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Magnitude and associated factors of unmet need for family planning among rural women in Ethiopia: a multilevel analysis

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Abstract

Objective: This study was aimed to assess the magnitude and associated factors of unmet need for family planning among rural women in Ethiopia.

Design: Cross-sectional study.

Setting: Ethiopia.

Participants: Reproductive age group women.

Primary outcome: Unmet need for family planning.

Methods: This study drawn data from 2016 Ethiopian Demographic and Health Survey (EDHS). A total of 8,327 rural reproductive-aged (15-49 years) women were included**.** The multilevel logistic regression model was carried out to identify factors associated with unmet need for family planning. Adjusted odds ratio (AOR) with a 95% CI was used to assess the strength of association between independent and dependent variables.

Results: The overall unmet need for family planning among rural women was 24.08% (95% CI: 23.17, 25.01) of which 14.79% was for spacing and 9.29% for limiting. Women's age (AOR=1.05;

95%CI: 1.04,1.06), number of children (AOR=1.15; 95% CI: 1.07, 1.24), and working status of women (AOR=1.18; 95% CI: 1.02,1.37) were significantly associated with a higher odds of unmet needs for family planning. However, women with primary education (AOR=0.87; 95% CI: 0.74,0.94), women married at age 18 or later (AOR=0.82; 95% CI: 0.70, 0.96), being rich (AOR= 0.77; 95% CI: 0.64,0.94), distance to a health facility not the big problem (AOR=0.85; 95% CI: 0.73, 0.99), women from communities with a high percentage of educated women (AOR=0.73; 95% CI: 0.59, 0.89), and women who live in communities with high media exposure (AOR=0.81, 95% CI: 0.68,0.98) were significantly associated with a lower odds of unmet needs for family planning.

Conclusion: Unmet need for family planning among reproductive-aged women in rural Ethiopia was high. Women's age, number of children, working status of women, women's education, age at first marriage, wealth, distance to a health facility, community women's education, and community media exposure were significantly associated with unmet needs for family planning. Therefore, public health policies and interventions that will strengthen women's education, improve the existing strategies to increase the marital age of women, improve media exposure on family planning issues, and increase the wealth status of a household should be designed and implemented.

Keywords: Unmet need, Family planning, Rural reproductive-aged women, Ethiopia

Strength and limitation of study

- ✓ This study used nationally representative data, which was collected with standard and validated data collection tools.
- ✓ This study used an advanced model that accounts for the correlated nature of the EDHS data in the determination of estimates.

- ✓ The cross-sectional nature of the survey does not show the temporal relationship between independent variables and outcome variable.
- ✓ Additionally, due to the use of secondary data essential factors such as knowledge and attitude of FP methods, fear of side effects, health worker training on FP and men's perspectives on contraceptive use were not available in the EDHS so that it was not possible to incorporate these variables in the analysis.

Background

Improving family planning (FP) is fundamental for Sustainable Development Goal (SDG) goals achievement. It is linked to human rights, gender equality, and empowerment, and has an impact on maternal, newborn, child, and adolescent health. Additionally, it has a role in shaping economic development and environmental and political futures.[1] Although sexual exposure and an expressed intention to avoid pregnancy, millions of women across the developing countries who don't use contraceptives prefer to space or limit the number of their children.[2] This indicates an unsatisfied demand for family planning, which is commonly referred to as unmet need for family planning. It refers percentage of fecund women who are married or living in union and thus presumed to be sexually active but are not using any family planning methods, either want to spacing (when the woman would have wished to delay the birth of her next child by at least 2 years) or limiting births (woman who do not want any more children).[3]

Unmet need for FP is a major public health concern in developing countries particularly in sub-Saharan Africa.[4–7] In developing countries, the unmet need for modern FP methods increased from 225 million in 2014 to 230 million in 2019.[6,7] In Ethiopia, the magnitude of overall unmet needs for family planning varied from 16.2 % to 34.6 % [8–14] with 10.3% to 15.8 for spacing and

6.0 to 9.8 for limiting.[11,13,14] According to the Ethiopian Demographic and Health Survey (EDHS), it declined from 37% in 2000 to 22% in 2016.[3,15] But the unmet need for family planning was a significant disparity in residence and regional states among women in Ethiopia that varied from 19.1% to 28.0% in rural areas and 7.2% to 15.0% in urban areas.[3,14,15] Despite Ethiopia introduced an ambitious community health program, relying on Health Extension Workers to address limited access to health services including family planning in rural areas, women in rural areas have high unmet for FP compared with women in urban areas.[13,14,16,17]

Unmet need for family planning is an essential concept that is largely used for reproductive health policies, as it bears serious consequences for the woman, the child, family, and society as a whole [18]. It has consequences for women, such as unwanted pregnancy, unsafe abortion, closely spaced births, childbearing at a very early age, and physical abuse [18,19], all of which are considered main contributors to preventable high maternal and infant mortality in many low and middle-income countries (LMICs).[18,20] If all women with unmet need for family planning were to use FP, World Health Organization (WHO) estimated that maternal mortality could be declined by one third.[21] Moreover, in Ethiopia, if the unmet need of FP were satisfied more than 1 million under-five death could be prevented and nearly 13, 000 maternal mortalities would be declined over ten years' period.[22] In addition, the use of contraceptives to regulate fertility either for child spacing or limiting childbearing is considered as an effective tool to control population [23,24] and related to high female literacy, gender equality, and poverty [25,26]. For these reasons, responding unmet need for family planning has become a crucial global health priority. Ethiopia has adapted sustainable development goals (SDGs) which has 17 goals, with Goal 3.1 reduce maternal

mortality and goal 3.7 to ensure universal access to reproductive health services including family planning.[27]

Previous studies in Ethiopia[8–14,16,17,28] have assessed factors associated with unmet need for FP such as educational status of the women and their partners, partner attitude towards family planning services utilization, healthcare providers visit, discussion about family planning with their parents, numbers of desired children, place of residence, marital status, previous use of family planning, parity, age at first marriage, media exposure, age, wealth, number of living children visited, and attitude of respondents towards FP use. However, inconsistent results have been reported in different settings in Ethiopia. For example, a study conducted in Debre Berhan town revealed that having a discussion with husband was more likely to have unmet need for FP [9], while a study in Shashemene town and Enemay district observed that lack of discussion between partners was more likely to have unmet need for FP [12,13]. In addition, while numbers of desired children >5 were positively associated with total unmet need in Shire-Enda- Slassie [11], a negative association was observed in Kersa District.[8] These findings indicate that the need to take the context into account when assessing factors associated with unmet need for FP.

Unmet need for FP is also associated with household-level and community-level factors.[24,29] Despite these previous studies in Ethiopia have assessed only individual-level factors and community-level factors remained insufficiently explored. Additionally, unmet need remains high in rural areas, yet there is a scarcity of information on the factors explaining it in rural Ethiopia. Therefore, understanding the factors of unmet need for FP among women residing in rural households will help public health practitioners working in FP programs to the identification,

implementation, and evaluation of evidence-based interventions to tackle the unmet need and expand contraception use by considering the effects of community characteristics.

Methods

Study design period and setting

This study was a cross-sectional study conducted using secondary data collected through 2016 Ethiopian Demographic and Health Survey (EDHS). Ethiopian Demographic and Health Survey (EDHS) drew nationally representative samples for the Ethiopian population which was collected from January 18, 2016 to June 27, 2016. It is the fourth Demographic and Health Survey conducted in Ethiopia and the data obtained from the nine regions and two administrative cities. A detailed explanation of methodological strategies used in the EDHS has been outlined elsewhere.[30]

Data source and extraction

The study used secondary data from the Ethiopian Demographic and Health Survey (EDHS) 2016, which is a nationally representative survey**.** It used a two-stage cluster sampling method in which the first stage, 645 clusters (202 urban areas and 443 rural areas) were randomly selected from the sampling frame (i.e. the 2007 Ethiopian population and housing census) and household listing. The second stage involved a systematic selection of 18008 households from the selected clusters, of which 17,067 were occupied. Of occupied, 16,650 were successfully interviewed. The information we used was related to women of reproductive ages (15-49 years). A total of 15,683 eligible women were identified for the survey, our analysis was restricted to fecund women who are married or living in union and thus presumed to be sexually active living in rural areas. A total of a weighted sample of 8,327 women in reproductive age were included for analysis.

Variables of study

Outcome variable

The main outcome variable was the need for FP where it combined both unmet need for spacing and unmet need for limiting form of unmet need. It refers to the proportion of women who desire to either delay the next pregnancy or limit child birth, but not using any method of contraception. It was a binary variable, women with unmet need for spacing or limiting were recoded as "unmet need", while those using contraception for spacing or limiting or with no unmet need were recoded as "not unmet need".

Independent variables

Based on literature[8–14,16–18,23,24,29,31–37], independent variables included in the analysis are broadly categorized as individual and community-level factors that are associated with unmet need for FP.

Individual-level variables considered in the analysis were age, women's level of education (no education, primary, secondary, and higher), religion (recoded as Muslim, Orthodox, Protestant, and others), education level of husband (categorized as no education, primary, and secondary/higher), marital status (categorized as ever married and never married), working status (not working/working), exposure to the media (radio, magazine/newspaper or television) at least once a week were labeled as 'yes' and those who did not were labeled as 'no', wealth index (poorest and poorer categorized as "poor", middle categorized as "middle" ,and richer and richest categorized as "rich"), number of living children, desired number of children (categorized as <5 and ≥5), age at marriage (categorized as <18 and ≥18 years), pregnancy termination (yes/no), child death (yes/no), visited by field worker (yes/no), Visited health facility last 12

months (yes/no), discussion on women's health care (categorized as women alone, jointly, husband alone and others), and knowledge of ovulatory cycle recoded as "knowledgeable" if they answer correctly (middle of the cycle) and otherwise recoded as "not knowledgeable".

community-level factors such as community wealth, community women educational level, community husband educational level, community media exposure, community working status, and perceived distance to the health facility were defined as the proportion of women in the poorest and poorer quintile, women with a minimum of primary level of education, husband with a minimum of primary level of education, women exposed to at least one type of media; radio, newspaper television, and internet, women who are working and women who perceived distance to a health facility as a problem within a community respectively. Community-level factors, namely, community wealth, community women educational level, community husband educational level, community media exposure were constructed by aggregating individual-level variables into community-level variables. Each aggregated community variables were divided into low and high based on the national median value since they were not normally distributed.

Statistical analysis

All statistical analysis was performed using Stata version 14.0. Sample weighting was done before doing any statistical analysis, to adjust for the non-proportional allocation of the sample to different regions and their urban and rural areas as well as to adjust for the non-response rates. Descriptive statistics using frequency and percentage were used to get an overview of the selected variables. Multilevel logistic regression models were used to estimate the effects of unmet need for FP factors at the two specified levels. It allows for the estimation of valid standard errors by adjusting for the within-cluster correlation of the outcome variable [38].

Four models were fitted. Firstly, model I, the empty or unconditional model, without covariates were performed. This model was used to estimate the random intercept at community and region level and the variation in the odds of unmet need for FP experience between communities. Secondly, model II was constructed by adding individual-level factors. Thirdly, model III was constructed by adding community-level factors. Finally, model IV including both individual-level community-level factors were constructed. Then, the appropriate model was selected using deviance and the model with the lowest deviance was fitted to estimate the association between independent factors and unmet need for FP. In addition, the measure of variance (random effects), which is the measure of residual errors at the individual level and community variation, was reported in terms of the intra-class correlation coefficient (ICC)[38] and proportional change in variance (PCV).[39]

Firstly, bivariable multilevel logistic regression models were fitted and all variables with a p-value < 0.20 at bi-variable analysis were entered into the multivariable analysis. Then multivariable multilevel logistic regression model was performed to control for possible confounders. In multivariable multilevel logistic regression model odds ratios together with 95% CI were calculated and statistical significance was declared at p-value <0.05.

Ethical Consideration

Permission for data access was obtained from Major Demographic and Health Survey program through the online request from http://www.dhsprogram.com.

Patient and public involvement statement

In this study, patients and the public were not involved in the study design or planning of the study. Furthermore, since we used secondary analysis EDHS data patients were not consulted to

interpret the results and were not invited to contribute to the writing or editing of this document for readability or accuracy.

Results

In this study, a total of a weighted sample of 8,327 women in reproductive age were included. The mean age of the study participants was 29.08±7.71 years. Most of them were orthodox (n = 3,262, 39.2%), ever married (n = 8,158, 98.0%), married before 18 years of age (n = 6,193, 75.9%), desire to have five or more children (n = 4,511, 54.2), and were not exposed to media (n = 6,729, 80.2%). Regarding educational status, nearly two-third (n = 5,449, 65.4%) of women and nearly half of their parents (n =3,801, 50.3%) had no formal education (**Table 1**).

Magnitude of unmet for family planning

In this study overall unmet need for FP among rural women was 24.08% (95%CI: 23.17, 25.01) of which 14.79% (95%CI: 14.04, 15.57) was for spacing and 9.29% (95%CI: 8.68, 9.93) for limiting (**Figure 1**).

Factors associated with unmet need for FP.

Random effect model

As presented in table 2, in the null model, about 9.6% of the total variance in the unmet need for FP was at the community level and may be attributable to other unobserved community factors (ICC = 0.096). In the final model (model IV), as indicated by the PCV 17.2% of the variation in unmet need for FP across communities was explained by both individual and community-level factors. Additionally, the final model indicates that the lowest MOR value (1.67) which showed

the effects of community heterogeneity. Model IV with the lowest deviance was used to identify significantly associated factors with unmet need for FP.

Fixed effect model

After adjusting for possible confounders, age, women education level, wealth of household, number of children, age at first marriage, working status, distance from the health facility, community husband education, and community media exposure were significantly associated with unmet need for FP in Ethiopia.

As age of women increases the odds of unmet need for FP increases (AOR=1.05; 95% CI: 1.04,1.06). The odds of unmet need for FP among women who attend primary education was 13% (AOR=0.87; 95% CI: 0.74,0.94) lower as compared with women with no formal education. As number of children increases the odds of unmet need for FP increases (AOR=1.15; 95% CI: 1.07, 1.24). Working status of women also affect unmet need for FP positively (AOR=1.18; 95% CI: 1.02,1.37). Women married at age 18 or later had 18% (AOR=0.82; 95% CI: 0.70, 0.96) lower odds of unmet need for FP as compared to marital age less than 18. Additionally, considering the wealth index, the odds of unmet need for FP among women from richer/richest class was 23% (AOR= 0.77; 95% CI: 0.64,0.94) lower as compared with women from the poorer/poorest class.

Among community factors, the odds of unmet for FP among women complaining about the distance to a health facility as not the big problem was decreased by 15% (AOR=0.85; 95% CI: 0.73, 0.99) compared with their defined counterparts. Moreover, women from communities with high percentage of educated women (AOR=0.73; 95% CI: 0.59, 0.89) was less likely to have unmet need for FP compared with women from communities with a low percentage of educated women. Similarly, this study further reveals that women who live in communities with high media

exposure were associated with decreased odds of unmet need for FP compared to women in the reference category (AOR=0.81, 95% CI: 0.68,0.98) (**Table 2**).

