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Innovative approach to improve maternal health service in Ethiopia, Women's development army: A systematic review of evidences

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Abstract

Purpose: the aim of this review was to assess the contribution of women's development army (female voluntary community workers) on maternal and child health development.

Outcome: maternal and child health services; maternal and child mortality

Design: A systematic review was conducted incorporating both quantitative and qualitative evidences from peer reviewed journals. The search was conducted in three databases.

Setting: English articles conducted 2010 onwards in Ethiopia were considered.

Participants: Out of 299 extracted papers only nine were included in data synthesis. Data were extracted from papers included in the review using pre planned data extraction tool separately for each study design. Findings from the included studies were synthesized using tables and narrative summary.

Results: Nine studies met the inclusion criteria and were included in the review. The results revealed that, poor participation and non-membership in women's development army were predictors of maternal death and default from child immunization. On the other hand, distance of women's development group within two kilometers from health facility is a determinant factor for skilled delivery and antenatal care service use. These groups were the main sources of information for mothers for birth preparedness and complication readiness. Moreover, well established groups have strengthened the linkage of the health facility to the community so that, delays in maternal health service use were minimized; health extension workers could effectively refer women to health facility for birth; and skilled birth attendance was improved.

Conclusion: Membership and well-functioning of women's development army has a positive impact on child immunization service use, minimizing delays on maternal health services use and minimizing maternal mortality, and improving birth preparedness, complication readiness and antenatal care and skilled delivery. It is also effective and efficient mechanism to share information to the community and create linkage between the communities with the primary health care system.

Keywords: Women's development army, Maternal and child health, Ethiopia

Article summary

Strengths and limitations of this study

- The review has used two independent reviewers
- The review has used structured procedure during literature search, appraisal, data collection and synthesis
- Despite the strengths described above, we haven't conducted meta-analysis due to heterogeneous types of study designs and population included in this review
- We have included only full text articles found free online

Introduction

Evidence from various countries in the world disclosed that community volunteers' health service intervention has shown significant health impact.[1,2] They accomplish various functions related to health service delivery. In fact, usually they do not have formal professional or paraprofessional education and can be involved in voluntary care. They intervene in health care after attending job related trainings. These community health volunteers have different naming in different settings for example, lay health workers, community health workers, and unpaid community volunteers.[3,4]

Community health volunteers have a great importance especially in less developed countries so as to overcome the increasing demand for health care services and the shortage of formal health care providers.[5] After Alma Ata declaration of Primary Health Care (PHC), community involvement in the health care was given due attention in order to improve wide access and acceptance of the services by service users and the community at large. It is believed that, problems cannot be solved from only the side of service providers and programmers. Moreover, it is a good strategy to mobilize resources relevant to health services.[6–8]

These health interventions using community volunteers has a sort of structure in some countries and unstructured in others.[1,5] Some nations linked the service under their PHC structure. Ethiopia is a good example of well-structured community health interventions. The primary health care unit (PHCU) is in the front line to PHC in the country. This system encompasses five satellite health posts (the lowest village-level health service facility) and a referral health center (HC). In the countries health care system PHC is administered and the services facilitated in this point.[9] So as to address the deficit in human resources for health, Ethiopia launched the community health extension program (HEP) in 2004. It was implemented by establishing a health post and positioning two female health extension workers (HEWs) in every *kebele* (the smallest administrative division in Ethiopia). The HEP was launched to improve access to preventive essential health services and to create a healthy environment. This program works to increase and sustain preventive health actions and health awareness. HEP has sixteen packages divided in to four major categories.[9–11]

Six years after its introduction in 2010 a new innovative approach, Women's Development Army (WDA) strategy was linked with HEP. This army has various development roles, from which health is the major one.[9] At the community level, members of the community linked with the PHC system through this strategy.[12] It was adopted based on the experience that using a network of the community health volunteers increased the efficiency of the HEWs in reaching households with actionable health messages. Women's development teams (WDTs) involving up to 30 households within the same neighborhood have to be developed for functional WDA. The WDT made its base on "one-to-five" connections, smaller groups of six members (households).[10,13,14]

This system has its own structural arrangement. The group's developmental works monitored in a meeting every two weeks by a command post formulated at the *kebele* level which is led by the *kebele* leader. Similar follow-up undertaken by the development group leaders to the one-to-five networks.[9] WDTs and the one-to-five networks leaders elected with full participation of the members. Their trust worthiness to the team members and being model family are being considered as criteria for selection. Model families recognized when they fully implement the all HEP packages or perform with distinction among the group members.[15]

Health extension workers in collaboration with *kebele* administration and personnel from other developmental sectors facilitate formation of the WDTs and the one-to-five networks. These unpaid health volunteers, WDT leaders, undertake various preventive and promotive health services in collaboration with HEWs. They carry out a number of tasks, including, support during health information delivery programs, keeping track of pregnancies and illnesses, helping during immunization campaigns, and transmitting messages between households and HEWs.[9,10]

The Ethiopian unpaid community health intervention has its unique structural arrangement. It is included in various development sectors' strategic plan.[13] Some evidences claim that the program has variations in aims, goals, and experiences among various players included and suggests further researchers.[16]

This review aimed to assess the contribution of this structured community involvement in health service delivery. This was the reason for the existence of the structural arrangement. Finally it will come up with strong evidence to say the WDA structure has an impact in the development

of the country's health. Moreover it will suggest a way to continue and/or extend the intervention for the future.

Methods

Search Strategy

The search strategy targeted to find both published and unpublished studies. A step by step search strategy was utilized in this review. Primarily, major databases that comprise health system researches including MEDLINE, CINAHL, EBSCOhost, World Health Organization library database were utilized. Unpublished works were also searched from ProQuest Dissertations and Theses and Google Scholar. Afterwards, the reference list of all identified reports and articles were searched for additional studies. Studies conducted in Ethiopia, 2010 onwards and published in English language were considered for inclusion in this review. By the year 2010 WDA was introduced in Ethiopia. Key words initially used were: community health workers, community volunteer, women's development army, women's development group, women's development team, health development team, lay health workers, health development army, Ethiopia, maternal health, child health and maternal health services. Extracted references were downloaded and stored in Mendeley reference manager file. MEDLINE (on PubMed platform) search strategy is included in supplementary file I.

To guide the overall review, PRISMA flow diagram was used.[17] (Figure 1) Starting from identification of records up to inclusion of the relevant literatures for the review question were documented to comprehensive and accurate reporting.

Inclusion and exclusion criteria

Both quantitative and qualitative studies were included in this review. Women in reproductive age group (14-49 years) and children less than five years from both sexes were considered in the review. The quantitative component of the review has considered studies that evaluated the effect of women's development army, and participation in the group, on maternal mortality, maternal and child health service use, health literacy and referral linkage. Similarly the qualitative component of this review has considered studies that investigated contribution of WDA to maternal and child health development.

The women's development army approach was launched in Ethiopia since 2010 to support the HEP that was introduced six years back in 2004.[14] The main concern for its existence is better implementation of health extension packages.[11] This review considered studies that included outcomes like maternal health, maternal mortality, ANC, delivery, family planning, birth preparedness and complication readiness.

The quantitative component of the review considered cross-sectional and case control studies for inclusion. On the other hand the qualitative component of the review considered studies that focus on qualitative data, but not limited to study designs.

Description of studies

Eleven potentially relevant studies were found in addition to the three hundred fifty two studies identified in database searches. A total of 299 articles were eligible for primary examination after duplications were removed. On reviewing titles and abstracts against the review objectives and inclusion criteria, 276 studies were excluded. The full text of the remaining 23 studies was retrieved for detailed examination and 9 were excluded. Afterwards, 14 studies were assessed for methodological quality. After the appraisal five studies that didn't met the minimum requirements of methodological appraisal tools were excluded and nine were used for the review.

Patient and Public Involvement

Patients and/or public were not involved in this review.

Data collection

Two independent reviewers collected information relevant for the review. Before data collection all titles and abstracts of the searched literatures were assessed for potential relevance; and those records deemed not relevant were verified. Later on, full-text reports were assessed for eligibility. All possible ways were used to obtain full text articles for those that were not available online. Some full articles were obtained from research-gate authors pages. Reports that are co-publications or multiple reports of the same study were identified. The eligibility criteria were applied to all reports. Only evidence thoughtful of the review's eligibility criteria were included.

All papers selected for inclusion in the review were subjected to appraisal prior to inclusion in the review using critical appraisal instruments from the Joanna Briggs Institute (JBI). The critical

appraisal tool is different for each study design used (Supplementary file II). Case control and qualitative studies' appraisal checklist have ten methodological assessment items but the cross-sectional checklist has eight. Those studies fulfilled more than 70% of the requirements were selected to be included in the review.

Data extraction was for quantitative and qualitative studies separately using pre designed checklists (Supplementary file III). The extracted data has included specific details about the interventions, populations, study methods and outcomes of significance to the review question and objectives (Supplementary file IV).

Data synthesis and analysis

Findings from the included studies were synthesized using tables and a narrative summary. Meta-analysis was not possible since the included studies were heterogeneous in terms of the populations, methods and outcomes. The results categorized in to three major sub sections, participation in WDGs, and distance of WDGs from health facility and effective functioning of WDGs.

Results: Findings of the Review

We have included a total of nine studies regardless of their study design. These studies met the critical appraisal requirements more than 70% (Supplementary file V). The review comprised both observational and qualitative studies. The studies were conducted on various maternal and child health issues including child immunization, maternal mortality, birth preparedness and complication readiness (BPCR), skilled delivery, ANC, linking pregnant women with health facilities for delivery, delays on maternal health services and community relationships with health extension workers and health sector (Table 1).

Table 1: Characteristics of included studies for review

Category	Sub-category	Frequency	Percentage (%)
Study design	Cross-sectional	3	33.33
	Case-control	2	22.22
	Qualitative	4	44.44
Year of publication	2015	2	22.22
	2016	3	33.33
	2017	3	33.33
	2018	1	11.11
Addressed maternal & child health issue	Child immunization	1	11.11
	Skilled maternal health service	1	11.11
	Maternal mortality	1	11.11
	BPCR	2	22.22
	Relationship of community with health sector	2	22.22
	Maternal health services use	2	22.22

Narrative synthesis

Participation in WDGs

In a study by Aregawi et al[18] 270 study subjects were included. From them 90 were defaulters from completion of child immunization (cases) and 180 were non defaulters (controls). 14(15.6%) of cases and 89(49.4%) of controls had satisfactory participation in WDGs. Result of statistical analysis showed that poor participation in women's developmental groups [AOR = 3.3,95%CI 1.54±7.08] is a determinant for defaulting immunization among children aged between 9 and 23 months.

A study by Godefay et al.[19] has included 310 study participants. Among them 62 were dead mothers (cases) and 248 alive mothers (controls). From 62 died mothers 40 (64.5%) were members of WDTs and among 248 alive mothers 197 (79.4%) were members of WDTs. The statistical taste revealed that women who were not members of the voluntary women's development army were more likely to experience maternal death [OR 2.07, 95%CI 1.04–4.11] (Table 2).

Table 2: Summary of evidences on the effect of participation in women's development group on maternal and child health service

Author, year	Target population	Study design	Outcome	Result
Aregawi HG, Gebrehiwot TG et al, 2017[18]	Children aged between 9 and 23 months	Case control	Default from immunization among children aged between 9 and 23 months	Poor participation in WDGs (AOR = 3.3,95%CI 1.54±7.08) is a determinant for defaulting
Godefay H, Byass P et al, 2015[19]	Mothers in reproductive age group	Case control	Maternal mortality	Women who were not members of WDG were more likely to experience maternal death (OR 2.07, 95%CI 1.04–4.11)

Distance of WDGs from health facility

In a study by Negero MG. et al[20] 748 reproductive-age women who gave birth in 1 year preceding the study in 380 clusters of WDA were included. 336 (45%) of women have received skilled delivery care and the remaining 412 haven't received. A significant heterogeneity was observed between "Women's Development Teams (clusters)" for skilled delivery care service utilization which explains about 62% of the total variation. The distance of WDTs within 2 km radius from the nearest health facility was significantly associated [AOR (95% CI) 6.03 (1.92, 18.93)] with skilled delivery service utilization. The performance level of WDTs has no significant effect on skilled delivery care service utilization. Best performing [AOR (95% CI) 2.14 (0.38, 12.27)] and good performing [AOR (95% CI) 4.38 (0.75, 25.56)].

Another cross-sectional study was conducted by Girmaye M. and Berhan Y.[21] which assessed 748 reproductive-age women who gave birth in 1 year preceding the study. 531 (71%) of the participants received skilled ANC service at least once. Similar to the above study, significant heterogeneity was observed between WDTs for skilled ANC utilization. Distance of WDA within 2 km radius from the nearest health facility was significant predictor of skilled ANC service utilization [AOR=8.28; 95%CI, 1.08-62.20] (Table 3).

Table 3: Summary of evidences on the effect of women's development groups' distance from health facility on maternal health service

Author, year	Target population	Study design	Outcome	Result
Negero MG, Mitike YB, et al, 2018[20]	Reproductive-age women who gave birth in 1 year preceding the study	Cross-sectional	Skilled delivery service utilization	The distance of WDTs within 2 km radius from the nearest health facility was significantly associated with skilled delivery service use [AOR (95% CI) 6.03 (1.92, 18.93)]
Girmaye M. and Berhan Y., 2016[21]	Reproductive-age women who gave birth in 1 year preceding the study	Cross-sectional	Skilled antenatal care utilization	Distance of WDT within 2 km radius from the nearest health facility was significant predictor of skilled ANC service utilization [AOR=8.28; 95%CI, 1.08-62.20]

Effective functioning of WDGs

A study by Zepre K. and Kaba M. [22] has assessed 454 women. 168 respondents were found to have prepared for birth and its complications and 286 were not. 30 (68.2%) of members and 134 (34.7%) of non-members of one-to-five connection were prepared for birth and its complication. The statistical assessment showed that those who got information from their one-to-five

connection are more likely to prepare for birth and its complications [OR 2.52, 95% CI 1.17, 5.39].

A study by Jackson R. and Hailemariam A.[23] has assessed the role of HEWs in linking pregnant women with health facilities for delivery. The target of the study were pregnant women. The result revealed that HEWs can effectively refer more women to give birth in health facilities when the WDA is well established.

A study by Jackson R., Tesfay FH. et al[24] was aimed to document factors that hinder or enable strategies to reduce the first and second delays of the three delays in rural and pastoralist areas in Ethiopia. The study concluded that initiatives to reduce delays can improve access to maternal health services, especially when Health Extension Workers are supported by the Health Development Army.

