conducted using demographic health data, 12.10% (95% CI:
20 5.66, 18.50) (supplementary figure 5).
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27 Furthermore, subgroup analysis reveals that the highest pooled prevalence of abortion was seen
28 among gynecological admitted patients, at 60.60% (95% CI: 59.47, 61.73), followed by 25.38%
29 (95% CI: 9.39, 41.32) among university/college students, and 27.90% (95% CI: 20.01, 35.79)
30 among insecurely housed women, with the lowest pooled prevalence being seen among pregnant
31 women and youth women (supplementary figure 6). Additionally, subgroup analysis was
32 conducted based on the year before and after the Millennium Development Goals'
33 implementation. The pooled prevalence of pregnancy termination before and after MDGs was
34 20.55% (95% CI: 16.10–24.99) and 21.61% (95% CI: 15.01–28.03), respectively (supplementary
35 figure 7).
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Table 1: Subgroup analysis for the prevalence of pregnancy termination in Ethiopia, 2004-2022

Subgroup	Number of studies	Total Sample	Prevalence (95%CI)	Heterogeneity	
				I ²	p-value
By region					
Addis Ababa	2	855	25.49(10.39, 40.09)	92.4	< 0.001
Amhara	6	2371	18.06(6.27, 29.85)	99.0	< 0.001
SNNP	8	3678	24.63(95% CI: 10.52, 37.75)	99.4	< 0.001
National Data	3	19854	12.10(5.70, 18.50)	99.7	< 0.001
Tigray	2	7463	34.17(17.6, 86.01)	99.9	< 0.001
Harari	2	1835	16.13(12.21, 20.05)	81.2	< 0.001
Oromia	1	194	35.60(28.86, 42.34)	.	.
Afar	1	509	8.80(6.34, 11.26)	.	.
By publication year					
2016 to 2022 (post MDG)	15	24234	20.55(16.10, 24.99)	99.3	< 0.001
Before MDG	10	12525	22.61(4.55, 40.66)	99.9	< 0.001
Study population					
Reproductive age	8	4426	17.03(8.55, 25.52)	99.0	< 0.001
Pregnant women	1	12378	8.90 (8.40, 9.40)	.	.
Abortion care seeker	7	2990	21.19(14.65, 27.72)	95.3	< 0.001
University or college student	6	3237	25.36 (9.39, 41.32)	99.5	< 0.001
Gynecological patient	1	7203	60.60 (59.47, 61.73)	.	.
Youth women	1	6401	2.50 (2.12, 2.88)	.	.
Insecurely housed women	1	124	27.90 (20.01, 35.79)	.	.
Total	25	36759	21.52(15.01, 28.03)	99.8	< 0.001

Insecurely household women: it means women who live or spend their time on the street.

Determinants of pregnancy termination

Socio-demographic characteristics

The sociodemographic factors included in this analysis were the place of residence, age, marital, occupational, and educational status of the women. A separate analysis was conducted for each variable. Finally, a meta-analysis of (16, 39) two studies showed that being a student was

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3 significantly associated with pregnancy termination (OR: 4.85; 95% CI: 1.98, 11.91). There was
4 moderate heterogeneity ($I^2 = 39\%$) (supplementary figures 8 and 9).
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7 **Reproductive characteristics**

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10 A total of 5 articles (15, 24, 28, 43, 47) were included to assess the association between first
11 sexual initiation before the age of 18 and pregnancy termination. The pooled meta-analysis found
12 that women who had their first sexual experience before the age of 18 were twice as likely as
13 those who had their first sexual experience after the age of 18 to have their pregnancy terminated
14 (OR = 1.78; 95% CI = 1.13, 2.82). There was moderate heterogeneity ($I^2 = 41.6\%$). Moreover,
15 two articles (11, 43) were also included to determine the association between irregular menstrual
16 bleeding and pregnancy termination. The final pooled meta-analysis using data from the two
17 articles found that pregnancy termination was nearly two times more likely to occur in women
18 with irregular menstrual bleeding than in those who had regular menstrual bleeding, (OR = 1.86;
19 95% CI = 1.25, 2.77). Similarly, a meta-analysis of six studies (14, 15, 24, 32, 34, 43) showed
20 that women who had multiple sexual partners were significantly associated with pregnancy
21 termination (OR: 4.88; 95% CI: 3.43, 6.93). There was low heterogeneity ($I^2 = 13.4\%$)
22 (supplementary figures 10).
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Discussion

Pregnancy termination is a major public health concern in Ethiopia (49). In this systematic review and meta-analysis, the overall magnitude of pregnancy termination was pooled from 25 published articles in Ethiopia, and significant determinants of pregnancy termination were identified using different articles. Being a student increased the rate of termination of pregnancy nearly five times. In addition, first sexual initiation before the age of 18, women with irregular menstrual bleeding, and multiple sexual partners were determinants of pregnancy termination in Ethiopia. The findings of this review revealed evidence to help reduce the impact of pregnancy termination in Ethiopia by aiming at the main determinants for pregnancy termination.

In Ethiopia various studies have been conducted on the issue of pregnancy termination, involving different settings such as the community, healthcare institutions, and higher education institutions. These studies have yielded varying figures regarding the prevalence of pregnancy termination in the country. However, this particular study revealed Ethiopia has a higher prevalence of pregnancy termination compared to other low- and middle-income countries.

The study found that the pooled prevalence of termination of pregnancy in Ethiopia was 21.52%. This finding is lower compared to a study done in Ghana at 25% (50), higher than in Mozambique at 9 % ($\times 2.33$) (50), and in India at 1.7% ($\times 12$) (51). The difference could be attributed to various factors like; study population, study design, study area, socio-demographic characteristics, and the differences in health policies of the countries. Additionally, the current study utilized a meta-analysis approach at the national level, incorporating community or institutional studies, while the study in Ghana and Mozambique was conducted using demographic health data with a small sample size compared to the current study (50). Additionally, in our study, huge variations were seen across the regions. A spatial analysis study conducted in Ethiopia using national DHS data also also showed variation even within the regions of the country (48). Thus, acting according to the needs of the region and age-specific policy is important during national policy or guideline development.

Our study observed that being a student was significantly associated with the termination of pregnancy. One of the possible explanations could be that students are likely to be adolescents, belonging to the younger age category. In addition, adolescent girls are remaining in school

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3 longer, which may factor into their decisions to postpone childbearing and terminate unintended
4 pregnancies (52). Likewise, a study conducted in India shows the tendency for pregnancy
5 termination is high in this age category since the rate of unintended pregnancies and unmet needs
6 for family planning are high in this age group (53). The higher rate of pregnancy termination
7 could also be attributed to a failure to provide education about the risks of pregnancy termination
8 and ways of prevention for unintended pregnancy (54).
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14 Additionally, the idea supported by Van Rensburg that societal poverty, unemployment, and
15 other socio-demographic factors affect youth pregnancies and it might prone to pregnancy
16 termination (55). In addition, a review from the late 1990s found that young women often cited a
17 desire to stay in school as a major reason for pregnancy termination (56). Moreover, many
18 adolescents continue to have difficulty accessing contraception, often as a result of stigma and/or
19 a lack of resources (57).
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26 The study from Nigeria indicated that 15–24-year old women are still being left behind on
27 reproductive health matters despite increasing global attention to prioritizing their health (58).
28 Studies found that educational programs aimed at reducing sexual risk behaviors and preventing
29 pregnancy among young people can effectively reduce pregnancy rates among teenagers (59).
30 Also, programs aimed at abstinence-centered sexuality education are effective in preventing
31 adolescent pregnancy (60). Thus, this implies a future focus on reproductive health issues
32 specific to students to address their needs. Additionally, future researchers should better focus on
33 possible interventions to reduce the risk of pregnancy and pregnancy termination among students.
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41 This review also assessed the association of selected variables with pregnancy termination.
42 Women under the age of 18 at first sex were significantly more likely to terminate their
43 pregnancy. This finding is consistent with studies conducted in Nigeria and Peru that reported a
44 higher rate of pregnancy termination among women who had their age at first sex before 18
45 years old (61-63). Studies also revealed that early sexual debuts are significantly associated with
46 adolescent pregnancies, which are usually unwanted (64, 65). As well, a study conducted in
47 Ethiopia shown initiation of sexual intercourse before the age of 18 years was found significant
48 association with repeated pregnancy termination (66).
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3 In many low income countries, rising ages at first marriage combined with increasing levels of
4 premarital sex continue to result in unintended pregnancies among adolescents (67). Thus,
5 improving the knowledge of adolescents about sexual and reproductive health issues, and
6 increasing contraceptive access and use among young people, are important to prevent unsafe
7 abortion or pregnancy termination (68). This necessitates the development of reproductive health
8 education specifically for adolescent girls. Future researchers should also address the gap in
9 studies on the needs of adolescent girls and possible interventions needed to reduce sexual
10 initiation before the age of 18 years.
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13 Furthermore, at the individual level, we found that pregnancy termination was significantly
14 associated with women who had multiple sexual partners. Likewise, a study conducted in Peru
15 indicated that as the number of sexual partners increased, the odds of getting a pregnancy
16 termination increased (69). Studies conducted in Cambodia, China, and the United Kingdom also
17 have found that having multiple sexual partners is associated with a higher rate of repeated
18 pregnancy termination. (54, 70, 71). The government shall be emphasized reproductive health
19 education, particularly for women regarding the risks of multiple sexual partners, the access
20 where, and how to get counseling on how to prevent pregnancy.
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23 This study also found that pregnancy termination was two times higher among women who had
24 menstrual irregularities compared to their counterparts. Lastly, this systematic review and meta-
25 analysis indicated that there were no statistical association between the termination of pregnancy
26 and rural residents, marital status, women's age, educational status, primiparous, history of
27 abortion, and wanted pregnancy.
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30 As a limitation, this finding might be prone to the risk of bias due to the significant heterogeneity
31 of articles included from a different region of Ethiopia. In addition, differences in the study
32 population, setting, and design within the included studies might influence the results of this
33 review. Moreover, studies conducted in health institutions, Colleges, or higher education might
34 affect the pooled estimates. Additionally, in this review, only published articles were included.
35 Also, this review didn't include qualitative studies on the explanations for pregnancy
36 termination.
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3 Future research must explain the relationship between pregnancy termination and other
4 determinants such as social, economic, substance use, peer pressure, alcohol use, sexual or
5 physical violence, and knowledge of sexual and reproductive health issues such as family
6 planning and fertility.
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10 11 **Conclusions**

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14 One in every five women had their pregnancies terminated, which is a high rate when compared
15 to Sub-Saharan countries. Being a student was significantly associated with the termination of a
16 pregnancy. In addition, irregular menstrual bleeding, early initiation of sexual intercourse, and
17 multiple sexual partners were important determinants of pregnancy termination.
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21 22 **Abbreviations**

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25 OR: odds ratios; CI: confidence interval; JBI: Joanna Briggs Institute; MDG: Millennium
26 Development Goals'
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30 31 **Declarations**

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33 **Ethical approval:** This article was conducted using published articles. Therefore, it don't
34 required ethical approval.
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36 **Funding:** No funding was used in this study.

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38 **Availability of data and materials:** The datasets used and analyzed during the review are
39 available from the corresponding author upon reasonable request.
40

41 **Competing interests:** None declared.

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43 **Author contributions:** HK, MWA, AB, EM, TH, and LAT conducted the data curation and
44 extraction. HK, LAT, EM, and MWA. wrote the original and final draft of the research. LAT, EM,
45 MWA and HK were conducted formal analyses and data interpretation. All authors read and
46 approved the final manuscript.
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50 51 **Supplementary file**

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53 The supplementary file contains the data extraction sheet for the study included in the review as
54 supplementary table 1 and supplementary figures 1-10.
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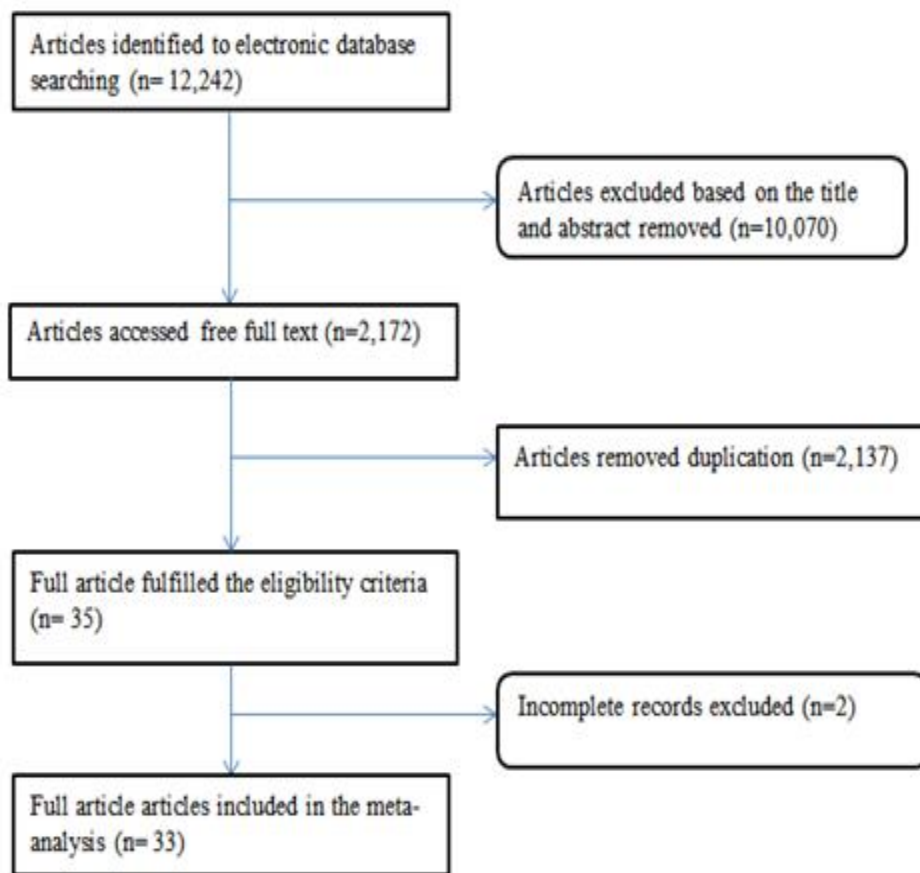


Figure 1. Flow chart of describing the selection of studies for the systematic review and meta-analysis of the prevalence of pregnancy termination and associated factors in Ethiopia, 2023