Discussion

This study was conducted to investigate the magnitude and factors of unmet need in FP among rural women in the reproductive age group. This study made contributions to the literature on unmet need for FP since it focused rural women which have high unmet for FP prevalence and has only been covered in few studies on unmet need for FP in the rural areas. Identifying specific factors associated with unmet need for family planning in a rural area has therefore been brought further to the fore of national family planning awareness and improving access to reproductive health services, as this is critical for achieving SDG five.[40] Additionally, this study extended factors associated with unmet need for FP by considering community-level factors that may shape the level of unmet need for family planning in Ethiopia. This provides information on a wider range of factors to be targeted by family planning policymakers in the country.

The current study revealed that 24.08% (95%CI: 23.17, 25.01) of rural women in reproductive age in Ethiopia had total unmet need for FP. The result is lower than a study conducted in Ethiopia,[8–10,12,13] Ghana,[41] and Cameroon.[36] This discrepancy could be explained by the fact that the previous studies conducted in Ethiopia[8–10,12,13] were small scale surveys compared to the EDHS which were nationally representative survey and covered more women in the region. The discrepancy could be due to the differences in studied populations and background characteristics differences among participants. For example, assessing unmet need of long-acting and permanent family planning methods [12] and among young married women [8] in Ethiopia, and unmet need among HIV positive women in Ghana[41] versus assessing unmet need among

reproductive-age group women in our study. From background characteristics differences among participants the proportion of women who were married in this study was 98.0%, and in the Cameroon study, it was 61.1%.[36] Previous study implies that married women had 59% lower odds of unmet need for FP compared to never married women.[24]

However, the magnitude of unmet need for FP in this study was higher than a study conducted in Ethiopia,[11,14] Sudan,[31] Burkina Faso,[18] Malawi,[24] Cameroon,[32] and Nigeria.[29] This variation might be attributed to the differences in study population and study setting. The current study exclusively includes rural women. In most part of Ethiopia, rural residents have usually low health services coverage and decreased awareness of FP due to low education, low socioeconomic status, and have limited access to FP services this may lead to a higher prevalence of unmet need in rural areas. Therefore, this provides information on rural residents to be targeted by family planning policymakers in the country because the high unmet need for FP further exposes women to unintended pregnancies and unsafe abortion which raises the risk of maternal and child death.[18,20,42,43] Another possible explanation for the difference in the prevalence of unmet need could be the difference in the educational level of study participants. For instance, a previous study done in Ethiopia reported that 41.6% of women have no formal education which was lower than that of this study (65.4%). Moreover, a study conducted in Sudan reveals that 51.1% of women were secondary education which was higher than that of the current study (3.6%). Previous literature documented that educational level has a negative relationship with unmet need for FP.[12,13,16,24,28,29,33,44,45] Therefore, expansion of women's education which is currently poor as found in the current study is recommended to increase awareness and to reduce unmet need for FP among women in rural areas. A higher proportion was observed for

unmet need for spacing in comparison with that for limiting (14.79% Vs 9.28%). This finding is in line with other studies conducted in different parts of Ethiopia,[11,13,14] Sudan,[31] and Cameroon [32,36] where unmet need for spacing contributed to a higher proportion of the total unmet need.

In this study age of women was statistically significant that as age of women increased, the magnitude of unmet need also increased. Similarly, a study conducted in Ethiopia[8,11,13] and Malawi[24] reveals that unmet need for family planning was higher among older women than younger women. This could be because older women near to menopause may perceive as low risk to the pregnancy and because of near schooling period among younger creates better awareness on unmet need for FP. Older women are considered to have more children than younger women might be another possible explanation of this association.

In this study, women's education is another most important variable which significantly associated with unmet need for FP. That is women with primary education were less likely to report having an unmet need for FP as compared to women without education. This is congruent with the study conducted in Ethiopia,[12,13,16,28,44] Nigeria,[29] Malawi,[24] Burundi,[45] and LMICs .[33] This might be due to women who attained education are more exposed to family planning through media and other modes of exposure which improves access to FP alternatives and helps them to understand the health benefits of the FP to reduce fertility, maternal and child morbidity and mortality. It suggests that educated women are more likely to gain family planning services because education of women makes them more empowered in decision making regarding contraceptive use.[46] Furthermore, the educational status of women is directly related to economic and social empowerment which increased exposure to resources such as access to media and utilization of desired health care delivery services. Our study contradicts the finding

of studies conducted in Ethiopia,[14,44] Sudan,[31] Burundi,[45] Nigeria,[34] Kenya,[47] and Nepal,[48] which have reported educated women coincides with higher odds of unmet need for FP. These findings indicate that the need to take the context into account when assessing factors associated with unmet need for FP.

A lower proportion of unmet need for FP was observed among women in the rich wealth quantile. Results of this study show that women who were in the rich wealth quintile were 23% less likely to have unmet need for FP than women who belong to the poor quintile; this is in line with the results of other studies conducted in Ethiopia,[14] Kenya,[47] Burundi,[45] Nigeria,[34] and Pakistan.[23] This may be due to our result reveals women in the rich category were most of them attend higher education but those in the poor category were most of them are not educated. Additionally, most of the women in the rich category are exposed to media (54.0%) as compared with women in the poor category (23.7%). Education and mass media exposure could probably give women a better chance to understand the uses of family planning and the negative effects of family planning methods thereby increased their consistent use.

The current study found that women who had been working within the 12 months preceding the survey had higher odds of having unmet for FP. This finding is supported by studies in Ethiopia [16] and Malawi [24]. The possible explanation for this association might be because women who were working can have a good income so they may be able to afford private health facilities compared with their counterparts.[49] Moreover, women who were working would have a great deal of trust and decision-making ability on health services including FP.[49,50]

Consistent with previous studies,[10,11,18,29,33,34,45,47,48] our study indicates that unmet need for FP is positively associated with the number of children, in which an increased number of children is

associated with the higher odds of unmet need for FP. This would be due to even though women with many children actually want to either to delay the birth of her next child or limiting births, they are not empowered to use family planning by the socio-cultural setting in rural areas [16,51]. Therefore, it is important to empower women to use family planning in rural areas by increasing contraceptive information through mass media, education, and communication program in the country to specifically target women with many children.

We also identified as the first marital age increased, the level of unmet need was decreased. Women married at age 18 or later had lower odds of unmet need for FP as compared to marital age less than 18. This finding is similar to a study conducted in Enemay District and Gonji Kolela District, Ethiopia,[13,52] but it disagrees with another study done in Southern Nations, Nationalities and Peoples Region, Ethiopia.[16] This might be due to women who marry at age 18 or later were able to plan and decide their family size because they had more exposure to FP methods and were mature enough to use FP. In addition, to increase unmet need for FP, child marriage (marriage before their 18th birthday) raises the risk of early childbearing of a mother, low economic status of women, termination of education, psychological impact, higher rates of divorce, a number of poor social and physical outcomes for young women, and their offspring, complications of pregnancy and an increased risk of both mother and child mortality.[53–55] This implies policymakers should strive to create awareness and implement the legal age for marriage so as to increase the marital age ≥18 years to contribute to the decrement of unmet need for FP and its consequences.

Similar to a study conducted in Malawi [24] this study found that unmet need for FP was found high among women complaining about the distance to a health facility as a big problem. This finding

suggests improving geographical access to health facilities decreases unmet need for FP. This could be explained by women who live closest to health facility are more likely to receive appropriate maternal healthcare services and increase in distance for health facility makes difficult to access maternal healthcare services among women.[56–58] Previous studies reveal that women who receive maternal healthcare services (postnatal care and antenatal care) was significantly associated with a higher prevalence of contraception than women who did not receive any maternal healthcare services.[59,60]

Furthermore, the current study reveals that community-level factors were also associated with the unmet need for FP. Unmet need for FP was found to be lower among women from communities with a high percentage of educated husband. Which is inconsistent with a study conducted in Malawi.[24] The result of this study further reveals that women who live in communities with high media exposure were associated with decreased odds of unmet need for FP compared to women in the reference category. This might be due to educated women have higher odds of understanding health messages and demand services. Additionally, educated women and women from rich households are more likely to be empowered which may subsequently increase accessing information and affording private health facilities to access FP services.[61,62] Mass media is an important tool for mobilizing community to use FP service.[28] Therefore, women from communities with a high percentage of exposure to media and educated women may learn from others on the benefit of using FP services and where these may be accessed.

Strength and limitations

The main strength of this study was it used large population-based data with a large sample size, which more representative of the entire population of rural Ethiopia. Furthermore, multilevel logistic regression was applied for this study that can be able to identify the contextual factors in the occurrence of unmet need for FP among rural women of reproductive age. Despite its strength, the findings of this study have limitations. Due to the cross-sectional nature of the EDHS data, it does not show temporal relationship between independent variables and outcome variable. Additionally, due to the use of secondary data essential factors such as knowledge and attitude of FP methods, fear of side effects, health worker training on FP and men's perspectives on contraceptive use were not available in the EDHS so that it was not possible to incorporate these variables in the analysis.

Conclusion

This study has shown that unmet need for family planning among reproductive-aged women in rural Ethiopia was high. Women's age, number of children, and working status of women were significantly associated with higher odds of unmet needs for family planning. However, women with primary education, women married at age 18 or later, being rich, distance to a health facility not the big problem, women from communities with a high percentage of educated women and women who live in communities with high media exposure were significantly associated with a lower odds of unmet needs for family planning. Therefore, public health policies and interventions that will strengthen women's education, improve the existing strategies to increase the marital age of women, improve media exposure of women on family planning issue and increase the wealth status of household should be designed and implemented.

List of abbreviations

AOR: Adjusted Odds Ratio; CI: Confidence Interval; EDHS: Ethiopian Demographic and Health Survey; ICC: Intraclass Correlation Coefficient; FP: Family Planning; LLR: Loglikelihood Ratio; MOR: Median Odds Ratio; PCV: Proportional Change in Variance

Consent for publication

Not applicable

Availability of data and materials

The datasets used and/or analyzed during the current study is available in a public, open access repository which is accessible online http://www.dhsprogram.com.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

AZA: developed the concept, reviewed literature, carried out the statistical analysis, interpreted the results and prepared the manuscript. CDA: reviewed literature, involved in analysis, interpretation and prepared the manuscript. Both the authors read and approved the manuscript.

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References

1. Ellen Starbird, Maureen Norton RM. Investing in Family Planning: Key to Achieving the Sustainable Development Goals. *Glob Heal Sci Pract*. 2016;4(2):1-20.

2. United Nations. World contraceptive use: 2014 report. New York, NY: Department of Economic and Social Affairs, Population Division, United Nations, 2014.

3. *CSA [Ethiopia] and ICF.Ethiopia Demographic and Health Survey*.; 2016.

4. Darroch JE SS. Trends in contraceptive need and use in developing countries in 2003, 2008, and 2012: an analysis of national surveys. *Lancet*. 2013;381:1756–62.

5. Alkema L, Kantorova V, Menozzi C BA. National, regional, and global rates and trends in contraceptive prevalence and unmet need for family planning between 1990 and 2015: a systematic and comprehensive analysis. *Lancet*. 2013;381:1642–52.

6. United Nations Department of Economic and Social Affairs, Estimates and projections of family planning indicators. Available from: https://www. un.org/en/development/desa/population/theme/family-planning/cp_model. asp. Accessed 17 April. 2020.

7. Sedgh G, Ashford LS HR. Unmet need for contraception in developing countries: examining Women's reasons for not using a method. *New York Guttmacher Institute*. 216AD;2:2015–6.

8. Dingeta T, Oljira L, Worku A, Berhane Y. Unmet Need for Contraception Among Young Married Women in Eastern Ethiopia. 2019:89-101.

9. Worku SA, Ahmed SM, Mulushewa TF. Unmet need for family planning and its associated

factor among women of reproductive age in Debre Berhan Town ,. *BMC Res Notes*. 2019:9-14. doi:10.1186/s13104-019-4180-9

10. Solomon T, Nigatu M, Gebrehiwot TT, Getachew B. Unmet need for family planning and associated factors among currently married reproductive age women in Tiro Afeta District , South West Ethiopia , 2017 : cross- sectional study. 2019:1-9.

11. Gebre G, Birhan N, Kahsay Gebreslasie. Prevalence and factors associated with unmet need for family planning among the currently married reproductive age women in Shire-Enda- Slassie, Northern West of Tigray, Ethiopia : a community based cross-sectional study. *Pan Afr Med J*. 2016;8688:1-9. doi:10.11604/pamj.2016.23.195.8386

12. Mota K, Reddy S, Getachew B. Unmet need of long-acting and permanent family planning methods among women in the reproductive age group in shashemene town , Oromia region , Ethiopia : a cross sectional study. *BMC Womens Health*. 2015:1-8. doi:10.1186/s12905-015-0209-y

13. Dejenu G, Ayichiluhm M, Abajobir AA. Prevalence and Associated Factors of Unmet need for Family Planning among Married Women in Enemay District, Northwest Ethiopia: A Comparative Cross-Sectional Study. 2013;13(4).

14. Tadele A, Abebaw D, Ali R. Predictors of unmet need for family planning among all women of reproductive age in Ethiopia. 2019:1-9.

15. CSA [Ethiopia] and ICF.Ethiopia Demographic and Health Survey. 2011.

16. Hailemariam A, Fikrewold Haddis. FACTORS AFFECTING UNMET NEED FOR FAMILY

PLANNING IN SOUTHERN NATIONS , NATIONALITIES AND. *Ethiop J Heal Sci*. 2011;21(2):77-89.

17. Mekonnen W, Worku A. Determinants of low family planning use and high unmet need in Butajira District , South Central Ethiopia. *Reprod Health*. 2011;8(1):37. doi:10.1186/1742-4755-8-37

18. Wulifan JK, Jahn A, Hien H, et al. Determinants of unmet need for family planning in rural Burkina Faso : a multilevel logistic regression analysis. 2017:1-11. doi:10.1186/s12884-017-1614-z

19. Ali AAA, Okud A. Factors affecting unmet need for family planning in Eastern Sudan. *BMC Public Health*. 2013;13(1):1. doi:10.1186/1471-2458-13-102

20. Bankole A, Hussain R, Sedgh G, Rossier C, Kaboré I GG. Unintended pregnancy and induced abortion. In: Burkina Faso: causes and consequences; 2014.

21. Organization WH: A guide to family planning for community health workers and their clients. 2012.

22. Conference on Family Planning: Research and Best Practices. Munyonyo, Uganda. (2009). Retrieved from http:// www.fpconference2009.orgInternational.

23. Asif MF. Socio-demographic determinants of unmet need for family planning among married women in Pakistan. 2019:1-8.

24. Nkoka O, Mphande WM, Ntenda PAM, Milanzi EB, Kanje V, Guo SJG. Multilevel analysis of factors associated with unmet need for family planning among Malawian women.

2020:1-12.