Another study conducted by Jackson R., Tesfay FH. et al[25] aimed at studying health extension workers' and mothers' attitudes to maternal health service utilization and acceptance. And the result uncovered that, with the support of WDGs, HEWs have increased the rate of skilled birth attendance by calling ambulances to transfer women to health centers either before their expected date of delivery (EDD) or when labor starts at home. These findings add to the growing body of evidence that health workers at the community level can work with women's groups to improve maternal health, thus reducing the need for emergency obstetric care in low-income countries.

A study by Kok MC. et al.[26] has addressed health extension workers' relationships with the community and health sector in Ethiopia: opportunities for enhancing maternal health performance. This assessment found that the health development army supported HEWs in liaising with community members (Table 4).

Table 4: Summary of evidence in the effect of women's development army's effective functioning on maternal health services

Author, year	Target population	Study design	Outcome	Result
Zepre K and Kaba M, 2017[22]	Pregnant women	Cross-sectional	Birth preparedness and complication readiness	Those who got information from their one-to-five connections

				are more likely to prepare for birth and its complications (OR 2.52, 95%CI 1.17, 5.39)
Jackson R. and Hailemariam A., 2016[23]	Pregnant women	Qualitative	Linking pregnant women with health facilities for delivery	HEWs can effectively refer more women to give birth in health facilities when the WDA is well established.
Jackson R., Tesfay FH. et al, 2017[24]	Pregnant women	Qualitative	Delays in maternal health service use	Initiatives to reduce delays can improve access to maternal health services, especially when HEWs are supported by the WDA.
Jackson R., Tesfay FH. et al, 2016[25]	Mothers and HEWs	Qualitative	Maternal health service utilization and acceptance	With the support of WDGs, HEWs have increased the rate of skilled birth attendance
Kok MC., Kea AZ; et al., 2015[26]	Mothers and HEWs	Qualitative	Relationship of community with HEWs and Health sector	The WAD supported HEWs in liaising with community members

Discussion

The main objective of this systematic review was to assess the Ethiopian innovative women's voluntary health intervention's (women's development army's) contribution to maternal and child health development. The major activity of this structure is supporting the primary health care intervention under the health extension program.[27,28] Most probably this is the first systematic review that synthesized information on women's development army and its contribution. Nine studies were assessed and all of them revealed women's development army has contributed enormously for the improved maternal and child health, and health service use. The evidences have shown that the benefit of WDAs was obtained through participation in the group,[18,19] closeness of the groups to health facilities[20,21] and their effective functioning.[22–26]

Women in a village level is expected to being a part and actively participate in to one-to-five connection under the WDGs. By doing so they can easily obtain information, care and support from the primary health care structure[15,16] Involving community members in health services brings about an improvement of health service use and health status of the community.[10,29,30] Poor participation of the mothers in WDGs was found protective for defaulting from immunization of their children. Those who were not members of WDGs are more than three times more likely to default from the service as compared to those included.[18]Community involvement in vaccination programs for children was found effective in many low and middle income countries.[31,32] Their involvement lets the community participate in decision making and improves their knowledge.[33]

Participation in WDGs in Ethiopia minimized maternal deaths. Women who are not members of WDGs are two times at risk of experiencing maternal death in the study area.[19] Participating community members has positive effect on mothers' survival. [34] More over the Ethiopian WDG involvement resulted in improved birth preparedness and complication readiness.[22] This implied that being a member of WDGs had enabled mothers to have knowledge on maternal health services and changed their attitude towards the use of the services so that they visited health institutions for maternal health services.

The other major issues regarding WDA's contribution to maternal health and health service use is distance from health facilities in reference to their meeting area. When the distance became beyond two kilometers from the nearest health center or hospital members were less likely to use

ANC and delivery service as compared to their counterparts.[20,21] Even if many national and international policy documents have given due concern for physical access to improve maternal health service use[13,35,36] still the problem prevails in many low and middle income countries.[37–40] This concern is also experienced by WDGs in Ethiopia.

Although there are some information that revealed performance of WDGs doesn't have anything in improving maternal health service use,[20,21] there are an ample of evidence that showed effective functioning and well performing of these groups resulted in improved maternal health and health service use.[22–26] In the previous studies performance of the groups was measured with traditional way of performance measurement at the village level. The performance measurement ways, measurement indicators and evaluators may not be effective in measuring actual performance of the groups. Well performing WDGs facilitated the linkage between service mothers and the primary health care system as a result service utilization and acceptance were improved. [23–25] On top of this strongly established WDGs and their strong linkage with the primary health care system ease the health service practitioners especially HEWs effort to refer significant amount of women to give birth in health facilities.[23] Moreover these voluntary system is serving as an initiatives to reduce delays in maternal health services use.[24]

Health Extension Workers (HEWs) are paid health workers at the community level. They are required to deliver health information and other health service packages to the community.[41,42] These health workers are using the WDA structure as a perfect strategy to share information and create linkage with the community members at the household and individual level.[26] By doing so they can deliver the services effectively.

Limitations of the Review

A potential limitation of the present review might be that we haven't conducted meta-analysis due to heterogeneous types of study designs and population included in this review. The other thing is that we have included only full text articles found free online.

Conclusions

The results from the review have indicated that even if the reason for existence of WDA system is to support HEWs for all the health extension packages, their intervention is limited only on maternal and child health service. Nevertheless, its contribution to maternal and child health

service utilizations and mothers improved health is countless. Being member of a WDG and one-to-five connection under the group, has a positive effect on child immunization service use, minimizing maternal mortality, birth preparedness and complication readiness, skilled delivery, skilled ANC and minimizing delays to use maternal health service. Moreover, it was found an effective and efficient mechanism to share information to the community and create linkage between the communities with the primary health care system.

Implication for practice

The government is required to continue the existing achievements regarding WDA's contribution for maternal and child health services utilization. Again the responsible bodies in each structure in the Ethiopian health care system have to extend their intervention to health issues other than maternal and child health.

The responsible bodies in the Ethiopian Federal Ministry of Health have to prepare clear, objective and standardized performance measurement indicators for WDGs.

Since the distance of existing WDGs from health facilities is important determinant for maternal health service utilization, the government is supposed to establish new health facilities as near as possible to the population and organize the community living around health facilities into WDGs.

Implications for research

Although there are some studies regarding WDA, still there is paucity of literatures regarding the issue. Therefore researchers are responsible to conduct various enquiries on the issue.

Moreover, researchers are supposed to examine WDA's contribution to other health issues in addition to maternal and child health service use.

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version of this paper and finalized the final version. KY, GA and MS have written and revised the manuscript.

A patient consent form: not required

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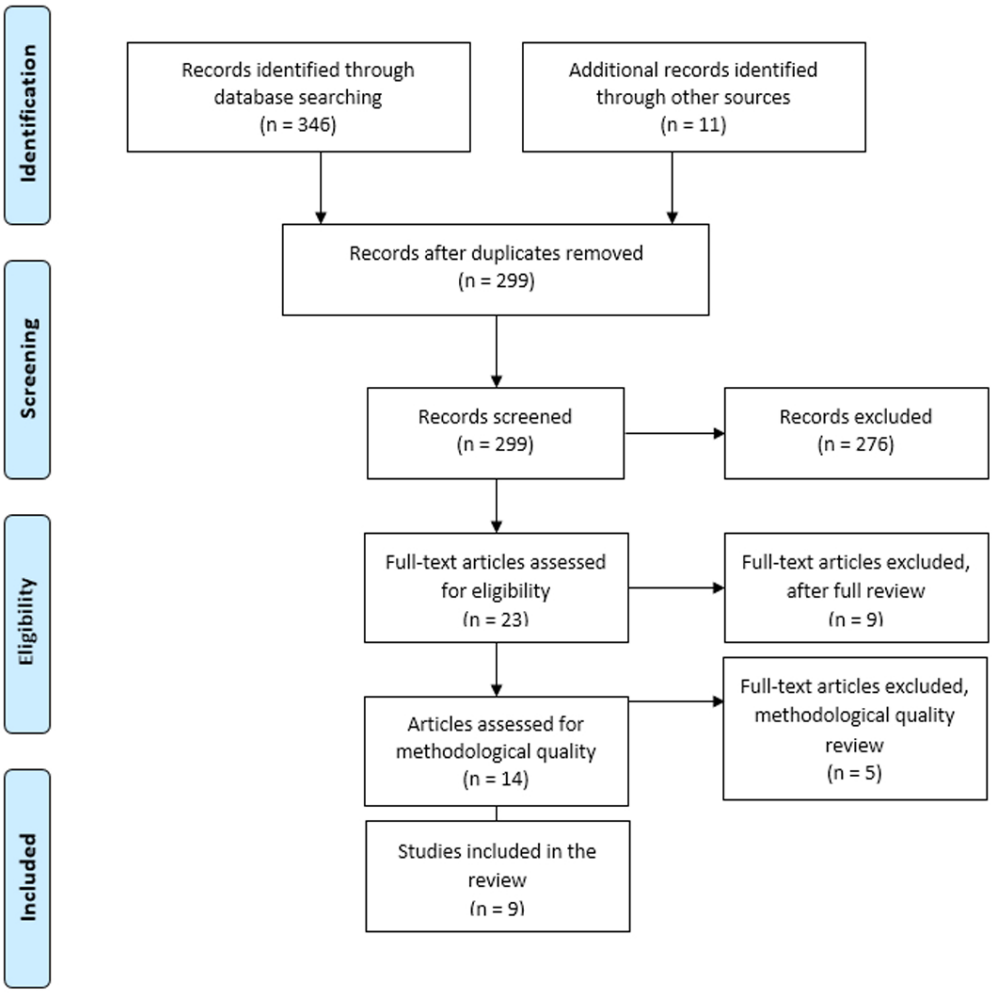
Figure legend:

Figure 1: Literature search and screening



Literature search and screening

90x90mm (300 x 300 DPI)

Supplementary file I: Search strategy

Search	Query
#1	Search (((((((community health workers) OR community volunteer) OR women's development army) OR women's development team) OR health development team) OR lay health workers) OR health development army
#2	Search ((((maternal health) OR maternal health service) OR child health) OR child health service) OR health
#3	Search Ethiopia
#4	#1 AND #2 AND #3
#5	Limit to: Full text
#6	Limit to: Publication date from 2010/01/01 to 2018/12/31
#7	Limit to: English language

The Joanna Briggs Institute Critical Appraisal tools
for use in JBI Systematic Reviews

Checklist for Analytical Cross Sectional Studies

http://joannabriggs.org/research/critical-appraisal-tools.html

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JBI Critical Appraisal Checklist for Analytical Cross Sectional Studies

Reviewer_____Date_____

Author _____Year_____Record Number_____

	Yes	No	Unclear	Not applicable
1. Were the criteria for inclusion in the sample clearly defined?	☐	☐	☐	☐
2. Were the study subjects and the setting described in detail?	☐	☐	☐	☐
3. Was the exposure measured in a valid and reliable way?	☐	☐	☐	☐
4. Were objective, standard criteria used for measurement of the condition?	☐	☐	☐	☐
5. Were confounding factors identified?	☐	☐	☐	☐
6. Were strategies to deal with confounding factors stated?	☐	☐	☐	☐
7. Were the outcomes measured in a valid and reliable way?	☐	☐	☐	☐
8. Was appropriate statistical analysis used?	☐	☐	☐	☐

Overall appraisal: Include ☐ Exclude ☐ Seek further info ☐

Comments (Including reason for exclusion)

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Explanation of analytical cross sectional studies critical appraisal

How to cite: Moola S, Munn Z, Tufanaru C, Aromataris E, Sears K, Sfetcu R, Currie M, Qureshi R, Mattis P, Lisy K, Mu P-F. Chapter 7: Systematic reviews of etiology and risk . In: Aromataris E, Munn Z (Editors). *Joanna Briggs Institute Reviewer's Manual.* The Joanna Briggs Institute, 2017. Available from https://reviewersmanual.joannabriggs.org/

Analytical cross sectional studies Critical Appraisal Tool

Answers: Yes, No, Unclear or Not/Applicable

1. Were the criteria for inclusion in the sample clearly defined?

The authors should provide clear inclusion and exclusion criteria that they developed prior to recruitment of the study participants. The inclusion/exclusion criteria should be specified (e.g., risk, stage of disease progression) with sufficient detail and all the necessary information critical to the study.

2. Were the study subjects and the setting described in detail?

The study sample should be described in sufficient detail so that other researchers can determine if it is comparable to the population of interest to them. The authors should provide a clear description of the population from which the study participants were selected or recruited, including demographics, location, and time period.

3. Was the exposure measured in a valid and reliable way?

The study should clearly describe the method of measurement of exposure. Assessing validity requires that a 'gold standard' is available to which the measure can be compared. The validity of exposure measurement usually relates to whether a current measure is appropriate or whether a measure of past exposure is needed.
Reliability refers to the processes included in an epidemiological study to check repeatability of measurements of the exposures. These usually include intra-observer reliability and inter-observer reliability.

4. Were objective, standard criteria used for measurement of the condition?

It is useful to determine if patients were included in the study based on either a specified diagnosis or definition. This is more likely to decrease the risk of bias. Characteristics are another useful approach to matching groups, and studies that did not use specified diagnostic methods or definitions should provide evidence on matching by key characteristics.

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5. Were confounding factors identified?

Confounding has occurred where the estimated intervention exposure effect is biased by the presence of some difference between the comparison groups (apart from the exposure investigated/of interest). Typical confounders include baseline characteristics, prognostic factors, or concomitant exposures (e.g. smoking). A confounder is a difference between the comparison groups and it influences the direction of the study results. A high quality study at the level of cohort design will identify the potential confounders and measure them (where possible). This is difficult for studies where behavioral, attitudinal or lifestyle factors may impact on the results.

6. Were strategies to deal with confounding factors stated?

Strategies to deal with effects of confounding factors may be dealt within the study design or in data analysis. By matching or stratifying sampling of participants, effects of confounding factors can be adjusted for. When dealing with adjustment in data analysis, assess the statistics used in the study. Most will be some form of multivariate regression analysis to account for the confounding factors measured.

7. Were the outcomes measured in a valid and reliable way?

Read the methods section of the paper. If for e.g. lung cancer is assessed based on existing definitions or diagnostic criteria, then the answer to this question is likely to be yes. If lung cancer is assessed using observer reported, or self-reported scales, the risk of over- or under-reporting is increased, and objectivity is compromised. Importantly, determine if the measurement tools used were validated instruments as this has a significant impact on outcome assessment validity.