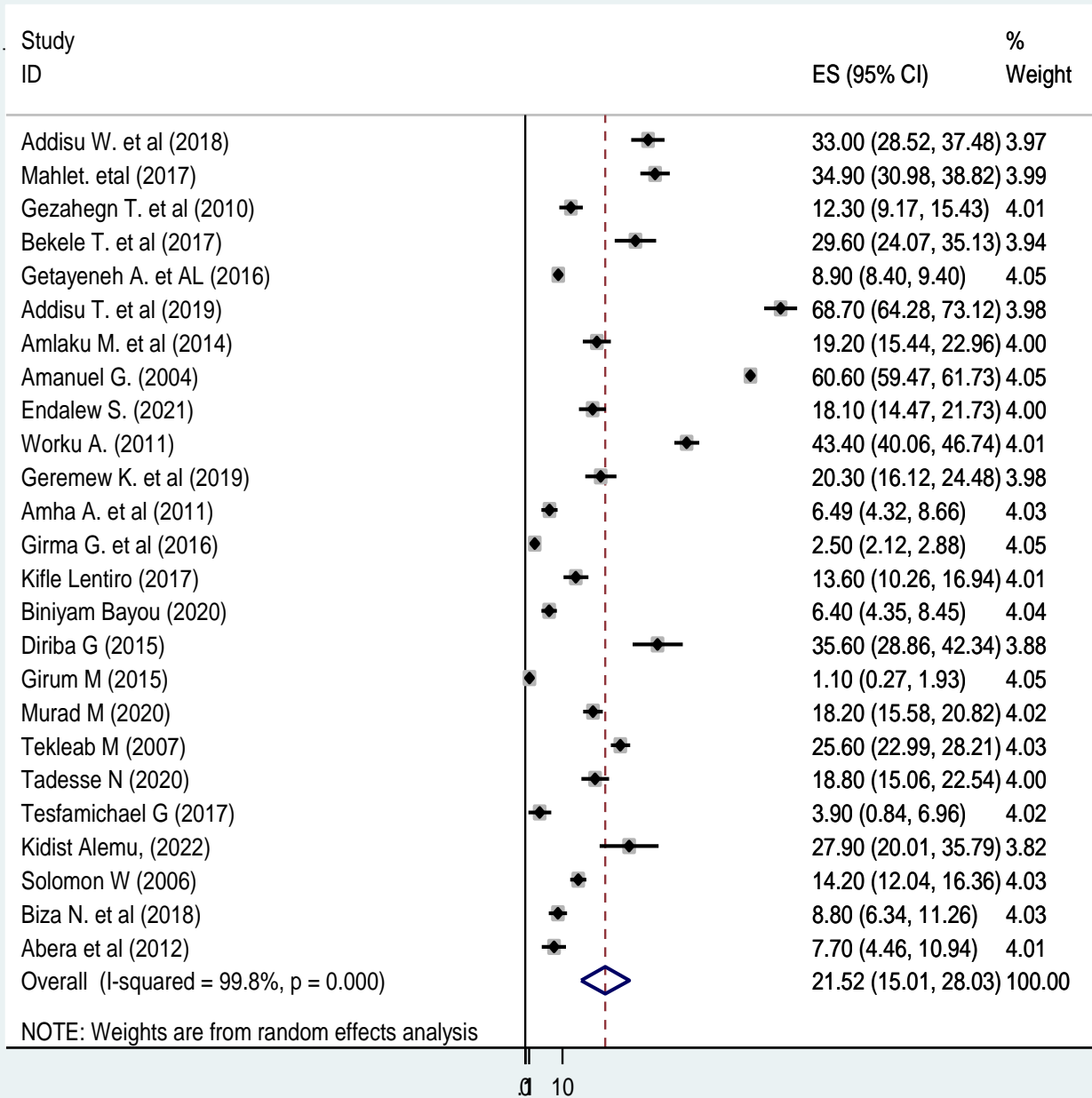


Figure 2: Forest plot of the pooled prevalence of pregnancy termination in Ethiopia, 2023

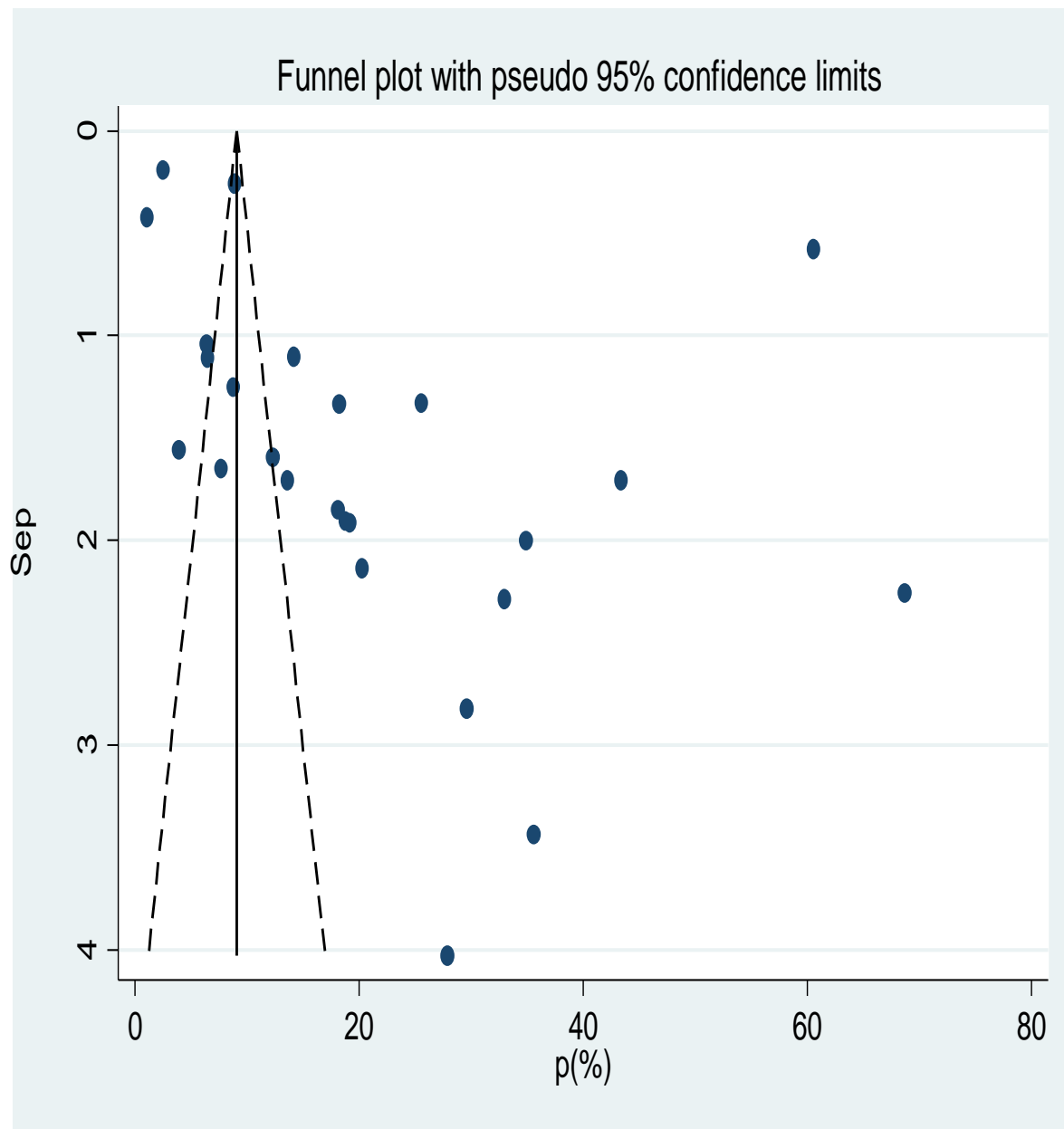


Figure 3: Funnel plot to test publication bias of pregnancy termination in Ethiopia, 2023

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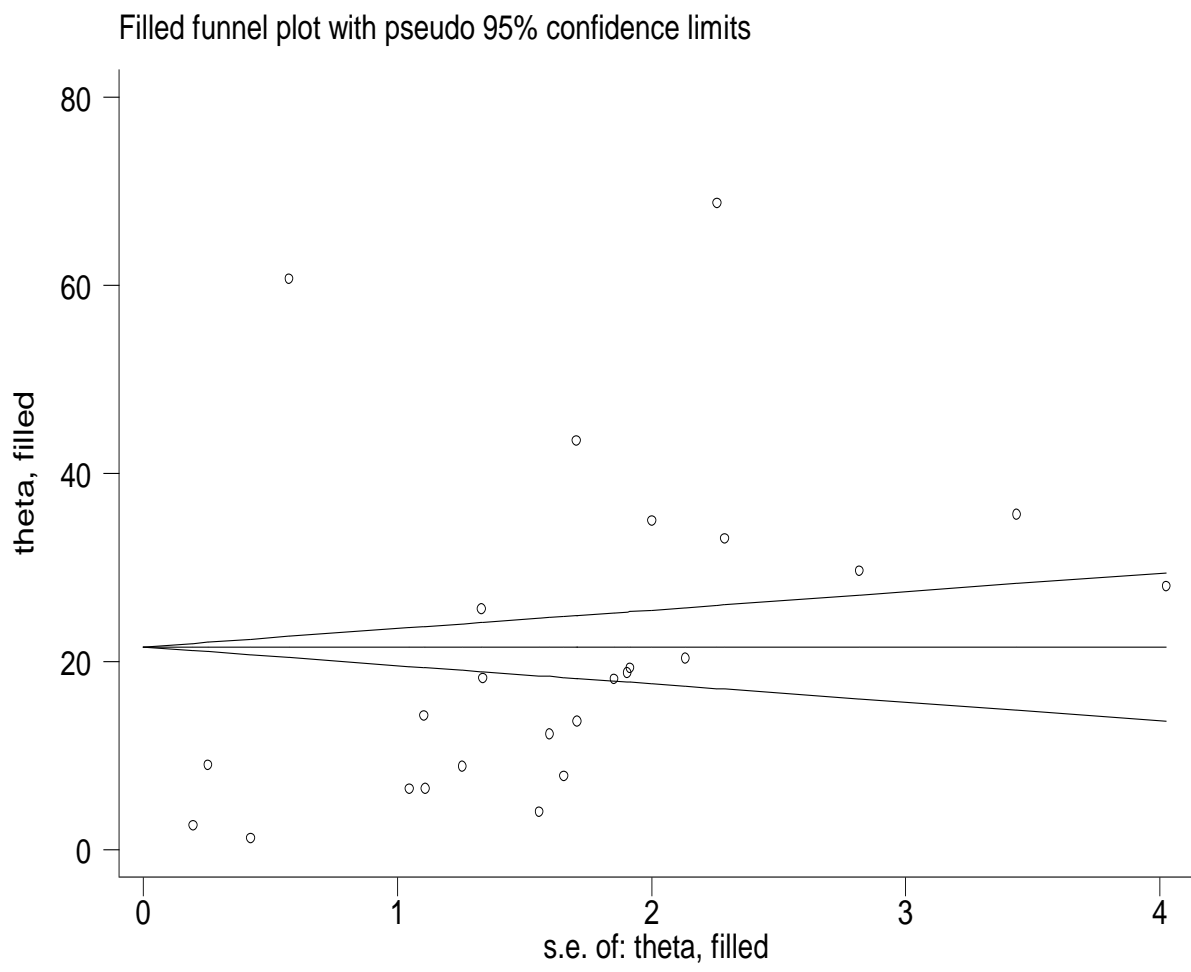


Figure 4: The Duval and Tweedie nonparametric trim and fill analysis of abortion among women in Ethiopia, 2023

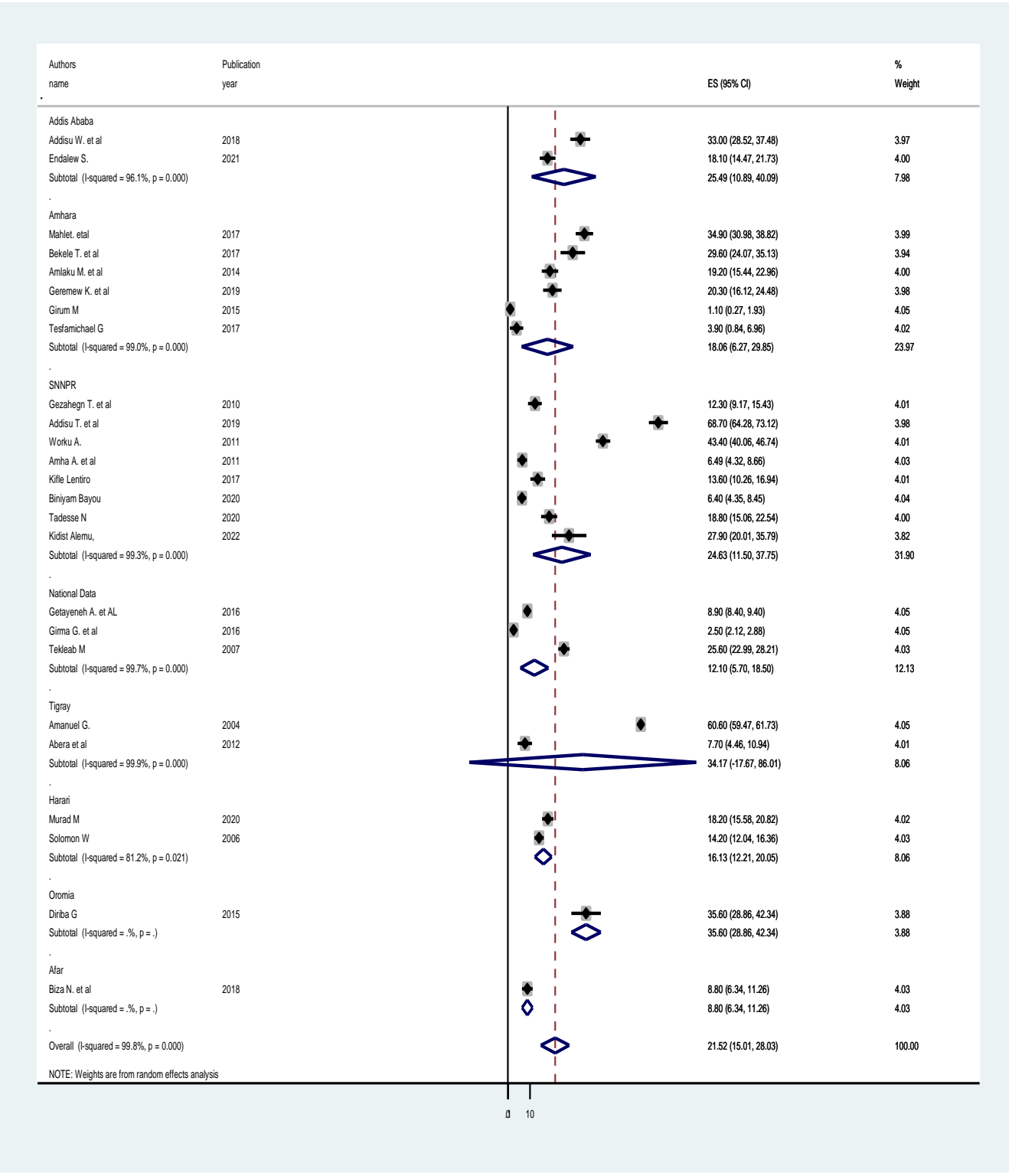


Figure 5: Subgroup analysis of the pregnancy termination based on regional distribution in Ethiopia, 2023