25. Mosha I, Ruben R KD. Family planning decisions, perceptions and gender dynamics among couples in Mwanza, Tanzania. A Qualitative Study. *BMC Pub Heal*. 2013;13:523.

26. Kabagenyi A, Jennings L, Reid A, Nalwadda G, Ntozi J AL. Barriers to male involvement in contraceptive uptake and reproductive health services. A Qualitative Study of Men and Women's Perceptions in Two Rural Districts in Uganda. *Reprod Heal*. 2014;11(21).

27. National Planning Commission, The Federal Democratic Republic of Ethiopia. The second growth and transformation plan (GTP II), 2015/16-2019/20: NPC Addis Ababa, Ethiopia, 2016. http:// dagethiopia.org/new/docstation/com_content.article/100/gtpii__ english.

28. Duressa LT, Getahun A, Regassa T, Babure ZK, Bidu KT. Unmet Need for Family Planning and Related Factors among Currently Married Women in Sibu Sire District , 2016 Journal of Women ' s Health Care. 2016;7(5):1-14. doi:10.4172/2167-0420.1000446

29. Solanke BL, Oyinlola FF, Oyeleye OJ, Ilesanmi BB. Maternal and community factors associated with unmet contraceptive need among childbearing women in Northern Nigeria. 2019;1:1-12.

30. Central Statistics Agency (CSA) [Ethiopia] and ICF International: Ethiopia demographic and health survey 2016. In. Addis Ababa, Ethiopia and Rockville, Maryland, USA: Central Statistical Agency (CSA) and ICF International; 2016.

31. Ali AAA, Okud A. Factors affecting unmet need for family planning in Eastern Sudan. 2013.

32. Ajong AB, Njotang PN, Yakum MN, et al. Determinants of unmet need for family planning among women in Urban Cameroon : a cross sectional survey in the Biyem-Assi Health District , Yaoundé. *BMC Womens Health*. 2016:1-8. doi:10.1186/s12905-016-0283-9

33. Wulifan JK, Brenner S, Jahn A, Allegri M De. A scoping review on determinants of unmet need for family planning among women of reproductive age in low and middle income countries. *BMC Womens Health*. 2016. doi:10.1186/s12905-015-0281-3

34. Alaba OO, Olaomi JO, Olubusoye OE. Spatial pattern and determinants of unmet need of family planning in Nigeria Spatial pattern and determinants of unmet need of family planning in Nigeria. *South African Fam Pract*. 2015;57(5):306-312. doi:10.1080/20786190.2015.1071536

35. Adebowale A, Palamuleni ME. Determinants of Unmet Need for Modern Contraception and Reasons for Non-use among Married Women in Rural Areas of Burkina Faso. 2014;28(1).

36. Edietah EE, Njotang PN, Ajong AB, Essi MJ, Yakum MN, Mbu ER. Contraceptive use and determinants of unmet need for family planning ; a cross sectional survey in the North West Region , Cameroon. 2018:1-8.

37. Tukue D, Gebru T, Id G, et al. PLOS ONE Prevalence and determinants of modern contraceptive utilization among women in the reproductive age group in Edaga-hamus Town , Eastern zone , Tigray region , Ethiopia ,. 2020:1-17. doi:10.1371/journal.pone.0227795

38. Peugh J.L. A practical guide to multilevel modeling. *J Sch Psychol 2*. 2010;48(1):85– 112.

39. Merlo J. et al. A brief conceptual tutorial of multilevel analysis in social epidemiology: using measures of clustering in multilevel logistic regression to investigate contextual phenomena. *J Epidemiol Community Health*. 2006;60(4):290–297.

40. Starbird E, Norton M MR. Investing in family planning: key to achieving the sustainable development goals. *Glob Heal Sci Pr*. 2016;4:191–210.

41. Laryea DO, Amoako YA, Spangenberg K, Frimpong E, Kyei-ansong J. Contraceptive use and unmet need for family planning among HIV positive women on antiretroviral therapy in Kumasi , Ghana. 2014:1-8.

42. Bishwajit G, Tang S, Yaya S FZ. Unmet need for contraception and its association with unintended pregnancy in Bangladesh. *BMC Pregnancy Childbirth*. 2017;17:186.

43. Cleland J, Conde-Agudelo A, Peterson H, Ross J TA. Contraception and health. *Lancet*. 2012;380:149–56.

44. Workie DL, Zike DT, Fenta HM, Mekonnen MA. A binary logistic regression model with complex sampling design of unmet need for family planning among all women aged (15-49) in Ethiopia . 2017;17(3):637-646.

45. Nzokirishaka A. Determinants of unmet need for family planning among married women of reproductive age in Burundi : a cross-sectional study. 2018:1-13.

46. Riaz S PZ. The impact of women's education and employment on their empowerment: an empirical evidence from household level survey. *Qual Quan*. 2018:1–6.

47. Nyauchi B, Omedi G. Determinants of Unmet Need for Family Planning among Women in Rural Kenya. 2014;28(2).

48. Lamichhane K. Unmet Need for Family Planning among Currently Married Young Women in Nepal. 2017;25:83-94.

49. Tiruneh FN, Chuang K-Y CY-C. Women ’s autonomy and maternal healthcare service utilization in Ethiopia. *BMC Heal Serv Res*. 2017;217(1):718.

50. Viswan SP, Ravindran TKS, Kandala N-B, Petzold MG FS. Sexual autonomy and contraceptive use among women in Nigeria: findings from the demographic and health survey data. *Int J Women ’s Heal*. 2017;9:581 –90.

51. Cleland J, Harbison S SI. Unmet need for contraception: issues and challenges. *Stud Fam Plan*. 2014;45:105–22.

52. Alebel Biadgie AN, Handebo S, Berhe R. Prevalence and Associated Factors of Unmet Need for Family Planning among Married Women in Rural Communities of Gonji Kolela District ,. *J Community Med Health Educ*. 2019;9(1):1-7. doi:10.4172/2161-0711.1000642

53. Herliana BR, Wayan N, Utami A, Putu D, Kurniati Y. Early marriage practices and the health impacts on female adolescent health in Central Lombok : a qualitative study. 2018;6(1):61-67. doi:10.15562/phpma.v6i1.11

54. Groot R De, Kuunyem MY, Palermo T. Child marriage and associated outcomes in northern Ghana : a cross-sectional study. 2018:1-12.

55. WHO. Child marriages : 39 000 every day. (March):. *WHO Media Cent*. 2013:1-7.

56. Tanou, M., Kamiya Y. Assessing the impact of geographical access to health facilities on maternal healthcare utilization: evidence from the Burkina Faso demographic and health survey. *BMC Public Health*. 2019;19:838.

57. Soubeiga D, Sia D GK. Increasing institutional deliveries among antenatal clients: effect of birth preparedness counselling. *Heal Policy Plan*. 2014;29(8):1061–70.

58. De Allegri M, Tiendrebéogo J, Müller O, Yé M, Jahn A R V. Understanding home delivery in a context of user fee reduction: a cross-sectional mixed methods study in rural Burkina Faso. *BMC Pregnancy Childbirth*. 2015;15:1–13.

59. Linnea A. Zimmerman, Yuanyuan Yi, Mahari Yihdego, Solomon Abrha, Solomon Shiferaw, Assefa Seme 5and Saifuddin Ahmed. Effect of integrating maternal health services and family planning services on postpartum family planning behavior in Ethiopia: results from a longitudinal survey. *BMC Public Health*. 2019;19:1448.

60. Amanu Aragaw Emiru , Getu Degu Alene GTD. The role of maternal health care services as predictors of time to modern contraceptive use after childbirth in Northwest Ethiopia: Application of the shared frailty survival analysis. *PLoS One*. 2020.

61. Hameed W, Azmat SK, Ali M, Sheikh MI, Abbas G, Temmerman M AB. Women's empowerment and contraceptive use: the role of independent versus Couples' decision-making, from a lower middle income country perspective. *PLoS One*. 2014;9(8):e104633.

62. Samarakoon S PR. Does education empower women? Evidence from Indonesia. *World Dev*. 2015;66:428 –42.

Figure legend

Figure 1: Magnitude of unmet contraceptive need among rural women in Ethiopia

Table 1: Background characteristics of respondents in Ethiopia, EDHS 2016

Variables	Frequency	Percent
Marital status		
Ever married	8,158	98.0
Never married	169	2.0
Education of respondent		
No education	5,449	65.4
Primary	2,497	30.0
Secondary	301	3.6
Higher	80	1.0
Educational status of husband		
No education	3,801	50.3
Primary	3,016	39.9
Secondary/above	736	9.8
Wealth index		
Poor	3,863	46.4
Middle	2,005	24.1
Rich	2,459	29.5
Religion		
Orthodox	3,262	39.2
Protestant	1,824	21.9
Muslim	3,011	36.1
Others	230	2.8
Working status		
No	6,067	72.9
Yes	2,260	27.1

Media exposure		
No	6,729	80.2
Yes	1,598	19.8
Knowledge of ovulatory cycle		
Knowledgeable	1,681	20.2
Not knowledgeable	6,646	79.8
Ideal number of children you want		
<5	3,816	45.8
≥5	4,511	54.2
Age at marriage		
<18 years	6,193	75.9
≥18 years	1,964	24.1
Pregnancy termination		
No	7,560	90.8
Yes	767	9.2
Child death		
No	7,175	95.7
Yes	372	4.3
Distance from health facility		
Big problem	5,106	61.3
Not big problem	3,221	38.7
Visited by field worker		
No	5,859	70.4
Yes	2,468	29.6
Visited health facility last 12 months		
No	6,068	72.9
Yes	2,259	27.1

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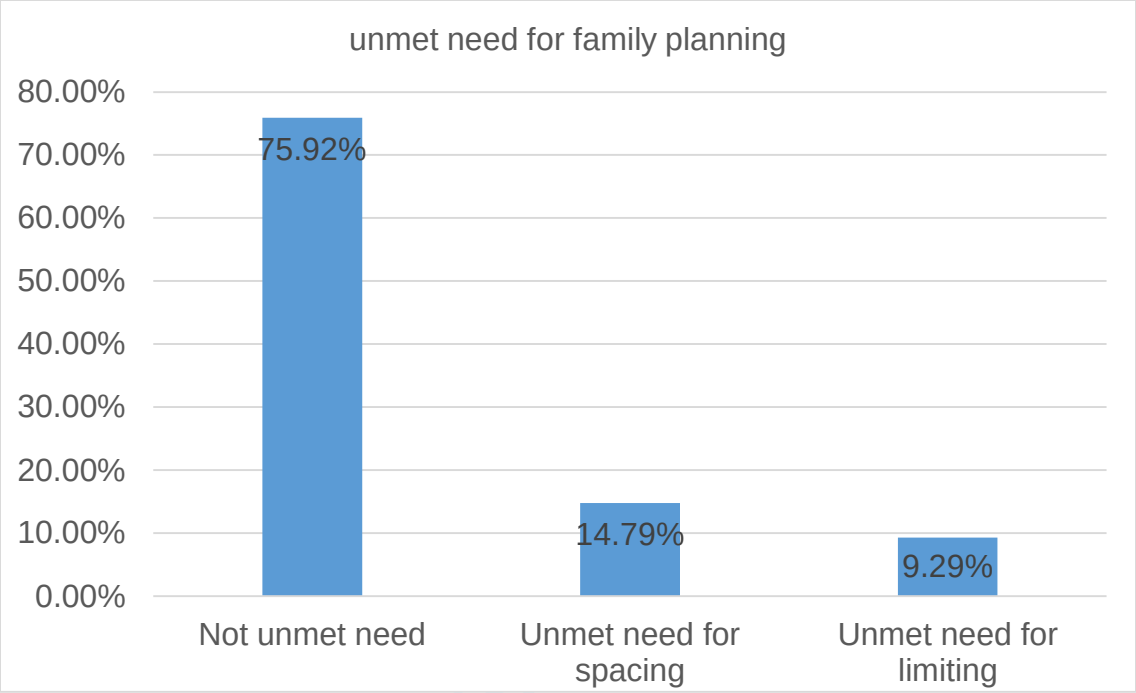
Table 2: Multi-level logistic regression analysis for factors associated with unmet need for FP among reproductive-age women in Ethiopia, EDHS 2016

Variables	Model 1	Model 2 (AOR with 95 % CI)	Model 3 (AOR with 95 % CI)	Model 4 (AOR with 95 % CI)
Age		1.05 (1.04, 1.06)		1.05 (1.04, 1.06)*
Level of women education				
No education		1		1
Primary		0.91 (0.80, 0.98)		0.87 (0.74, 0.94)*
Secondary		1.08 (0.71, 1.61)		1.09 (0.73, 1.64)
Higher		0.90 (0.39, 2.09)		0.91 (0.39, 2.11)
Working status of respondents				
Not working		1		1
working		1.21 (1.04, 1.40)		1.18 (1.02, 1.37)*
Type of media exposed				
No		1		1
Yes		0.87 (0.72, 1.05)		0.84 (0.69, 1.02)
Husband education				
No education		1		1
Primary		1.28 (1.08, 1.52)		1.23 (0.97, 1.33)
Secondary/above		1.13 (0.88, 1.44)		1.07 (0.84, 1.38)
Wealth Index				
Poor		1		1
Middle		0.94 (0.78, 1.12)		0.93 (0.77, 1.11)
Rich		0.77 (0.64, 0.94)		0.77 (0.64, 0.94)*
Age at marriage				
<18		1		1
≥18		0.82 (0.70, 0.96)		0.82 (0.70, 0.96)*
Religion				

Orthodox	1		1
protestant	1.08 (0.86, 1.36)		1.01(0.79, 1.2)
Muslim	1.14 (0.94, 1.38)		1.13(0.93, 1.38)
Others	1.64 (1.05, 2.56)		1.60 (1.03, 2.50)
Child death			
No	1		
Yes	1.19 (0.84, 1.69)		1.18 (0.84,1.68)
Pregnancy termination			
No	1		
Yes	0.94 (0.75, 1.17)		0.94 (0.75, 1.17)
Number of alive children	1.16 (1.07, 1.25)		1.15 (1.07, 1.24)*
Desire number of children			
<5	1		1
≥5	0.97 (0.84, 1.13)		0.99 (0.86, 1.15)
Distance from health facility			
Big problem		1	1
Not big problem		0.86 (0.76, 0.98)	0.85 (0.73, 0.99)
Community women education			
low		1	1
High		0.78 (0.64, 0.93)	0.73 (0.59, 0.89)*
Community husband education			
low		1	1
High		1.17 (0.97, 1.14)	1.15 (0.94, 1.41)
Community wealth			
Low		0.83 (0.61, 1.12)	1
High			0.90 (0.66, 1.24)
Community media exposure			
Low		1	1

High			0.89 (0.75, 1.06)	0.81 (0.68, 0.98)*
Community working status				
Low			1.35 (1.04, 1.76)	
High				1.15 (0.87, 1.51)
Random effects and model comparison				
Community level variance (SE)	0.35(0.056)	0.32 (0.059)	0.30 (0.053)	0.29 (0.057)
ICC (%)	9.6	8.7	8.4	8.1
Deviance (-2LL)	7121.163	6140.094	7078.809	6125.343
PCV (%)	Ref	8.6	14.3	17.2
MOR	1.75	1.71	1.68	1.67

579 *P value <0.05



STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	1
Introduction			**3-5**
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4&5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			**6-9**
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7 & 8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7 & 8
Bias	9	Describe any efforts to address potential sources of bias	
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Not applicable
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	8 & 9
		(*b*) Describe any methods used to examine subgroups and interactions	Not Applicable
		(*c*) Explain how missing data were addressed	Not Applicable
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	8 & 9
		(*e*) Describe any sensitivity analyses	Not Applicable
Results			10-12
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility,	10

		confirmed eligible, included in the study, completing follow-up, and analysed	
		(b) Give reasons for non-participation at each stage	Not Applicable
		(c) Consider use of a flow diagram	Not Applicable
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	10
		(b) Indicate number of participants with missing data for each variable of interest	Not Applicable
Outcome data	15*	Report numbers of outcome events or summary measures	10
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	11& 12
		(*b*) Report category boundaries when continuous variables were categorized	7
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Not Applicable
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Not Applicable
Discussion			13-15
Key results	18	Summarise key results with reference to study objectives	11 & 12
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	2 & 3
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	12-17
Generalizability	21	Discuss the generalisability (external validity) of the study results	12
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	19

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Magnitude and associated factors of unmet need for family planning among rural women in Ethiopia: a multilevel cross-sectional analysis

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Abstract

Objective: This study was aimed to assess the magnitude and associated factors of unmet need for family planning among rural women in Ethiopia.