Having established the objectivity of the outcome measurement (e.g. lung cancer) instrument, it's important to establish how the measurement was conducted. Were those involved in collecting data trained or educated in the use of the instrument/s? (e.g. radiographers). If there was more than one data collector, were they similar in terms of level of education, clinical or research experience, or level of responsibility in the piece of research being appraised?

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8. Was appropriate statistical analysis used?

As with any consideration of statistical analysis, consideration should be given to whether there was a more appropriate alternate statistical method that could have been used. The methods section should be detailed enough for reviewers to identify which analytical techniques were used (in particular, regression or stratification) and how specific confounders were measured.

For studies utilizing regression analysis, it is useful to identify if the study identified which variables were included and how they related to the outcome. If stratification was the analytical approach used, were the strata of analysis defined by the specified variables? Additionally, it is also important to assess the appropriateness of the analytical strategy in terms of the assumptions associated with the approach as differing methods of analysis are based on differing assumptions about the data and how it will respond.

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Checklist for Case Control Studies

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JBI Critical Appraisal Checklist for Case Control Studies

Reviewer_____Date_____

Author _____Year_____Record Number_____

	Yes	No	Unclear	Not applicable
1. Were the groups comparable other than the presence of disease in cases or the absence of disease in controls?	☐	☐	☐	☐
2. Were cases and controls matched appropriately?	☐	☐	☐	☐
3. Were the same criteria used for identification of cases and controls?	☐	☐	☐	☐
4. Was exposure measured in a standard, valid and reliable way?	☐	☐	☐	☐
5. Was exposure measured in the same way for cases and controls?	☐	☐	☐	☐
6. Were confounding factors identified?	☐	☐	☐	☐
7. Were strategies to deal with confounding factors stated?	☐	☐	☐	☐
8. Were outcomes assessed in a standard, valid and reliable way for cases and controls?	☐	☐	☐	☐
9. Was the exposure period of interest long enough to be meaningful?	☐	☐	☐	☐
10. Was appropriate statistical analysis used?	☐	☐	☐	☐

Overall appraisal: Include ☐ Exclude ☐ Seek further info ☐

Comments (Including reason for exclusion)

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Explanation of case control studies critical appraisal

How to cite: Moola S, Munn Z, Tufanaru C, Aromataris E, Sears K, Sfetcu R, Currie M, Qureshi R, Mattis P, Lisy K, Mu P-F. Chapter 7: Systematic reviews of etiology and risk . In: Aromataris E, Munn Z (Editors). *Joanna Briggs Institute Reviewer's Manual.* The Joanna Briggs Institute, 2017. Available from https://reviewersmanual.joannabriggs.org/

Case Control Studies Critical Appraisal Tool

Answers: Yes, No, Unclear or Not/Applicable

1. **Were the groups comparable other than presence of disease in cases or absence of disease in controls?**

The control group should be representative of the source population that produced the cases. This is usually done by individual matching; wherein controls are selected for each case on the basis of similarity with respect to certain characteristics other than the exposure of interest. Frequency or group matching is an alternative method. Selection bias may result if the groups are not comparable.

2. **Were cases and controls matched appropriately?**

As in item 1, the study should include clear definitions of the source population. Sources from which cases and controls were recruited should be carefully looked at. For example, cancer registries may be used to recruit participants in a study examining risk factors for lung cancer, which typify population-based case control studies. Study participants may be selected from the target population, the source population, or from a pool of eligible participants (such as in hospital-based case control studies).

3. **Were the same criteria used for identification of cases and controls?**

It is useful to determine if patients were included in the study based on either a specified diagnosis or definition. This is more likely to decrease the risk of bias. Characteristics are another useful approach to matching groups, and studies that did not use specified diagnostic methods or definitions should provide evidence on matching by key characteristics. A case should be defined clearly. It is also important that controls must fulfil all the eligibility criteria defined for the cases except for those relating to diagnosis of the disease.

4. **Was exposure measured in a standard, valid and reliable way?**

The study should clearly describe the method of measurement of exposure. Assessing validity requires that a 'gold standard' is available to which the measure can be compared. The validity

of exposure measurement usually relates to whether a current measure is appropriate or whether a measure of past exposure is needed.

Case control studies may investigate many different 'exposures' that may or may not be associated with the condition. In these cases, reviewers should use the main exposure of interest for their review to answer this question when using this tool at the study level.

Reliability refers to the processes included in an epidemiological study to check repeatability of measurements of the exposures. These usually include intra-observer reliability and inter-observer reliability.

5. Was exposure measured in the same way for cases and controls?

As in item 4, the study should clearly describe the method of measurement of exposure. The exposure measures should be clearly defined and described in detail. Assessment of exposure or risk factors should have been carried out according to same procedures or protocols for both cases and controls.

6. Were confounding factors identified?

Confounding has occurred where the estimated intervention exposure effect is biased by the presence of some difference between the comparison groups (apart from the exposure investigated/of interest). Typical confounders include baseline characteristics, prognostic factors, or concomitant exposures (e.g. smoking). A confounder is a difference between the comparison groups and it influences the direction of the study results. A high quality study at the level of case control design will identify the potential confounders and measure them (where possible). This is difficult for studies where behavioral, attitudinal or lifestyle factors may impact on the results.

7. Were strategies to deal with confounding factors stated?

Strategies to deal with effects of confounding factors may be dealt within the study design or in data analysis. By matching or stratifying sampling of participants, effects of confounding factors can be adjusted for. When dealing with adjustment in data analysis, assess the statistics used in the study. Most will be some form of multivariate regression analysis to account for the confounding factors measured. Look out for a description of statistical methods as regression methods such as logistic regression are usually employed to deal with confounding factors/ variables of interest.

8. Were outcomes assessed in a standard, valid and reliable way for cases and controls?

Read the methods section of the paper. If for e.g. lung cancer is assessed based on existing definitions or diagnostic criteria, then the answer to this question is likely to be yes. If lung cancer is assessed using observer reported, or self-reported scales, the risk of over- or under-

reporting is increased, and objectivity is compromised. Importantly, determine if the measurement tools used were validated instruments as this has a significant impact on outcome assessment validity.

Having established the objectivity of the outcome measurement (e.g. lung cancer) instrument, it's important to establish how the measurement was conducted. Were those involved in collecting data trained or educated in the use of the instrument/s? (e.g. radiographers). If there was more than one data collector, were they similar in terms of level of education, clinical or research experience, or level of responsibility in the piece of research being appraised?

9. Was the exposure period of interest long enough to be meaningful?

It is particularly important in a case control study that the exposure time was sufficient enough to show an association between the exposure and the outcome. It may be that the exposure period may be too short or too long to influence the outcome.

10. Was appropriate statistical analysis used?

As with any consideration of statistical analysis, consideration should be given to whether there was a more appropriate alternate statistical method that could have been used. The methods section should be detailed enough for reviewers to identify which analytical techniques were used (in particular, regression or stratification) and how specific confounders were measured.

For studies utilizing regression analysis, it is useful to identify if the study identified which variables were included and how they related to the outcome. If stratification was the analytical approach used, were the strata of analysis defined by the specified variables? Additionally, it is also important to assess the appropriateness of the analytical strategy in terms of the assumptions associated with the approach as differing methods of analysis are based on differing assumptions about the data and how it will respond.

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Checklist for Qualitative Research

http://joannabriggs.org/research/critical-appraisal-tools.html

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JBI Critical Appraisal Checklist for Qualitative Research

Reviewer_____Date_____

Author _____Year_____Record Number_____

		Yes	No	Unclear	Not applicable
1.	Is there congruity between the stated philosophical perspective and the research methodology?	☐	☐	☐	☐
2.	Is there congruity between the research methodology and the research question or objectives?	☐	☐	☐	☐
3.	Is there congruity between the research methodology and the methods used to collect data?	☐	☐	☐	☐
4.	Is there congruity between the research methodology and the representation and analysis of data?	☐	☐	☐	☐
5.	Is there congruity between the research methodology and the interpretation of results?	☐	☐	☐	☐
6.	Is there a statement locating the researcher culturally or theoretically?	☐	☐	☐	☐
7.	Is the influence of the researcher on the research, and vice- versa, addressed?	☐	☐	☐	☐
8.	Are participants, and their voices, adequately represented?	☐	☐	☐	☐
9.	Is the research ethical according to current criteria or, for recent studies, and is there evidence of ethical approval by an appropriate body?	☐	☐	☐	☐
10.	Do the conclusions drawn in the research report flow from the analysis, or interpretation, of the data?	☐	☐	☐	☐

Overall appraisal: Include ☐ Exclude ☐ Seek further info ☐

Comments (Including reason for exclusion)

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Discussion of Critical Appraisal Criteria

How to cite: Lockwood C, Munn Z, Porritt K. Qualitative research synthesis: methodological guidance for systematic reviewers utilizing meta-aggregation. Int J Evid Based Healthc. 2015;13(3):179–187.

1. Congruity between the stated philosophical perspective and the research methodology

Does the report clearly state the philosophical or theoretical premises on which the study is based? Does the report clearly state the methodological approach adopted on which the study is based? Is there congruence between the two? For example:

A report may state that the study adopted a critical perspective and participatory action research methodology was followed. Here there is congruence between a critical view (focusing on knowledge arising out of critique, action and reflection) and action research (an approach that focuses on firstly working with groups to reflect on issues or practices, then considering how they could be different; then acting to create a change; and finally identifying new knowledge arising out of the action taken). However, a report may state that the study adopted an interpretive perspective and used survey methodology. Here there is incongruence between an interpretive view (focusing on knowledge arising out of studying what phenomena mean to individuals or groups) and surveys (an approach that focuses on asking standard questions to a defined study population); a report may state that the study was qualitative or used qualitative methodology (such statements do not demonstrate rigour in design) or make no statement on philosophical orientation or methodology.

2. Congruity between the research methodology and the research question or objectives

Is the study methodology appropriate for addressing the research question? For example: A report may state that the research question was to seek understandings of the meaning of pain in a group of people with rheumatoid arthritis and that a phenomenological approach was taken. Here, there is congruity between this question and the methodology. A report may state that the research question was to establish the effects of counselling on the severity of pain experience and that an ethnographic approach was pursued. A question that tries to establish cause-and effect cannot be addressed by using an ethnographic approach (as ethnography sets out to develop understandings of cultural practices) and thus, this would be incongruent.

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3. **Congruity between the research methodology and the methods used to collect data**

Are the data collection methods appropriate to the methodology? For example:

A report may state that the study pursued a phenomenological approach and data was collected through phenomenological interviews. There is congruence between the methodology and data collection; a report may state that the study pursued a phenomenological approach and data was collected through a postal questionnaire. There is incongruence between the methodology and data collection here as phenomenology seeks to elicit rich descriptions of the experience of a phenomena that cannot be achieved through seeking written responses to standardized questions.

4. **Congruity between the research methodology and the representation and analysis of data**

Are the data analyzed and represented in ways that are congruent with the stated methodological position? For example:

A report may state that the study pursued a phenomenological approach to explore people's experience of grief by asking participants to describe their experiences of grief. If the text generated from asking these questions is searched to establish the meaning of grief to participants, and the meanings of all participants are included in the report findings, then this represents congruity; the same report may, however, focus only on those meanings that were common to all participants and discard single reported meanings. This would not be appropriate in phenomenological work.

5. **There is congruence between the research methodology and the interpretation of results**

Are the results interpreted in ways that are appropriate to the methodology? For example:

A report may state that the study pursued a phenomenological approach to explore people's experience of facial disfigurement and the results are used to inform practitioners about accommodating individual differences in care. There is congruence between the methodology and this approach to interpretation; a report may state that the study pursued a phenomenological approach to explore people's experience of facial disfigurement and the results are used to generate practice checklists for assessment. There is incongruence between the methodology and this approach to interpretation as phenomenology seeks to understand the meaning of a phenomenon for the study participants and cannot be interpreted to suggest that this can be generalized to total populations to a degree where standardized assessments will have relevance across a population.

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6. **Locating the researcher culturally or theoretically**

Are the beliefs and values, and their potential influence on the study declared? For example:

The researcher plays a substantial role in the qualitative research process and it is important, in appraising evidence that is generated in this way, to know the researcher's cultural and theoretical orientation. A high quality report will include a statement that clarifies this.

7. **Influence of the researcher on the research, and vice-versa, is addressed**

Is the potential for the researcher to influence the study and for the potential of the research process itself to influence the researcher and her/his interpretations acknowledged and addressed? For example:

Is the relationship between the researcher and the study participants addressed? Does the researcher critically examine her/his own role and potential influence during data collection? Is it reported how the researcher responded to events that arose during the study?

8. **Representation of participants and their voices**

Generally, reports should provide illustrations from the data to show the basis of their conclusions and to ensure that participants are represented in the report.

9. **Ethical approval by an appropriate body**

A statement on the ethical approval process followed should be in the report.

10. **Relationship of conclusions to analysis, or interpretation of the data**

This criterion concerns the relationship between the findings reported and the views or words of study participants. In appraising a paper, appraisers seek to satisfy themselves that the conclusions drawn by the research are based on the data collected; data being the text generated through observation, interviews or other processes.

Supplementary file III: Data extraction checklist

Qualitative

Study ID	Study Design	Population	Phenomenon of interest	Outcome	Remark

Quantitative

Study ID	Study Design	Population	Outcome	Result	Remark

Supplementary file IV: Table of included studies

Study	Purpose	Study design	Participants and sample size
Aregawi HG, Gebrehiwot TG et al, 2017[18]	To identify the determinants of defaulting from child immunization completion among children aged 9-23 months in the Laelay Adiabo District, North Ethiopia.	Case-control	270 children aged 9-23 months • 90 cases and • 180 controls
Godefay H, Byass P et al, 2015[19]	To characterize individual risk factors for maternal mortality in Tigray, Ethiopia.	Case-control	The sample size was 310 • 62 cases and • 248 controls from six randomly-selected rural districts
Zepre K and Kaba M, 2017[22]	To assess the current BPCR practice and determine associated factors among rural women of reproductive age in Abeshige district, Guraghe zone, SNNPR, Ethiopia	Cross-sectional	454 women who delivered within 12 months prior to this survey
Negero MG. et al, 2018[20]	To assess Skilled delivery service utilization and its association with the establishment of Women's Health Development army	Cross-sectional	748 reproductive-age women who gave birth in 1 year preceding the study in 380 clusters of WDA were included
Girmaye M. and Berhan Y.[21]	To assess Skilled ANC service utilization and its association with the establishment of	Cross-sectional	748 reproductive-age women who gave birth in 1 year preceding the study

	Women's Health Development army		
Jackson R. and Hailemariam A., 2016[23]	To examine the barriers and facilitators for HEWs as they refer women to mid-level health facilities for birth.	Qualitative	45 HEWs, 14 women extension workers (employed by Afar Pastoralist Development Association, Afar Region) and 11 other health workers from health centers, hospitals or health offices.
Jackson R. Tesfay FH. et al, 2017[24]	To document factors that hinder or enable strategies to reduce the first and second delays of the Three Delays in rural and pastoralist areas in Ethiopia	Qualitative	A key informant study was conducted with 44 HEWs in Afar, SNNP, and Tigray Regions
Jackson R. Tesfay FH. et al, 2016[25]	To explored HEWs' and mother's attitudes to maternal health services in Adwa Woreda, Tigray Region.	Qualitative	45 women were interviewed
Kok MC. et al., 2015[26]	To understand how relationships between HEWs, the community and health sector were shaped, in order to inform policy on optimizing HEW performance in providing maternal health services.	Qualitative	14 FGDs with HEWs, women and men from the community and 44 semi-structured interviews with HEWs; key informants working in program management, health service delivery and supervision of HEWs; mothers; and traditional birth attendants.

