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Male involvement in prevention of mother-to-child transmission of HIV, and its association with knowledge and residence in Ethiopia: a systematic review and meta-analysis

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Abstract

Introduction: Male involvement is crucial in preventing vertical transmission of human immunodeficiency virus (HIV) among pregnant and lactating women. Different studies were conducted on male involvement in prevention of mother-to-child transmission (PMTCT) of HIV, but there is inconsistency among the findings. Thus, the aim of this systematic review and meta-analysis was to determine the pooled prevalence of male involvement in PMTCT of HIV, and its association with knowledge and residence in Ethiopia.

Material and methods: Searching of articles was carried out from March 10 to April 20, 2020. Quality of each article was assessed by Newcastle-Ottawa scale for observational studies. Data were analyzed using STATA/SE version 14. Heterogeneity among the reported prevalence was assessed by computing values for χ^2, I^2, and p-values. Random effects-model was applied to estimate the pooled effect. To minimize random variations among primary studies, sub-group analysis and meta-regression analysis were performed. For assessing publication bias, Egger and Begg tests were applied.

Results: Sixteen research articles were included for this systematic review and meta-analysis, with 6,670 sample size. The overall pooled prevalence of male involvement in PMTCT of HIV was 37.93% (95% CI: 29.41-46.45%) in Ethiopia. Having good knowledge on HIV (OR = 4.77; 95% CI: 3.30-6.82%) and urban dwellers (OR = 2.69; 95% CI: 2.11-3.44%) were associated factors with male involvement in PMTCT.

Conclusions: The level of male involvement in PMTCT of HIV in Ethiopia is low. Male involvement is influenced by knowledge on HIV and urban residence. The government of Ethiopia should give concern for rural male population to enhance their involvement in the prevention of mother-to-child HIV transmission.

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Key words: Ethiopia, male involvement, PMTCT, systematic review, meta-analysis.

Introduction

Over 90% of children under the age of five are getting human immunodeficiency virus (HIV)-infected through vertical transmission during pregnancy, delivery, and lactation. Without treatment, half of these children die before celebrating their second birthday. Prevention of mother-to-child

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transmission (PMTCT) reduce the risk of vertical transmission below 5% [1, 2].

Increasing male involvement in reproductive services has gained global recognition to improve health outcomes of men, women, and children [3]. PMTCT HIV programs largely focus on women; however, there is strong evidence that partners' involvement in women's reproductive health can have a significant impact on utilization of PMTCT services [2-4]. Increased focus on couples' counseling for HIV testing has improved communication and collective decision-making for treatment within households, conferring benefits not only for mother and her HIV-exposed child, but also for her partner [5, 6].

Across many cultures, men are key decision-makers in issues affecting their wives and children, particularly in sub-Saharan Africa where reproductive health decisions are greatly influenced by male partners [7]. Ethiopia has adopted the global target in PMTCT with the rate of transmission from mother-to-child reduced to zero by 2030 [8]. In Ethiopia, PMTCT of HIV services have been implemented since 2001. However, the program face challenges, such as low level of service utilization, low respect full care, and low level of male involvement [9, 10].

Male involvement is important in PMTCT adherence, acceptance of post-testing counseling, spousal communication about safe sexual practice, and uptake of male partner HIV testing [1, 10, 11]. Also, male involvement provides opportunity for condom utilization and child feeding options for the couple [12]. In Ethiopia, only 18% of males are tested for HIV from those counseled as couple during maternal health service visiting. This indicates that there is high lost opportunity to reduce HIV vertical transmission [12, 13].

Male involvement is insufficient in low- and middle-income countries [14-17]. Different studies have been conducted in Ethiopia showing various levels and determinant factors of male involvement in prevention of mother-to-child transmission [18-33]. The prevalence ranges from 21.21% [27] to 84.88% [33]. Although these studies have been done in Ethiopia, they were conducted in different institutions and communities with small sample sizes, and their results are inconsistent; thus, the national level of male involvement in PMTCT remain unknown. Because of that, the objective of the current systematic review and meta-analysis was to estimate the national level of male involvement in PMTCT, and the association of knowledge and residence in PMTCT, with the level of male involvement in PMTCT in Ethiopia. These findings will be important to develop effective interventional strategies to increase male involvement in PMTCT, and achieve different national and international reproductive healthcare strategies.