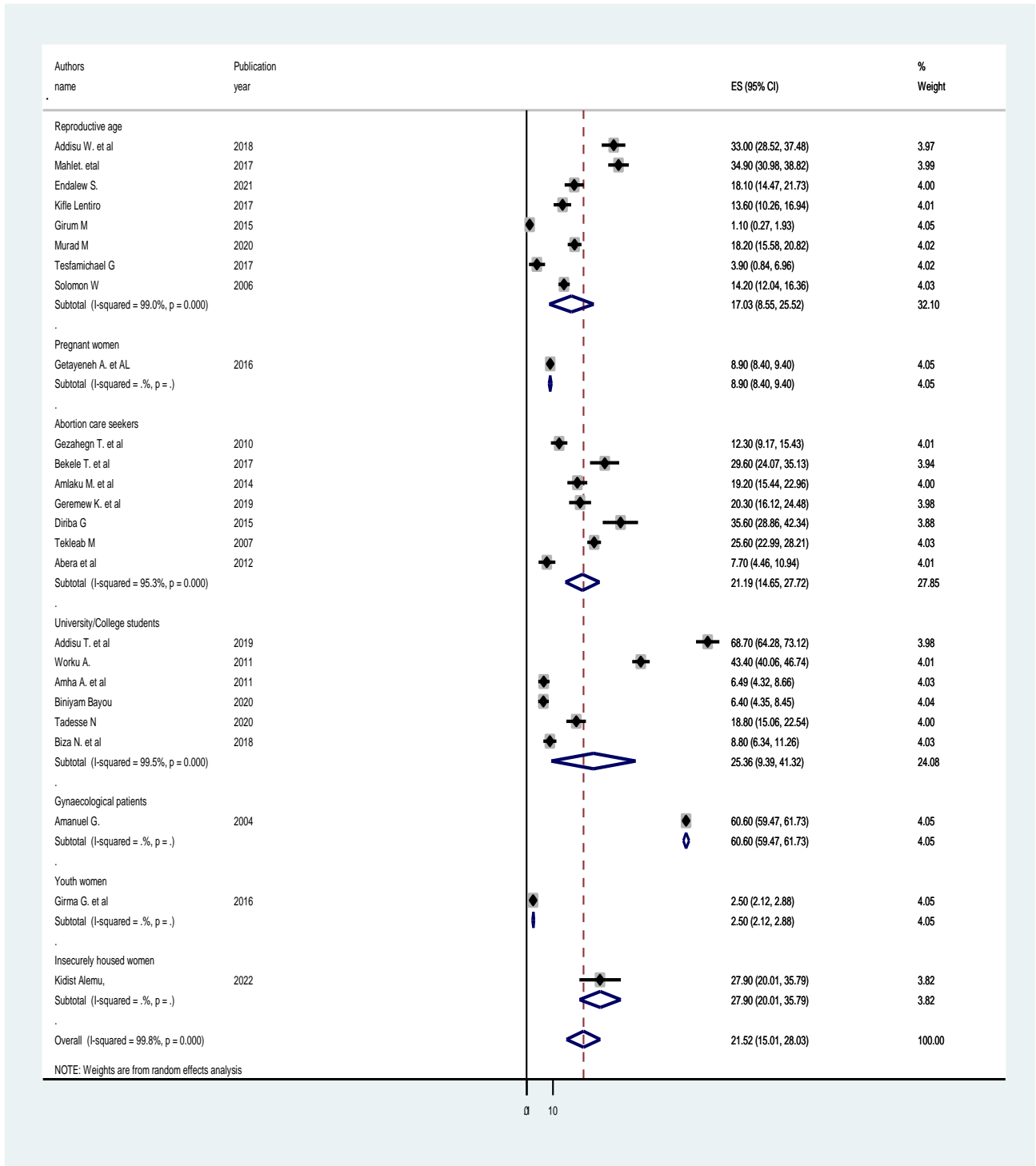


Figure 6: Subgroup analysis of the prevalence of pregnancy termination based on study population in Ethiopia, 2022

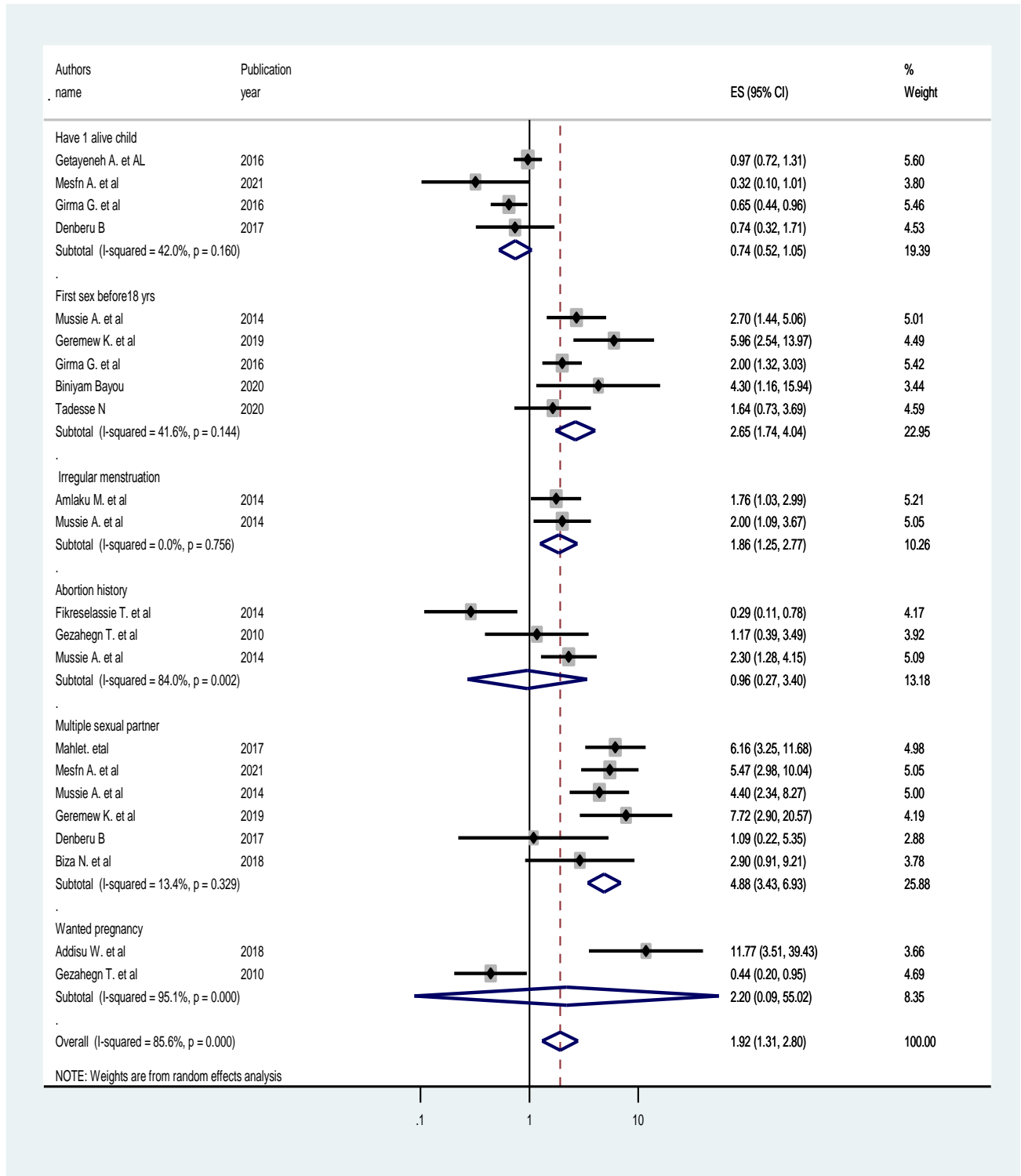


Figure 7: Subgroup analysis of the prevalence of pregnancy termination based on before and after MDG in Ethiopia, 2023

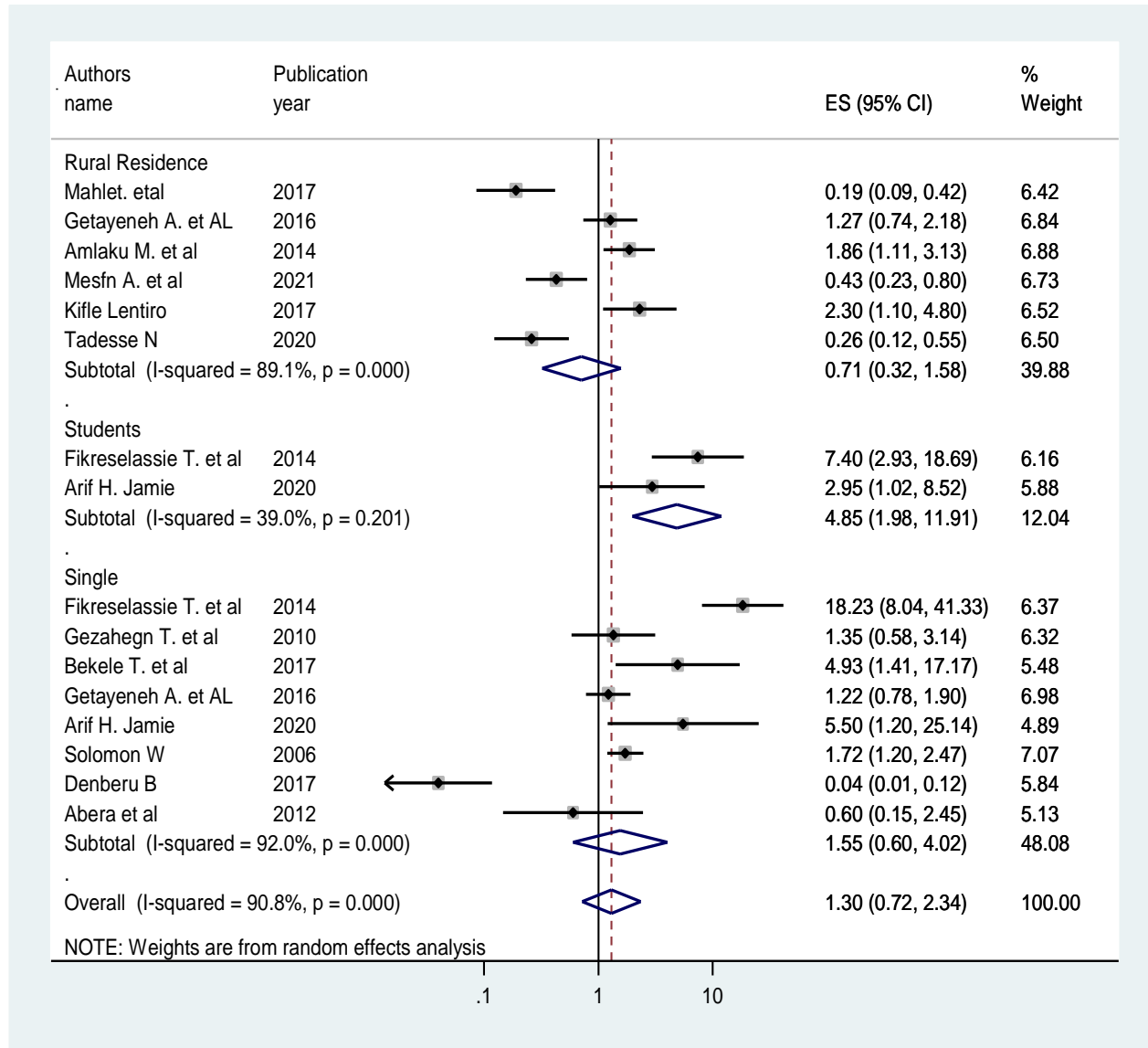


Figure 8: Forest plot of odds ratio for the association of selected socio-demographic characteristics and pregnancy termination in Ethiopia, 2023

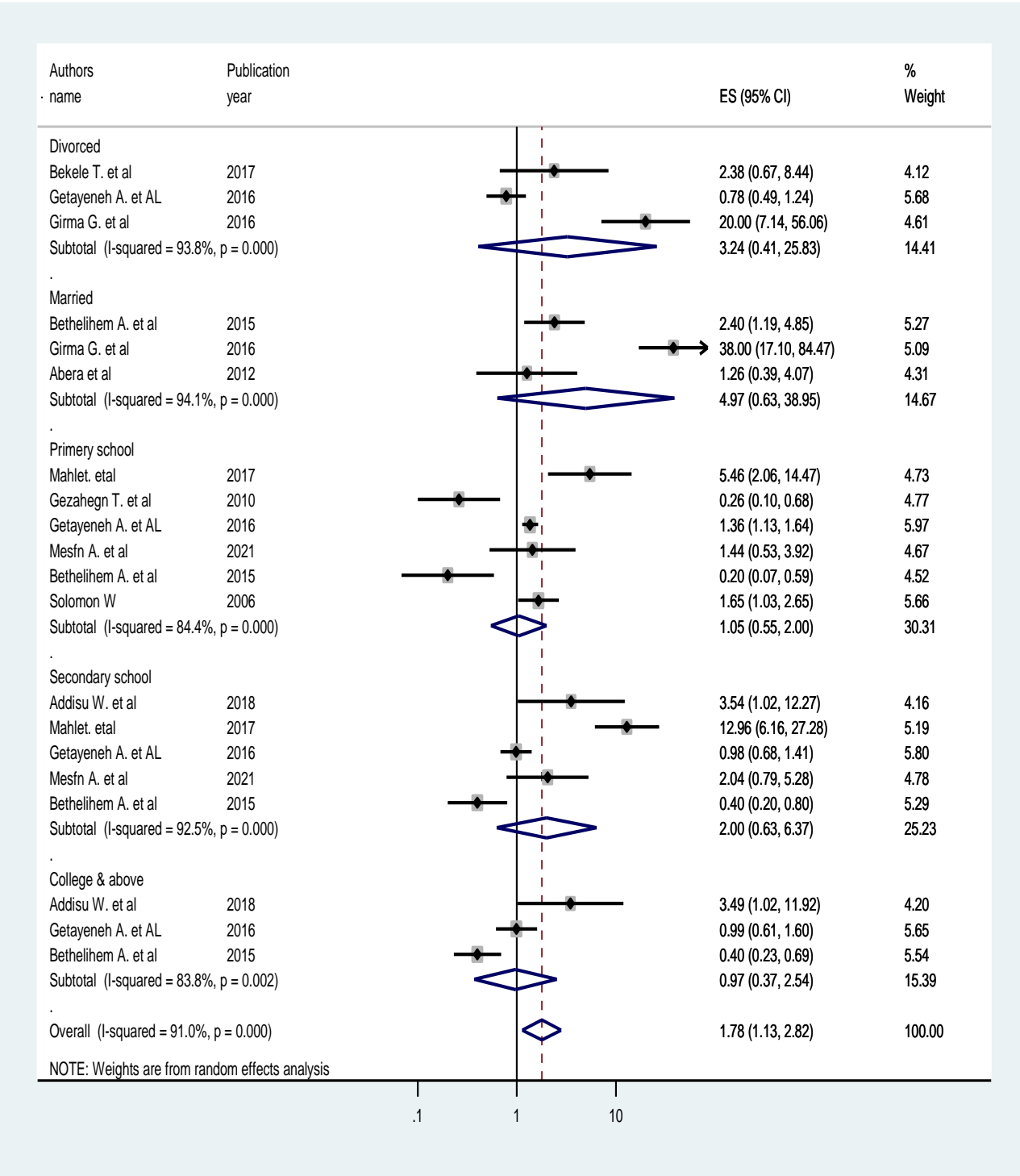


Figure 9: Forest plot of odds ratio for the association of selected socio-demographic characteristics and pregnancy termination in Ethiopia, 2023