Supplementary file V: Critical appraisal result

Case control

Studies	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Total
Aregawi HG. et al[18]	U	Y	Y	Y	Y	Y	Y	Y	U	Y	8 Y 2 U
Godefay H, Byass P et al[19]	U	Y	Y	Y	Y	Y	Y	Y	U	Y	8 Y 2 U

Cross-sectional

Studies	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Total
Haile F. et al[43]	Y	Y	N	Y	Y	Y	U	Y	5 Y 2 N 1 U
Negero MG. et al [20]	Y	Y	U	Y	Y	Y	Y	Y	7 Y 1 U
Zepre K. et al[22]	Y	Y	Y	Y	Y	Y	U	Y	7 Y 1 U
Girmaye M. and Berhan Y.[21]	Y	Y	Y	Y	Y	Y	U	Y	7 Y 1 U

Qualitative

Studies	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Total
Banteyerga H.[44]	Y	U	Y	Y	Y	N	N	Y	N	Y	6 Y 3 N 1 U
Maes K. et al[15]	U	U	U	U	U	N	N	Y	Y	U	2 Y 2 N 6 U
Sako B. et al[45]	Y	Y	Y	Y	Y	N	N	Y	Y	Y	8 Y 2 N

Jackson R., Hailemariam A. et al.[23]	U	Y	Y	Y	Y	N	N	Y	Y	Y	7 Y 2 N 1 U
Jackson R., Tesfay FH., Gebrehiwot TG. et al[24]	Y	Y	Y	Y	Y	N	N	Y	Y	Y	8 Y 2 N
Jackson R., Tesfay FH., Godefay H. et al [25]	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	9 Y 1 N
Kok MC., Kea AZ. et al[26]	Y	Y	Y	Y	Y	N	N	Y	Y	Y	8 Y 2 N
Maesa K., Closser S. et al[16]	U	Y	Y	Y	Y	N	N	U	Y	Y	6 Y 2 N 2 U

Y: Yes; N: No; U: Unclear

Reporting checklist for systematic review and meta-analysis.

Based on the PRISMA guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

Upload your completed checklist as an extra file when you submit to a journal.

In your methods section, say that you used the PRISMA reporting guidelines, and cite them as:

Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement

		Reporting Item	Page Number
	#1	Identify the report as a systematic review, meta-analysis, or both.	1
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
Rationale	#3	Describe the rationale for the review in the context of what is already known.	4-5
Objectives	#4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	6
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 the registration number.	

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 rational	6
Information sources	#7	Describe all information sources in the search (e.g., databases with dates of coverage, contact with study authors to identify additional studies) and date last searched.	6
Search	#8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	6
Study selection	#9	State the process for selecting studies (i.e., for screening, for determining eligibility, for inclusion in the systematic review, and, if applicable, for inclusion in the meta-analysis).	7-8
Data collection process	#10	Describe the method of data extraction from reports (e.g., piloted forms, independently by two reviewers) and any processes for obtaining and confirming data from investigators.	9
Data items	#11	List and define all variables for which data were sought (e.g., PICOS, funding sources), and any assumptions and simplifications made.	
Risk of bias in individual studies	#12	Describe methods used for assessing risk of bias in individual studies (including specification of whether this was done at the study or outcome level, or both), and how this information is to be used in any data synthesis.	
Summary measures	#13	State the principal summary measures (e.g., risk ratio, difference in means).	
Planned methods of analyis	#14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I2) for each meta-analysis.	9
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).	
Additional analyses	#16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	
Study selection	#17	Give numbers of studies screened, assessed for eligibility, and	7-8

		included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	
Study characteristics	#18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citation.	10
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).	
Results of individual studies	#20	For all outcomes considered (benefits and harms), present, for each study: (a) simple summary data for each intervention group and (b) effect estimates and confidence intervals, ideally with a forest plot.	10-14
Synthesis of results	#21	Present the main results of the review. If meta-analyses are done, include for each, confidence intervals and measures of consistency.	10-14
Risk of bias across studies	#22	Present results of any assessment of risk of bias across studies (see Item 15).	
Additional analysis	#23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	
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., health care providers, users, and policy makers	10-14
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).	16
Conclusions	#26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	15-16
Funding	#27	Describe sources of funding or other support (e.g., supply of data) for the systematic review; role of funders for the systematic review.	17

BMJ Open

Contribution of women's development army to maternal and child health in Ethiopia: A systematic review of evidence

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Contribution of women's development army to maternal and child health in Ethiopia: A systematic review of evidence

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Abstract

Objective: the aim of this review was to identify, appraise and synthesize studies that reported on the contribution of women's development army to maternal and child health development.

Setting: studies conducted in Ethiopia 2010 onwards and published in English were considered.

Data Sources: evidence were searched in MEDLINE, CINAHL, and EBSCOhost from 25 March to 10 April, 2018.

Eligibility Criteria: both quantitative and qualitative studies assessing the contribution of women's development army to maternal and child health.

Data Extraction and Synthesis: Two independent reviewers have extracted data using pre-planned data extraction tool separately for each study design. Findings were synthesized using tables and narrative summary.

Outcome: maternal and child health services; maternal and child mortality.

Results: nine studies met the inclusion criteria and used for synthesis. The results revealed that, participation and membership in women's development army has a positive effect on minimizing maternal death and improving child immunization service use. Skilled delivery and antenatal care service use were higher in women's development groups located within two kilometers radius of health facilities. These groups were also the main sources of information for mothers for birth preparedness and complication readiness. Moreover, well-established groups have strengthened the linkage of the health facility to the community so that, delays in maternal health service use were minimized; health extension workers could effectively refer women to a health facility for birth; and use of skilled birth service was improved.

Conclusion: voluntary health service intervention in Ethiopia has improved maternal and child health services' outcome. Decrease in maternal deaths, increase in antenatal and delivery service use and improved child immunization service uptake are attributable to this intervention. It is also effective and efficient mechanism to share information to the community linking the community members with the primary health care system.

Keywords: Women's development army, Maternal and child health, Ethiopia

Article summary

Strengths and limitations of this study

- The review has used two independent reviewers and additional reviewer who participated in resolving disagreements arise between the two reviewers.
- The review has used structured procedure during literature search, appraisal, data collection and synthesis
- Despite the strengths described above, we have not conducted meta-analysis due to heterogeneous types of study designs and population included in this review
- We have included only full text articles found free online

Introduction

Evidence from various countries in the world disclosed that community volunteers' health service intervention has shown significant health impact.[1,2] They accomplish various functions related to health service delivery. In fact, usually they do not have formal professional or paraprofessional education and can be involved in voluntary care. They intervene in health care after attending job related trainings. These community health volunteers have different names in different settings for example, lay health workers, community health workers, and unpaid community volunteers.[3,4]

Community health volunteers have a great importance, especially in less developed countries, so as to overcome the increasing demand for health care services and the shortage of formal health care providers.[5] After Alma Ata declaration of Primary Health Care (PHC), community involvement in the health care was given due attention in order to improve wide access and acceptance of the services by service users and the community at large. It is believed that, problems cannot be solved from only the side of service providers and programmers. Moreover, it is a good strategy to mobilize resources relevant to health services.[6–8]

These health interventions using community volunteers have a sort of structure in some countries and unstructured in others.[1,5] Some nations linked the service under their PHC structure. Ethiopia is a good example of well-structured community health interventions. The primary health care unit (PHCU) is in the front line to PHC in the country. This system encompasses five satellite health posts (the lowest village-level health service facility) and a referral health center (HC). In the countries health care system, PHC is administered and the services facilitated in this point.[9] So as to address the deficit in human resources for health, Ethiopia launched the community health extension program (HEP) in 2004. It was implemented by establishing a health post and positioning two female health extension workers (HEWs) in every *kebele* (the smallest administrative division in Ethiopia). The HEP was launched to improve access to preventive, essential health services and to create a healthy environment. This program works to increase and sustain preventive health actions and health awareness. HEP has sixteen packages divided into four major categories.[9–11]

Six years after its introduction in 2010 a new innovative approach, Women's Development Army

(WDA) strategy was linked with HEP. This army has various development roles, from which health is the major one.[9] At the community level, members of the community linked with the PHC system through this strategy.[12] It was adopted based on the experience that using a network of the community health volunteers increased the efficiency of the HEWs in reaching households with actionable health messages. For a functional WDA, a team involving up to 30 households within the same neighborhood has to be developed. These teams are called Women's Development Teams (WDTs) A WDT again sub-divided into "one-to-five" connections, smaller groups of six members (households). Five households make up a single WDT.[10,13,14]

This system has its own structural arrangement. The group's developmental works monitored in a meeting every two weeks by a command post formulated at the *kebele* level which is led by the *kebele* leader. Similar follow-up undertaken by the development group leaders to the one-to-five networks.[9] WDTs and the one-to-five networks leaders elected with full participation of the members. Their trust worthiness to the team members and being model family are being considered as criteria for selection. Model families recognized when they fully implement all the HEP packages or perform with distinction among the group members.[15]

Health extension workers in collaboration with *kebele* administration and personnel from other developmental sectors (the agricultural and educational) facilitate the formation of the WDTs and the one-to-five networks. These unpaid health volunteers, WDT leaders, undertake various preventive and promotive health services in collaboration with HEWs. They carry out a number of tasks, including, support during health information delivery programs, keeping track of pregnancies and illnesses, helping during immunization campaigns, and transmitting messages between households and HEWs.[9,10]

The Ethiopian unpaid community health intervention has its unique structural arrangement. It is included in various development sectors' strategic plan.[13] Some evidence claim that the program has variations in aims, goals, and experiences among various players included and suggests further researchers.[16]

This review aimed to assess the contribution of this structured community involvement in health service delivery. Finally, it came up with strong evidence to say the WDA structure has an impact

in the development of the country's maternal and child health. Moreover it has suggested a way to continue and/or extend the intervention for the future.

Methods

Search Strategy

The search strategy targeted to find both published and unpublished studies. A step by step search strategy was utilized in this review. Primarily, major databases that comprise health system research including MEDLINE, CINAHL and EBSCOhost were utilized. Unpublished works were also searched from ProQuest Dissertations and Theses and Google Scholar. Afterwards, the reference list of all identified reports and articles were searched for additional studies. Key words initially used were: community health workers, community volunteer, women's development army, women's development group, women's development team, health development team, lay health workers, health development army, Ethiopia, maternal health, child health and maternal health services. Extracted references were downloaded and stored in Mendeley reference manager file. MEDLINE (on PubMed platform) search strategy is included in supplementary file I.

To guide the overall review, PRISMA flow diagram was used (Figure 1).[17] Starting from identification of records up to the inclusion of the relevant literatures for the review question were documented to comprehensive and accurate reporting.

Inclusion and exclusion criteria

Both quantitative and qualitative studies were included in this review regardless of their study design, given they included women in reproductive age group (14-49 years) and children less than five years of age for both sexes. To be considered the studies should have evaluated the effect of women's development army, and participation in the group on maternal mortality, maternal and child health service use. These are major intervention areas of WDAs regarding maternal and child health. Moreover, studies conducted in Ethiopia, 2010 (a year when WDA was introduced in Ethiopia) onwards and published in English language were considered for inclusion in this review. We have excluded narrative summaries, case reports and technical reports.

Description of studies

Eleven potentially relevant studies were found in addition to the three hundred fifty two studies

identified in database searches. A total of 299 articles were eligible for primary examination after duplications were removed. On reviewing titles and abstracts against the review objectives and inclusion criteria, 276 studies were excluded. The full text of the remaining 23 studies was retrieved for detailed examination and 9 were excluded. Afterwards, 14 studies were assessed for methodological quality. The quality assessment was done by two independent reviewers for methodological validity prior to inclusion in the review using standardized critical appraisal instruments from the Joanna Briggs Institute.[18–20] Disagreements that arise between the reviewers was resolved through discussion, and with the participation of a third reviewer. After the appraisal five studies that did not meet the minimum requirements of methodological appraisal tools were excluded and nine were finally reviewed.

Patient and Public Involvement

Patients and/or public were not involved in this review.

Data collection

Two independent reviewers collected information relevant for the review. Before data collection all titles and abstracts of the searched literatures were assessed for potential relevance; and those records deemed not relevant were verified. Later on, full-text reports were assessed for eligibility. In the cases we fail to get articles free online, we tried to obtain full texts from research-gate[21] authors' pages and we obtained three. Reports that are co-publications or multiple reports of the same study were identified. The eligibility criteria were applied to all reports. Only evidence thoughtful of the review's eligibility criteria were included. Studies that fulfilled more than 70% of the critical appraisal check lists' requirements were selected to be included in the review (Supplementary file II).

Data extraction was for quantitative and qualitative studies separately using pre designed checklists (Supplementary file III). The extracted data have included specific details about the interventions, populations, study methods and outcomes of significance to the review question and objectives (Supplementary file IV).

Data synthesis and analysis

Findings from the included studies were synthesized using tables and a narrative summary. Meta-analysis was not possible since the included studies were heterogeneous in terms of the

populations, methods and outcomes. We have categorized the results in to: participation in WDGs, distance of WDGs from health facility and effective functioning of WDGs.

Results: Findings of the Review

We have included a total of nine studies, that meet the requirements of critical appraisal checklists, regardless of their study design. These studies met the critical appraisal requirements more than 70% (Supplementary file IV). The review comprised both observational and qualitative studies. The studies were conducted on various maternal and child health issues including child immunization, maternal mortality, birth preparedness and complication readiness (BPCR), skilled delivery, antenatal care (ANC), linking pregnant women with health facilities for delivery, delays on maternal health services and community relationships with health extension workers and health sector (Table 1).