Material and methods

Search strategy

The search for this systematic review and meta-analysis search was done using Hinary, PubMed, Google Scholar, CINAHL, Cochrane Library, and Global Health databases, to find both published and unpublished research articles.

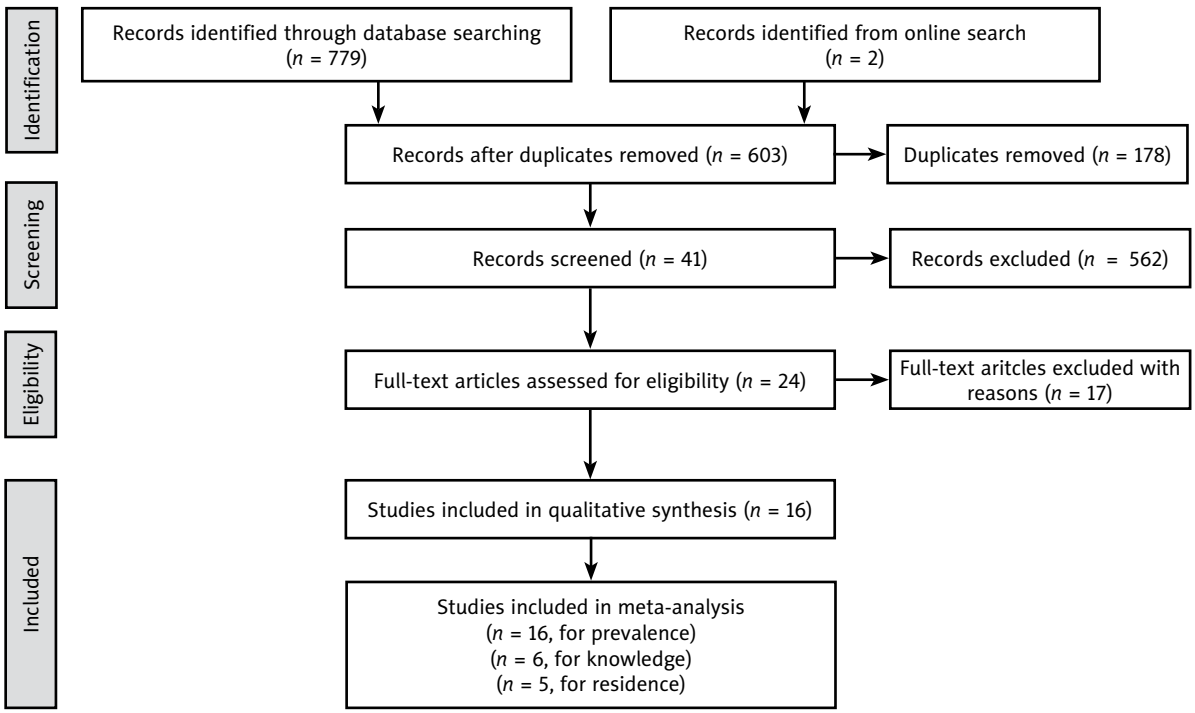

Figure 1. PRISMA flow chart describing selection of studies for the systematic review and meta-analysis of male involvement in prevention of mother-to-child transmission (PMTCT), and its association with knowledge and residence in Ethiopia, 2020

Grey literatures were identified through the input of content experts and review of reference lists. Additionally, digital libraries of University of Gonder and Addis Ababa University were explored to identify unpublished papers. Unpublished papers of different universities were addressed by consulting collages. Searching of research articles was carried out from March 10 to April 20, 2020 by three authors independently, and articles published until April 20, 2020 were included in this review. EndNote software was used to manage articles and remove duplications identified by search strategy that included the following key words: "Proportion", "Magnitude", "Prevalence", "Incidence", "Level", "Male Involvement", "Partner Involvement", "Partner Participation", "Husband Involvement", "Husband Participation", "Male Participation", "PMTCT", "Prevention of Mother to Child Transmission", "HIV", "HIV/AIDS", "Risk Factors", "Predictors", "Factors", "Determinants", "Associated Factors", "Pregnant Women", "Lactating Women", "Postpartum Women", "Breastfeeding Women" independently and in combination using Boolean operators "OR" or "AND". This systematic review and meta-analysis was performed using the preferred reporting items for systematic reviews and meta-analysis (PRISMA) checklist [34] (Figure 1).