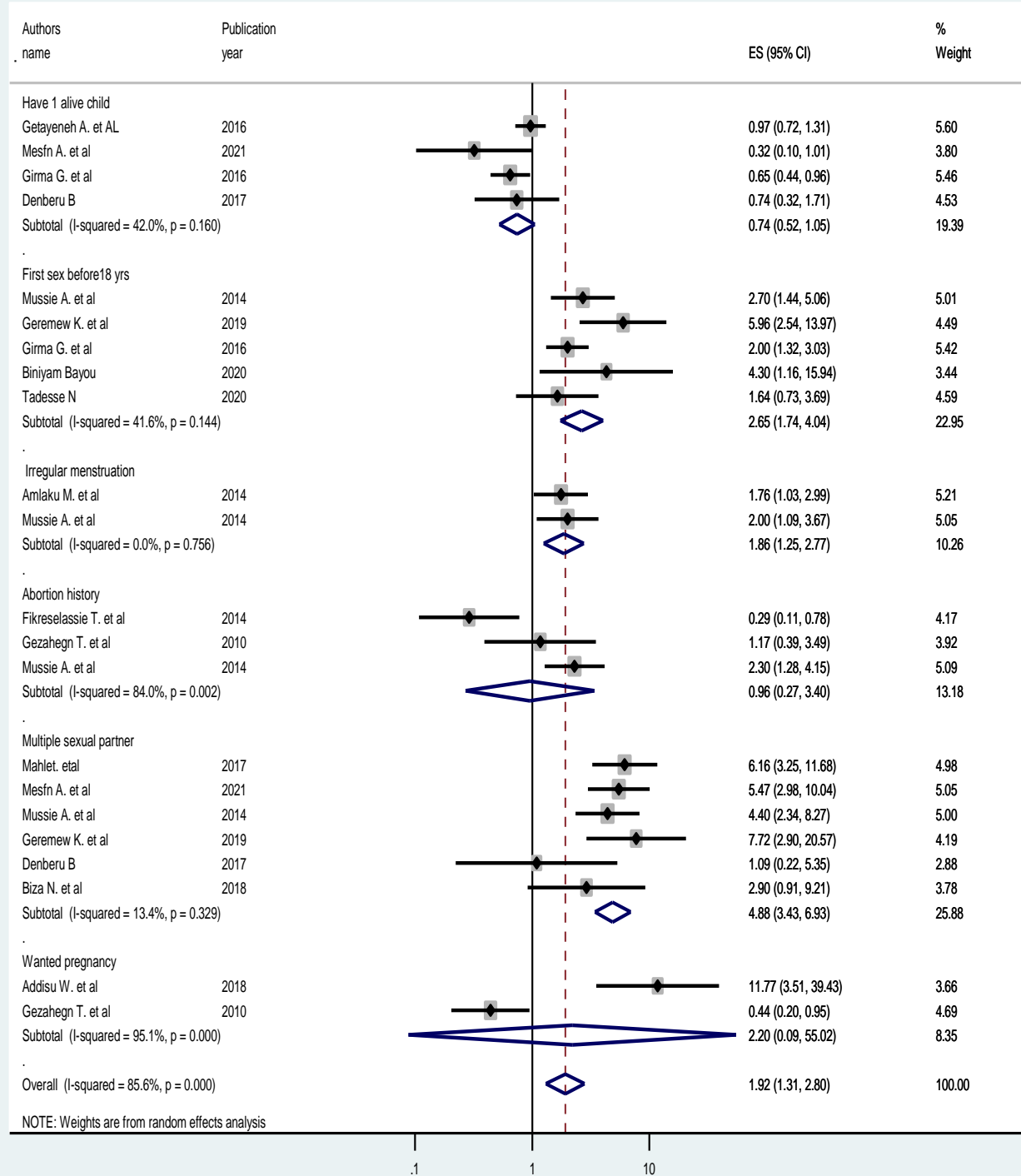


Figure 10: Forest plot of odds ratio for the association of selected reproductive characteristics and pregnancy termination in Ethiopia, 2023

Table 1. Data extraction sheet of the studies

Authors name	Publication year	Study area	Region	Study design	Study setting	Study population	Sample size
Addisu W. et al	2018	Addis Ababa	Addis Ababa	Cross-sectional	Institutional	Reproductive age group	423
Mahlet T. et al.	2017	Debre Markos	Amhara	Cross-sectional	Institutional	Reproductive age group	567
Fikreselassie T. et al.	2014	Bahr Dar	Amhara	Case-control	Institutional	Pregnant women	175
Gezahegn T. et al.	2010	Guraghe Zone	SNNP	Cross-sectional	Institutional	Abortion care service seekers	422
Bekele T. et al.	2017	Debre Markos	Amhara	Cross-sectional	Institutional	Abortion care service seekers	262
Getayeneh A. et al.	2016	Ethiopia	National data	Cross-sectional	Community	Pregnant women	12378
Addisu T. et al.	2019	Hawassa	SNNP	Cross-sectional	Institutional	University/College students	422
Amlaku M. et al.	2014	Amhara region referral hospitals	Amhara	Cross-sectional	Institutional	Abortion care service seekers	422
Birye D. et al.	2019	Gondar	Amhara	Cross-sectional	Institutional	University/College students	648
Amanuel G. et al.	2004	Adigrat	Tigray	Cross-sectional	Institutional	Women with Gynecologic problem	7203
Endalew S. et al.	2021	Addis Ababa	Addis Ababa	Cross-sectional	Institutional	Reproductive age	432
Worku A. et al.	2011	Arba Minch	SNNP	Cross-sectional	Institutional	University/College students	845
Mesfn A. et al.	2021	Arba minch & Wolayita Sodo town	SNNP	Case control	Institutional	Reproductive age group	413
Bethelihem A. et al.	2015	Addis Ababa	Addis Ababa	Cross-sectional	Institutional	Abortion care service seekers	429
Mussie A. et al.	2014	Tigray region health hospitals	Tigray	Case control	Institutional	Abortion care service seekers	309
Geremew K. et al.	2019	Debre Berhan town health institutions	Amhara	Cross-sectional	Institutional	Abortion care service seekers	355
Amha A. et al.	2011	Hawassa University	SNNP	Cross-sectional	Institutional	University/College students	493

Girma G. et al.	2016	Ethiopia	National data	Cross-sectional	Community	Youth women	6401
Kifle L. et al.	2017	Guraghe zone	SNNP	Cross-sectional	Institutional	Reproductive age	404
Arif H. et al.	2020	Harari	Harari	Cross-sectional	Institutional	Reproductive age group	611
Biniyam B. et al.	2020	Dilla University	SNNPR	Cross-sectional	Institutional	University/College students	548
Denberu B. et al	2017	Addis Ababa	Addis Ababa	Case control	Institutional	Youth women	330
Diriba G. et al.	2015	Jimma	Oromia	Cross-sectional	Institutional	Abortion care service seekers	194
Girum M. et al.	2015	Gonji Kollela District	Amhara	Cross-sectional	Community	Reproductive age group	611
Murad M. et al.	2020	Harar	Harari	Cross-sectional	Institutional	Reproductive age group	835
Tekleab M. et al.	2007	Ethiopia	National data	Cross-sectional	Institutional	Abortion care service seekers	1075
Tadesse N. et al.	2020	Mizan Tepi University	SNNP	Cross-sectional	Institutional	University/College students	420
Tesfamichael G. et al.	2017	Gondar	Amhara	Cross-sectional	Community	Reproductive age	154
Kidist A. et al	2022	Jimma, Bonga, and Mizan-Aman	SNNPR	Cross-sectional	Community	Insecurely housed women	124
Solomon W. et al	2006	Harer	Harari	Cross-sectional	Community	Reproductive age	1000
Biza N. et al.	2018	Semera	Afar	Cross-sectional	Institutional	University/College students	509
Abera et al.	2012	Mekelle	Tigray	Cross-sectional	Institutional	Abortion care seekers	260

Table 2: Characteristics of the studies for the prevalence of pregnancy termination in Ethiopia, 2004-2022

Authors name	Publication year	Study area	Region	Study design	Study setting	Study population	Sample size
Addisu W. et al	2018	Addis Ababa	Addis Ababa	Cross-sectional	Institutional	Reproductive age group	423
Mahlet T. et al.	2017	Debre Markos	Amhara	Cross-sectional	Institutional	Reproductive age group	567
Fikreselassie T. et al.	2014	Bahr Dar	Amhara	Case-control	Institutional	Pregnant women	175
Gezahegn T. et al.	2010	Guraghe Zone	SNNP	Cross-sectional	Institutional	Abortion care service seekers	422
Bekele T. et al.	2017	Debre Markos	Amhara	Cross-sectional	Institutional	Abortion care service seekers	262
Getayeneh A. et al.	2016	Ethiopia	National data	Cross-sectional	Community	Pregnant women	12378
Addisu T. et al.	2019	Hawassa	SNNP	Cross-sectional	Institutional	University/College students	422
Amlaku M. et al.	2014	Amhara region referral hospitals	Amhara	Cross-sectional	Institutional	Abortion care service seekers	422
Birye D. et al.	2019	Gondar	Amhara	Cross-sectional	Institutional	University/College students	648
Amanuel G. et al.	2004	Adigrat	Tigray	Cross-sectional	Institutional	Women with Gynecologic problem	7203
Endalew S. et al.	2021	Addis Ababa	Addis Ababa	Cross-sectional	Institutional	Reproductive age	432
Worku A. et al.	2011	Arba Minch	SNNP	Cross-sectional	Institutional	University/College students	845
Mesfn A. et al.	2021	Arba minch & Wolayita Sodo town	SNNP	Case control	Institutional	Reproductive age group	413
Bethelihem A. et al.	2015	Addis Ababa	Addis Ababa	Cross-sectional	Institutional	Abortion care service seekers	429
Mussie A. et al.	2014	Tigray region health hospitals	Tigray	Case control	Institutional	Abortion care service seekers	309

Geremew K. et al.	2019	Debre Berhan town health institutions	Amhara	Cross-sectional	Institutional	Abortion care service seekers	355
Amha A. et al.	2011	Hawassa University	SNNP*	Cross-sectional	Institutional	University/College students	493
Girma G. et al.	2016	Ethiopia	National data	Cross-sectional	Community	Youth women	6401
Kifle L. et al.	2017	Guraghe zone	SNNP	Cross-sectional	Institutional	Reproductive age	404
Arif H. et al.	2020	Harari	Harari	Cross-sectional	Institutional	Reproductive age group	611
Biniyam B. et al.	2020	Dilla University	SNNPR	Cross-sectional	Institutional	University/College students	548
Denberu B. et al	2017	Addis Ababa	Addis Ababa	Case control	Institutional	Youth women	330
Diriba G. et al.	2015	Jimma	Oromia	Cross-sectional	Institutional	Abortion care service seekers	194
Girum M. et al.	2015	Gonji Kollela District	Amhara	Cross-sectional	Community	Reproductive age group	611
Murad M. et al.	2020	Harar	Harari	Cross-sectional	Institutional	Reproductive age group	835
Tekleab M. et al.	2007	Ethiopia	National data	Cross-sectional	Institutional	Abortion care service seekers	1075
Tadesse N. et al.	2020	Mizan Tepi University	SNNP	Cross-sectional	Institutional	University/College students	420
Tesfamichael G. et al.	2017	Gondar	Amhara	Cross-sectional	Community	Reproductive age	154
Kidist A. et al	2022	Jimma, Bonga, and Mizan-Aman	SNNPR	Cross-sectional	Community	Insecurely housed women	124
Solomon W. et al	2006	Harer	Harari	Cross-sectional	Community	Reproductive age	1000
Biza N. et al.	2018	Semera	Afar	Cross-sectional	Institutional	University/College students	509
Abera et al.	2012	Mekelle	Tigray	Cross-sectional	Institutional	Abortion care seekers	260

*SNNP: South Nations and Nationalities Peoples



PRISMA 2020 Checklist

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



PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
assessment			
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	7
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	7
Study characteristics	17	Cite each included study and present its characteristics.	7
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	7
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	7-9
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	7-9 & 14
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	7-9 & 14
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	7-9 & 14
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	7-9 & 14
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	7-9
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	7-9
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	11-13
	23b	Discuss any limitations of the evidence included in the review.	11-13
	23c	Discuss any limitations of the review processes used.	13
	23d	Discuss implications of the results for practice, policy, and future research.	11-13
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	5
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	5
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	5
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	14
Competing interests	26	Declare any competing interests of review authors.	14
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	14



PRISMA 2020 Checklist

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Prevalence and determinants of pregnancy termination in Ethiopia: A systematic review and meta-analysis

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3 **Prevalence and determinants of pregnancy termination in Ethiopia: A systematic review**
4 **and meta-analysis**
5

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Abstract

Objective: This review aims to determine the prevalence of pregnancy termination and its determinant factors in Ethiopia.

Design: Systematic review and meta-analysis

Data sources: Relevant articles were retrieved from databases such as PubMed, EMBASE, Medline, and other search engines.

Eligibility criteria for selecting studies: The research design for this study had no restrictions, allowing for the inclusion of cross-sectional and case-control studies that examined the prevalence or determinants of pregnancy termination. However, case reports, case series, reviews, editorials, and studies published as abstracts only were excluded from the analysis.

Data extraction and synthesis: The review precisely in accordance with PRISMA criteria, and the quality of the review was assessed using the Joanna Briggs Institute critical appraisal checklist. Heterogeneity was indicated by the p-value for I^2 statistics less than 0.05. Data were entered into Microsoft Excel, and the analysis was conducted using Stata 16.

Results: The pooled prevalence pregnancy termination in Ethiopia was 21.52% (95% CI: 15.01, 28.03). Women who had their first sexual initiation before the age of 18 (OR = 1.78; 95% CI = 1.13, 2.82, P=0.144), had irregular menstrual bleeding (OR = 1.86; 95% CI = 1.25, 2.77, P=0.756), being a student (OR: 4.85; 95% CI: 1.98, 11.91, P=0.201), and had multiple sexual partners (OR: 4.88; 95% CI: 3.43, 6.93, P=0.329) were significantly associated with pregnancy termination.

Conclusions: One in five women terminated their pregnancies, which is higher than in other Sub-Saharan countries. Being a student, irregular menstrual bleeding, early initiation of sexual intercourse, and multiple sexual partners were determinants of pregnancy termination. Special attention is needed in avoiding early sexual initiation and in reducing sexual risk behaviors.

Strength and limitation

- Comprehensive inclusion of studies from various regions provides a broader perspective.
- Variations in study population, setting, and design may impact the results.
- Exclusion of qualitative studies on pregnancy termination explanations limits the overall understanding.

Keywords: Pregnancy termination, Determinants, Systematic review and meta analysis, Ethiopia

Introduction

Pregnancy termination is a sensitive and contentious issue with religious, moral, cultural, and political dimensions. Also, it presents a significant public health concern in developing countries (1). Above 60% of unintended pregnancies result in pregnancy termination, with the majority of those being unsafe (2). Developing countries bear the burden of 97% of all unsafe abortions which contributes to 220 deaths per 100,000 live births (3).

Pregnancy termination imposes an additional burden on health institutions and individuals; in developing countries alone, each year an estimated 7 million women seek treatment in health facilities for the complication of pregnancy termination (4). It is estimated that health-care systems will spend \$553 million per year on post-abortion complications and will lose \$922 million in income due to long-term disability caused by unsafe termination (5). Additionally, a woman who undergo pregnancy termination, particularly through methods such as mechanical dilation and curettage, face an increased a risk of experiencing preterm birth and repeated pregnancy loss (6).

Though the burden of pregnancy termination in Ethiopia is a significant contributor to maternal mortality and morbidity (7). Previous studies conducted in Ethiopia have shown that the prevalence of pregnancy termination and its negative consequences are increasing over time (8, 9), and repeated pregnancy termination also accounts significant amount (10-12). Several variables, including early age marriage, low level of education, early sexual intercourse initiation, violence/rape, emotional well-being, educational status, employment status, and resources, and sexual intercourse relationship, have been implicated as factors of pregnancy termination in studies conducted across Ethiopia (13-16).

However, at the national level, illustrative evidence is lacking in Ethiopia regarding the level and underlying factors of pregnancy termination. Thus, this systematic review and meta-analysis aimed to assess the prevalence of pregnancy termination and its determinant factors in Ethiopia. The findings of this study provide evidence for intervention to reduce the burden of pregnancy termination, its complications, and its economic impact in the country. Additionally, this study will help to design strategies and monitor the progress of programs aimed at achieving the maternal mortality reduction targets of the sustainable development goals.