Design: Cross-sectional study.

Setting: Ethiopia.

Participants: Reproductive age group women.

Primary outcome: Unmet need for family planning.

Methods: This study drew data from Ethiopian Demographic and Health Survey (EDHS) which is conducted from January 18 to June 27, 2016. A total of 8,327 rural reproductive-aged (15-49 years) women were included**.** A two-level multivariable logistic regression model was carried out to identify factors associated with unmet need for family planning. Adjusted odds ratio (AOR) with a 95% CI was used to assess the strength of association between independent and dependent variables.

Results: The overall unmet need for family planning among rural women was 24.08% (95% CI: 23.17, 25.01) of which 14.79% was for spacing and 9.29% for limiting. Women's age (AOR=1.05; 95%CI: 1.04,1.06), number of children (AOR=1.15; 95% CI: 1.07, 1.24), and working status of women (AOR=1.18; 95% CI: 1.02,1.37) were significantly associated with a higher odds of unmet need for family planning. However, women with primary education (AOR=0.87; 95% CI: 0.74,0.94), women married at age 18 or later (AOR=0.82; 95% CI: 0.70, 0.96), women from households with high wealth index (AOR= 0.77; 95% CI: 0.64,0.94), women who deem distance to a health facility as not a big problem (AOR=0.85; 95% CI: 0.73, 0.99), women from communities with a high percentage of educated women (AOR=0.73; 95% CI: 0.59, 0.89), and women who live in communities with high media exposure (AOR=0.81, 95% CI: 0.68,0.98) were significantly associated with a lower odds of unmet needs for family planning.

Conclusion: Unmet need for family planning among reproductive-aged women in rural Ethiopia was high. Women's age, number of children, working status of women, women's education, age at first marriage, wealth, distance to a health facility, community women's education, and community media exposure were significantly associated with unmet needs for family planning. Therefore, to reduce unmet need for family planning public health policymakers should consider both individual and community-level factors when designing FP programs and emphasis should be given to high-risk populations.

Keywords: Unmet need, Family planning, Rural reproductive-aged women, Ethiopia

Strength and limitation of study

- ✓ This study used nationally representative data, which was collected with standardized and validated data collection tools.

- ✓ This study used an advanced model that accounts for the correlated nature of the EDHS data in the determination of estimates.
- ✓ The cross-sectional nature of the survey does not show the temporal relationship between independent variables and outcome variable.
- ✓ Additionally, due to the use of secondary data, essential factors such as knowledge and attitudes about family planning (FP) methods, fear of side effects, health worker training on FP and men's perspectives on contraceptive use were not available in the EDHS; therefore, these factors were not included in our analysis.

Background

Improving family planning (FP) access is fundamental for Sustainable Development Goal (SDG) goals achievement. It is linked to human rights, gender equality, and women's empowerment, and has an impact on maternal, newborn, child, and adolescent health. [1] Additionally, it has a role in enhancing broad socio-economic development, improving environmental preservation, and reducing poverty.[1,2] Although sexual exposure and an expressed intention to avoid pregnancy, millions of women across the developing countries who don't use contraceptives prefer to space or limit the number of their children.[3] This indicates an unsatisfied demand for family planning, which is commonly referred to as unmet need for family planning. It refers to the percentage of fecund women who are married or living in union and thus presumed to be sexually active but are not using any family planning methods, who either want to spacing (when the woman would have wished to delay the birth of her next child by at least 2 years) or limiting births (woman who do not want any more children).[4]

Although Ethiopian government incorporated FP as one of essential health services provided at the community level by health extension workers, family planning utilization is low.[5] In the country, the overall utilization of FP methods among women was 36% (35% were using a modern method and 1% were using a traditional method).[4]

Unmet need for FP is a major public health concern in developing countries particularly in sub-Saharan Africa.[6–9] In developing countries, 225 million women had an unmet need for modern FP methods in 2014, and 230 million women experiencing unmet need for modern FP methods in 2019.[8,9] The prevalence of unmet need for FP among reproductive age group women was 18.3% (15.1% for spacing and 3.2% for limiting) in Burkina Faso,[10] 21.0% (12.6% for spacing and 8.4% for limiting) in Malawi,[11] 46.6% (31.1% for spacing and 15.5% for limiting) in Cameroon,[12] 15.8% (15.1% for spacing and 0.7% for limiting) in Sudan,[13] and 36. 9% in Ghana.[14] In Ethiopia, the magnitude of overall unmet needs for family planning varied from 16.2 % to 34.6 % [15–21] with 10.3% to 15.8 for spacing and 6.0 to 9.8 for limiting.[18,20,21] According to the Ethiopian Demographic and Health Survey (EDHS), overall unmet need for FP declined from 37% in 2000 to 22% by 2016.[4,22] But the unmet need for family planning was a significant disparity in residence and regional states among women in Ethiopia that varied from 19.1% to 28.0% in rural areas and 7.2% to 15.0% in urban areas.[4,21,22] Despite Ethiopia introduced an ambitious community health program, relying on Health Extension Workers to address limited access to health services including family planning in rural areas, women in rural areas have high unmet for FP compared with women in urban areas.[20,21,23,24] Therefore, this study investigated factors associated with unmet need for FP among reproductive-age women in rural Ethiopia.

Unmet need for family planning is an essential concept that is largely used for reproductive health policies, as it bears serious implications for the woman, the child, family, and society as a whole. [10] Reducing unmet need for family planning would significantly reduce unwanted pregnancy, unsafe abortion, closely spaced births, childbearing at a very early age, and physical abuse,[10,13] all of which are considered main contributors to preventable high maternal and infant mortality in many low and middle-income countries (LMICs).[10,25] If all women with unmet need for family planning were to use family planning, World Health Organization (WHO) estimated that maternal mortality could be declined by one-third.[26] Moreover, in Ethiopia, if the unmet need for FP were satisfied more than 1 million deaths of children under the age of 5 could be prevented and nearly 13,000 maternal mortalities would be declined over ten years period.[27] In addition, the use of contraceptives to regulate fertility either for child spacing or limiting childbearing is considered as an effective tool to control population growth[11,28] and is related to higher female literacy, gender equality, and poverty [29,30]. For these reasons, responding to unmet need for family planning has become a crucial global health priority. Ethiopia has adapted sustainable development goals (SDGs) which have 17 goals, with Goal 3.1 reduce maternal mortality and goal 3.7 to ensure universal access to reproductive health services including family planning.[31] Even though Ethiopia's Health Sector Development Plan target to reduce maternal mortality to 267 per 100,000 live births by 2015, maternal mortality in the country is 412 per 100,000 live births in 2016.[4,32]

A variety of literature have assessed factors associated with unmet need for FP such as educational status of the women and their partner,[13,19,20,28,33–38] partner attitudes towards family planning services utilization,[17,20] healthcare providers visit at their home,[20,33] discussion about

family planning with their partner,[16,39] numbers of desired children,[10,15,20,35] place of residence,[28,34,35,38] marital status,[11,14,16,40] previous use of family planning,[18] parity,[14,15,17,21,41] age at first marriage,[18,23] media exposure,[15,28,33,35,42] age,[11,15,18,28,34,35,37,38,43] wealth index/income,[14,21,28,35] number of living children,[10,28,33,37,38,42] experience of child death,[35,38] knowledge about contraceptive methods,[23,43] working status,[14] fear of side effects,[28] occupation,[13,16,34] and the attitude of respondents towards family planning use.[33] However, inconsistent results have been reported in different settings in Ethiopia. For example, a study conducted in Debre Berhan town revealed that having a discussion with husband was more likely to have unmet need for FP,[16] while a study in Shashemene town and Enemay district observed that lack of discussion between partners was more likely to have unmet need for FP. [19,20] In addition, while numbers of desired children >5 were positively associated with total unmet need in Shire-Enda- Slassie, [18] a negative association was observed in Kersa District.[15] These findings indicate that the need to take the study in the national or larger scale context into account when assessing factors associated with unmet need for FP.

Unmet need for FP is also associated with household-level and community-level factors.[11,38] Despite these previous studies in Ethiopia have assessed only individual-level factors, and community-level factors remained insufficiently explored. Additionally, unmet need remains high in rural areas, yet there is a scarcity of information on the factors explaining it in rural Ethiopia. Therefore, understanding the factors for unmet need for FP among women residing in rural households will help public health practitioners working in FP programs to the identify, implement, and evaluate evidence-based interventions to tackle the unmet need and expand contraception use by considering the effects of community characteristics.

Methods

Study design period and setting

This study was a cross-sectional study conducted using secondary data collected in the 2016 Ethiopian Demographic and Health Survey (EDHS). The Ethiopian Demographic and Health Survey (EDHS) drew nationally representative samples for the Ethiopian population, which was collected from January 18, 2016, to June 27, 2016. It is the fourth Demographic and Health Survey conducted in Ethiopia includes data collected from nine regions and two administrative cities. A detailed explanation of methodological strategies used in the EDHS has been outlined elsewhere.[44]

Data source and extraction

The study used secondary data from the Ethiopian Demographic and Health Survey (EDHS) 2016, which is a nationally representative survey. The EDHS is a nationally representative survey using a two-stage cluster sampling method. In the first stage, 645 clusters (202 urban areas and 443 rural areas) were randomly selected from the sampling frame (i.e. the 2007 Ethiopian population and housing census) and household listing. The second stage involved a systematic selection of 18,008 households from the selected clusters, of which 17,067 were occupied. Of the occupied, 16,650 were successfully interviewed. The information we used was related to women of reproductive ages (15-49 years). A total of 15,683 eligible women were identified for the survey. Women who are never had sex/sexually inactive, and infecund were excluded from this study. A total of a weighted sample of 8,327 women of reproductive age were included for analysis.

Variables of study

Outcome variable

The main outcome variable was the unmet need for FP where it composed of both unmet need for spacing and limiting form of unmet need. It refers to the proportion of women who desire to either delay the next pregnancy or limit future pregnancies, but are not using any method of contraception.[12,38] It was a binary variable, women with unmet need for spacing or limiting were recoded as "unmet need", while those using FP methods for spacing or limiting or with no unmet need were recorded as "no unmet need".

Independent variables

Based on the literature, independent variables included in the analysis are broadly categorized as individual and community-level factors that are associated with unmet need for FP.

Individual-level variables considered in the analysis were age, women's level of education (no education, primary, secondary, and higher), religion (recoded as Muslim, Orthodox, Protestant, and others), education level of husband (categorized as no education, primary, and secondary/higher), marital status (categorized as ever married and never married), working status (not working/working), exposure to the media (categorized as "no" if there is no media exposure at all and "yes" if there is media exposure to either radio, magazine/newspaper, internet or television), wealth index (poorest and poorer categorized as "low", middle categorized as "middle" ,and richer and richest categorized as "high"), number of living children, desired number of children (categorized as <5 and ≥5), age at marriage (categorized as <18 and ≥18 years), pregnancy termination (yes/no), child death (yes/no), visited by field worker at home (yes/no), visited health facility last 12 months (yes/no), discussion on women's health care

(categorized as women alone, jointly, husband alone and others), and knowledge of ovulatory cycle recoded as "knowledgeable" if they answer correctly (in the middle of the menstrual cycle) and otherwise recoded as "not knowledgeable".

Community-level factors included in the study were community wealth, community women's educational level, community husband's educational level, community media exposure, and perceived distance to the health facility (big problem and not a big problem). Community wealth was defined as the proportion of women in the poorest and poorer quintile. Community women's educational level was defined as the proportion of women with a minimum of primary level of education. Community husband educational level was defined as the proportion of husband with a minimum of primary level of education. Community media exposure was defined as the proportion of women exposed to at least one type of media such as radio, newspaper television, or internet. Community-level factors, namely, community wealth, community women's educational level, community husband educational level, and community media exposure were constructed by aggregating individual-level variables into community-level variables. Each aggregated community variable was divided into low and high based on the median value since they were not normally distributed.

Statistical analysis

All statistical analysis was performed using Stata version 14.0. Sample weighting was done before doing any statistical analysis, to adjust for the non-proportional allocation of the sample to different regions and their urban and rural areas as well as to adjust for the non-response rates. Descriptive statistics using frequency and percentage were used to get an overview of the selected variables. Multilevel logistic regression models were used to estimate the effects of

unmet need for FP factors at the two specified levels. It allows for the estimation of valid standard errors by adjusting for the intra-cluster correlation of the outcome variable [45].

Four models were fitted. Firstly, model I, the empty or unconditional model, without covariates was analyzed. This model was used to estimate the random intercept at community/cluster level and the variation in the odds of unmet need for FP experience between communities. Secondly, model II was constructed by adding individual-level factors. Thirdly, model III was constructed by adding community-level factors. Finally, model IV including both individual-level community-level factors was constructed. Then, the appropriate model was selected using deviance and the model with the lowest deviance was fitted to estimate the association between independent factors and unmet need for FP. In addition, the measure of variance (random effects), which is the measure of residual errors at the individual level and community variation, was reported in terms of the intra-class correlation coefficient (ICC)[45] and proportional change in variance (PCV).[46]

Firstly, bivariable multilevel logistic regression models were fitted and all variables with a p-value < 0.20 at bi-variable analysis were entered into the multivariable analysis. Then multivariable multilevel logistic regression model was performed to control for possible confounders. In multivariable multilevel logistic regression models, odds ratios together with 95% confidence interval (CI) were calculated and statistical significance was declared at p-value <0.05.