Table 1: Characteristics of included studies for review

Category	Sub-category	Frequency	Percentage (%)
Study design	Cross-sectional	3	33.33
	Case-control	2	22.22
	Qualitative	4	44.44
Year of publication	2015	2	22.22
	2016	3	33.33
	2017	3	33.33
	2018	1	11.11
Addressed maternal and child health issue	Skilled maternal health service use	3	33.33
	Relationship of community with health sector	3	33.33
	Child immunization	1	11.11
	Maternal mortality	1	11.11
	BPCR	1	11.11

Narrative synthesis

Participation in WDGs

In a study by Aregawi et al[22] 270 study subjects were included. From them 90 were defaulters from completion of child immunization (cases) and 180 were non defaulters (controls). 14 (15.6%) of cases and 89 (49.4%) of controls had satisfactory participation in WDGs. Result of statistical analysis showed that poor participation in women's developmental groups [AOR = 3.3,95%CI

1.54±7.08] is a determinant for defaulting immunization among children aged between 9 and 23 months.

A study by Godefay et al.[23] has included 310 study participants. Among them, 62 were dead mothers (cases) and 248 alive mothers (controls). From 62 died mothers 40 (64.5%) were members of WDTs and among 248 alive mothers 197 (79.4%) were members of WDTs. The statistical test revealed that women who were not members of the voluntary women's development army were more likely to experience maternal death [OR 2.07, 95%CI 1.04–4.11] (Table 2).

Table 2: Summary of evidence on the effect of participation in women's development group on maternal and child health service

Author, year	Target population	Study design	Outcome	Result
Aregawi HG, Gebrehiwot TG et al, 2017[22]	Children aged between 9 and 23 months	Case control	Default from immunization among children aged between 9 and 23 months	Poor participation in WDGs (AOR = 3.3,95%CI 1.54±7.08) is a determinant for defaulting
Godefay H, Byass P et al, 2015[23]	Mothers in reproductive age group	Case control	Maternal mortality	Women who were not members of WDG were more likely to experience maternal death (OR 2.07, 95%CI 1.04–4.11)

Distance of WDGs from health facility

In a study by Negero MG. et al[24] 748 reproductive-age women who gave birth in 1 year preceding the study in 380 clusters of WDA were included. 336 (45%) of women have received skilled delivery care and the remaining 412 have not received. A significant heterogeneity was observed between "Women's Development Teams (clusters)" for skilled delivery care service utilization which explains about 62% of the total variation. The distance of WDTs within 2 km radius from the nearest health facility was significantly associated [AOR (95% CI) 6.03 (1.92, 18.93)] with skilled delivery service utilization. The performance level of WDTs has no significant effect on

skilled delivery care service utilization. Best performing [AOR (95% CI) 2.14 (0.38, 12.27)] and good performing [AOR (95% CI) 4.38 (0.75, 25.56)].

Another cross-sectional study was conducted by Girmaye M. and Berhan Y.[25] which assessed 748 reproductive-age women who gave birth in 1 year preceding the study. 531 (71%) of the participants received skilled ANC service at least once. Similar to the above study, significant heterogeneity was observed between WDTs for skilled ANC utilization. Distance of WDA within 2 km radius from the nearest health facility was a significant predictor of skilled ANC service utilization [AOR=8.28; 95%CI, 1.08-62.20] (Table 3).

Table 3: Summary of evidence on the effect of women's development groups' distance from health facility on maternal health service

Author, year	Target population	Study design	Outcome	Result
Negero MG, Mitike YB, et al, 2018[24]	Reproductive-age women who gave birth in 1 year preceding the study	Cross-sectional	Skilled delivery service utilization	The distance of WDTs within 2 km radius from the nearest health facility was significantly associated with skilled delivery service use [AOR (95% CI) 6.03 (1.92, 18.93)]
Girmaye M. and Berhan Y., 2016[25]	Reproductive-age women who gave birth in 1 year preceding the study	Cross-sectional	Skilled antenatal care utilization	Distance of WDT within 2 km radius from the nearest health facility was significant predictor of skilled ANC service utilization [AOR=8.28; 95%CI, 1.08-62.20]

Effective functioning of WDGs

A study by Zepre K. and Kaba M.[26] has assessed 454 women. 168 respondents were found to have prepared for birth and its complications and 286 were not. 30 (68.2%) of members and 134 (34.7%) of non-members of one-to-five connection were prepared for birth and its complication. The

statistical assessment showed that those who got information from their one-to-five connection are more likely to prepare for birth and its complications [OR 2.52, 95% CI 1.17, 5.39].

A study by Jackson R. and Hailemariam A.[27] has assessed the role of HEWs in linking pregnant women with health facilities for delivery. The target of the study were pregnant women. The result revealed that HEWs can effectively refer more women to give birth in health facilities when the WDA is well established.

A study by Jackson R., Tesfay FH. et al[28] was aimed to document the factors that hinder or enable strategies to reduce the first and second delays of the three delays in rural and pastoralist areas in Ethiopia. The study concluded that, initiatives to reduce delays can improve access to maternal health services, especially when HEWs are supported by the WDA.

Another study conducted by Jackson R., Tesfay FH. et al[29] aimed at exploring health extension workers' and mothers' attitudes to maternal health service utilization and acceptance. And the result uncovered that, with the support of WDGs, HEWs have increased the rate of skilled birth attendance by calling ambulances to transport women to health centers either before their expected date of delivery (EDD) or when labor starts at home. These findings add to the growing body of evidence that health workers at the community level can work with women's groups to improve maternal health, thus reducing the need for emergency obstetric care in low-income countries.

A study by Kok MC. et al.[30] has addressed health extension workers' relationships with the community and health sector in Ethiopia: opportunities for enhancing maternal health performance. This assessment found that the WDA supported HEWs in liaising with community members (Table 4).

Table 4: Summary of evidence in the effect of women's development army's effective functioning on maternal health services

Author, year	Target population	Study design	Outcome	Result
Zepre K and Kaba M, 2017[26]	Pregnant women	Cross-sectional	Birth preparedness and complication readiness	Those who got information from their one-to-five connections are more likely to prepare for birth and its

				complications (OR 2.52, 95%CI 1.17, 5.39)
Jackson R. and Hailemariam A., 2016[27]	Pregnant women	Qualitative	Linking pregnant women with health facilities for delivery	HEWs can effectively refer more women to give birth in health facilities when the WDA is well established.
Jackson R., Tesfay FH. et al, 2017[28]	Pregnant women	Qualitative	Delays in maternal health service use	Initiatives to reduce delays can improve access to maternal health services, especially when HEWs are supported by the WDA.
Jackson R., Tesfay FH. et al, 2016[29]	Mothers and HEWs	Qualitative	Maternal health service utilization and acceptance	With the support of WDGs, HEWs have increased the rate of skilled birth attendance
Kok MC., Kea AZ; et al., 2015[30]	Mothers and HEWs	Qualitative	Relationship of community with HEWs and Health sector	The WAD supported HEWs in liaising with community members

Discussion

The main objective of this systematic review was to identify, appraise and synthesize studies that reported on the contribution of Ethiopian innovative women's voluntary health intervention's (women's development army's) contribution to maternal and child health development. The major activity of this structure is supporting the primary health care intervention under the health extension program.[31,32] Most probably this is the first systematic review that synthesized information on women's development army and its contribution. Nine studies were assessed and all of them revealed women's development army has contributed for the improved maternal and child health, and health service use. The evidence have shown that the benefit of WDAs was obtained through participation in the group,[22,23] closeness of the groups to health facilities[24,25] and their effective functioning.[26–30]

Despite the fact that Ethiopian female community health intervention has special features, unpaid community health intervention has been used in various countries to improve population's health.[14] As various findings indicated it is a cost effective measure, especially for low income countries with low access to health services. They applied this strategy to curve the disastrous shortfalls in the health workforce and to improve community ownership.[33–36]

Women in a village level are expected to be a part and actively participate in to one-to-five connection under the WDGs. By doing so they can easily obtain information, care and support from the primary health care structure.[15,16] Involving community members in health services brings about an improvement of health service use and health status of the community.[10,37,38] Good participation of mothers in WDGs was found protective for defaulting from child immunization . Those who were not members of WDGs are more than three times more likely to default from the service as compared to those included.[22] Community involvement in vaccination programs for children was found effective in many low and middle income countries.[39,40] For example, two systematic reviews focused on low income population revealed, participation of community health workers has improved child immunization.[41,42] Their involvement lets the community participate in decision making and improves their knowledge, so that ownership improved.[43]

Participation in WDGs in Ethiopia minimized maternal deaths. Women who are not members of WDGs are two times at risk of experiencing maternal death in the study area.[23] Participating community members has positive effect on mothers' survival.[44] Moreover the Ethiopian WDG

involvement resulted in improved birth preparedness and complication readiness.[26] Community health participation in India has also significantly minimized maternal death.[45] This implied those who took part in promoting health with WDGs could improve their health literacy and developed a good attitude towards the use of maternal health services.

The other major issues regarding WDA's contribution to maternal health and health service use is distance from health facilities in reference to their meeting area. When the distance became beyond two kilometers from the nearest health center or hospital, members were less likely to use ANC and delivery service as compared to their counterparts.[24,25] As the meeting area of WDGs became nearer to health facilities, HEWs and health professionals from health facility can easily supervise and support the members during their meeting. Even if many national and international policy documents have given due concern for physical access to improve maternal health service use,[13,46,47] still the problem prevails in many low and middle income countries.[48–51] This concern is also experienced by WDGs in Ethiopia.

Although there are some information that revealed performance of WDGs does not have anything in improving maternal health service use,[24,25] there are an ample of evidence that showed effective functioning and well performing of these groups resulted in improved maternal health and health service use.[26–30] In the previous studies, performance of the groups was measured by traditional ways of performance measurement at the village level. The performance measurement ways, measurement indicators and evaluators may not be effective in measuring actual performance of the groups. Other evidence revealed that, well performing WDGs facilitated the linkage between mothers and the primary health care system. As a result, service utilization and acceptance were improved.[27–29] Although the performance measurement ways differ in diverse settings, good performing community health interventions succeeded in improving maternal and child health development in low income countries.[52–54] As a result countries tend to improve the performance of their community health practitioners.[55,56]

On top of this, strongly operating WDGs and their strong linkage with the primary health care system ease the health service practitioners, especially HEWs effort to refer significant amount of women to give birth in health facilities.[27] HEWs are required to deliver health information and other health service packages to the community.[57,58] These health workers are using the WDA structure as a perfect strategy to share information and create linkage with the community members

at the household and individual level.[30] By doing so they could deliver the services effectively. Moreover, this voluntary system is serving as an initiative to reduce delays in maternal health services use.[28]

The other best indicators of the contribution of WDA to maternal and child health are consecutive demographic and health surveys carried out in Ethiopia. For instance, maternal death was 673 in 2005 and 676 in 2011 per 100 000 live births. But it became 412 in 2016, just it is 6 years after the introduction of WDA in Ethiopia. Under 5 mortality was also decreased from 88 in 2011 to 67 in 2016. Maternal health services have shown a massive increase during these points as compared to prior years. ANC increased from 28% in 2005 to 34% in 2011 and 62% in 2016. Institutional delivery increased from 5% in 2005 to 10% in 2011 and 26% in 2016. Postnatal care (PNC) was also increased from 5% in 2005 to 8% in 2011, and 17% in 2016.[59–62] These figures indicated that there is an impressive improvements in maternal and child health after the introduction of WDA in the country. Even though we can not hide the contribution of other interventions for the accievents, WDA's contribution has accelerated the improvements in various maternal and child health indicators.

Limitations of the Review

A potential limitation of the present review might be, we have not conducted meta-analysis due to heterogeneous types of study designs and population included in this review. The other thing is that we have included only full text articles found free online.

Conclusions

The results from the review have indicated that even if the reason for the existence of WDA system is to support HEWs for all the health extension packages, their intervention is limited only to maternal and child health service. Nevertheless, its contribution to maternal and child health service utilizations and mothers improved health is countless. Being a member of a WDG and one-to-five connection under the group, has a positive effect on child immunization service use, minimizing maternal mortality, birth preparedness and complication readiness, skilled delivery, skilled ANC and minimizing delays to use maternal health service. Moreover, it was found an effective and efficient mechanism to share information to the community as well as to create links between the communities and the primary health care system.

Implication for practice

The government is required to continue the existing achievements regarding WDA's contribution for maternal and child health services utilization. Again responsible bodies at each level in the structure of Ethiopian health care system have to extend the benefits from WDA to other health issues in addition to the maternal and child health.

The responsible bodies in the Ethiopian Federal Ministry of Health have to prepare clear, objective and standardized performance measurement indicators for WDGs.

Since the distance of existing WDGs from health facilities is an important determinant for maternal health service utilization, the government is supposed to establish new health facilities as near as possible to the population and organize the community living around health facilities into WDGs. Moreover, HEWs and health professionals from health facilities are expected to support and supervise WDGs far away from health facilities.

Implications for research

Although there are some studies regarding WDA, still there is a paucity of literatures. Therefore, researchers are responsible to conduct various inquiries on the issue.

Moreover, researchers are supposed to examine the WDA's contribution to other health issues in addition to maternal and child health service use.

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A patient consent form: not required

Data statement: all relevant data are provided in the paper and supplementary files. Additional details can be provided by the contact author on request.