Methods

Study design and setting

This systematic review and meta-analysis included cross sectional, and case control studies which has been conducted in Ethiopia. Systematic review and meta-analysis using computerized databases; searches were performed to estimate the prevalence and identify the determinants of pregnancy termination in Ethiopia.

Search strategy

For this review, a comprehensive search was conducted using various searching strategies to identify relevant articles. Published articles were searched in well-known online databases including EMBASE, Medline, Google, PubMed, Google Scholar, African Journal Online, and Science Direct databases. Additionally, the search was expanded by examining the reference lists of eligible articles to retrieve and extract potential articles. This systematic review was conducted using the preferred reporting items for systematic Reviews and Meta-Analyses PRISMA guidelines. Similarly, the quality of our systematic review and meta-analysis was assessed using the Joanna Briggs Institute (JBI) critical appraisal checklist (17).

Searching was done by using Medical Subject Heading (MeSH) terms related with determinants of pregnancy termination. MeSH terms enables us to select related research articles. We conducted the search for terms using Boolean operators "AND" and "OR," both separately and in combinations. We used the search terms “(((((((Abortion) OR (termination of pregnancy)) OR (miscarriage)) AND (determinant factors)) OR (determinants)) OR (associated factors)) OR (influencing factors)) AND (Amhara) OR (Oromia) OR (Tigray) OR (Southern nation, nationalities and people’s) OR (Afar) OR (Benshagul gumuz) OR (Gamabella) OR (Somali) OR (Dire dawa) OR (Addis Ababa) OR (Hareri) OR (Ethiopia)”.

Eligibility criteria

Inclusion criteria

There were no restrictions on research design. We included cross-sectional and case-control studies that showed the prevalence of or determinants of pregnancy termination. Additionally, Only articles reported in the English language and conducted studies until February 2023 were included.

Exclusion criteria

Case reports, case series, reviews, editorials, and studies published as abstracts only were excluded. Agreements on the inclusion and exclusion of the articles were held through the participation of all authors.

Quality assessment and data extraction

Articles were screened using their titles, abstracts, and full paper reviews before being included in the meta-analysis. The quality of included studies was evaluated using the JBI critical appraisal checklist (17). The quality scores of included studies were assessed and presented using the mean scores to designate them as high or low quality. The JBI tool for prevalence and determinat studies was used as a guideline for data extraction from the final selected articles. Moreover, all authors independently reviewed the titles and abstracts of studies to be included in this systematic review and meta-analysis. Agreements on the inclusion and exclusion of the articles were reached with the participation of all authors. The extraction sheet contains name of authors, study year, publication year, region of study, study design, sample size, prevalence in percentage or proportion, odd ratio of factors, confidence intervals both the upper and lower bound of each corresponding odds ratio. The odd ratio of each factors are transformed as log (OR). The lower and upper confidence intervals are log transformed as log (upper confidence interval), and log (lower confidence interval). The standard error for the proportion was also created as: $\text{Standard error} = \sqrt{\frac{p(1-p)}{n}}$. Then the standard error of the confidence intervals were also estimated using the log transformed upper and lower limits which is calculated as $\text{SE} = (\log\text{UCL} - \log\text{LCL})/3.92$. Finally for pooled prevalence estimation, the proportion and its corresponding standard errors were used. For factors, the log transformed odd ratios and the standard error of their corresponding confidence intervals were used to estimate the effect sizes.

Measurement of the outcome variable

In this study, termination of pregnancy is the removal of pregnancy tissue, conception products, or fetus, and placenta from the uterus. The term 'fetus' and 'placenta' is commonly used after eight weeks of pregnancy. Pregnancy tissue and products of conception are the tissues that are

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3 produced by the union of an egg and sperm before eight weeks. Terminating a pregnancy is a
4 deliberate action taken by a health professional or the woman herself (18).
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7 **Registration and protocol**

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10 This review has not previously registered or prepared a protocol. As a result, no adjustments
11 have been made.
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14 **Patient and Public Involvement:** not applicable
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16 **Statistical methods and analysis**

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18 The meta-analysis was conducted using Stata 16 software after entering data into Microsoft
19 Excel. Forest plots were used to demonstrate the prevalence of pregnancy termination in Ethiopia.
20 The random effect model of analysis was utilized as a method of meta-analysis to minimize the
21 heterogeneity of included studies (19). The study setting, population, and study period were
22 used to conduct sub-group analysis. The presentation of pregnancy termination determinants was
23 based on odds ratios (ORs) with a 95% confidence interval(CI).
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31 The heterogeneity of the studies included was assessed using the I^2 statistics. The presence of
32 heterogeneity was determined by using p-value for I^2 statistics that was less than 0.05. Based on
33 the I^2 test statistics results, the heterogeneity is categorized as low (25%), moderate (50%), and
34 high (75%) (19). Furthermore, the Egger regression asymmetry test was used to evaluate the
35 publication bias (20, 21). When the Egger test result's P-value is less than 0.05, there is a
36 declaration of publication bias. As well, the Duval and Tweedie nonparametric trim and fill
37 analysis using the random effect analysis was conducted to detect the presence of publication
38 bias (22).
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Result

Study selection

This systematic review and meta-analysis included published studies on the termination of pregnancy in Ethiopia. A total of 12,242 records were retrieved through electronic database searching, and only 33 articles were included in the final analysis (supplementary figure 1).

Characteristics of included studies

This review included Thirty-three studies conducted in various regions of Ethiopia. Of all the studies, 8 (24.24%) were from the Amhara Region (11, 12, 15, 16, 23-26), South Nations and Nationalities Peoples accounted for 9 (27.27%) of the total (13, 27-34), 1 was from Oromia (35), 5 (15.15%) from Addis Ababa city administration (10, 14, 36-38), 3 (9.09%) were from Harari region (39-41), 3 (9.09%) were from Tigray region (42-44), 1 (3.03%) was from Afar region (45), 3 (9.09) were from National data (46-48). Twenty-eight (84.85%) of the included articles were cross-sectional studies (10-13, 15, 23-31, 33-35, 37-42, 44-48), and remains five (15.15%) were case-control studies(14, 16, 32, 36, 43).

As well, twenty-seven of the studies were institution-based (10-16, 24, 27-33, 35-46), while six were community-based studies(23, 25, 26, 34, 47, 48). The sample size of the included studies ranged from a minimum of 124 in a study conducted in southwest Ethiopia (34) and to a maximum of 12,378 in a study conducted using DHS data (48). Overall, a total of 40,116 study participants were included in this review detail is available in supplementary table 1.

Prevalence of pregnancy termination in Ethiopia

Based on the random effect model, the overall pooled prevalence of termination of pregnancy among women in Ethiopia was 21.52% (95% CI: 15.01–28.03) (supplementary figure 2). The meta-analysis included studies with significant heterogeneity: I^2 value of 99.8%, $p < 0.000$. Publication biases among the included studies were examined using funnel plots and Egger's regression test. The results of funnel plots showed an asymmetric shape, which indicates the presence of publication bias among included studies. Additionally, the Duval and Tweedie nonparametric trim and fill analysis was applied to correct publication bias among the studies, but no trimming was performed since the data is unchanged (supplementary figures 3 and 4).

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7 Objective assessments of publication bias by Egger's regression test also showed the presence of
8 publication bias across studies (P-value < 0.001). After conducting the trim and fill analysis to
9 address publication bias, the final pooled prevalence of pregnancy termination in Ethiopia was
10 adjusted to 21.52% (95% CI: 15.01–28.03).
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13 14 **Subgroup analysis** 15

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17 We performed subgroup analysis based on the region, study population, and study setting of the
18 included studies. Table 1 shows the pooled prevalence was highest, 35.60% (95% CI: 28.86,
19 42.34) in the Oromia region, followed by 34.17% (95% CI: 17.67, 86.01) in the Tigray region,
20 24.63% (95% CI: 10.52, 37.75) in the South Nation and Nationalities People Region, and the
21 lowest was seen in three studies conducted using demographic health data, 12.10% (95% CI:
22 5.66, 18.50) (supplementary figure 5).
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29 Furthermore, subgroup analysis reveals that the highest pooled prevalence of abortion was seen
30 among gynecological admitted patients, at 60.60% (95% CI: 59.47, 61.73), followed by 25.38%
31 (95% CI: 9.39, 41.32) among university/college students, and 27.90% (95% CI: 20.01, 35.79)
32 among insecurely housed women, with the lowest pooled prevalence being seen among pregnant
33 and youth women (supplementary figure 6). Additionally, subgroup analysis was conducted
34 based on the year before and after the Millennium Development Goals' implementation. The
35 pooled prevalence of pregnancy termination before and after MDGs was 20.55% (95% CI:
36 16.10–24.99) and 21.61% (95% CI: 15.01–28.03), respectively (supplementary figure 7).
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Table 1: Subgroup analysis for the prevalence of pregnancy termination in Ethiopia, 2004-2022

Subgroup	Number of studies	Total Sample	Prevalence (95%CI)	Heterogeneity	
				I ²	p-value
By region					
Addis Ababa	2	855	25.49(10.39, 40.09)	92.4	< 0.001
Amhara	6	2371	18.06(6.27, 29.85)	99.0	< 0.001
SNNP	8	3678	24.63(95% CI: 10.52, 37.75)	99.4	< 0.001
National Data	3	19854	12.10(5.70, 18.50)	99.7	< 0.001
Tigray	2	7463	34.17(17.6, 86.01)	99.9	< 0.001
Harari	2	1835	16.13(12.21, 20.05)	81.2	< 0.001
Oromia	1	194	35.60(28.86, 42.34)	.	.
Afar	1	509	8.80(6.34, 11.26)	.	.
By publication year					
2016 to 2022 (post MDG)	15	24234	20.55(16.10, 24.99)	99.3	< 0.001
Before MDG	10	12525	22.61(4.55, 40.66)	99.9	< 0.001
Study population					
Reproductive age	8	4426	17.03(8.55, 25.52)	99.0	< 0.001
Pregnant women	1	12378	8.90 (8.40, 9.40)	.	.
Abortion care seeker	7	2990	21.19(14.65, 27.72)	95.3	< 0.001
University or college student	6	3237	25.36 (9.39, 41.32)	99.5	< 0.001
Gynecological patient	1	7203	60.60 (59.47, 61.73)	.	.
Youth women	1	6401	2.50 (2.12, 2.88)	.	.
Insecurely housed women	1	124	27.90 (20.01, 35.79)	.	.
Total	25	36759	21.52(15.01, 28.03)	99.8	< 0.001

Insecurely household women: it means women who live or spend their time on the street.

Determinants of pregnancy termination

Socio-demographic characteristics

The sociodemographic factors included in this analysis were the place of residence, age, marital, occupational, and educational status of the women. A separate analysis was conducted for each variable. Finally, a meta-analysis of (16, 39) two studies showed that being a student was significantly associated with pregnancy termination (OR: 4.85; 95% CI: 1.98, 11.91). There was moderate heterogeneity ($I^2 = 39\%$) (supplementary figures 8 and 9).

Reproductive characteristics

A total of 5 articles (15, 24, 28, 43, 47) were included to assess the association between first sexual initiation before the age of 18 and pregnancy termination. The pooled meta-analysis found that women who had their first sexual experience before the age of 18 were twice as likely as those who had their first sexual experience after the age of 18 to have their pregnancy terminated (OR = 1.78; 95% CI = 1.13, 2.82). There was moderate heterogeneity ($I^2 = 41.6\%$). Moreover, two articles (11, 43) were also included to determine the association between irregular menstrual bleeding and pregnancy termination. The final pooled meta-analysis using data from the two articles found that pregnancy termination was nearly two times more likely to occur in women with irregular menstrual bleeding than in those who had regular menstrual bleeding, (OR = 1.86; 95% CI = 1.25, 2.77). Similarly, a meta-analysis of six studies(14, 15, 24, 32, 34, 43) showed that women who had multiple sexual partners were significantly associated with pregnancy termination (OR: 4.88; 95% CI: 3.43, 6.93). There was low heterogeneity ($I^2 = 13.4\%$) (supplementary figures 10).

Discussion

Pregnancy termination is a major public health concern in Ethiopia (49). In this systematic review and meta-analysis, the overall magnitude of pregnancy termination was pooled from 25 published articles in Ethiopia, and significant determinants of pregnancy termination were identified using different articles. Being a student increased the rate of termination of pregnancy nearly five times. In addition, first sexual initiation before the age of 18, women with irregular menstrual bleeding, and multiple sexual partners were determinants of pregnancy termination in Ethiopia. The findings of this review revealed evidence to help reduce the impact of pregnancy termination in Ethiopia by aiming at the main determinants.

In Ethiopia various studies have been conducted on the issue of pregnancy termination, involving different settings such as the community, healthcare institutions, and higher education institutions. These studies have yielded varying figures regarding the prevalence of pregnancy termination. However, this particular study revealed Ethiopia has a higher prevalence of pregnancy termination compared to other low- and middle-income countries.

The study found that the pooled prevalence of termination of pregnancy in Ethiopia was 21.52%. This finding is lower compared to a study done in Ghana at 25% (50), higher than in Mozambique at 9 % ($\times 2.33$) (50), and in India at 1.7% ($\times 12$) (51). The difference could be attributed to various factors like; study population, study design, study area, socio-demographic characteristics, and the differences in health policies of the countries. Additionally, the current study utilized a meta-analysis approach at the national level, incorporating community or institutional studies, while the study in Ghana and Mozambique was conducted using demographic health data with a small sample size compared to the current study (50). Moreover, in our study, huge variations were seen across the regions. A spatial analysis study conducted in Ethiopia using national data also showed variation within the regions (48). Thus, acting according to the needs of the region and age-specific policy is important during national policy or guideline development.

Our study observed that being a student was significantly associated with the termination of pregnancy. One of the possible explanations could be that students are likely to be adolescents,

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3 belonging to the younger age category. In addition, adolescent girls are remaining in school
4 longer, which may factor into their decisions to postpone childbearing and terminate unintended
5 pregnancies (52). Likewise, a study conducted in India shows the tendency for pregnancy
6 termination is high in this age category since the rate of unintended pregnancies and unmet needs
7 for family planning are high in this age group (53). The higher rate of pregnancy termination
8 could also be attributed to a failure to provide education on prevention for unintended pregnancy
9 and complications of pregnancy termination (54).

15
16 Additionally, the idea supported by Van Rensburg that societal poverty, unemployment, and
17 other socio-demographic factors affect youth pregnancies and it might prone to pregnancy
18 termination (55). In addition, a review from the late 1990s found that young women often cited a
19 desire to stay in school as a major reason for pregnancy termination (56). Moreover, many
20 adolescents continue to have difficulty accessing contraception, often as a result of stigma and/or
21 a lack of resources (57).

26
27 The study from Nigeria indicated that 15–24-year old women are still being left behind on
28 reproductive health matters despite increasing global attention to prioritizing their health (58).
29 Studies found that educational programs aimed at reducing sexual risk behaviors and preventing
30 pregnancy among young people can effectively reduce pregnancy rate among teenagers (59).
31 Also, programs aimed at abstinence-centered education are effective in preventing adolescent
32 pregnancy (60). Thus, this implies a future focus on reproductive health issues specific to
33 students to address their needs. Additionally, future researchers should better focus on possible
34 interventions to reduce the risk of pregnancy and pregnancy termination among students.