Ethical Consideration

The data was accessed from the Demographic Health Survey Program at http://www.dhsprogram.com. Ethical approval was not needed because the study used publicly available data. However, permission to use the data for the study was obtained from the

Demographic Health Survey program. Informed consent was obtained at the beginning of each interview by the EDHS data collectors.

Patient and public involvement statement

In this study, patients and the public were not involved in the study design or planning of the study. Furthermore, as we used secondary analysis EDHS data patients were not consulted to interpret the results and were not invited to contribute to the writing or editing of this document for readability or accuracy.

Results

In this study, a total weighted sample of 8,327 women in reproductive age was included. The mean age of the study participants was 29.08±7.71 years. Most of them were Orthodox (n = 3,262, 39.2%), had ever been married (n = 8,158, 98.0%), married before 18 years of age (n = 6,193, 75.9%), desired to have five or more children (n = 4,511, 54.2), and were not exposed to media (n = 6,729, 80.2%). Regarding educational status, nearly two-third (n = 5,449, 65.4%) of women and nearly half of their parents (n =3,801, 50.3%) had no formal education (**Table 1**).

Magnitude of unmet for family planning

In this study overall unmet need for FP among rural women was 24.08% (95%CI: 23.17, 25.01) of which 14.79% (95%CI: 14.04, 15.57) was for spacing and 9.29% (95%CI: 8.68, 9.93) for limiting (**Figure 1**).

Factors associated with unmet need for FP.

Random effect model

As presented in table 2, in the null model, about 9.6% of the total variance in the unmet need for FP was at the community level and may be attributable to other unobserved community factors (ICC = 0.096). In the final model (model IV), as indicated by the PCV 17.2% of the variation in unmet need for FP across communities was explained by both individual and community-level factors. Additionally, the final model indicates that the lowest MOR value (1.67) which showed the effects of community heterogeneity. This means if we randomly select women from different clusters, women at the cluster with higher risk of unmet need for FP had 1.6 times higher odds of unmet need for FP as compared with those women at cluster with lower risk of unmet for FP. Besides, model fitness was checked using deviance and model IV with the lowest deviance (deviance= 6125.343) was used to identify significantly associated factors with unmet need for FP. Therefore, all interpretations and conclusions of results were thus being based on model IV.

Fixed effect model

After adjusting for possible confounders, age, women's education level, wealth of household, number of children, age at first marriage, working status, distance from the health facility, community husband education level, and community media exposure were significantly associated with unmet need for FP in Ethiopia.

As age of women increases the odds of unmet need for FP increases (AOR=1.05; 95% CI: 1.04,1.06). The odds of unmet need for FP among women who attend primary education was 13% (AOR=0.87; 95% CI: 0.74,0.94) lower as compared with women with no formal education. As the number of children increases, the odds of unmet need for FP increases (AOR=1.15; 95% CI: 1.07, 1.24). The working status of women also affect unmet need for FP positively (AOR=1.18; 95% CI: 1.02,1.37). Women married at age 18 or later had 18% (AOR=0.82; 95% CI: 0.70, 0.96)

lower odds of unmet need for FP as compared to marital age less than 18. Additionally, considering the wealth index, the odds of unmet need for FP among women from richer/richest class was 23% (AOR= 0.77; 95% CI: 0.64,0.94) lower as compared with women from the poorer/poorest class.

Among community factors, the odds of unmet for FP among women reporting distance to a health facility as not the big problem was decreased by 15% (AOR=0.85; 95% CI: 0.73, 0.99) compared with their defined counterparts. Moreover, women from communities with a high percentage of educated women (AOR=0.73; 95% CI: 0.59, 0.89) were less likely to have unmet need for FP compared with women from communities with a low percentage of educated women. Similarly, this study further reveals that women who live in communities with high media exposure were associated with decreased odds of unmet need for FP compared to women in the reference category (AOR=0.81, 95% CI: 0.68,0.98) (**Table 2**).

Discussion

This study was conducted to investigate the magnitude and factors for unmet need in FP among rural women in the reproductive age group. This study made contributions to the literature on unmet need for FP since it focused rural women which have high unmet for FP prevalence and has only been covered in few studies on unmet need for FP in the rural areas. Identifying specific factors associated with unmet need for family planning in a rural area has therefore been brought further to the fore of national family planning awareness and improving access to reproductive health services, as this is critical for achieving the fifth SDG goal.[47] Additionally, this study extended factors associated with unmet need for FP by considering community-level factors that

may shape the level of unmet need for family planning in Ethiopia. This provides information on a wider range of factors to be targeted by family planning policymakers in the country.

The current study revealed that 24.08% (95%CI: 23.17, 25.01) of rural women in reproductive age in Ethiopia had total unmet need for FP. The result is lower than a study conducted in Ethiopia,[15–17,19,20] Ghana,[48] and Cameroon.[12] This discrepancy could be explained by the fact that the previous studies conducted in Ethiopia[15–17,19,20] were small scale surveys compared to the EDHS which is a nationally representative survey and covered more women in the region. The discrepancy could be due to the differences in studied populations and background characteristics differences among participants. For example, assessing unmet need of long-acting and permanent family planning methods [19] and among young married women [15] in Ethiopia, and unmet need among HIV positive women in Ghana[48] versus assessing unmet need for FP among reproductive-age group women in our study. In terms of background characteristics differences among participants the proportion of women who were married in this study was 98.0%, and in the Cameroon study, it was 61.1%.[12] The previous study implies that married women had 59% lower odds of unmet need for FP compared to never married women.[11]

However, the magnitude of unmet need for FP in this study was higher than a study conducted in Ethiopia,[18,21] Sudan,[49] Burkina Faso,[10] Malawi,[11] Cameroon,[39] and Nigeria.[38] This variation might be attributed to the differences in study population and study setting. The current study exclusively includes rural women. In most parts of Ethiopia, rural residents have usually low health services coverage and decreased awareness of FP due to low education, low socioeconomic status, and have limited access to FP services this may lead to a higher prevalence of unmet need in rural areas. Therefore, this provides information on rural residents to be

targeted by family planning policymakers in the country because the high unmet need for FP further exposes women to unintended pregnancies and unsafe abortion, which raises the risk of maternal and child death.[10,25,50,51] Another possible explanation for the difference in the prevalence of unmet need could be the difference in the educational level of study participants. For instance, a previous study done in Ethiopia reported that 41.6% of women have no formal education which was lower than that of this study (65.4%). Moreover, a study conducted in Sudan reveals that 51.1% of women had secondary education which was higher than that of the current study (3.6%). Previous literature documented that educational level has a negative relationship with unmet need for FP.[11,19,20,23,33,35,37,38,40] Therefore, expansion of women's education which is currently poor as found in the current study is recommended to increase awareness and to reduce unmet need for FP among women in rural areas. A higher proportion was observed for unmet need for spacing in comparison with that for limiting (14.79% Vs 9.28%). This finding is in line with other studies conducted in different parts of Ethiopia,[18,20,21] Sudan,[49] and Cameroon [12,39] where unmet need for spacing contributed to a higher proportion of the total unmet need.

In this study age of women was statistically significant that as age of women increased, the magnitude of unmet need also increased. Similarly, a study conducted in Ethiopia[15,18,20] and Malawi[11] reveals that unmet need for family planning was higher among older women than younger women. This could be because older women near to menopause may perceive as low risk to the pregnancy and because of near schooling period among younger creates better awareness on unmet need for FP. Older women are considered to have more children than younger women might be another possible explanation of this association.

In this study, women's education is another most important variable which significantly associated with unmet need for FP. That is women with primary education were less likely to report having an unmet need for FP as compared to women without education. This is congruent with the study conducted in Ethiopia,[19,20,23,33,40] Nigeria,[38] Malawi,[11] Burundi,[35] and LMICs .[37] This might be due to women who attained education are more exposed to family planning through media and other modes of exposure which improves access to FP alternatives and helps them to understand the health benefits of the FP to reduce fertility, maternal and child morbidity and mortality. It suggests that educated women are more likely to gain family planning services because education of women makes them more empowered in decision making regarding contraceptive use.[52] Furthermore, the educational status of women is directly related to economic and social empowerment which increased exposure to resources such as access to media and utilization of desired health care delivery services. Our study contradicts the finding of studies conducted in Ethiopia,[21,40] Sudan,[49] Burundi,[35] Nigeria,[36] Kenya,[53] and Nepal,[34] which have reported educated women coincides with higher odds of unmet need for FP. These findings indicate that the need to take the context into account when assessing factors associated with unmet need for FP.

A lower proportion of unmet need for FP was observed among women in the high wealth quantile. Results of this study show that women who were in the high wealth quintile were 23% less likely to have unmet need for FP than women who belong to the low quintile; this is in line with the results of other studies conducted in Ethiopia,[21,54] Kenya,[53] Burundi,[35] Nigeria,[36] and Pakistan.[28] This may be due to our result reveals women in the high wealth category were most of them attend higher education but those in the low wealth category were most of them are

not educated. Additionally, most of the women in the high wealth category are exposed to media (54.0%) as compared with women in the low wealth category (23.7%). Education and mass media exposure could probably give women a better chance to understand the uses of family planning and the negative effects of family planning methods thereby increased their consistent use.

The current study found that women who had been working within the 12 months preceding the survey had higher odds of having unmet for FP. This finding is supported by studies in Ethiopia [23] and Malawi [11]. The possible explanation for this association might be because women who were working can have a good income so they may be able to afford private health facilities compared with their counterparts.[55] Moreover, women who were working would have a great deal of trust and decision-making ability on health services including FP.[55,56]

Consistent with previous studies,[10,17,18,34–38,53] our study indicates that unmet need for FP is positively associated with the number of children, in which an increased number of children is associated with the higher odds of unmet need for FP. Even though women with many children actually want to either delay the birth of her next child or to limit births, they are not empowered to use family planning by the socio-cultural setting in rural areas [23,57]. Therefore, it is important to address socio-cultural barriers to reproductive health services in rural areas by strengthening the traditional governance structure, forming volunteer groups and committees, promoting male involvement in reproductive health services, engaging religious and clan leaders in reproductive health services.[58]

We also identified as the first marital age increased, the level of unmet need was decreased. Women married at age 18 or later had lower odds of unmet need for FP as compared to marital age less than 18. This finding is similar to a study conducted in Enemay District and Gonji Kolela

District, Ethiopia,[20,59] but it disagrees with another study done in Southern Nations, Nationalities and Peoples Region, Ethiopia.[23] Women who marry at age 18 or later were able to plan and decide their family size because they had more exposure to FP methods. In addition, to increased unmet need for FP, child marriage (marriage before their 18th birthday) is associated with early childbearing of a mother, low economic status of women, termination of education, psychological impact, higher rates of divorce, a number of poor social and physical outcomes for young women and their offspring, complications of pregnancy and an increased risk of both maternal and child mortalities.[60–62] This implies policymakers should strive to create awareness and enforce the legal age for marriage so as to increase the marital age ≥18 years to reduce unmet need for FP. However, studies on marital age has resulted in conflicting findings in Ethiopia. Some studies reported that marital age are negatively associated with unmet need for FP[20,59], while one study reported that marital age are positively associated with unmet need for FP[23]. In this regard, systematic meta-analysis conducted in Ethiopia revealed that the odds of unmet need for FP was 2.3 times higher among women with age at first marriage < 18 years than women marriage at 18 years and above.[63]

Similar to a study conducted in Malawi [11] this study found that unmet need for FP was greater among women who cited the distance to a health facility as a problem. This finding suggests improving geographical access to health facilities decreases unmet need for FP. This could be explained by women who live closest to health facility are more likely to receive appropriate maternal healthcare services..[64–66] Previous studies reveal that women who receive maternal healthcare services (postnatal care and antenatal care) was significantly associated with a higher

prevalence of contraception than women who did not receive any maternal healthcare services.[67,68]

Furthermore, the current study reveals that community-level factors were also associated with the unmet need for FP. Unmet need for FP was found to be lower among women from communities with a high percentage of educated husbands. This is consistent with a study conducted in Malawi.[11] The result of our study further reveals that women who live in communities with high media exposure had decreased odds of unmet need for FP. This might be due to educated women having higher odds of understanding health messages and experiencing demand for FP services. Additionally, educated women and women from wealthier households are more likely to be empowered to make decision on their own choices which may subsequently increase accessing information and affording private health facilities to access FP services.[69,70] Mass media is an important tool for mobilizing communities to use FP services.[33] Therefore, women from communities with a high percentage of exposure to media and educated women may learn from others about the benefit of using FP services and where these may be accessed. This study builds literature on both individual and community-level factors associated with unmet need for FP among rural women using EDHS. Besides, taking intervention at individual level, identifying community-level factors is important to take intervention at community-level. Therefore, we hope this study will help policymakers to make wise decisions to reduce unmet need for FP, and it could be used as a baseline for future researchers to address limitations of study.

Strength and limitations

The main strength of this study was it used large population-based data with a large sample size, which more representative of the entire population of rural Ethiopia. Furthermore, multilevel logistic regression was applied for this study to identify the contextual factors in the occurrence of unmet need for FP among rural women of reproductive age. Despite the study's strengths, it has limitations. Due to the cross-sectional nature of the EDHS data, it does not show a temporal relationship between independent variables and outcome variable. Additionally, due to the use of secondary data essential factors such as knowledge and attitude of FP methods, fear of side effects, health worker training on FP and men's perspectives on contraceptive use were not available in the EDHS; therefore, it was not possible to incorporate these variables in the analysis.

Conclusion

This study has shown that unmet need for family planning among reproductive-aged women in rural Ethiopia was high. Women's age, number of children, and working status of women were significantly associated with higher odds of unmet needs for family planning. However, women with primary education, women married at age 18 or later, being higher wealth, distance to a health facility not the big problem, women from communities with a high percentage of educated women and women who live in communities with high media exposure were significantly associated with a lower odds of unmet needs for family planning. Therefore, there is the need to implement consistently effective family planning policies among rural women in Ethiopia. Moreover, public health policies and interventions that will strengthen women's education, improve the existing strategies to increase the marital age of women, improve media exposure of women on family planning issues and increase the wealth status of households should be designed and implemented to reduce unmet need for FP in rural parts of country.

List of abbreviations

AOR: Adjusted Odds Ratio; CI: Confidence Interval; EDHS: Ethiopian Demographic and Health Survey; ICC: Intraclass Correlation Coefficient; FP: Family Planning; LLR: Loglikelihood Ratio; MOR: Median Odds Ratio; PCV: Proportional Change in Variance

Consent for publication

Not applicable

Availability of data and materials

The datasets used and/or analyzed during the current study is available in a public, open access repository which is accessible online http://www.dhsprogram.com.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

AZA: developed the concept, reviewed literature, carried out the statistical analysis, interpreted the results and prepared the manuscript. CDA: reviewed literature, involved in analysis, interpretation and prepared the manuscript. Both the authors read and approved the manuscript.