Inclusion and exclusion criteria

Inclusion criteria:

- Participants: This systematic review included studies conducted on males involved in PMTCT.
- Setting: Studies conducted at either facility or community level.
- Outcome: Studies conducted on males involved in PMTCT as primary outcome.
- Publication: Either published in peer-reviewed journals or unpublished studies.
- Time frame: All studies irrespective of data collection and publication year until end of April 20, 2020.
- Language: Studies published in English language only were included in this review.

Exclusion criteria:

- Studies, in which the outcome was not clearly reported.
- Studies with repetitive publication.
- Failing in accessing full-text article after two e-mail requests from corresponding authors.
- Pure qualitative studies were excluded.

Study setting

Ethiopia is located in the Horn of Africa between 30 and 150 North latitudes and 330 and 480 East longitudes. It is surrounded by six countries, including Djibouti, Kenya, Eritrea, Sudan, Somalia, and South Sudan, and covers 1.1 million square kilometers. The country has two administrative cities (Dire Dawa and Addis Ababa) and nine regions (Afar, Tigray, Benishangul-Gumuz, Amhara, Harari, Gambella, Oromia, Somali, and Southern Nations, Nationalities, and Peoples' Region of Ethiopia). According to the 2007 Ethiopian Population and Housing Census Projection, the country has a total of 110,582,083 population, of which 55,047,955 are women.

Outcomes measurement

This review measured two main outcomes. The first outcome was pooled prevalence of male involvement in prevention of mother-to-child transmission of HIV, which was computed by dividing a number of males involved in PMTCT of HIV to a total sample size (the actual number of respondents) multiplied by 100. The second outcome was the association of male knowledge on PMTCT and place of residence, with male involvement in PMTCT in the form of log odds ratio.

Data abstraction

Three authors (MA, BK, and BA) independently extracted all necessary data from the relevant studies using a standardized data extraction form, and data were documented in Microsoft Excel spreadsheet. Two authors (YD and MY) solved any disagreement raised at the time of data extraction. Also, corresponding author was contacted for clarification and additional information. For pooled prevalence, the first author, region, study area, study year, publication year, study design, study setting, sample size, response rate, and number of males involved in prevention of mother-to-child transmission of HIV were extracted. For associated factors, frequencies in the form of a two-by-two tables were obtained, and log odds ratio for each factor was calculated accordingly. For factors, i.e., knowledge and residence, two-by-two table was applied: knowledgeable_involved, knowledgeable_non-involved, not knowledgeable_involved, not knowledgeable_non-involved, and for residence, Urban_involved, Urban_non-involved, and Rural_involved, Rural_ non-involved.

Quality assessment

MY and YD independently assessed the quality of each article using Newcastle-Ottawa scale for observational studies (cross-sectional, case control, and cohort studies) quality assessment tool [35, 36]. This quality assessment tool has three sub-divisions. The first segment deals with methodological quality, the second mainly focuses on comparability of a study, and the third section concentrates on statistical analysis and outcomes of each research article. Finally, studies scoring ≥ 6 out of 10 were considered high quality research articles. Mean score was taken to solve any disagreement between the three authors.

Data analysis

Relevant data were documented in Microsoft Excel spreadsheet form and exported into STATA/SE statistical

software version 14.0 for analysis. Standard error for each original study was calculated using a binomial distribution formula. Heterogeneity among the reported prevalence was assessed by computing values from χ^2, I^2, and p-values. As the test statistic showed, there was a significant heterogeneity among studies (I^2 = 98.4%, $p < 0.001$); as a result, random effects-model was applied to estimate DerSimonian and Laird's pooled effect. To minimize random variations between point estimates of primary study, sub-group analysis was done by using region, study setting, sample size, and study year. In addition, to identify possible source of heterogeneity, meta regression was undertaken by region, study setting, sample size, and study year, but none was statistically significant. Furthermore, Egger and Begg tests at 5% significant level were employed for assessing publication bias. Point prevalence and 95% confidence interval (CI) were presented in forest plot. In this plot, the size of each box indicated the weight of the study, while each crossed line referred to a 95% CI. For the second outcome, logs odds ratio was used to determine the association between knowledge on PMTCT and residence with male involvement in PMTCT.