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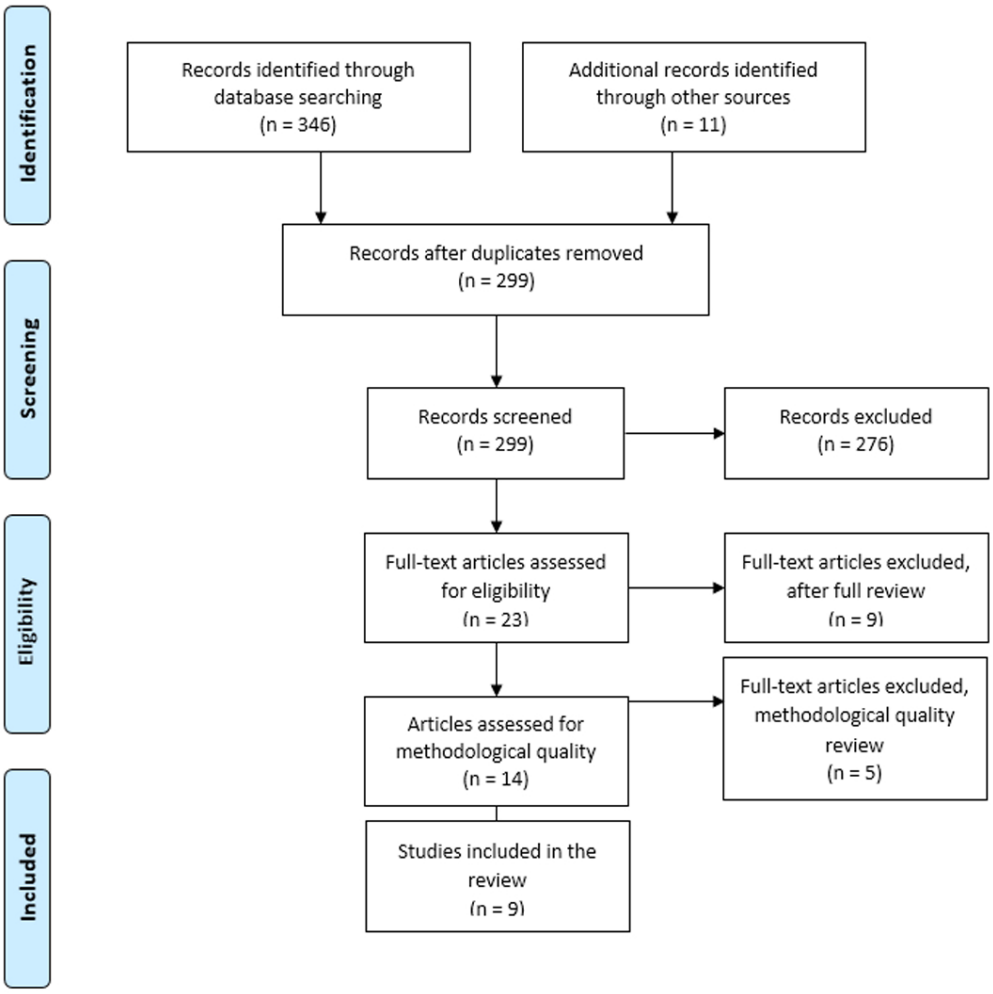
Figure legend:

Figure 1: Literature search and screening



Literature search and screening

90x90mm (300 x 300 DPI)

Supplementary file I: Search strategy

Search	Query
#1	Search (((((((community health workers) OR community volunteer) OR women's development army) OR women's development team) OR health development team) OR lay health workers) OR health development army
#2	Search ((((maternal health) OR maternal health service) OR child health) OR child health service) OR health
#3	Search Ethiopia
#4	#1 AND #2 AND #3
#5	Limit to: Full text
#6	Limit to: Publication date from 2010/01/01 to 2018/12/31
#7	Limit to: English language

Supplementary file II: Critical appraisal result

Case control

Studies	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Total
Aregawi HG. et al[18]	U	Y	Y	Y	Y	Y	Y	Y	U	Y	8 Y 2 U
Godefay H, Byass P et al[19]	U	Y	Y	Y	Y	Y	Y	Y	U	Y	8 Y 2 U

Cross-sectional

Studies	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Total
Haile F. et al[43]	Y	Y	N	Y	Y	Y	U	Y	5 Y 2 N 1 U
Negero MG. et al [20]	Y	Y	U	Y	Y	Y	Y	Y	7 Y 1 U
Zepre K. et al[22]	Y	Y	Y	Y	Y	Y	U	Y	7 Y 1 U
Girmaye M. and Berhan Y.[21]	Y	Y	Y	Y	Y	Y	U	Y	7 Y 1 U

Qualitative

Studies	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Total
Banteyerga H.[44]	Y	U	Y	Y	Y	N	N	Y	N	Y	6 Y 3 N 1 U
Maes K. et al[15]	U	U	U	U	U	N	N	Y	Y	U	2 Y 2 N 6 U
Sako B. et al[45]	Y	Y	Y	Y	Y	N	N	Y	Y	Y	8 Y 2 N

Jackson R., Hailemariam A. et al.[23]	U	Y	Y	Y	Y	N	N	Y	Y	Y	7 Y 2 N 1 U
Jackson R., Tesfay FH., Gebrehiwot TG. et al[24]	Y	Y	Y	Y	Y	N	N	Y	Y	Y	8 Y 2 N
Jackson R., Tesfay FH., Godefay H. et al [25]	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	9 Y 1 N
Kok MC., Kea AZ. et al[26]	Y	Y	Y	Y	Y	N	N	Y	Y	Y	8 Y 2 N
Maesa K., Closser S. et al[16]	U	Y	Y	Y	Y	N	N	U	Y	Y	6 Y 2 N 2 U

Y: Yes; N: No; U: Unclear

Supplementary file III: Data extraction checklist

Qualitative

Study ID	Study Design	Population	Phenomenon of interest	Outcome	Remark

Quantitative

Study ID	Study Design	Population	Outcome	Result	Remark

Supplementary file IV: Table of included studies

Study	Purpose	Study design	Participants and sample size
Aregawi HG, Gebrehiwot TG et al, 2017[18]	To identify the determinants of defaulting from child immunization completion among children aged 9-23 months in the Laelay Adiabo District, North Ethiopia.	Case-control	270 children aged 9-23 months • 90 cases and • 180 controls
Godefay H, Byass P et al, 2015[19]	To characterize individual risk factors for maternal mortality in Tigray, Ethiopia.	Case-control	The sample size was 310 • 62 cases and • 248 controls from six randomly-selected rural districts
Zepre K and Kaba M, 2017[22]	To assess the current BPCR practice and determine associated factors among rural women of reproductive age in Abeshige district, Guraghe zone, SNNPR, Ethiopia	Cross-sectional	454 women who delivered within 12 months prior to this survey
Negero MG. et al, 2018[20]	To assess Skilled delivery service utilization and its association with the establishment of Women's Health Development army	Cross-sectional	748 reproductive-age women who gave birth in 1 year preceding the study in 380 clusters of WDA were included
Girmaye M. and Berhan Y.[21]	To assess Skilled ANC service utilization and its association with the establishment of	Cross-sectional	748 reproductive-age women who gave birth in 1 year preceding the study

	Women's Health Development army		
Jackson R. and Hailemariam A., 2016[23]	To examine the barriers and facilitators for HEWs as they refer women to mid-level health facilities for birth.	Qualitative	45 HEWs, 14 women extension workers (employed by Afar Pastoralist Development Association, Afar Region) and 11 other health workers from health centers, hospitals or health offices.
Jackson R. Tesfay FH. et al, 2017[24]	To document factors that hinder or enable strategies to reduce the first and second delays of the Three Delays in rural and pastoralist areas in Ethiopia	Qualitative	A key informant study was conducted with 44 HEWs in Afar, SNNP, and Tigray Regions
Jackson R. Tesfay FH. et al, 2016[25]	To explored HEWs' and mother's attitudes to maternal health services in Adwa Woreda, Tigray Region.	Qualitative	45 women were interviewed
Kok MC. et al., 2015[26]	To understand how relationships between HEWs, the community and health sector were shaped, in order to inform policy on optimizing HEW performance in providing maternal health services.	Qualitative	14 FGDs with HEWs, women and men from the community and 44 semi-structured interviews with HEWs; key informants working in program management, health service delivery and supervision of HEWs; mothers; and traditional birth attendants.

Reporting checklist for systematic review and meta-analysis.

Based on the PRISMA guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

Upload your completed checklist as an extra file when you submit to a journal.

In your methods section, say that you used the PRISMA reporting guidelines, and cite them as:

Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement

		Reporting Item	Page Number
	#1	Identify the report as a systematic review, meta-analysis, or both.	1
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
Rationale	#3	Describe the rationale for the review in the context of what is already known.	4-5
Objectives	#4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	6
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 the registration number.	

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 rational	6
Information sources	#7	Describe all information sources in the search (e.g., databases with dates of coverage, contact with study authors to identify additional studies) and date last searched.	6
Search	#8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	6
Study selection	#9	State the process for selecting studies (i.e., for screening, for determining eligibility, for inclusion in the systematic review, and, if applicable, for inclusion in the meta-analysis).	7-8
Data collection process	#10	Describe the method of data extraction from reports (e.g., piloted forms, independently by two reviewers) and any processes for obtaining and confirming data from investigators.	9
Data items	#11	List and define all variables for which data were sought (e.g., PICOS, funding sources), and any assumptions and simplifications made.	
Risk of bias in individual studies	#12	Describe methods used for assessing risk of bias in individual studies (including specification of whether this was done at the study or outcome level, or both), and how this information is to be used in any data synthesis.	
Summary measures	#13	State the principal summary measures (e.g., risk ratio, difference in means).	
Planned methods of analyis	#14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I2) for each meta-analysis.	9
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).	
Additional analyses	#16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	
Study selection	#17	Give numbers of studies screened, assessed for eligibility, and	7-8

		included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	
Study characteristics	#18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citation.	10
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).	
Results of individual studies	#20	For all outcomes considered (benefits and harms), present, for each study: (a) simple summary data for each intervention group and (b) effect estimates and confidence intervals, ideally with a forest plot.	10-14
Synthesis of results	#21	Present the main results of the review. If meta-analyses are done, include for each, confidence intervals and measures of consistency.	10-14
Risk of bias across studies	#22	Present results of any assessment of risk of bias across studies (see Item 15).	
Additional analysis	#23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	
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., health care providers, users, and policy makers	10-14
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).	16
Conclusions	#26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	15-16
Funding	#27	Describe sources of funding or other support (e.g., supply of data) for the systematic review; role of funders for the systematic review.	17

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Contribution of women's development army to maternal and child health in Ethiopia: A systematic review of evidence

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Abstract

Objective: the aim of this review was to identify, appraise and synthesize studies that reported on the contribution of women's development army to maternal and child health development.

Setting: studies conducted in Ethiopia 2010 onwards and published in English were considered.

Data Sources: evidence were searched in MEDLINE, CINAHL, and EBSCOhost from 25 March to 10 April, 2018.

Eligibility Criteria: both quantitative and qualitative studies assessing the contribution of women's development army to maternal and child health were considered.

Data Extraction and Synthesis: Two independent reviewers have extracted data using pre-planned data extraction tool separately for each study design. Findings were synthesized using tables and narrative summary.

Outcome: maternal and child health services; maternal and child mortality.

Results: nine studies met the inclusion criteria and used for synthesis. The results revealed that participation and membership in women's development tems have a positive effect on minimizing maternal death and improving child immunization service use. Skilled delivery and antenatal care service use were higher in women's development teams located within two kilometers radius from health facilities. These groups were also the main sources of information for mothers to prepare themselves for birth and related complications. Moreover, well-established groups have strengthened the linkage of the health facility to the community so that, delays in maternal health service use were minimized; health extension workers could effectively refer women to a health facility for birth; and utilization of skilled birth service was improved.

Conclusion: voluntary health service intervention in Ethiopia has improved maternal and child health services' outcome. A decrease in maternal deaths, increase in antenatal and delivery service use and improved child immunization service uptake are attributable to this intervention. This linkage between community members and the primary health care system served as an effective and efficient mechanism to share information.

Keywords: Women's development army, Maternal and child health, Ethiopia

Article summary

Strengths and limitations of this study

- The review has used two independent reviewers who rigorously search and review published materials. Furthermore, a third reviewer was participated during disagreements arise between the two reviewers.
- The review has used structured procedure during literature search, appraisal, data collection and synthesis
- Despite the strengths described above, we have not conducted meta-analysis due to heterogeneous types of study designs and population included in this review
- We have included only full text articles found free online.

Introduction

Evidence from various countries in the world disclosed that community volunteers' health service intervention has shown significant health impact.[1,2] They accomplish various functions related to health service delivery. In fact, usually, they do not have formal professional or paraprofessional education and can be involved in voluntary care. They intervene in health care after attending job-related pieces training. These community health volunteers have different names in different settings, for example, lay health workers, community health workers, and unpaid community volunteers.[3,4]

Community health volunteers have great importance, especially in less developed countries, so as to overcome the increasing demand for health care services and the shortage of formal health care providers.[5] After Alma Ata declaration of Primary Health Care (PHC), community involvement in the health care was given due attention in order to improve wide access and acceptance of the services by service users and the community at large. It is believed that problems cannot be solved from only the side of service providers and programmers. Moreover, it is a good strategy to mobilize resources relevant to health services.[6–8]

These health interventions using community volunteers have a sort of structure in some countries and unstructured in others.[1,5] Some nations linked the service under their PHC structure. Ethiopia is a good example of well-structured community health interventions. The primary health care unit (PHCU) is in the front line to PHC in the country. This system encompasses five satellite health posts (the lowest village-level health service facility) and a referral health center (HC). In the countries health care system, PHC is administered and the services facilitated in this point.[9] So as to address the deficit in human resources for health, Ethiopia launched the community health extension program (HEP) in 2004. It was implemented by establishing a health post and positioning two female health extension workers (HEWs) in every *kebele* (the smallest administrative division in Ethiopia). The HEP was launched to improve access to preventive, essential health services and to create a healthy environment. This program works to increase and sustain preventive health actions and health awareness. HEP has sixteen packages divided into four major categories.[9–11]

Six years after its introduction in 2010 a new innovative approach, Women's Development Army (WDA) was linked with HEP. The women's development army is a structural arrangement that involves women's development team (WDT) and one-to-five connections. One-to-five connections involve six household with in the same neighborhood. A women who knows 16 packages of HEP and practice them all is chosen as a leader to serve five households. A household that implemented the 16 packages of HEP recognized as a model family. Five to six one-to-five connections together formulate a WDT, that mens 30 to 36 households in the same neighborhood constitute a WDT. Similar procedure followed to select the leader of WDTs in addition to says of members. They serve as volunteers.[12] This structure has various development roles, from which health is the major one.[9] At the community level, members of the community linked with the PHC system through this strategy.[13] It was adopted based on the experience that using a network of the community health volunteers increased the efficiency of HEWs in reaching households with actionable health messages. leader.[10,14,15]

The WDT's developmental works are monitored in a meeting every two weeks by a command post formulated at the *kebele* level which is led by the *kebele* leader. The development team leaders undertake similar follow-up to the one-to-five networks.[9] WDTs and the leaders of one-to-five network selected with full participation of the members. Their trustworthiness to the team members and being model family are considered as criteria for selection.[16]

Health extension workers in collaboration with *kebele* administration and personnel from other developmental sectors (the agricultural and educational) facilitate the formation of the WDTs and one-to-five networks. These unpaid health volunteers, WDT leaders, undertake various preventive and promotive health services in collaboration with HEWs. They carry out a number of tasks, including, support during health information delivery programs, keeping track of pregnancies and illnesses, helping during immunization campaigns, and transmitting messages between households and HEWs.[9,10]

The WDA's contribution can be related to maternal and child health indicators as consecutive Ethiopian demographic and health surveys indicated. For instance, maternal death was 673 in 2005 and 676 in 2011 per 100 000 live births. However, it became 412 in 2016, note that WDA structure was introduced in Ethiopia in 2010. Under 5 mortality was also decreased from 88 in 2011 to 67

in 2016. Maternal health services have shown a massive increase during these points as compared to prior years. ANC increased from 28% in 2005 to 34% in 2011 and 62% in 2016. Institutional delivery increased from 5% in 2005 to 10% in 2011 and 26% in 2016. Postnatal care (PNC) was also increased from 5% in 2005 to 8% in 2011, and 17% in 2016.[17–20] These figures indicated that there is an impressive improvements in maternal and child health and service use after the introduction of WDA in the country.