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References

1. Ellen Starbird, Maureen Norton RM. Investing in Family Planning: Key to Achieving the Sustainable Development Goals. *Glob Heal Sci Pract*. 2016;4(2):1-20.

2. Habumuremyi, Pierre Damien MZ. Investments in Family Planning will Stimulate Socio-Economic Development in Africa. *African Inst Dev Policy*. 2012;(3):1-4.

3. United Nations. World contraceptive use: 2014 report. New York, NY: Department of Economic and Social Affairs, Population Division, United Nations, 2014.

4. *CSA [Ethiopia] and ICF.Ethiopia Demographic and Health Survey*.; 2016.

5. Mulatu T, Sintayehu Y, Dessie Y, Deressa M. Modern Family Planning Utilization and Its Associated Factors among Currently Married Women in Rural Eastern Ethiopia : A Community-Based Study. 2020;2020.

6. Darroch JE SS. Trends in contraceptive need and use in developing countries in 2003, 2008, and 2012: an analysis of national surveys. *Lancet*. 2013;381:1756–62.

7. Alkema L, Kantorova V, Menozzi C BA. National, regional, and global rates and trends in contraceptive prevalence and unmet need for family planning between 1990 and 2015: a systematic and comprehensive analysis. *Lancet*. 2013;381:1642–52.

8. United Nations Department of Economic and Social Affairs, Estimates and projections of family planning indicators. Available from: https://www. un.org/en/development/desa/population/theme/family-planning/cp_model. asp. Accessed 17 April. 2020.

9. Sedgh G, Ashford LS HR. Unmet need for contraception in developing countries:

examining Women's reasons for not using a method. *New York Guttmacher Institute*. 216AD;2:2015–6.

10. Wulifan JK, Jahn A, Hien H, et al. Determinants of unmet need for family planning in rural Burkina Faso : a multilevel logistic regression analysis. 2017:1-11. doi:10.1186/s12884-017-1614-z

11. Nkoka O, Mphande WM, Ntenda PAM, Milanzi EB, Kanje V, Guo SJG. Multilevel analysis of factors associated with unmet need for family planning among Malawian women. 2020:1-12.

12. Edietah EE, Njotang PN, Ajong AB, Essi MJ, Yakum MN, Mbu ER. Contraceptive use and determinants of unmet need for family planning ; a cross sectional survey in the North West Region , Cameroon. 2018:1-8.

13. Ali AAA, Okud A. Factors affecting unmet need for family planning in Eastern Sudan. *BMC Public Health*. 2013;13(1):1. doi:10.1186/1471-2458-13-102

14. Nyarko SH, Sparks CS, Bitew F. Spatio-temporal variations in unmet need for family planning in Ghana : 2003 – 2014. 2019.

15. Dingeta T, Oljira L, Worku A, Berhane Y. Unmet Need for Contraception Among Young Married Women in Eastern Ethiopia. 2019:89-101.

16. Worku SA, Ahmed SM, Mulushewa TF. Unmet need for family planning and its associated factor among women of reproductive age in Debre Berhan Town ,. *BMC Res Notes*. 2019:9-14. doi:10.1186/s13104-019-4180-9

17. Solomon T, Nigatu M, Gebrehiwot TT, Getachew B. Unmet need for family planning and associated factors among currently married reproductive age women in Tiro Afeta District , South West Ethiopia , 2017 : cross- sectional study. 2019:1-9.

18. Gebre G, Birhan N, Kahsay Gebreslasie. Prevalence and factors associated with unmet need for family planning among the currently married reproductive age women in Shire-Enda- Slassie, Northern West of Tigray, Ethiopia : a community based cross-sectional study. *Pan Afr Med J*. 2016;8688:1-9. doi:10.11604/pamj.2016.23.195.8386

19. Mota K, Reddy S, Getachew B. Unmet need of long-acting and permanent family planning methods among women in the reproductive age group in shashemene town , Oromia region , Ethiopia : a cross sectional study. *BMC Womens Health*. 2015:1-8. doi:10.1186/s12905-015-0209-y

20. Dejenu G, Ayichiluhm M, Abajobir AA. Prevalence and Associated Factors of Unmet need for Family Planning among Married Women in Enemay District, Northwest Ethiopia: A Comparative Cross-Sectional Study. 2013;13(4).

21. Tadele A, Abebaw D, Ali R. Predictors of unmet need for family planning among all women of reproductive age in Ethiopia. 2019:1-9.

22. CSA [Ethiopia] and ICF.Ethiopia Demographic and Health Survey. 2011.

23. Hailemariam A, Fikrewold Haddis. Factors affecting unmet need for family planning in Southern Nations, Nationalities and people. *Ethiop J Heal Sci*. 2011;21(2):77-89.

24. Mekonnen W, Worku A. Determinants of low family planning use and high unmet need

in Butajira District , South Central Ethiopia. *Reprod Health*. 2011;8(1):37. doi:10.1186/1742-4755-8-37

25. Bankole A, Hussain R, Sedgh G, Rossier C, Kaboré I GG. Unintended pregnancy and induced abortion. In: Burkina Faso: causes and consequences; 2014.

26. Organization WH: A guide to family planning for community health workers and their clients. 2012.

27. Conference on Family Planning: Research and Best Practices. Munyonyo, Uganda. (2009). Retrieved from http:// www.fpconference2009.orgInternational.

28. Asif MF. Socio-demographic determinants of unmet need for family planning among married women in Pakistan. 2019:1-8.

29. Mosha I, Ruben R KD. Family planning decisions, perceptions and gender dynamics among couples in Mwanza, Tanzania. A Qualitative Study. *BMC Pub Heal*. 2013;13:523.

30. Kabagenyi A, Jennings L, Reid A, Nalwadda G, Ntozi J AL. Barriers to male involvement in contraceptive uptake and reproductive health services. A Qualitative Study of Men and Women's Perceptions in Two Rural Districts in Uganda. *Reprod Heal*. 2014;11(21).

31. National Planning Commission, The Federal Democratic Republic of Ethiopia. The second growth and transformation plan (GTP II), 2015/16-2019/20: NPC Addis Ababa, Ethiopia, 2016. http:// dagethiopia.org/new/docstation/com_content.article/100/gtpii__ english.

32. FMOH. Health Sector Development Programme IV-2010/11–2014/15 2010.

33. Duressa LT, Getahun A, Regassa T, Babure ZK, Bidu KT. Unmet Need for Family Planning

and Related Factors among Currently Married Women in Sibu Sire District. *J Women 's Heal Care*. 2016;7(5):1-14. doi:10.4172/2167-0420.1000446

34. Lamichhane K. Unmet Need for Family Planning among Currently Married Young Women in Nepal. 2017;25:83-94.

35. Nzokirishaka A. Determinants of unmet need for family planning among married women of reproductive age in Burundi : a cross-sectional study. 2018:1-13.

36. Alaba OO, Olaomi JO, Olubusoye OE. Spatial pattern and determinants of unmet need of family planning in Nigeria Spatial pattern and determinants of unmet need of family planning in Nigeria. *South African Fam Pract*. 2015;57(5):306-312. doi:10.1080/20786190.2015.1071536

37. Wulifan JK, Brenner S, Jahn A, Allegri M De. A scoping review on determinants of unmet need for family planning among women of reproductive age in low and middle income countries. *BMC Womens Health*. 2016. doi:10.1186/s12905-015-0281-3

38. Solanke BL, Oyinlola FF, Oyeleye OJ, Ilesanmi BB. Maternal and community factors associated with unmet contraceptive need among childbearing women in Northern Nigeria. 2019;1:1-12.

39. Ajong AB, Njotang PN, Yakum MN, et al. Determinants of unmet need for family planning among women in Urban Cameroon : a cross sectional survey in the Biyem-Assi Health District , Yaoundé. *BMC Womens Health*. 2016:1-8. doi:10.1186/s12905-016-0283-9

40. Workie DL, Zike DT, Fenta HM, Mekonnen MA. A binary logistic regression model with

complex sampling design of unmet need for family planning among all women aged (15-49) in Ethiopia . 2017;17(3):637-646.

41. Mercer LD, Lu F, Proctor JL. Sub-national levels and trends in contraceptive prevalence , unmet need , and demand for family planning in Nigeria with survey uncertainty. 2020;(2019):1-9.

42. Pal A, Yadav J, Singh KJ. Factors associated with unmet need of family planning in Bihar , India : a spatial and multilevel analysis. 2018;7(9):3638-3645.

43. Wilopo SA, Setyawan A, Pinandari AW, Prihyugiarto T, Juliaan F, Magnani RJ. Levels , trends and correlates of unmet need for family planning among postpartum women in Indonesia : 2007 – 2015. 2017:1-14. doi:10.1186/s12905-017-0476-x

44. Central Statistics Agency (CSA) [Ethiopia] and ICF International: Ethiopia demographic and health survey 2016. In. Addis Ababa, Ethiopia and Rockville, Maryland, USA: Central Statistical Agency (CSA) and ICF International; 2016.

45. Peugh J.L. A practical guide to multilevel modeling. *J Sch Psychol 2*. 2010;48(1):85– 112.

46. Merlo J. et al. A brief conceptual tutorial of multilevel analysis in social epidemiology: using measures of clustering in multilevel logistic regression to investigate contextual phenomena. *J Epidemiol Community Health*. 2006;60(4):290–297.

47. Starbird E, Norton M MR. Investing in family planning: key to achieving the sustainable development goals. *Glob Heal Sci Pr*. 2016;4:191–210.

48. Laryea DO, Amoako YA, Spangenberg K, Frimpong E, Kyei-ansong J. Contraceptive use

and unmet need for family planning among HIV positive women on antiretroviral therapy in Kumasi , Ghana. 2014:1-8.

49. Ali AAA, Okud A. Factors affecting unmet need for family planning in Eastern Sudan. 2013.

50. Bishwajit G, Tang S, Yaya S FZ. Unmet need for contraception and its association with unintended pregnancy in Bangladesh. *BMC Pregnancy Childbirth*. 2017;17:186.

51. Cleland J, Conde-Agudelo A, Peterson H, Ross J TA. Contraception and health. *Lancet*. 2012;380:149–56.

52. Riaz S PZ. The impact of women's education and employment on their empowerment: an empirical evidence from household level survey. *Qual Quan*. 2018:1–6.

53. Nyauchi B, Omedi G. Determinants of Unmet Need for Family Planning among Women in Rural Kenya. 2014;28(2).

54. Yalew M, Adane B, Kefale B, Damtie Y. Individual and community-level factors associated with unmet need for contraception among reproductive-age women in Ethiopia ; a multi-level analysis of 2016 Ethiopia Demographic and Health Survey. *BMC Pub Heal*. 2020:1-9.

55. Tiruneh FN, Chuang K-Y CY-C. Women 's autonomy and maternal healthcare service utilization in Ethiopia. *BMC Heal Serv Res*. 2017;217(1):718.

56. Viswan SP, Ravindran TKS, Kandala N-B, Petzold MG FS. Sexual autonomy and contraceptive use among women in Nigeria: findings from the demographic and health survey data. *Int J Women 's Heal*. 2017;9:581 –90.

57. Cleland J, Harbison S SI. Unmet need for contraception: issues and challenges. *Stud Fam Plan*. 2014;45:105–22.

58. Wester KC, Medhanyie AA, Spigt M, Beumer C, Alemayehu M. Best practices for addressing socio-cultural barriers to reproductive , maternal and neonatal health service utilization among women from pastoralist communities of Afar , Ethiopia : a qualitative study. *Ethiop J Heal Dev*. 2018:1-9.

59. Alebel Biadgie AN, Handebo S, Berhe R. Prevalence and Associated Factors of Unmet Need for Family Planning among Married Women in Rural Communities of Gonji Kolela District ,. *J Community Med Health Educ*. 2019;9(1):1-7. doi:10.4172/2161-0711.1000642

60. Herliana BR, Wayan N, Utami A, Putu D, Kurniati Y. Early marriage practices and the health impacts on female adolescent health in Central Lombok : a qualitative study. 2018;6(1):61-67. doi:10.15562/phpma.v6i1.11

61. Groot R De, Kuunyem MY, Palermo T. Child marriage and associated outcomes in northern Ghana : a cross-sectional study. 2018:1-12.

62. WHO. Child marriages : 39 000 every day. (March):. *WHO Media Cent*. 2013:1-7.

63. Getaneh T, Negesse A, Dessie G, Desta M, Moltot T. Predictors of unmet need for family planning in Ethiopia 2019 : a systematic review and meta analysis. *Arch Public Heal*. 2020;78(102):1-11.

64. Tanou, M., Kamiya Y. Assessing the impact of geographical access to health facilities on maternal healthcare utilization: evidence from the Burkina Faso demographic and health

survey. *BMC Public Health*. 2019;19:838.

65. Soubeiga D, Sia D GK. Increasing institutional deliveries among antenatal clients: effect of birth preparedness counselling. *Heal Policy Plan*. 2014;29(8):1061–70.

66. De Allegri M, Tiendrebéogo J, Müller O, Yé M, Jahn A R V. Understanding home delivery in a context of user fee reduction: a cross-sectional mixed methods study in rural Burkina Faso. *BMC Pregnancy Childbirth*. 2015;15:1–13.

67. Linnea A. Zimmerman, Yuanyuan Yi, Mahari Yihdego, Solomon Abrha, Solomon Shiferaw, Assefa Seme 5and Saifuddin Ahmed. Effect of integrating maternal health services and family planning services on postpartum family planning behavior in Ethiopia: results from a longitudinal survey. *BMC Public Health*. 2019;19:1448.

68. Amanu Aragaw Emiru , Getu Degu Alene GTD. The role of maternal health care services as predictors of time to modern contraceptive use after childbirth in Northwest Ethiopia: Application of the shared frailty survival analysis. *PLoS One*. 2020.

69. Hameed W, Azmat SK, Ali M, Sheikh MI, Abbas G, Temmerman M AB. Women's empowerment and contraceptive use: the role of independent versus Couples' decision-making, from a lower middle income country perspective. *PLoS One*. 2014;9(8):e104633.