Results

Search result and study characteristics

A total of 781 published and unpublished studies were identified through electronic databases (Google Scholar, PubMed, CINAHL, Cochrane Library, Hinary, and Global Health) as well as digital libraries of Addis Ababa University and University of Gonder. Of these, 178 articles were excluded due to duplication, and 562 were excluded after reviewing titles for relevance. The remaining 41 articles were screened, and 17 of them were excluded after reviewing their abstracts. Finally, 24 articles were assessed based on the inclusion criteria, of which 8 articles were excluded due to not fulfilling the eligibility criteria and absence of full texts. Finally, 16 eligible articles were included for analysis (Figure 1).

Sixteen research articles were included in the final analysis; they were published between 2013 and 2020 and conducted from 2011 to 2019. All the studies were involved in determining the pooled prevalence of male involvement in PMTCT, with overall sample size of 6,670 participants. Both the lowest level (21.21%) and highest level of male involvement (84.88%) were from Amhara Region. All the studies were cross-sectional in nature, with sample size ranging from 121 and 700. The meta-analysis included 6 (37.7%) studies from Amhara Region, 3 (18.75%) studies from Tigray Region, 3 (18.75%) from SNNPR, 2 (12.5%) from Oromia Region, 1 (6.25%) study from Addis Ababa, and 1 (6.25%) from Afar Region (Table 1).

Meta-analysis

The overall pooled prevalence of male involvement in PMTCT from 16 included studies from Ethiopia was 37.93% (95% CI: 29.41-46.45%). Significant heterogeneity was observed between the studies (I^2 = 98.4%, $p < 0.001$). As a result, a random effects meta-analysis model was used to estimate the pooled prevalence of male involvement in PMTCT (Figure 2).

Table 1. Characteristics of studies included in meta-analysis, Ethiopia 2020

Authors	Publication year	Study year	Region	Sample size	Number of male participants	Response rate (%)	Prevalence (%)	Quality score
Yohannes Abuhay *et al.*	2014	2013	Addis Ababa	431	168	94.9	38.98	8
Alemayehu	2017	2014	Oromia	409	93	97.0	22.74	9
Haile and Brhan	2014	2011	Tigray	473	95	100.0	20.08	7
Dagnew *et al.*	2020	2019	Amhara	561	119	100.0	21.21	9
Haftay Gebremedhin *et al.*	2019	2017	Tigray	121	40	100.0	33.06	7
Degefa Tadele Belato *et al.*	2017	2015	SNNPR	401	123	95.0	30.67	8
Alemayehu *et al.*	2014	2013	Tigray	299	93	91.7	31.10	7
Amsalu *et al.*	2013	2013	Amhara	274	198	96.4	72.26	7
Lemma *et al.*	2017	2016	Afar	272	83	100.0	30.51	8
Ayalew *et al.*	2020	2018	SNNPR	409	129	97.4	31.54	9
Shumi *et al.*	2018	2016	Oromia	405	211	96.2	52.10	8
Abdella Amano *et al.*	2016	2014	Amhara	802	168	99.3	20.95	7
Adane *et al.*	2020	2018	Amhara	525	137	96.9	26.10	9
Tilahun and Mohamed	2015	2013	SNNPR	700	359	97.2	51.29	9
Alemu Zenebe *et al.*	2016	2014	Amhara	416	167	96.6	40.14	8
Tsegaye and Getachew	2017	2016	Amhara	172	146	100.0	84.88	6