The Ethiopian unpaid community health intervention has a unique structural arrangement. It is included in various development sectors' strategic plan.[14] Some evidence claim that the program has variations in aims, goals, and experiences among various players included and suggests further researchers.[21] This review aimed to assess the contribution of this structured community involvement in maternal and child health and service use.

Methods

Search Strategy

The search strategy targeted to find both published and unpublished studies. A step by step search strategy was utilized in this review. Primarily, major databases that comprise health system research including MEDLINE, CINAHL, and EBSCOhost were utilized. Unpublished works were also searched from ProQuest Dissertations and Theses and Google Scholar. Afterward the reference list of all identified reports and articles were searched for additional studies. Key words initially used were: community health workers, community volunteer, women's development army, women's development group, women's development team, health development team, lay health workers, health development army, Ethiopia, maternal health, child health, and maternal health services. Extracted references were downloaded and stored into Mendeley reference manager file. MEDLINE (on PubMed platform) search strategy is included in supplementary file I.

To guide the overall review, PRISMA flow diagram was used (Figure 1).[22] Starting from identification of records up to the inclusion of the relevant literature for the review question were documented to comprehensive and accurate reporting.

Inclusion and exclusion criteria

Both quantitative and qualitative studies were included in this review regardless of their study design, given they included women in reproductive age group (14-49 years) and children less than five years of age for both sexes. To be considered the studies should have evaluated the effect of women's development army, and participation in the group on maternal mortality, maternal and child health service use. These are major intervention areas of WDAs regarding maternal and child health. Moreover, studies conducted in Ethiopia, 2010 (a year when WDA was introduced in Ethiopia) onwards and published in English language were considered for inclusion in this review. We have excluded narrative summaries, case reports and technical reports.

Description of studies

Eleven potentially relevant studies were found with a free search in google scholar and google search bars in addition to the three hundred fifty-two studies identified in database searches. A total of 299 articles were eligible for primary examination after duplications were removed. On reviewing titles and abstracts against the review objectives and inclusion criteria, 276 studies were excluded. The full text of the remaining 23 studies was then retrieved for detailed examination and 9 were excluded. Afterward 14 studies were assessed for methodological quality. The quality assessment was done by two independent reviewers for methodological validity prior to inclusion in the review using standardized critical appraisal instruments from the Joanna Briggs Institute.[23–25] Disagreements that arise between the reviewers were resolved through discussion, and with the participation of a third reviewer. After the appraisal, five studies that did not meet the minimum requirements of methodological appraisal tools were excluded and nine were finally reviewed.

Patient and Public Involvement

Patients and/or public were not involved in this review.

Data collection

Before data collection all titles and abstracts of the searched pieces of literature were assessed for potential relevance, and those records deemed not relevant were verified. Later on, full-text reports were assessed for eligibility. In the cases we fail to get articles free online, we tried to obtain full texts from research-gate[26] authors' pages and we obtained three. Reports that are co-publications or multiple reports of the same study were identified. The eligibility criteria were applied to all reports. Only evidence thoughtful of the review's eligibility criteria were included. Studies that

fulfilled more than 70% of the critical appraisal checklists' requirements were selected to be included in the review (Supplementary file II).

Two independent reviewers collected information relevant for the review. Data extraction was for quantitative and qualitative studies separately using pre-designed checklists (Supplementary file III). The extracted data have included specific details about the interventions, populations, study methods and outcomes of significance to the review question and objectives (Supplementary file IV).

Data synthesis and analysis

Findings from the included studies were synthesized using tables and a narrative summary. Meta-analysis was not possible since the included studies were heterogeneous in terms of the populations, methods and outcomes. We have categorized the results into participation in WDTs, distance of WDTs from health facility and effective functioning of WDTs. When we categorize the synthesis into these three parts we put a base on some major principles of PHC and their effectiveness. Access to basic preventive and promotive health care, active participation of the community in their health issues and effectiveness of the system.[27]

Results: Findings of the Review

We have included a total of nine studies, that meet the requirements of critical appraisal checklists, regardless of their study design. These studies met the critical appraisal requirements of more than 70% (Supplementary file IV). The review comprised both observational and qualitative studies. The studies were conducted on various maternal and child health issues including child immunization, maternal mortality, birth preparedness and complication readiness (BPCR), skilled delivery, antenatal care (ANC), linking pregnant women with health facilities for delivery, delays on maternal health services and community relationships with health extension workers and health sector (Table 1).

Table 1: Characteristics of included studies for review

Category	Sub-category	Frequency	Percentage (%)
Study design	Cross-sectional	3	33.33
	Case-control	2	22.22
	Qualitative	4	44.44
Year of publication	2015	2	22.22
	2016	3	33.33
	2017	3	33.33
	2018	1	11.11
Addressed maternal and child health issue	Skilled maternal health service use	3	33.33
	Relationship of community with health sector	3	33.33
	Child immunization	1	11.11
	Maternal mortality	1	11.11
	BPCR	1	11.11

Narrative synthesis

Participation in WDTs

We found two studies that focused on participation in WDTs. Aregawi et al,[28] studied 270 children ages between 9 and 23 months for immunization status with case control method. Of total 270 children 90 were in case group (children who default from immunization program) and 180 were from control group (children who have taken all recommended vaccines). Only 14 (15.6%) children from case group were from mothers who have good participation in WDT and 76 (84.4%) from poor participant mothers. Godefay et al.,[29] on the other hand study focused on maternal mortality. Out of 310 mothers 62 died and 248 were alive. Out of 62 dead mothers 40 (64.5%) were members of WDTs and from 248 alive mothers 197 (79.4%) were members of WDTs. This shows that more women (30.7%) who died and less women (22.6%) who were alive were not members of WDTs. In both categories, the majority of the mothers were members of WDTs. However, the proportion of alive mothers outweigh the dead ones.

Results from statistical analysis revealed that participation in WDTs has positive effect on both child immunization and maternal survival. Poor participation in women's developmental groups [AOR = 3.3,95%CI 1.54±7.08] is a determinant for defaulting immunization among children aged between 9 and 23 months. Similarly, women who were not members of the voluntary women's development army were more likely to experience maternal death [OR 2.07, 95%CI 1.04–4.11] (Table 2).

Table 2: Evidence summary of the effect of participation in women's development group on maternal and child health service

Author, year	Target population	Study design	Outcome	Result
Aregawi HG, Gebrehiwot TG et al, 2017[28]	Children aged between 9 and 23 months	Case control	Default from immunization among children aged between 9 and 23 months	Poor participation in WDGs (AOR = 3.3,95%CI 1.54±7.08) is a determinant for defaulting

Godefay H, Byass P et al, 2015[29]	Mothers in reproductive age group	Case control	Maternal mortality	Women who were not members of WDG were more likely to experience maternal death (OR 2.07, 95%CI 1.04–4.11)

Distance of WDTs from health facility

In relation to the distance of WDTs from health facility, we have found two studies by Negero MG. et al[30] and Girmaye M. and Berhan Y.[31] The first study has evaluated skilled delivery attendance and the second one ANC service use. Both studies totally assessed 748 reproductive-age women who gave birth in 1 year preceding the study in 380 clusters of WDT. In the study by Negero MG. et al,[30] 336 (45%) of women have received skilled delivery care. While 531 (71%) of the participants received skilled ANC service at least once, as indicated in the other study.[31] In both studies a significant heterogeneity was observed between WDT (clusters) for skilled delivery care service utilization which explains about 62% of the total variation. Even if the distance of WDTs within 2 km radius from the nearest health facility was in both studies, the adjusted odds ratio result has shown strong association with ANC service utilization [AOR=8.28; 95%CI, 1.08-62.20] as compared to skilled delivery care [AOR (95% CI) 6.03 (1.92, 18.93)] (Table 3).

Table 3: Evidence summary of the effect of women's development groups' distance from health facility on maternal health service

Author, year	Target population	Study design	Outcome	Result
Negero MG, Mitike YB, et al, 2018[30]	Reproductive-age women who gave birth in 1 year	Cross-sectional	Skilled delivery service utilization	The distance of WDTs within 2 km radius from the nearest health facility was significantly

	preceding the study			associated with skilled delivery service use [AOR (95% CI) 6.03 (1.92, 18.93)]
Girmaye M. and Berhan Y., 2016[31]	Reproductive-age women who gave birth in 1 year preceding the study	Cross-sectional	Skilled antenatal care utilization	Distance of WDT within 2 km radius from the nearest health facility was significant predictor of skilled ANC service utilization [AOR=8.28; 95%CI, 1.08-62.20]

Effective functioning of WDTs

When WDTs and one-to-five connections perform what they are intended to do effectively, good improvements were seen. In a study by Zepre K. and Kaba M.,[32] birth preparedness and complication readiness of pregnant women was assessed. From 454 pregnant women, 44 were members of one-to-five connections. Sixty eight percent got information from their network and prepared for birth and its complications as compared to 34% among non members. There was also a statistically significant association between effective information delivery in one-to-five connection and BPCR [OR 2.52, 95% CI 1.17, 5.39]. Whereas, performance of WDTs has no significant effect on skilled delivery service and ANC service utilization in two studies by Negero MG. et al[30] and Girmaye M. and Berhan Y.[31]

A strong and functional relationship between WDTs and HEWs is one aspect of good functioning WDT. Regarding this we have reviewed four studies. A study by Jackson R. and Hailemariam A.[33] has assessed the role of HEWs in linking pregnant women with health facilities for delivery. Two studies by Jackson R., Tesfay FH. et al[34,35] aimed to document the factors that hinder or enable strategies to reduce the first and second delays of the three delays in rural and pastoralist areas in Ethiopia; and exploring health extension workers' and mothers' attitudes to maternal health service

utilization and acceptance. Another study by Kok MC. et al.[36] has addressed health extension workers' relationships with the community and health sector in Ethiopia: opportunities for enhancing maternal health performance.

A well established WDA structure has facilitated the linkage and relationship between the health system and mothers.[33–36] Support from a well established WDTs enabled HEWs to effectively refer more women to give birth in health facilities. Moreover, initiatives to reduce delays in maternal health service use were effective with the support of WDTs. HEWs easily get information about the date of delivery of each meamber of women in the community through HDTs so that, they facilitate transportation and additional services to a health facility.[34,35] These relationships have increased skilled birth attendance in many parts of the country. In general, WDTs are serving as a liasing agent in the community to link the health system with mothers and children in the community.[35,36] (Table 4).

Table 4: Summary of evidence in the effect of women's development army's effective functioning on maternal health services

Author, year	Target population	Study design	Outcome	Result
Zepre K and Kaba M, 2017[32]	Pregnant women	Cross-sectional	Birth preparedness and complication readiness	Those who got information from their one-to-five connections are more likely to prepare for birth and its complications (OR 2.52, 95%CI 1.17, 5.39)
Jackson R. and Hailemariam A., 2016[33]	Pregnant women	Qualitative	Linking pregnant women with health facilities for delivery	HEWs can effectively refer more women to give birth in health

				facilities when the WDA is well functioning.
Jackson R., Tesfay FH. et al, 2017[34]	Pregnant women	Qualitative	Delays in maternal health service use	Initiatives to reduce delays can improve access to maternal health services, especially when HEWs are supported by the WDA.
Jackson R., Tesfay FH. et al, 2016[35]	Mothers and HEWs	Qualitative	Maternal health service utilization and acceptance	With the support of WDGs, HEWs have increased the rate of skilled birth attendance
Kok MC., Kea AZ; et al., 2015[36]	Mothers and HEWs	Qualitative	Relationship of community with HEWs and Health sector	The WDA supported HEWs in liaising with community members

Discussion

The main objective of this systematic review was to identify, appraise and synthesize studies that reported on the contribution of Ethiopian innovative women's voluntary health intervention's (women's development army's) contribution to maternal and child health development. The major activity of this structure is supporting the primary health care intervention under the health extension program.[37,38] Most probably this is the first systematic review that synthesized information on women's development army and its contribution. Nine studies were assessed and all of them revealed that women's development army has contributed for the improved maternal and child health, and health service use. The evidence have shown that the benefit of WDA was obtained through participation in the group,[28,29] closeness of the groups to health facilities[30,31] and their effective functioning.[32–36]

Despite the fact that Ethiopian female community health intervention has special features, unpaid community health intervention has been used in various countries to improve population's health.[15] As various findings indicated it is a cost-effective measure, especially in low income countries with low access to health services. They applied this strategy to curve the disastrous shortfalls in the health workforce and to improve community ownership.[39–42]

Women in a village level are expected to be a part and actively participate in to one-to-five connection under the WDTs. By doing so they can easily obtain information, care and support from the primary health care structure.[16,21] Involving community members in health services brings about an improvement of health service use and health status of the community.[10,43,44] Low level of default from immunization was found among children whose mothers have good experience of participating in WDTs. Those who were not members of WDTs are more than three times more likely to default from the service as compared to those included.[28] Community involvement in vaccination programs for children was found effective in many low and middle income countries.[45,46] For example, two systematic reviews focused on low income population revealed, participation of community health workers has improved child immunization.[47,48] Their involvement lets the community participate in decision making and improves their knowledge, so that ownership improved.[49]

Participation in WDTs in Ethiopia minimized maternal deaths. Women who are not members of WDTs are two times at risk of experiencing maternal death in the study area.[29] Participating

community members has a positive effect on mothers' survival.[50] Moreover, the Ethiopian WDT involvement resulted in improved birth preparedness and complication readiness.[32] Community health participation in India has also significantly minimized maternal death.[51] This implied those who took part in promoting health with WDTs could improve their health literacy and developed a good attitude towards the use of maternal health services.