70. Samarakoon S PR. Does education empower women? Evidence from Indonesia. *World Dev*. 2015;66:428 –42.

Figure legend

Figure 1: Magnitude of unmet need for family planning among rural women in Ethiopia

633 **Table 1:** Background characteristics of respondents in Ethiopia, EDHS 2016

Variables	Frequency	Percent
Marital status		
Ever married	8,158	98.0
Never married	169	2.0
Education of respondent		
No education	5,449	65.4
Primary	2,497	30.0
Secondary	301	3.6
Higher	80	1.0
Educational status of husband		
No education	3,801	50.3
Primary	3,016	39.9
Secondary/above	736	9.8
Wealth index		
Low	3,863	46.4
Middle	2,005	24.1
High	2,459	29.5
Religion		
Orthodox	3,262	39.2
Protestant	1,824	21.9
Muslim	3,011	36.1
Others	230	2.8
Working status		
No	6,067	72.9
Yes	2,260	27.1
Media exposure		
No	6,729	80.2
Yes	1,598	19.8

Knowledge of ovulatory cycle		
Knowledgeable	1,681	20.2
Not knowledgeable	6,646	79.8
Desired number of children		
<5	3,816	45.8
≥5	4,511	54.2
Age at marriage		
<18 years	6,193	75.9
≥18 years	1,964	24.1
Prior pregnancy termination		
No	7,560	90.8
Yes	767	9.2
Child death		
No	7,175	95.7
Yes	372	4.3
Distance from health facility		
Big problem	5,106	61.3
Not big problem	3,221	38.7
Visited by field worker		
No	5,859	70.4
Yes	2,468	29.6
Visited health facility last 12 months		
No	6,068	72.9
Yes	2,259	27.1

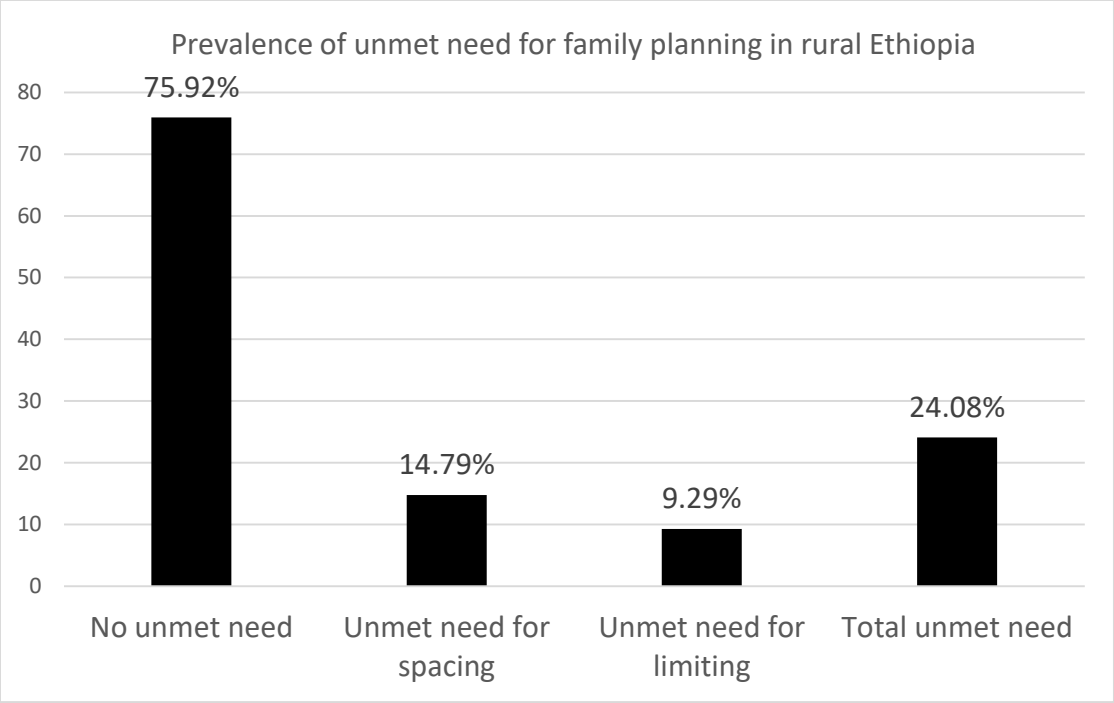
Table 2: Multi-level logistic regression analysis for factors associated with unmet need for FP among reproductive-age women in Ethiopia, EDHS 2016

Variables	Model 1	Model 2 (AOR with 95 % CI)	Model 3 (AOR with 95 % CI)	Model 4 (AOR with 95 % CI)
Age		1.05 (1.04, 1.06)		1.05 (1.04, 1.06)*
Level of women's education				
No education		1		1
Primary		0.91 (0.80, 0.98)		0.87 (0.74, 0.94)*
Secondary		1.08 (0.71, 1.61)		1.09 (0.73, 1.64)
Higher		0.90 (0.39, 2.09)		0.91 (0.39, 2.11)
Working status of respondents				
Not working		1		1
working		1.21 (1.04, 1.40)		1.18 (1.02, 1.37)*
Type of media exposed				
No		1		1
Yes		0.87 (0.72, 1.05)		0.84 (0.69, 1.02)
Husbands' education				
No education		1		1
Primary		1.28 (1.08, 1.52)		1.23 (0.97, 1.33)
Secondary/above		1.13 (0.88, 1.44)		1.07 (0.84, 1.38)
Wealth Index				
Low		1		1
Middle		0.94 (0.78, 1.12)		0.93 (0.77, 1.11)
High		0.77 (0.64, 0.94)		0.77 (0.64, 0.94)*
Age at marriage				
<18		1		1
≥18		0.82 (0.70, 0.96)		0.82 (0.70, 0.96)*
Religion				
Orthodox		1		1
Protestant		1.08 (0.86, 1.36)		1.01(0.79, 1.2)
Muslim		1.14 (0.94, 1.38)		1.13(0.93, 1.38)

Others	1.64 (1.05, 2.56)		1.60 (1.03, 2.50)
Child death			
No	1		
Yes	1.19 (0.84, 1.69)		1.18 (0.84,1.68)
Pregnancy termination			
No	1		
Yes	0.94 (0.75, 1.17)		0.94 (0.75, 1.17)
Number of alive children	1.16 (1.07, 1.25)		1.15 (1.07, 1.24)*
Desired number of children			
<5	1		1
≥5	0.97 (0.84, 1.13)		0.99 (0.86, 1.15)
Distance from health facility			
Big problem		1	1
Not big problem		0.86 (0.76, 0.98)	0.85 (0.73, 0.99)
Community women's education			
Low		1	1
High		0.78 (0.64, 0.93)	0.73 (0.59, 0.89)*
Community husbands' education			
Low		1	1
High		1.17 (0.97, 1.14)	1.15 (0.94, 1.41)
Community wealth			
Low		0.83 (0.61, 1.12)	1
High			0.90 (0.66, 1.24)
Community media exposure			
Low		1	1
High		0.89 (0.75, 1.06)	0.81 (0.68, 0.98)*
Random effects and model comparison			

Community level variance (SE)	0.35(0.056)	0.32 (0.059)	0.30 (0.053)	0.29 (0.057)
ICC (%)	9.6	8.7	8.4	8.1
Deviance (-2LL)	7121.163	6140.094	7078.809	6125.343
PCV (%)	Ref	8.6	14.3	17.2
MOR	1.75	1.71	1.68	1.67

637 *P value <0.05



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Magnitude and associated factors of unmet need for family planning among rural women in Ethiopia: a multilevel cross-sectional analysis

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Abstract

Objective: This study was aimed to assess the magnitude and associated factors of unmet need for family planning among rural women in Ethiopia.

Design: Cross-sectional study.

Setting: Ethiopia.

Participants: Reproductive age group women.

Primary outcome: Unmet need for family planning.

Methods: This study drew data from Ethiopian Demographic and Health Survey (EDHS), which was conducted from January 18 to June 27, 2016. A total of 8,327 rural reproductive-aged (15-49 years) women were included**.** A two-level multivariable logistic regression model was carried out to identify individual and community-level factors associated with unmet need for family planning. Adjusted odds ratio (AOR) with a 95% CI was used to assess the strength of association between independent and dependent variables.

Results: The overall unmet need for family planning among rural women was 24.08% (95% CI: 23.17, 25.01), of which 14.79% was for spacing and 9.29% for limiting. Number of children (AOR=1.15; 95% CI: 1.07, 1.24) and working status of women (AOR=1.18; 95% CI: 1.02,1.37) were significantly associated with a higher odds of unmet need for family planning. However, women with primary education (AOR=0.87; 95% CI: 0.74,0.94), women married at age 18 or later (AOR=0.82; 95% CI: 0.70, 0.96), women from households with high wealth index (AOR= 0.77; 95% CI: 0.64,0.94), women who deem distance to a health facility as not a big problem (AOR=0.85; 95% CI: 0.73, 0.99), women from communities with a high percentage of educated women (AOR=0.73; 95% CI: 0.59, 0.89), and women who live in communities with high media exposure (AOR=0.81, 95% CI: 0.68,0.98) were significantly associated with a lower odds of unmet needs for family planning.

Conclusion: Unmet need for family planning among reproductive-aged women in rural Ethiopia was high. Number of children, working status of women, women's education, age at first marriage, household wealth, distance to a health facility, community women's education, and community media exposure were significantly associated with unmet needs for family planning. Therefore, to reduce unmet need for family planning public health policymakers should consider both individual and community-level factors when designing FP programs and emphasis should be given to high-risk populations.

Keywords: Unmet need, Family planning, Rural reproductive-aged women, Ethiopia

Strength and limitation of study

- ✓ This study used nationally representative data, which was collected with standardized and validated data collection tools.

- ✓ This study used an advanced model that accounts for the correlated nature of the EDHS data in the determination of estimates.
- ✓ The cross-sectional nature of the survey does not show the temporal or causal relationship between independent variables and outcome variable.
- ✓ Additionally, due to the use of secondary data, essential factors such as knowledge and attitudes about family planning (FP) methods, fear of side effects, health worker training on FP and men's perspectives on contraceptive use were not available in the EDHS; therefore, these factors were not included in our analysis.

Background

Improving family planning (FP) access is fundamental for Sustainable Development Goal (SDG) goals achievement. It is linked to human rights, gender equality, and women's empowerment, and has an impact on maternal, newborn, child, and adolescent health. [1] Additionally, it has a role in enhancing broad socio-economic development, improving environmental preservation, and reducing poverty.[1,2] Despite being sexually active and expressing intention to avoid pregnancy, 40.9% of women in low and middle income countries (LMICs) who don't use any contraceptive methods prefer to space or limit the number of their children.[3] This indicates an unsatisfied demand for family planning, which is commonly referred to as unmet need for family planning. It refers to the percentage of fecund women who are married or living in union and thus presumed to be sexually active but are not using any family planning methods, who either want to space (when the woman would have wished to delay the birth of her next child by at least 2 years) or to limit births (woman who do not want any more children).[4]

Although the Ethiopian government incorporated FP as one of the essential health services provided at the community level by health extension workers, FP utilization is low.[5] In the country, the overall utilization of FP methods among women was 36% (35% were using a modern method and 1% were using a traditional method).[4]

Unmet need for FP is a major public health concern in developing countries, particularly in sub-Saharan Africa.[6–8] In developing countries, 225 million women had unmet need for modern FP methods in 2014, and 230 million women experienced unmet need for modern FP methods in 2019.[6,7] The prevalence of unmet need for FP among reproductive age group women was 18.3% (15.1% for spacing and 3.2% for limiting) in Burkina Faso,[9] 21.0% (12.6% for spacing and 8.4% for limiting) in Malawi,[10] 46.6% (31.1% for spacing and 15.5% for limiting) in Cameroon,[11] and 38. 9% (27.5% for spacing and 12.2% for limiting) in Ghana.[12] In Ethiopia, the magnitude of overall unmet need for family planning varied from 16.2% to 34.6% [13–18] with 10.3% to 15.8 for spacing and 6.0 to 9.8 for limiting.[14,18] According to the Ethiopian Demographic and Health Survey (EDHS), overall unmet need for FP declined from 37% in 2000 to 22% by 2016.[4,19] There was a significant disparity in unmet need by region of residence that varied from 19.1% to 28.0% in rural areas and 7.2% to 15.0% in urban areas.[4,18,19] Despite Ethiopia introducing an ambitious community health program, relying on Health Extension Workers to address limited access to health services including family planning in rural areas, women in rural areas have higher unmet need for FP compared with women in urban areas.[18,20] Therefore, this study investigated factors associated with unmet need for FP among reproductive-age women in rural Ethiopia.

Unmet need for family planning reveals issues in supply and demand for family planning resources that can have serious implications for women, children, the family and the society as a

whole.[9] Reducing unmet need for family planning would significantly reduce unwanted pregnancy, unsafe abortion, closely spaced births, childbearing at a very early age, and physical abuse,[9,21,22] all of which are considered main contributors to preventable high maternal and infant mortality in LMICs.[9] If all women with unmet need for family planning were to use family planning, the World Health Organization (WHO) estimated that maternal mortality could be declined by one-third.[23] Moreover, in Ethiopia, if the unmet need for FP were satisfied, more than 1 million deaths of children under the age of 5 could be prevented and nearly 13,000 maternal mortalities would be avoided over a ten year period.[24] In addition, the use of contraceptives to regulate fertility either for child spacing or limiting childbearing is considered as an effective tool to control population growth[10,25] and is related to higher female literacy, gender equality, and reduced poverty [26,27]. For these reasons, responding to unmet need for family planning has become a crucial global health priority. Ethiopia has adapted sustainable 145 development goals (SDGs), including Goal 3.1 to reduce maternal mortality and Goal 146, 3.7 to ensure universal access to reproductive health services, including family planning.[28] Despite Ethiopia's Health Sector Development Plan's target to reduce maternal mortality to 267 per 100,000 live births by 2015, maternal mortality in the country is 412 per 100,000 live births in 2016.[4,29]

Studies have assessed factors associated with unmet need for FP including educational status of the women and their partner,[13,25,30–35] partner attitudes towards family planning services utilization,[15] frequency of healthcare provider home visits,[30] discussion about family planning with their partner,[16,36] number of desired children,[9,17,32] place of residence,[25,31,32,35] marital status,[10,16,37,38] previous use of family planning,[14] parity,[15,17,18,38,39] age at first marriage,[14] media exposure,[17,25,30,32,40] age,[10,14,17,25,31,32,34,35,41] wealth index/income,[18,25,32,38] number of living

children,[9,25,30,34,35,40] experience of child death,[32,35] knowledge about contraceptive methods,[41] working status,[38] fear of side effects,[25] occupation,[16,31] and the attitude of respondents towards family planning use.[30] However, inconsistent results have been reported in different settings in Ethiopia. For example, a study conducted in Debre Berhan town revealed that women who discuss FP with their husbands were more likely to have unmet need for FP,[16] while a study in Shashemene town district observed that lack of discussion between partners was more likely to have unmet need for FP. [13] In addition, while number of desired children >5 were positively associated with total unmet need for FP in Shire-Enda- Slassie, [14] a negative association was observed in Kersa District.[17] These findings indicate that factors associated with the unmet need to FP are area-specific in Ethiopia, which motivates to conduct this study in rural-areas at the national level.

Unmet need for FP is also associated with household-level and community-level factors.[10,35] Although these previous studies in Ethiopia have assessed individual-level factors, community-level factors remained insufficiently explored. Additionally, unmet need remains high in rural areas, yet there is a scarcity of information on the factors explaining it in rural Ethiopia. Therefore, understanding the factors for unmet need for FP among women residing in rural households will help public health practitioners working in FP programs to the identify, implement, and evaluate evidence-based interventions to tackle the unmet need and expand contraception use by considering the effects of community characteristics.