SNNPR – South Nation Nationalities People's Region

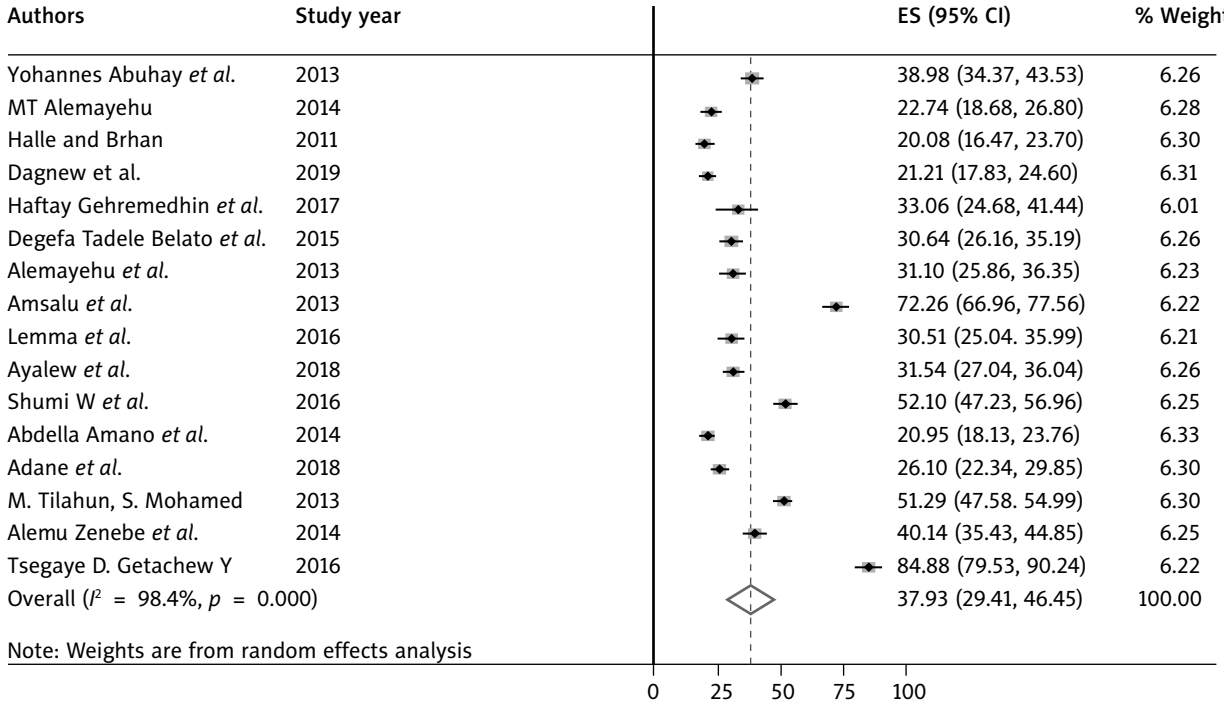

Figure 2. Forest plot of pooled prevalence of male involvement in prevention of mother-to-child transmission (PMTCT), Ethiopia 2020

Table 2. Sub-group analysis among studies included in meta-analysis, Ethiopia 2020

Variables	Number of studies	Sample size	Random effect (95% CI)	Heterogeneity test (I^2)
Region				
Addis Ababa	1	431	38.98 (34.38-43.58%)	–
Amhara	6	2,750	44.17 (24.87-63.47%)	99.3%
SNNPR	3	1,510	37.88 (23.91-51.86%)	97.0%
Tigray	3	893	27.63 (18.78-36.47%)	87.4%
Oromia	2	814	37.39 (8.61-66.16%)	98.8%
Afar	1	272	30.52 (25.04-35.99%)	–
Study year				
2011-2015	9	4,205	36.41 (25.99-46.84%)	98.3%
2016-2019	7	2,465	39.89 (24.20-55.59%)	98.7%
Sample size				
≤ 400	5	1,138	50.42 (26.70-74.13%)	98.8%
> 400	11	5,532	32.28 (25.29-39.28%)	97.1%
Study setting				
Community-based	8	4,099	39.12 (27.39-50.85%)	98.6%
Facility-based	8	2,571	36.73(23.10-50.37%)	98.4%
Overall	16	6,670	37.93 (29.41-46.45%)	98.4%

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To identify the possible source of heterogeneity, sub-group analysis (Table 2) and meta-regression (Table 3) were conducted using sample size, study year, region, and study setting, but neither of them showed the presence of heterogeneity. The pooled prevalence of male involvement in PMTCT was 44.17% (95% CI: 24.87-63.47%) in Amhara Region, and 27.63% (95% CI: 18.78-36.47%) in Tigray Region, with heterogeneity of I^2 = 98.6% and I^2 = 98.4%, respectively.