41
42 Women under the age of 18 at first sexual initiation were significantly more likely to terminate
43 their pregnancy. This finding is consistent with studies conducted in Nigeria and Peru that
44 reported a higher rate of pregnancy termination among women who had their age at first sex
45 before 18 years old (61-63). Studies also revealed that early sexual debuts are significantly
46 associated with adolescent pregnancies, which are usually unwanted (64, 65). As well, a study
47 conducted in Ethiopia shown initiation of sexual intercourse before the age of 18 years was
48 found significant association with repeated pregnancy termination (66).

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3 In many low income countries, rising ages at first marriage combined with increasing levels of
4 premarital sex continue to result in unintended pregnancies among adolescents (67). Therefore,
5 improving the knowledge of adolescents about sexual and reproductive health issues, and
6 increasing contraceptive access and use among young people, are important to prevent unsafe
7 abortion or pregnancy termination (68). This necessitates the development of reproductive health
8 education specifically for adolescent girls. Future researchers should also address the gap in
9 studies on the needs of adolescent girls and possible interventions needed to reduce sexual
10 initiation before the age of 18 years.
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13 Furthermore, at the individual level, we found that pregnancy termination was significantly
14 associated with women who had multiple sexual partners. Likewise, a study conducted in Peru
15 indicated that as the number of sexual partners increased, the odds of getting a pregnancy
16 termination increased (69). Studies conducted in Cambodia, China, and the United Kingdom also
17 have found that having multiple sexual partners is associated with a higher rate of repeated
18 pregnancy termination. (54, 70, 71). The government shall be emphasized reproductive health
19 education, particularly for women regarding the risks of multiple sexual partners, the access
20 where, and how to get counseling on how to prevent pregnancy.
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23 This study also found that pregnancy termination was two times higher among women who had
24 menstrual irregularities compared to their counterparts. Lastly, this systematic review and meta-
25 analysis indicated that there were no statistical association between the termination of pregnancy
26 and rural residents, marital status, women's age, educational status, primiparous, history of
27 abortion, and wanted pregnancy.
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30 Our study has several strengths. The comprehensive inclusion of studies from various regions in
31 Ethiopia provides a broader perspective. The rigorous methodology employed in the selection
32 and analysis of studies further strengthens the credibility of the results. As a limitation, this
33 finding might be prone to the risk of bias due to the significant heterogeneity of articles included
34 from a different region of Ethiopia. In addition, differences in the study population, setting, and
35 design within the included studies might influence the results of this review. Studies conducted
36 in health institutions, higher education might affect the pooled estimates. Furthermore, it is
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3 important to note that the review exclusively included published articles and did not incorporate
4 qualitative studies that explore the explanations for pregnancy termination.
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8 Future research must explain the relationship between pregnancy termination and other
9 determinants such as social, economic, substance use, peer pressure, alcohol use, sexual or
10 physical violence, and knowledge of sexual and reproductive health issues such as family
11 planning and fertility.
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15 16 **Conclusions**

17
18 One in every five women had their pregnancies terminated, which is a high rate when compared
19 to Sub-Saharan countries. Being a student was significantly associated with the termination of a
20 pregnancy. In addition, irregular menstrual bleeding, early initiation of sexual intercourse, and
21 multiple sexual partners were important determinants of pregnancy termination.
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26 27 **Abbreviations**

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29 OR: odds ratios; CI: confidence interval; JBI: Joanna Briggs Institute; MDG: Millennium
30 Development Goals'
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34 35 **Declarations**

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37 **Ethical approval:** This article was conducted using published articles. Therefore, it don't
38 required ethical approval.
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41
42 **Funding:** No funding was used in this study.
43

44
45 **Availability of data and materials:** The datasets used and analyzed during the review are
46 available from the corresponding author upon reasonable request.
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50 **Competing interests:** None declared.

51
52 **Author contributions:** HK, MWA, AB, EM, TH, and LAT conducted the data curation and
53 extraction. HK, LAT, EM, and MWA. wrote the original and final draft of the research. LAT, EM,
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3 MWA and HK were conducted formal analyses and data interpretation. All authors read and
4 approved the final manuscript.
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7 **Supplementary file**

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9 The supplementary file contains the data extraction sheet for the study included in the review as
10 supplementary table 1 and supplementary figures 1-10.
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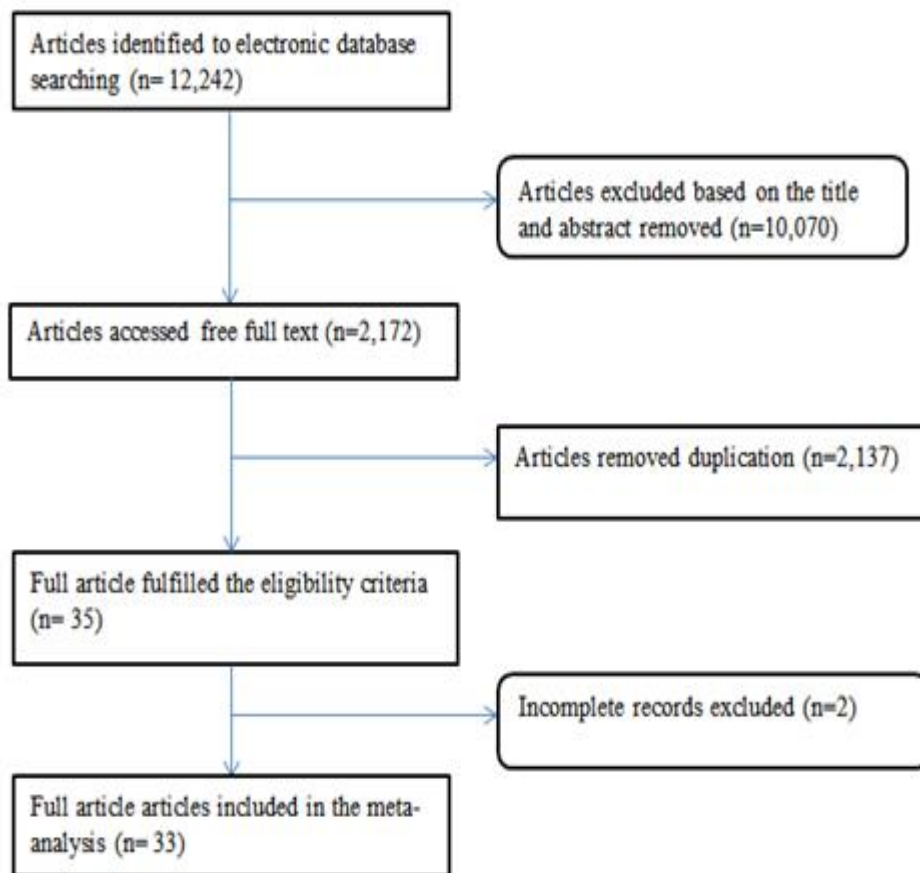


Figure1. Flow chart of describing the selection of studies for the systematic review and meta-analysis of the prevalence of pregnancy termination and associated factors in Ethiopia, 2023

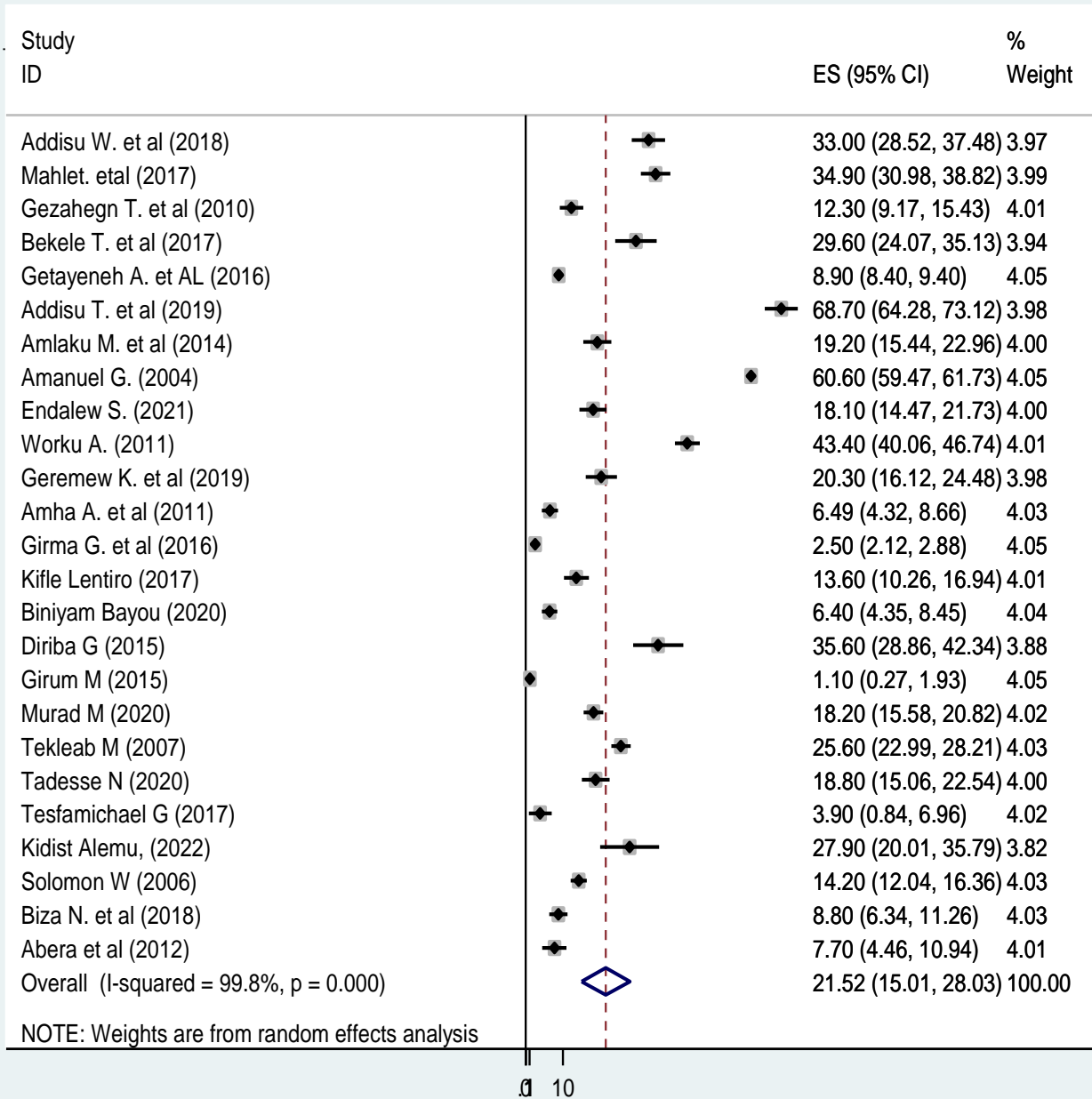


Figure 2: Forest plot of the pooled prevalence of pregnancy termination in Ethiopia, 2023

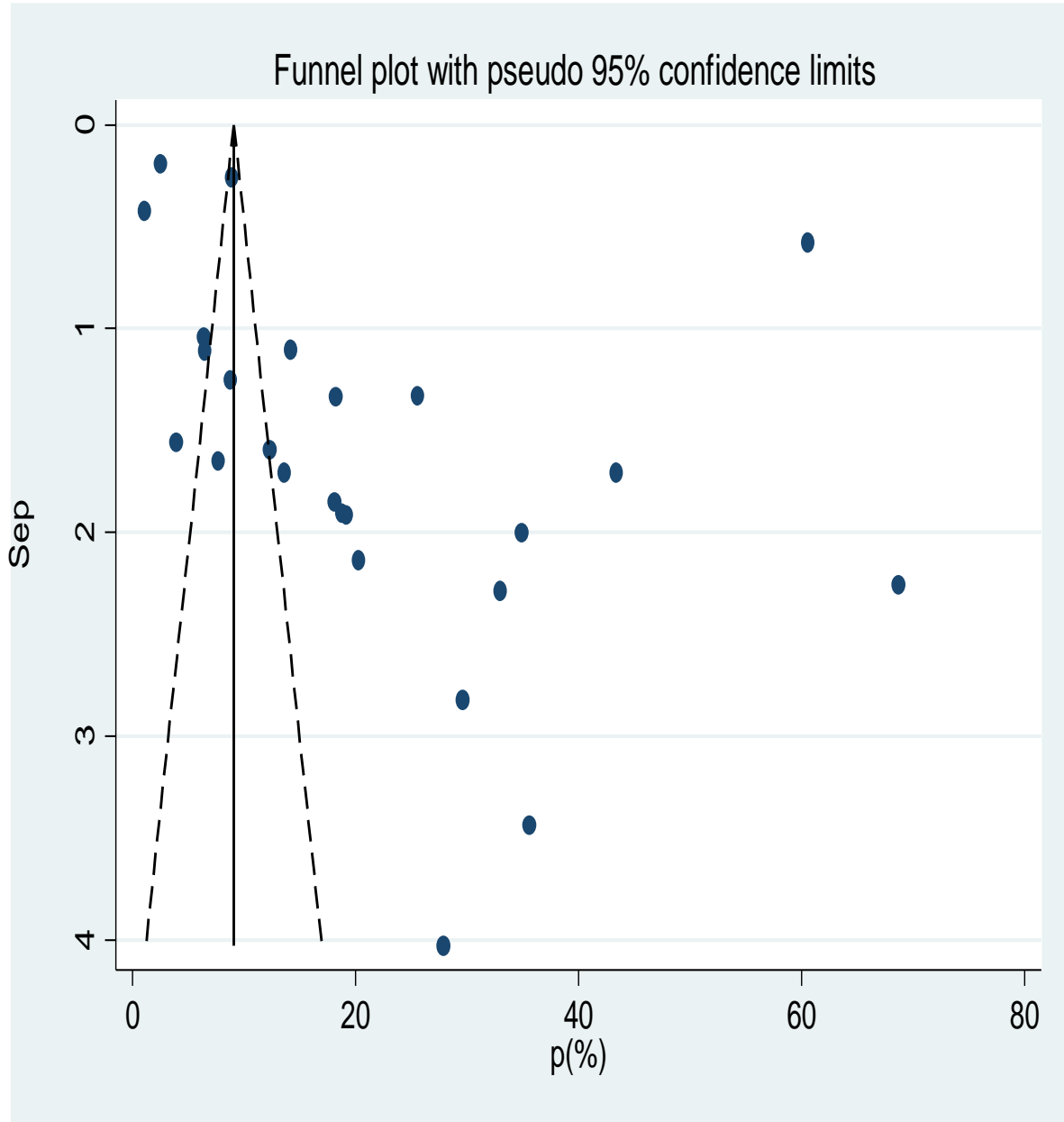


Figure 3: Funnel plot to test publication bias of pregnancy termination in Ethiopia, 2023