The other major issues regarding WDA's contribution to maternal health and health service use is the distance from health facilities in reference to their meeting area. When the distance became beyond two kilometers from the nearest health center or hospital, members were less likely to use ANC and delivery service as compared to their counterparts.[30,31] As the meeting area of WDTs became nearer to health facilities, HEWs and health professionals from health facility can easily supervise and support the members during their meeting. Even if many national and international policy documents have given due concern for physical access to improve maternal health service use,[14,52,53] still the problem prevails in many low and middle-income countries.[54–57] This concern is also experienced by WDTs in Ethiopia.

Although there is some information that revealed the performance of WDTs does not have anything in improving maternal health service use,[30,31] there are an ample of evidence that showed effective functioning and well performing of these groups resulted in improved maternal health and health service use.[32–36] In the previous studies, performance of the groups was measured by traditional ways of performance measurement at the village level. The performance measurement ways, measurement indicators, and evaluators may not be effective in measuring the actual performance of the groups. Other evidence revealed that well-performing WDTs facilitated the linkage between mothers and the primary health care system. As a result, service utilization and acceptance were improved.[33–35] Although the performance measurement ways differ in diverse settings, good performing community health interventions succeeded in improving maternal and child health development in low-income countries.[58–60] As a result, countries tend to improve the performance of their community health practitioners.[61,62] These findings add to the growing body of evidence that health workers at the community level can work with women's groups to improve maternal health, thus reducing the need for emergency obstetric care in low-income countries.

On top of this, strongly operating WDTs and their linkage with the primary health care system ease the health service practitioners, especially HEWs effort to refer significant amount of women

to give birth in health facilities.[33] HEWs are required to deliver health information and other health service packages to the community.[63,64] These health workers are using the WDA structure as a perfect strategy to share information and create linkage with the community members at the household and individual level.[36] By doing so they could deliver the services effectively. Moreover, this voluntary system is serving as an initiative to reduce delays in maternal health services use.[34]

Several improvements were exhibited on maternal and child health indicators in Ethiopia in the past decade. Even though we can not hide the contribution of other interventions for the achievements, WDA's contribution has accelerated the improvements.

Limitations of the Review

A potential limitation of the present review might be, we have not conducted meta-analysis due to heterogeneous types of study designs and population included in this review. Furthermore, we have included only full-text articles found free online.

Conclusions

The results from the review have indicated that the WDA structure has contributed for the improvement of maternal and child health and service use in many ways. Being a member of a WDG and one-to-five connection under the group, has a positive effect on child immunization service use, minimizing maternal mortality, birth preparedness and complication readiness, skilled delivery, skilled ANC and minimizing delays to use maternal health service. Moreover, it was found an effective and efficient mechanism to share information to the community as well as to create links between the communities and the primary health care system.

Implication for practice

The government is required to continue the existing achievements regarding WDA's contribution for maternal and child health services utilization. Again responsible bodies at each level in the structure of Ethiopian health care system have to extend the benefits from WDA to other health issues in addition to the maternal and child health.

Periodic measurement and improvement of performance advances the benefit of WDTs to maternal and child health and service use.

Since the distance of existing WDTs from health facilities is an important determinant for maternal health service utilization, the government is supposed to establish new health facilities as near as possible to the population and organize the community living around health facilities into WDTs. Government also should improve other infrastructure like all weather roads, and transportation. Moreover, HEWs and health professionals from health facilities are expected to support and supervise WDTs far away from health facilities.

Implications for research

Although there are some studies regarding WDA, still there is a paucity of literatures. Therefore, researchers are responsible to conduct various inquiries on the issue.

Moreover, researchers are supposed to examine the WDA's contribution to other health issues in addition to maternal and child health service use.

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Author Contributions: KY and MS conceived the papers, and written protocol for the systematic review. KY and GA searched articles, extracted data, analyzed data, drafted the first version of this paper and finalized the final version. KY, GA and MS have written and revised the manuscript.

A patient consent form: not required

Data statement: all relevant data are provided in the paper and supplementary files. Additional details can be provided by the author on request.

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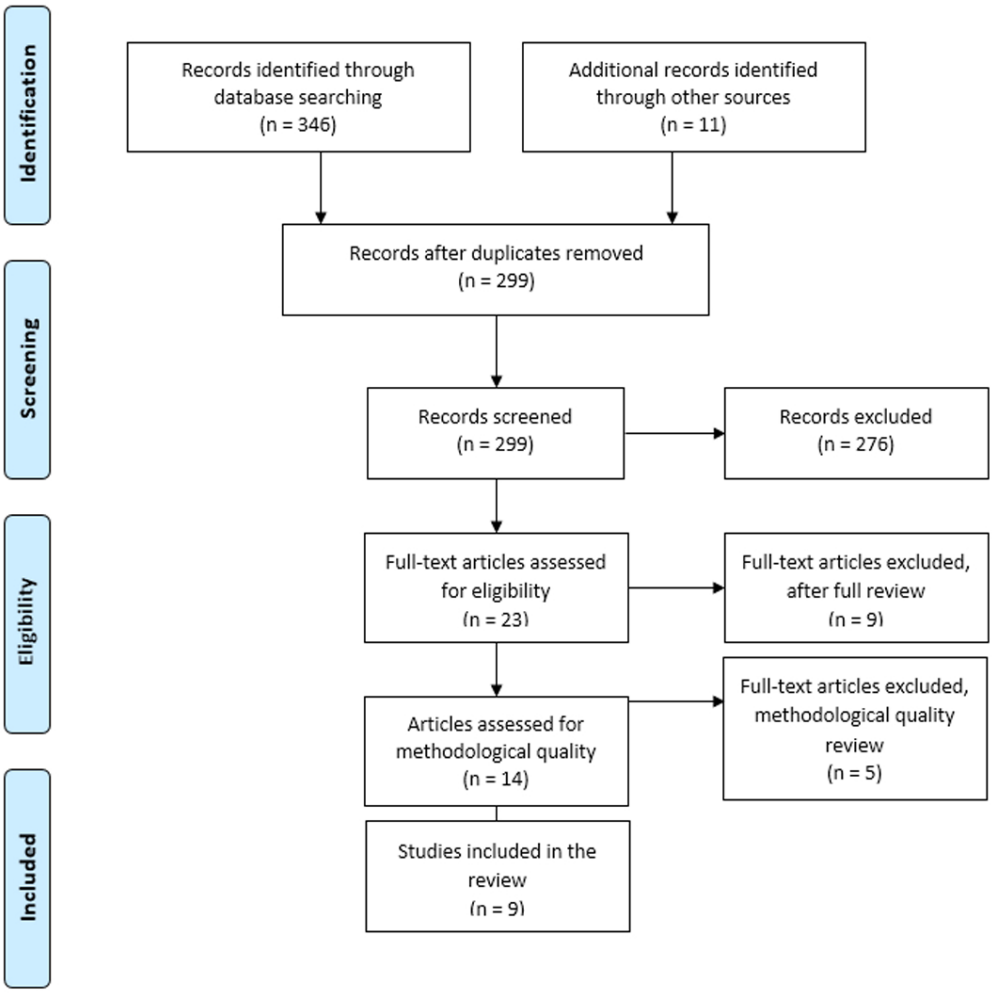
Figure legend:

Figure 1: Literature search and screening



Literature search and screening

90x90mm (300 x 300 DPI)

Supplementary file I: Search strategy

Search	Query
#1	Search (((((((community health workers) OR community volunteer) OR women's development army) OR women's development team) OR health development team) OR lay health workers) OR health development army
#2	Search ((((maternal health) OR maternal health service) OR child health) OR child health service) OR health
#3	Search Ethiopia
#4	#1 AND #2 AND #3
#5	Limit to: Full text
#6	Limit to: Publication date from 2010/01/01 to 2018/12/31
#7	Limit to: English language

Supplementary file II: Critical appraisal result

Case control

Studies	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Total
Aregawi HG. et al[18]	U	Y	Y	Y	Y	Y	Y	Y	U	Y	8 Y 2 U
Godefay H, Byass P et al[19]	U	Y	Y	Y	Y	Y	Y	Y	U	Y	8 Y 2 U

Cross-sectional

Studies	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Total
Haile F. et al[43]	Y	Y	N	Y	Y	Y	U	Y	5 Y 2 N 1 U
Negero MG. et al [20]	Y	Y	U	Y	Y	Y	Y	Y	7 Y 1 U
Zepre K. et al[22]	Y	Y	Y	Y	Y	Y	U	Y	7 Y 1 U
Girmaye M. and Berhan Y.[21]	Y	Y	Y	Y	Y	Y	U	Y	7 Y 1 U

Qualitative

Studies	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Total
Banteyerga H.[44]	Y	U	Y	Y	Y	N	N	Y	N	Y	6 Y 3 N 1 U
Maes K. et al[15]	U	U	U	U	U	N	N	Y	Y	U	2 Y 2 N 6 U
Sako B. et al[45]	Y	Y	Y	Y	Y	N	N	Y	Y	Y	8 Y 2 N

Jackson R., Hailemariam A. et al.[23]	U	Y	Y	Y	Y	N	N	Y	Y	Y	7 Y 2 N 1 U
Jackson R., Tesfay FH., Gebrehiwot TG. et al[24]	Y	Y	Y	Y	Y	N	N	Y	Y	Y	8 Y 2 N
Jackson R., Tesfay FH., Godefay H. et al [25]	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	9 Y 1 N
Kok MC., Kea AZ. et al[26]	Y	Y	Y	Y	Y	N	N	Y	Y	Y	8 Y 2 N
Maesa K., Closser S. et al[16]	U	Y	Y	Y	Y	N	N	U	Y	Y	6 Y 2 N 2 U

Y: Yes; N: No; U: Unclear

Supplementary file III: Data extraction checklist

Qualitative

Study ID	Study Design	Population	Phenomenon of interest	Outcome	Remark

Quantitative

Study ID	Study Design	Population	Outcome	Result	Remark

Supplementary file IV: Table of included studies

Study	Purpose	Study design	Participants and sample size
Aregawi HG, Gebrehiwot TG et al, 2017[18]	To identify the determinants of defaulting from child immunization completion among children aged 9-23 months in the Laelay Adiabo District, North Ethiopia.	Case-control	270 children aged 9-23 months • 90 cases and • 180 controls
Godefay H, Byass P et al, 2015[19]	To characterize individual risk factors for maternal mortality in Tigray, Ethiopia.	Case-control	The sample size was 310 • 62 cases and • 248 controls from six randomly-selected rural districts
Zepre K and Kaba M, 2017[22]	To assess the current BPCR practice and determine associated factors among rural women of reproductive age in Abeshige district, Guraghe zone, SNNPR, Ethiopia	Cross-sectional	454 women who delivered within 12 months prior to this survey
Negero MG. et al, 2018[20]	To assess Skilled delivery service utilization and its association with the establishment of Women's Health Development army	Cross-sectional	748 reproductive-age women who gave birth in 1 year preceding the study in 380 clusters of WDA were included
Girmaye M. and Berhan Y.[21]	To assess Skilled ANC service utilization and its association with the establishment of	Cross-sectional	748 reproductive-age women who gave birth in 1 year preceding the study

	Women's Health Development army		
Jackson R. and Hailemariam A., 2016[23]	To examine the barriers and facilitators for HEWs as they refer women to mid-level health facilities for birth.	Qualitative	45 HEWs, 14 women extension workers (employed by Afar Pastoralist Development Association, Afar Region) and 11 other health workers from health centers, hospitals or health offices.
Jackson R. Tesfay FH. et al, 2017[24]	To document factors that hinder or enable strategies to reduce the first and second delays of the Three Delays in rural and pastoralist areas in Ethiopia	Qualitative	A key informant study was conducted with 44 HEWs in Afar, SNNP, and Tigray Regions
Jackson R. Tesfay FH. et al, 2016[25]	To explored HEWs' and mother's attitudes to maternal health services in Adwa Woreda, Tigray Region.	Qualitative	45 women were interviewed
Kok MC. et al., 2015[26]	To understand how relationships between HEWs, the community and health sector were shaped, in order to inform policy on optimizing HEW performance in providing maternal health services.	Qualitative	14 FGDs with HEWs, women and men from the community and 44 semi-structured interviews with HEWs; key informants working in program management, health service delivery and supervision of HEWs; mothers; and traditional birth attendants.

Reporting checklist for systematic review and meta-analysis.

Based on the PRISMA guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

Upload your completed checklist as an extra file when you submit to a journal.

In your methods section, say that you used the PRISMA reporting guidelines, and cite them as:

Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement

		Reporting Item	Page Number
	#1	Identify the report as a systematic review, meta-analysis, or both.	1
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
Rationale	#3	Describe the rationale for the review in the context of what is already known.	4-5
Objectives	#4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	6
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 the registration number.	

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 rational	6
Information sources	#7	Describe all information sources in the search (e.g., databases with dates of coverage, contact with study authors to identify additional studies) and date last searched.	6
Search	#8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	6
Study selection	#9	State the process for selecting studies (i.e., for screening, for determining eligibility, for inclusion in the systematic review, and, if applicable, for inclusion in the meta-analysis).	7-8
Data collection process	#10	Describe the method of data extraction from reports (e.g., piloted forms, independently by two reviewers) and any processes for obtaining and confirming data from investigators.	9
Data items	#11	List and define all variables for which data were sought (e.g., PICOS, funding sources), and any assumptions and simplifications made.	
Risk of bias in individual studies	#12	Describe methods used for assessing risk of bias in individual studies (including specification of whether this was done at the study or outcome level, or both), and how this information is to be used in any data synthesis.	
Summary measures	#13	State the principal summary measures (e.g., risk ratio, difference in means).	
Planned methods of analyis	#14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I2) for each meta-analysis.	9
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).	
Additional analyses	#16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	
Study selection	#17	Give numbers of studies screened, assessed for eligibility, and	7-8

		included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	
Study characteristics	#18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citation.	10
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).	
Results of individual studies	#20	For all outcomes considered (benefits and harms), present, for each study: (a) simple summary data for each intervention group and (b) effect estimates and confidence intervals, ideally with a forest plot.	10-14
Synthesis of results	#21	Present the main results of the review. If meta-analyses are done, include for each, confidence intervals and measures of consistency.	10-14
Risk of bias across studies	#22	Present results of any assessment of risk of bias across studies (see Item 15).	
Additional analysis	#23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	
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., health care providers, users, and policy makers	10-14
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).	16
Conclusions	#26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	15-16
Funding	#27	Describe sources of funding or other support (e.g., supply of data) for the systematic review; role of funders for the systematic review.	17