Table 3. Meta-regression analysis of factors affecting study heterogeneity

Variables	Coefficient (95% CI)	*p*-value
Addis Ababa	0.438276 (–5.357076-6.233628%)	0.866
Amhara	Reference	
SNNPR	0.4240502 (–3.071814-3.919914%)	0.787
Tigray	–0.4178747 (–5.066232-4.230483%)	0.841
Oromia	0.2369215 (–4.186062-4.659905%)	0.905
Afar	–0.7395748 (–8.472603-6.993453%)	0.831
Study year	0.0290753 (–2.885505-2.943655%)	0.982
Sample size	–0.9280584 (–4.962627-3.10651%)	0.610
Study setting		
Community-based	Reference	
Facility-based	0.0049751 (–3.404297-3.414248%)	0.997

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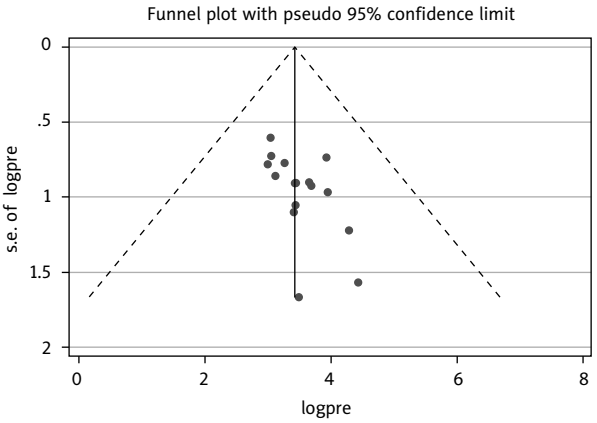

Figure 3. Funnel plot of pooled prevalence of male involvement in prevention of mother-to-child transmission, Ethiopia 2020

In community-based studies, the pooled prevalence was 39.12% (95% CI: 27.39-50.85%) while in facility-based studies, the pooled prevalence was 36.73% (95% CI: 23.1-50.37%), with heterogeneity of $I^2 = 99.3\%$ and $I^2 = 87.4\%$, respectively.

The issue of publication bias by visual inspection was assessed with funnel plot (Figure 3) and using Egger's regression test. Though the funnel plot looked asymmetrical, the Egger's test showed no relationship between the effect size and its precision ($p = 0.34$).

Factors associated with male involvement in PMTCT

The association between knowledge on PMTCT and male involvement was determined based on the results of the six studies. Male partners with good knowledge were five times