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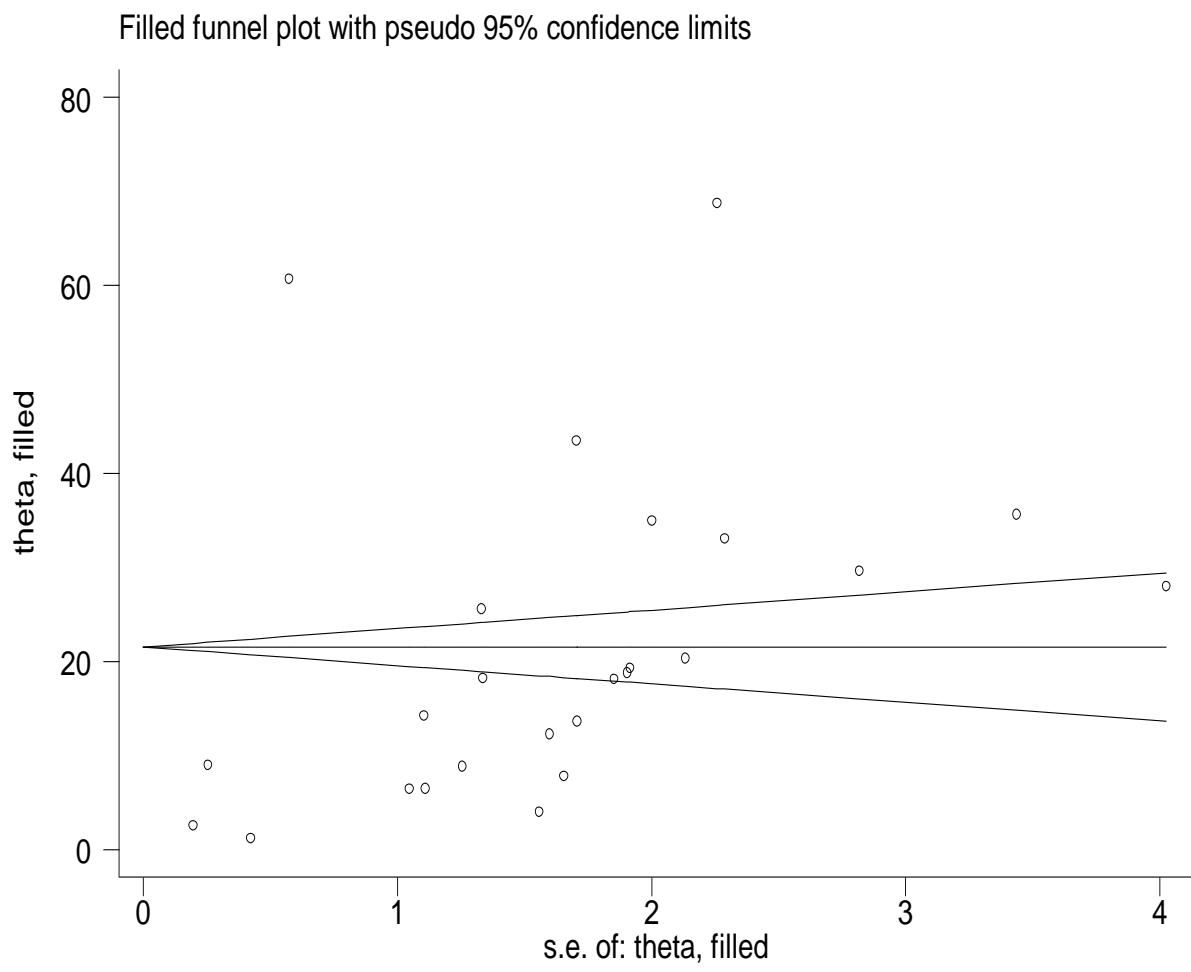


Figure 4: The Duval and Tweedie nonparametric trim and fill analysis of abortion among women in Ethiopia, 2023

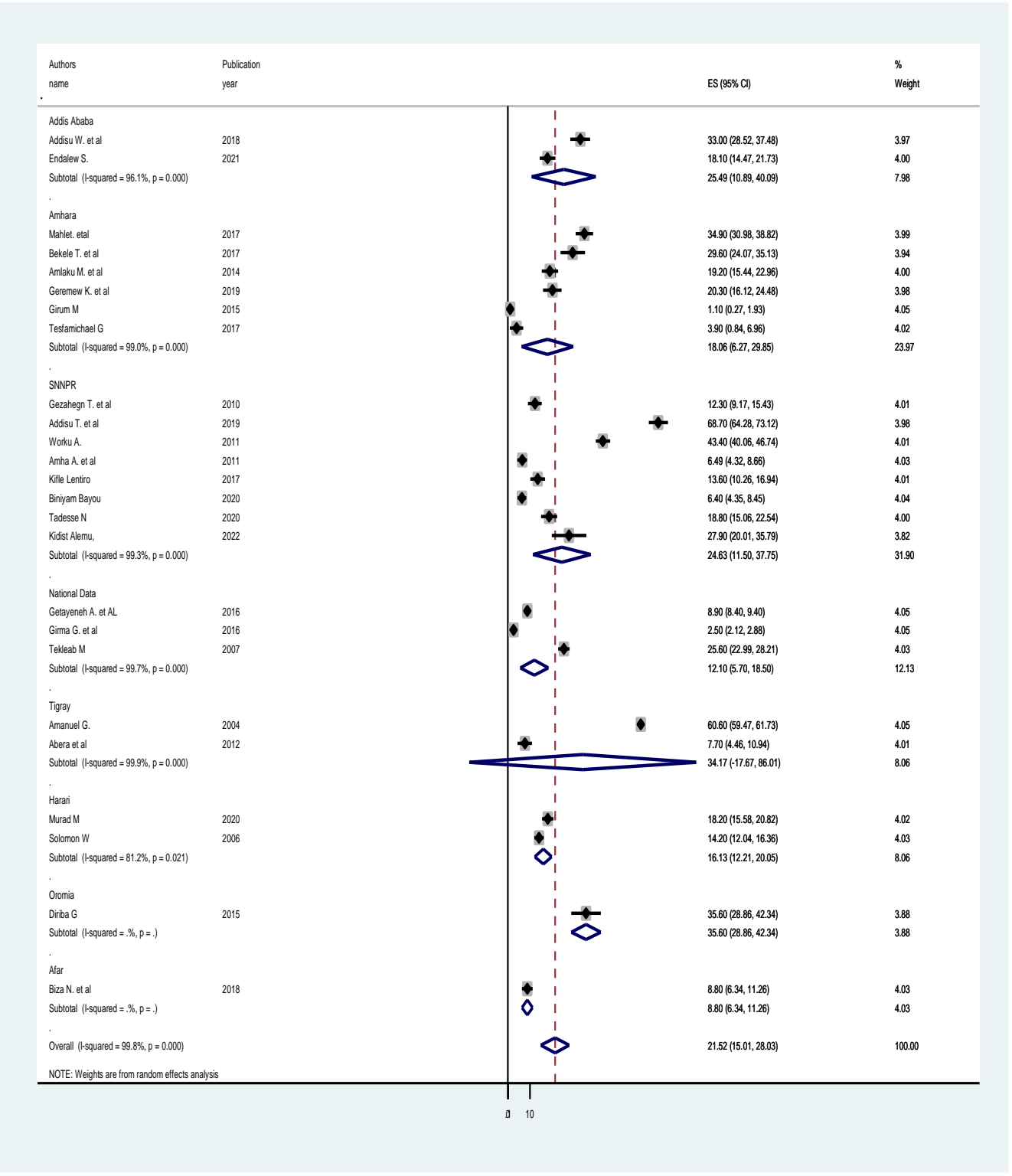


Figure 5: Subgroup analysis of the pregnancy termination based on regional distribution in Ethiopia, 2023

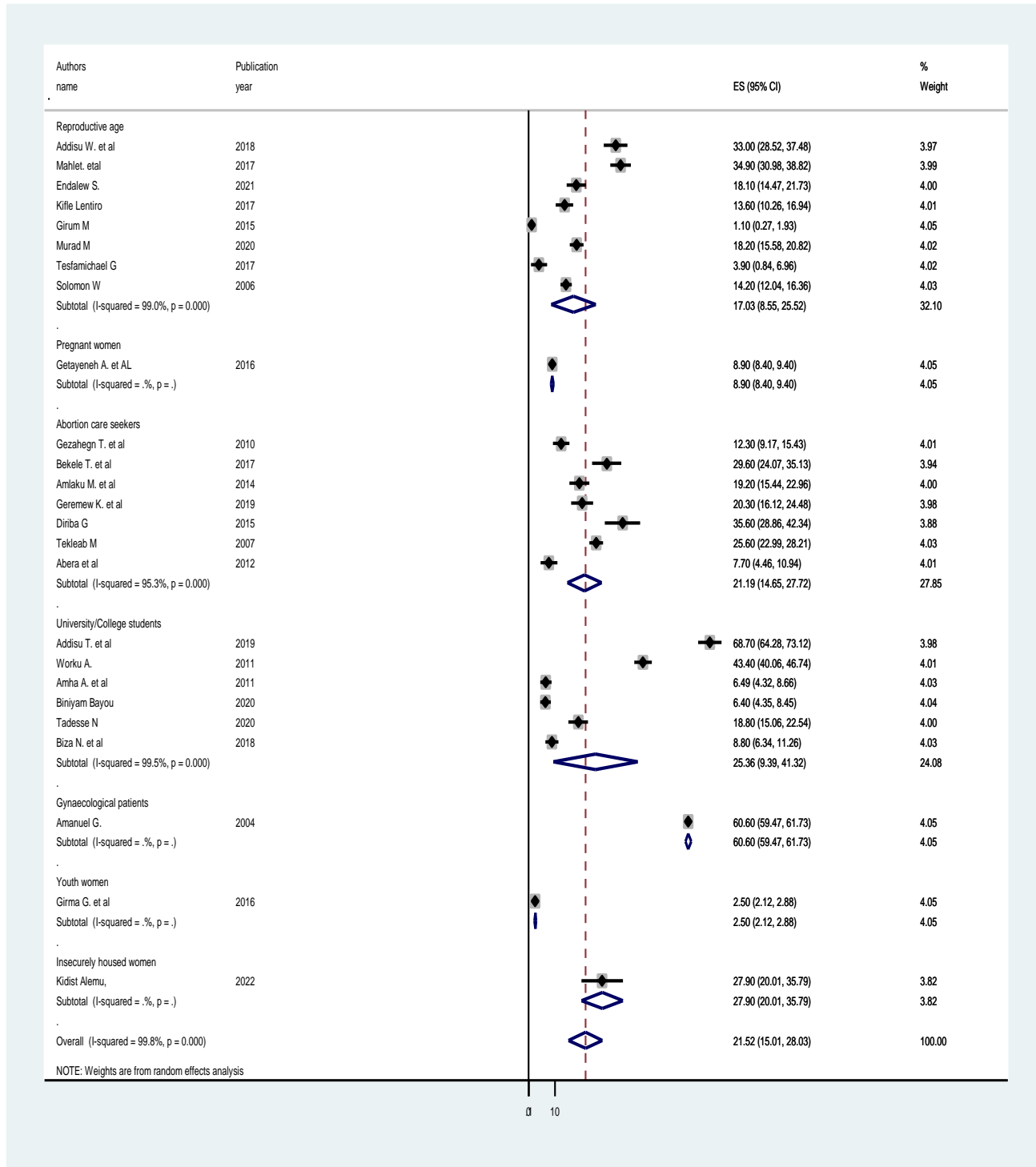


Figure 6: Subgroup analysis of the prevalence of pregnancy termination based on study population in Ethiopia, 2022

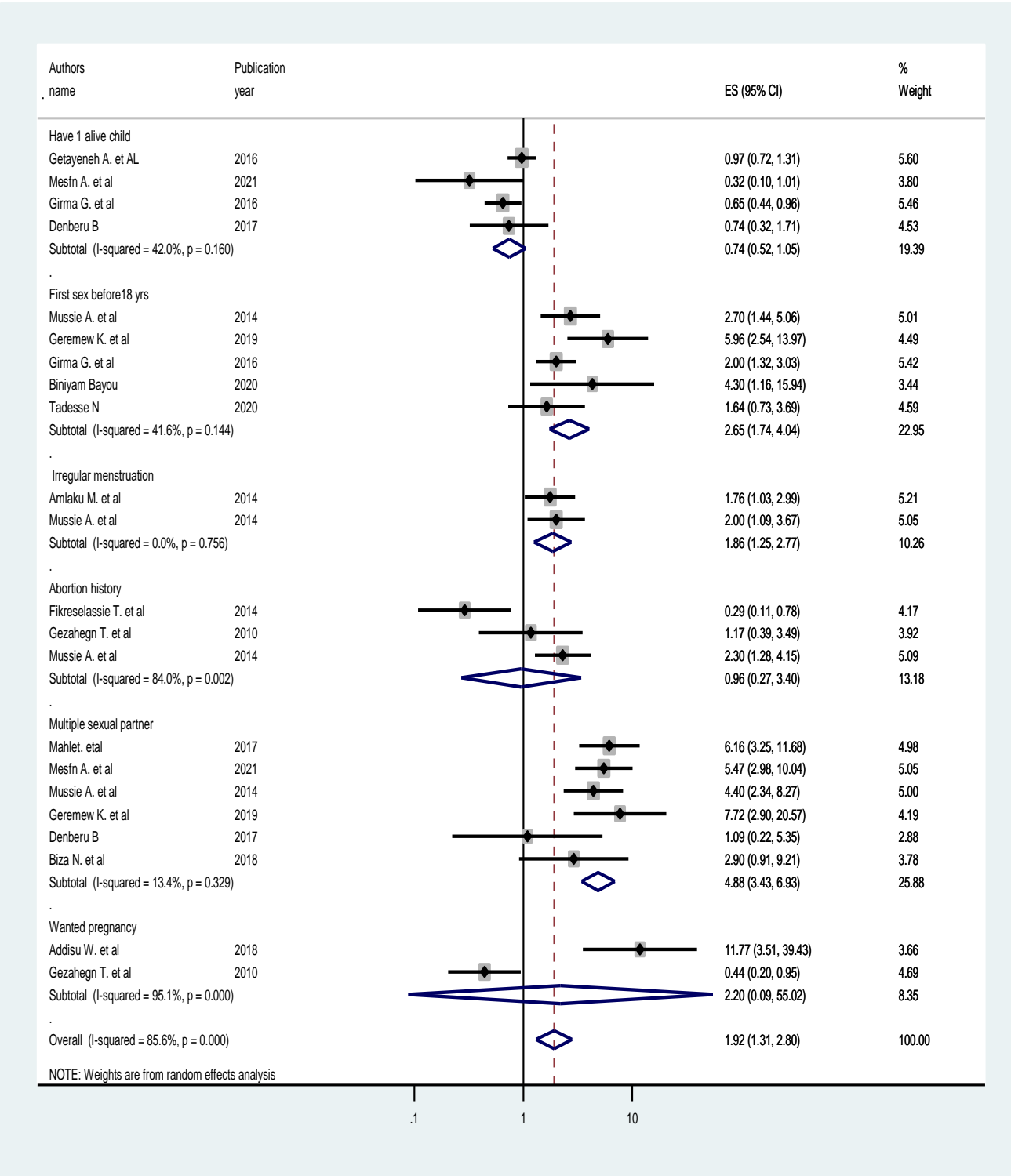


Figure 7: Subgroup analysis of the prevalence of pregnancy termination based on before and after MDG in Ethiopia, 2023