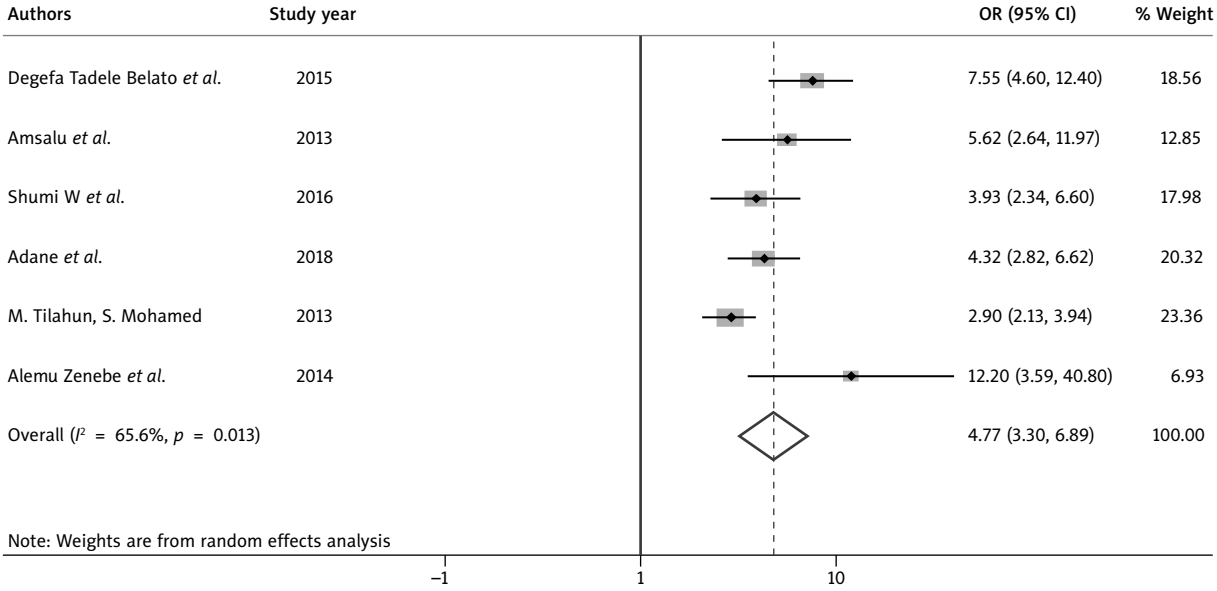

Figure 4. Forest plot showing a pooled odds ratio (log scale) of association between knowledge on prevention of mother-to-child transmission (PMTCT) and male involvement in PMTCT, Ethiopia 2020

more likely to participate in PMTCT compared with partners with poor knowledge (OR = 4.77; 95% CI: 3.30-6.82%). Random effect meta-analysis model was used to examine the association due to the presence of significant heterogeneity (I^2 = 65.6%, p < 0.013). Results of Egger's tests indicated the absence of publication bias (p = 0.071) (Figure 4).

Five research findings were used to assess the association between residence and male partner involvement in PMTCT. Urban dwellers male partners were three times more likely to participate in PMTCT as compared with male partners who lived in rural areas (OR = 2.69; 95% CI: 2.11-3.44%). Since the included articles did not show significant heterogeneity, fixed effect model to determine the relationship between residence and male partner involvement in PMTCT was applied (I^2 = 0%, p = 0.433) (Figure 5), and Egger's test revealed the absence of publication bias (p = 0.750).

Discussion

Ethiopian government aims to provide comprehensive maternal healthcare services for reproductive age group women, particularly for pregnant women. The government has launched universal HIV testing and counselling for pregnant women and their partners to reduce the number of mother-to-child transmissions of HIV [37, 38]. Different demographic, cultural, and economic factors influence male involvement during pregnancy, labor, and lactation. Therefore, the current meta-analysis and systematic review attempted to determine the pooled prevalence of male involvement and its association with knowledge on PMTCT and residence.

The overall pooled prevalence of male involvement in PMTCT in Ethiopia is 37.93% (95% CI: 29.41-46.45%). The result is low when compared with the national and WHO recommendations [8]. But it is high when compared with researches from Uganda (25%) [11] and Tanzania (24%) [39]. This finding is consistent with a study done in South Africa (44%) [40]. The difference may be due to cultural variance [10], type of measurement used, and time variation. Sub-group analysis indicated similar male involvement across different regions of Ethiopia, including Addis Ababa. However, individual studies indicated different magnitude in various parts of the country. This implies that efforts should be made to disseminate information about the importance of male involvement in PMTCT in all regions. Similar study setting, sample size, and study year indicate no difference in male involvement in PMTCT. This implies that with the government efforts in encouraging male involvement in PMTCT, male involvement did not increase significantly with time.

In this study, the association of knowledge on PMTCT and residence with male involvement was assessed. Both factors indicated an association with male involvement in PMTCT. Male partners with good knowledge on PMTCT were five times more likely to participate in PMTCT when compared with partners with poor knowledge. This finding is supported by previous researches performed in Tanzania, in which males did fully participated in PMTCT programs, and the reason was lack of information about the relationship between PMTCT and males [41, 42]. Men with good knowledge accompanied their wives in PMTCT [43, 44]. Male involvement further increased their awareness about PMTCT and reduced HIV-related stigma and discrimination [10, 45]. Low level of male involvement in PMTCT is one of the reason for refusing HIV testing among pregnant women by fearing of stigma and discrimination [46]. Additionally, good knowledge