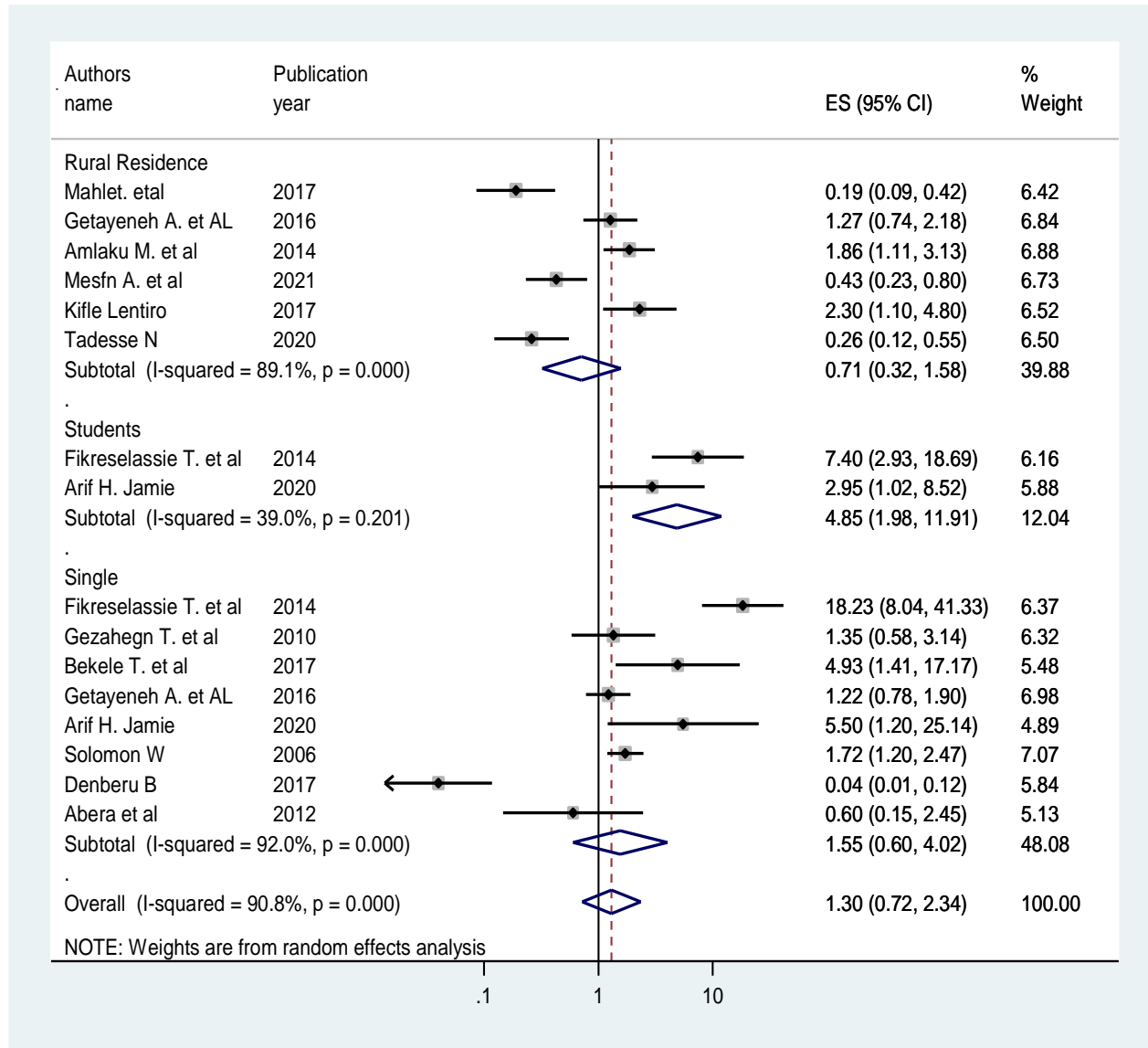


Figure 8: Forest plot of odds ratio for the association of selected socio-demographic characteristics and pregnancy termination in Ethiopia, 2023

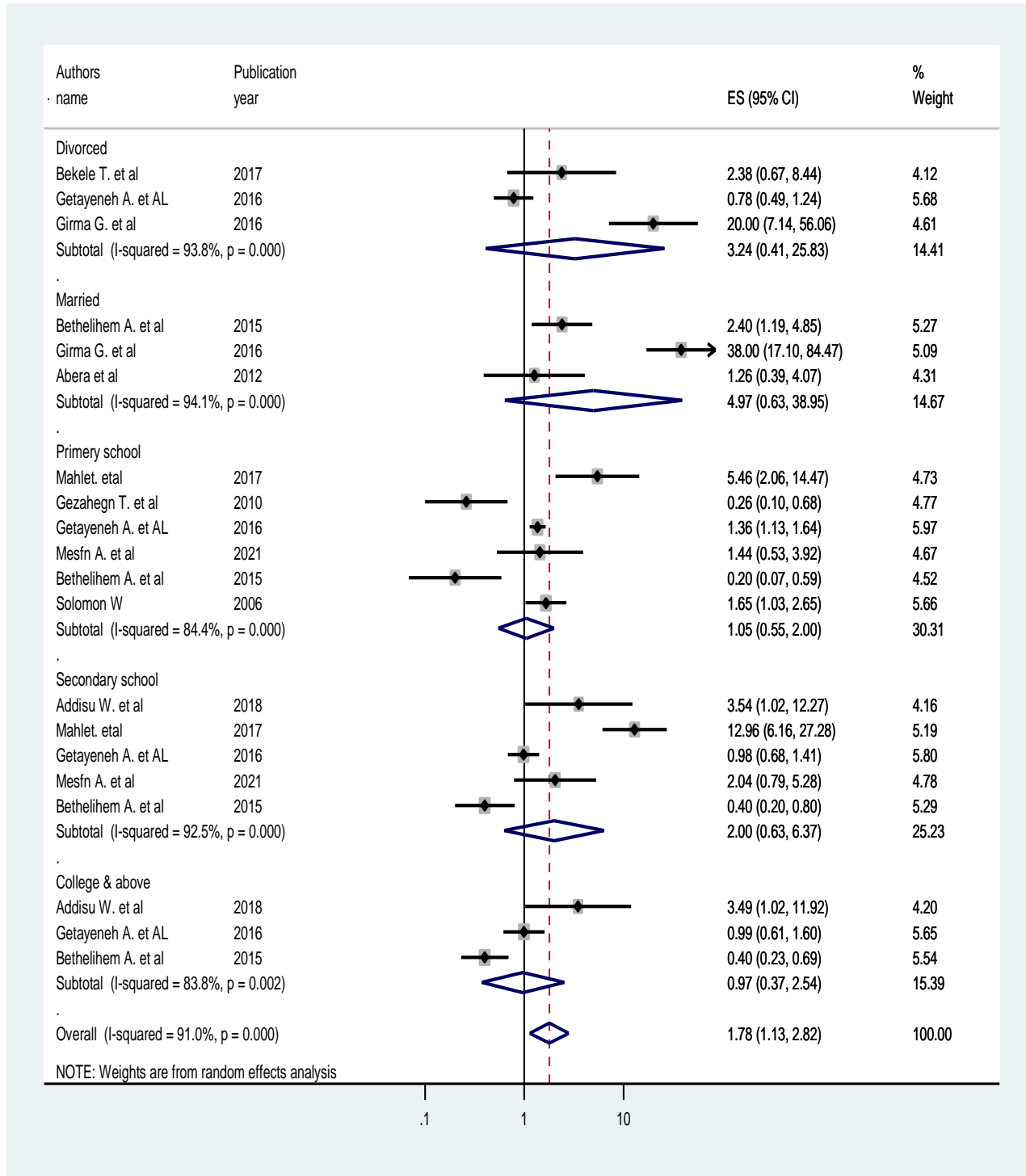


Figure 9: Forest plot of odds ratio for the association of selected socio-demographic characteristics and pregnancy termination in Ethiopia, 2023

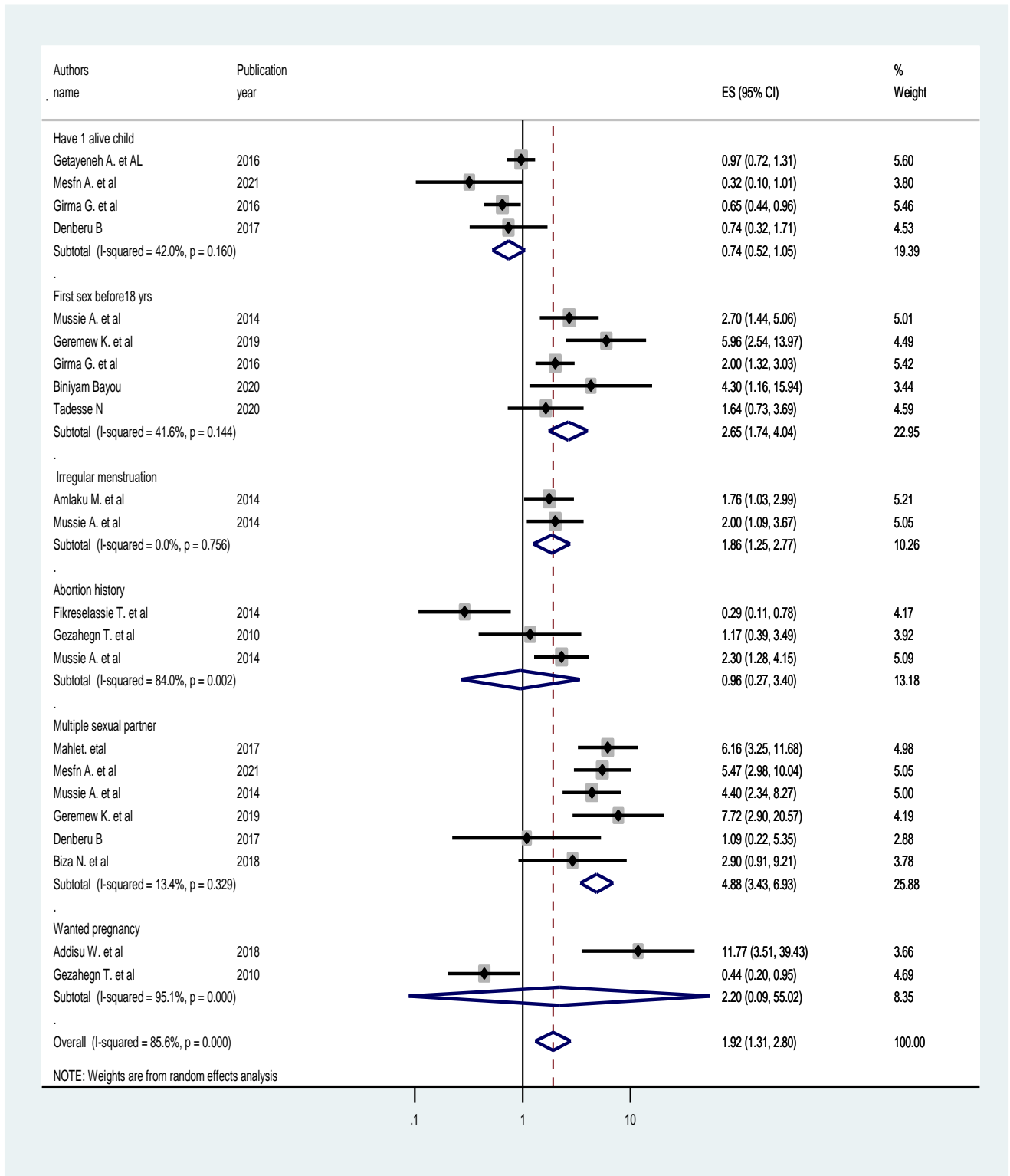


Figure 10: Forest plot of odds ratio for the association of selected reproductive characteristics and pregnancy termination in Ethiopia, 2023

Table 1. Data extraction sheet of the studies

Authors name	Publication year	Study area	Region	Study design	Study setting	Study population	Sample size
Addisu W. et al	2018	Addis Ababa	Addis Ababa	Cross-sectional	Institutional	Reproductive age group	423
Mahlet T. et al.	2017	Debre Markos	Amhara	Cross-sectional	Institutional	Reproductive age group	567
Fikreselassie T. et al.	2014	Bahr Dar	Amhara	Case-control	Institutional	Pregnant women	175
Gezahegn T. et al.	2010	Guraghe Zone	SNNP	Cross-sectional	Institutional	Abortion care service seekers	422
Bekele T. et al.	2017	Debre Markos	Amhara	Cross-sectional	Institutional	Abortion care service seekers	262
Getayeneh A. et al.	2016	Ethiopia	National data	Cross-sectional	Community	Pregnant women	12378
Addisu T. et al.	2019	Hawassa	SNNP	Cross-sectional	Institutional	University/College students	422
Amlaku M. et al.	2014	Amhara region referral hospitals	Amhara	Cross-sectional	Institutional	Abortion care service seekers	422
Birye D. et al.	2019	Gondar	Amhara	Cross-sectional	Institutional	University/College students	648
Amanuel G. et al.	2004	Adigrat	Tigray	Cross-sectional	Institutional	Women with Gynecologic problem	7203
Endalew S. et al.	2021	Addis Ababa	Addis Ababa	Cross-sectional	Institutional	Reproductive age	432
Worku A. et al.	2011	Arba Minch	SNNP	Cross-sectional	Institutional	University/College students	845
Mesfn A. et al.	2021	Arba minch & Wolayita Sodo town	SNNP	Case control	Institutional	Reproductive age group	413
Bethelihem A. et al.	2015	Addis Ababa	Addis Ababa	Cross-sectional	Institutional	Abortion care service seekers	429
Mussie A. et al.	2014	Tigray region health hospitals	Tigray	Case control	Institutional	Abortion care service seekers	309
Geremew K. et al.	2019	Debre Berhan town health institutions	Amhara	Cross-sectional	Institutional	Abortion care service seekers	355
Amha A. et al.	2011	Hawassa University	SNNP	Cross-sectional	Institutional	University/College students	493

Girma G. et al.	2016	Ethiopia	National data	Cross-sectional	Community	Youth women	6401
Kifle L. et al.	2017	Guraghe zone	SNNP	Cross-sectional	Institutional	Reproductive age	404
Arif H. et al.	2020	Harari	Harari	Cross-sectional	Institutional	Reproductive age group	611
Biniyam B. et al.	2020	Dilla University	SNNPR	Cross-sectional	Institutional	University/College students	548
Denberu B. et al	2017	Addis Ababa	Addis Ababa	Case control	Institutional	Youth women	330
Diriba G. et al.	2015	Jimma	Oromia	Cross-sectional	Institutional	Abortion care service seekers	194
Girum M. et al.	2015	Gonji Kollela District	Amhara	Cross-sectional	Community	Reproductive age group	611
Murad M. et al.	2020	Harar	Harari	Cross-sectional	Institutional	Reproductive age group	835
Tekleab M. et al.	2007	Ethiopia	National data	Cross-sectional	Institutional	Abortion care service seekers	1075
Tadesse N. et al.	2020	Mizan Tepi University	SNNP	Cross-sectional	Institutional	University/College students	420
Tesfamichael G. et al.	2017	Gondar	Amhara	Cross-sectional	Community	Reproductive age	154
Kidist A. et al	2022	Jimma, Bonga, and Mizan-Aman	SNNPR	Cross-sectional	Community	Insecurely housed women	124
Solomon W. et al	2006	Harer	Harari	Cross-sectional	Community	Reproductive age	1000
Biza N. et al.	2018	Semera	Afar	Cross-sectional	Institutional	University/College students	509
Abera et al.	2012	Mekelle	Tigray	Cross-sectional	Institutional	Abortion care seekers	260



PRISMA 2020 Checklist

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



PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
assessment			
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	7
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	7
Study characteristics	17	Cite each included study and present its characteristics.	7
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	7
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	7-9
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	7-9 & 14
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	7-9 & 14
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	7-9 & 14
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	7-9 & 14
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	7-9
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	7-9
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	11-13
	23b	Discuss any limitations of the evidence included in the review.	11-13
	23c	Discuss any limitations of the review processes used.	13
	23d	Discuss implications of the results for practice, policy, and future research.	11-13
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	5
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	5
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	5
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	14
Competing interests	26	Declare any competing interests of review authors.	14
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	14



PRISMA 2020 Checklist

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