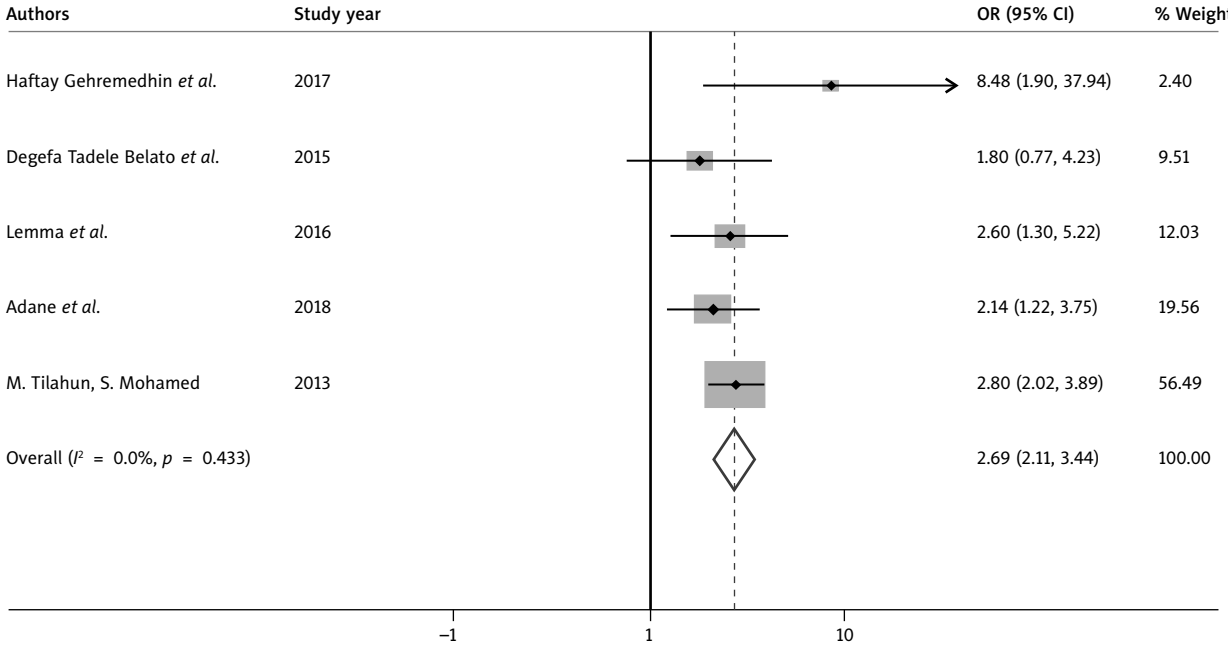

Figure 5. Forest plot showing a pooled odds ratio (log scale) of the association between residence and male involvement in prevention of mother-to-child transmission, Ethiopia 2020

improves communication between the couple, and poor communication reduce male involvement in PMTCT. Good communication improves HIV status disclosure and support between couples [45].

Male partners who were urban dwellers were three times more likely to participate in PMTCT as compared with male partners who lived in rural areas. This finding is supported by a previous research [47]. Urban residents might have better knowledge, social status, and less cultural influences [11, 39] to accompany their wives in PMTCT. Urban residence might reduce healthcare system barriers, which are among the bottle neck of male involvement in PMTCT [10, 44].

Ethiopian government has launched different strategies to reduce HIV pandemic in the country, including the three "90": 90% of the population should be tested for HIV and know their status, 90% of HIV-positive people initiate ART, and 90% of HIV-positive people on ART have good adherence to the drugs. The country also plan to reduce neonatal HIV infection level below 5%. Therefore, male involvement in PMTCT is essential to achieve the above goals.

The first limitation of this study was that only English articles and reports were included in the review. In addition, all the included studies were cross-sectional in nature, and the outcome variable might be affected by other confounding factors. The majority of the studies included in the review had a small sample size. Therefore, this factor could affect the estimated report. Further research is needed evaluating the correlation of male involvement in PMTCT and the reduction of risk of neonatal HIV infection.

Conclusions

Overall, the level of male involvement in PMTCT is low, and it is almost similar in different regions of the country. Having knowledge on PMTCT and urban residence are the factors positively associated with male involvement in PMTCT. The government of Ethiopia in collaboration with NGOs should develop strategies to increase male involvement in PMTCT by increasing males' knowledge, and educating on PMTCT in rural areas.

Disclosures

1. Institutional review board statement: Not applicable.
2. Assistance with the article: None.
3. Financial support and sponsorship: None.
4. Conflicts of interest: None.

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