Methods

Study design period and setting

This study was a cross-sectional study conducted using secondary data collected in the 2016 Ethiopian Demographic and Health Survey (EDHS). The Ethiopian Demographic and Health Survey (EDHS) drew nationally representative samples for the Ethiopian population, which was collected from January 18, 2016, to June 27, 2016. It is the fourth Demographic and Health Survey conducted in Ethiopia that includes data collected from nine regions and two administrative cities. A detailed explanation of methodological strategies used in the EDHS has been outlined elsewhere.[42]

Data source and extraction

The study used secondary data from the Ethiopian Demographic and Health Survey (EDHS) 2016. The EDHS is a nationally representative survey using a two-stage cluster sampling method. In the first stage, 645 clusters (202 urban areas and 443 rural areas) were randomly selected from the sampling frame (i.e. the 2007 Ethiopian population and housing census) and household listing. The second stage involved a systematic selection of 18,008 households from the selected clusters, of which 17,067 were occupied. Of the occupied cluster, 16,650 were successfully interviewed. The information we used was related to women of reproductive ages (15-49 years). A total of 15,683 eligible women were identified for the survey. Women who had never had sex, were not sexually active or were infecund were excluded from this study. A total of a weighted sample of 8,327 women of reproductive age were included for analysis.

Variables of study

Outcome variable

The main outcome variable was the unmet need for FP, where it composed of both unmet need for spacing and limiting form of unmet need. It refers to the proportion of women who desire to either delay the next pregnancy or limit future pregnancies, but are not using any method of contraception.[11,35] It was a binary variable, women with unmet need for spacing or limiting were recoded as "unmet need", while those using FP methods for spacing or limiting or with no unmet need were recorded as "no unmet need".

Independent variables

Based on the literature, independent variables included in the analysis are broadly categorized as individual and community-level factors that are associated with unmet need for FP.

Individual-level variables considered in the analysis were age, women's level of education (no education, primary, secondary, and higher), religion (recoded as Muslim, Orthodox, Protestant, and others), education level of husband (categorized as no education, primary, and secondary/higher), marital status (categorized as ever married and never married), working status (not working/working), exposure to the media (categorized as "no" if there is no media exposure at all and "yes" if there is media exposure to either radio, magazine/newspaper, internet or television), wealth index (poorest and poorer categorized as "low", middle categorized as "middle" ,and richer and richest categorized as "high"), number of living children, desired number of children (categorized as <5 and ≥5), age at marriage (categorized as <18 and ≥18 years), pregnancy termination (yes/no), child death (yes/no), visited by field worker at home (yes/no), visited health facility last 12 months (yes/no), discussion on women's health care

(categorized as women alone, jointly, husband alone and others), and knowledge of ovulatory cycle recoded as "knowledgeable" if they correctly identified middle of menstrual cycle as fertile window and otherwise recoded as "not knowledgeable".

Community-level factors included in the study were community wealth, community women's educational level, community husband's educational level, community media exposure, and perceived distance to the health facility (big problem and not a big problem). Community wealth was defined as the proportion of women in the poorest and poorer quintile. Community women's educational level was defined as the proportion of women with a minimum of primary level of education. Community husband educational level was defined as the proportion of husbands with a minimum of primary level of education. Community media exposure was defined as the proportion of women exposed to at least one type of media, such as radio, newspaper, television, or internet. Community-level factors, namely, community wealth, community women's educational level, community husband educational level, and community media exposure were constructed by aggregating individual-level variables into community-level variables. Each aggregated community variable was divided into low and high based on the median value since they were not normally distributed.

Statistical analysis

All statistical analysis was performed using Stata version 14.0. Sample weighting was done before doing any statistical analysis, to adjust for the non-proportional allocation of the sample to different regions and their urban and rural areas. Descriptive statistics using frequency and percentage were used to get an overview of the selected variables. Multilevel logistic regression models were used to estimate the effects of unmet need for FP factors at the two specified levels.

It allows for the estimation of valid standard errors by adjusting for the intra-cluster correlation of the outcome variable [43].

Four models were fitted. Firstly, model I, the empty or unconditional model, without covariates was analyzed. This model was used to estimate the random intercept at cluster level and the variation in the odds of unmet need for FP experience between communities. Secondly, model II was constructed by adding individual-level factors. Thirdly, model III was constructed by adding community-level factors. Finally, model IV including both individual-level community-level factors was constructed. Then, the appropriate model was selected using deviance and the model with the lowest deviance was fitted to estimate the association between independent factors and unmet need for FP. In addition, the measure of variance (random effects), which is the measure of residual errors at the individual level and community variation, was reported in terms of the intra-class correlation coefficient (ICC)[43] and proportional change in variance (PCV).[44]

Firstly, bivariable multilevel logistic regression models were fitted and all variables with a p-value < 0.20 at bi-variable analysis were entered into the multivariable analysis. Then multivariable multilevel logistic regression model was performed to control for possible confounders. In multivariable multilevel logistic regression models, odds ratios together with 95% confidence interval (CI) were calculated and statistical significance was declared at p-value <0.05.

Ethical Consideration

The data was accessed from the Demographic Health Survey Program at http://www.dhsprogram.com. Ethical approval was not needed because the study used publicly available data. However, permission to use the data for the study was obtained from the

Demographic Health Survey program. Informed consent was obtained at the beginning of each interview by the EDHS data collectors.

Patient and public involvement statement

In this study, patients and the public were not involved in the study design or planning of the study. Furthermore, as we used secondary analysis, EDHS data patients were not consulted to interpret the results and were not invited to contribute to the writing or editing of this document for readability or accuracy.

Results

In this study, a total weighted sample of 8,327 women in reproductive age was included. The mean age of the study participants was 29.08 ± 7.71 years. Most of them were Orthodox (n = 3,262, 39.2%), had ever been married (n = 8,158, 98.0%), married before 18 years of age (n = 6,193, 75.9%), desired to have five or more children (n = 4,511, 54.2), and were not exposed to media (n = 6,729, 80.2%). Regarding educational status, nearly two-third (n = 5,449, 65.4%) of women and nearly half of their parents (n =3,801, 50.3%) had no formal education (**Table 1**).

Magnitude of unmet for family planning

In this study overall unmet need for FP among rural women was 24.08% (95%CI: 23.17, 25.01) of which 14.79% (95%CI: 14.04, 15.57) was for spacing and 9.29% (95%CI: 8.68, 9.93) for limiting (**Figure 1**).

Factors associated with unmet need for FP.

Random effect model

As presented in table 2, in the null model, about 9.6% of the total variance in the unmet need for FP was at the community level and may be attributable to other unobserved community factors (ICC = 0.096). In the final model (model IV), as indicated by the PCV, 17.2% of the variation in unmet need for FP across communities was explained by both individual and community-level factors. Additionally, the final model indicates that the lowest MOR value (1.67) which showed the effects of community heterogeneity. This means if we randomly select women from different clusters, women at the cluster with higher risk of unmet need for FP had 1.67 times higher odds of unmet need for FP as compared with those women at cluster with the lowest risk of unmet for FP. Besides, model fitness was checked using deviance and model IV with the lowest deviance (deviance= 6125.343) was used to identify significantly associated factors with unmet need for FP. Therefore, all interpretations and conclusions of results were thus based on model IV.

Fixed effect model

After adjusting for possible confounders, age, women's education level, wealth of household, number of children, age at first marriage, working status, distance from the health facility, community husband education level, and community media exposure were significantly associated with unmet need for FP in Ethiopia.

As age of women increases the odds of unmet need for FP increases (AOR=1.05; 95% CI: 1.04,1.06). The odds of unmet need for FP among women who attend primary education was 13% (AOR=0.87; 95% CI: 0.74,0.94) lower as compared with women with no formal education. As the number of children increases, the odds of unmet need for FP increases (AOR=1.15; 95% CI: 1.07, 1.24). Women who had been working within the 12 months preceding the survey had higher odds of having unmet need for FP (AOR=1.18; 95% CI: 1.02,1.37) compared to women who

do not work. Women married at age 18 or later had 18% (AOR=0.82; 95% CI: 0.70, 0.96) lower odds of unmet need for FP as compared to marital age less than 18. Additionally, considering the wealth index, the odds of unmet need for FP among women from high wealth class was 23% (AOR= 0.77; 95% CI: 0.64,0.94) lower as compared with women from the poorer/poorest class. Among community factors, the odds of unmet for FP among women reporting distance to a health facility as not the big problem was decreased by 15% (AOR=0.85; 95% CI: 0.73, 0.99) compared with their defined counterparts. Moreover, women from communities with a high percentage of educated women (AOR=0.73; 95% CI: 0.59, 0.89) were less likely to have unmet need for FP compared with women from communities with a low percentage of educated women. Similarly, this study further reveals that women who live in communities with high media exposure were associated with decreased odds of unmet need for FP compared to women in low-media exposure communities (AOR=0.81, 95% CI: 0.68,0.98) (**Table 2**).

Discussion

This study was conducted to investigate the magnitude and factors for unmet need in FP among rural women in the reproductive age group. This study contributes to the literature on unmet need for FP by focusing on rural women, who have high unmet need for FP. Few studies of unmet need in rural areas have looked at this population. Identifying specific factors associated with unmet need for family planning in a rural area has therefore been brought further to the fore of national family planning awareness and improving access to reproductive health services, as this is critical for achieving the fifth SDG goal.[45] Additionally, this study extended factors associated with unmet need for FP by considering community-level factors that may shape the level of

unmet need for family planning in Ethiopia. This provides information on a wider range of factors to be targeted by family planning policymakers in the country.

The current study revealed that 24.08% (95%CI: 23.17, 25.01) of rural women in reproductive age in Ethiopia had total unmet need for FP. The result is lower than a study conducted in Ethiopia,[13,15–17,46] Ghana,[47] and Cameroon.[11] This discrepancy could be explained by the fact that the previous studies conducted in Ethiopia[13,15–17] were small scale surveys compared to the EDHS which is a nationally representative survey and covered more women in the region. It could be due to the differences in studied populations and background characteristics differences among participants. For example, assessing unmet need of long-acting and permanent family planning methods [13] and among young married women [17] in Ethiopia, and unmet need among HIV positive women in Ghana[47] versus assessing unmet need for FP among reproductive-age group women in our study. In terms of background characteristics differences among participants, the proportion of women who were married in this study was 98.0%, and in the Cameroon study, it was 61.1%.[11] In this regard, the previous study implies that married women had 59% lower odds of unmet need for FP compared to never married women.[10] Therefore, having large proportions of women who are married in our study may reduce the odds of unmet need for FP.

However, the magnitude of unmet need for FP in this study was higher than studies conducted in Ethiopia,[14,18] Burkina Faso,[9] Malawi,[10] Cameroon,[36] and Nigeria.[35] This variation might be attributed to the differences in study population and study setting. The current study exclusively includes rural women. In most parts of Ethiopia, rural residents have usually low health services coverage and decreased awareness of FP due to low education, low socioeconomic status, and have limited access to FP services this may lead to a higher prevalence of unmet need in rural

areas. Therefore, this provides information on rural residents to be targeted by family planning policymakers in the country because the high unmet need for FP further exposes women to unintended pregnancies and unsafe abortion, which raises the risk of maternal and child death.[9,48] Another possible explanation for the difference in the prevalence of unmet need could be the difference in the educational level of study participants. For instance, a previous study done in Ethiopia reported that 41.6% of women have no formal education which was lower than that of this study (65.4%). Moreover, a study conducted in Sudan reveals that 51.1% of women had secondary education which was higher than that of the current study (3.6%). Previous literature documented that educational level has a negative relationship with unmet need for FP.[10,13,30,32,34,35,37] Therefore, expansion of women's education, which is currently poor as found in the current study, is recommended to increase awareness and to reduce unmet need for FP among women in rural areas. Besides, empowering illiterate women to know about and use FP, and its promotion of men and couples through increasing outreach in the form of household visits by a community health worker may reduce unmet need for FP in rural areas.[49,50] A higher proportion was observed for unmet need for spacing in comparison with that for limiting (14.79% Vs 9.28%). This finding is in line with other studies conducted in different parts of Ethiopia[14,18] and Cameroon [11,36] where unmet need for spacing contributed to a higher proportion of the total unmet need.

In this study age of women was statistically significant that as age of women increased, the magnitude of unmet need also increased. Similarly, a study conducted in Ethiopia[14,17] and Malawi[10] reveals that unmet need for family planning was higher among older women than younger women. This could be because older women near to menopause may be perceived as

low risk for pregnancy and younger women may have better awareness of FP due to recently attending school. Moreover, this association may be explained by the fact that older women tend to have higher numbers of children than younger women.

In this study, women's education is another important variable which significantly associated with unmet need for FP. That is women with primary education were less likely to report having an unmet need for FP as compared to women without education. This is congruent with the study conducted in Ethiopia,[13,30,37] Nigeria,[35] Malawi,[10] Burundi,[32] and other LMICs .[34] This might be due to women who attained education being more exposed to family planning through media and other modes of exposure, which improves access to FP alternatives and helps them to understand the health benefits of the FP to reduce fertility, maternal and child morbidity and mortality. It suggests that educated women are more likely to gain family planning services because they are more empowered in decision making regarding contraceptive use.[51] Furthermore, the educational status of women is directly related to economic and social empowerment which increased exposure to resources such as access to media and utilization of desired health care delivery services. Our study contradicts the finding of studies conducted in Ethiopia,[18,37] Burundi,[32] Nigeria,[33] and Nepal,[31] which have reported educated women have higher odds of unmet need for FP. These findings indicate that the need to take the context into account when assessing factors associated with unmet need for FP.

A lower proportion of unmet need for FP was observed among women in the high wealth quantile. Results of this study show that women who were in the high wealth quintile were 23% less likely to have unmet need for FP than women who belong to the low quintile; this is in line with the results of other studies conducted in Ethiopia,[18,24] Burundi,[32] Nigeria,[33] and Pakistan.[25]

This may be due to our result reveals women in the high wealth category were most of them attend higher education but those in the low wealth category were most of them are not educated. Additionally, most of the women in the high wealth category are exposed to media (54.0%) as compared with women in the low wealth category (23.7%). Education and mass media exposure could probably give women a better chance to understand the uses of family planning and the negative effects of family planning methods thereby increased their consistent use.

The current study found that women who had been working within the 12 months preceding the survey had higher odds of having unmet need for FP. This finding is supported by study conducted in Malawi [10]. The possible explanation for this association might be because women who were working can have a good income so they may be able to afford private health facilities compared with their counterparts.[52] Moreover, women who were working would have a great deal of trust and decision-making ability on health services including FP.[52,53]

Consistent with previous studies,[9,14,15,31–35] our study indicates that unmet need for FP is positively associated with having more children. Even though women with many children may actually want to either delay the birth of their next child or to limit births, they are not empowered to use family planning by the socio-cultural setting in rural areas [54,55]. Therefore, it is important to address socio-cultural barriers to reproductive health services in rural areas by strengthening the traditional governance structure, forming volunteer groups and committees, promoting male involvement in reproductive health services and engaging religious, and clan leaders in reproductive health services.[56]

We also identified that as the first marital age increased, the level of unmet need decreased. Women married at age 18 or later had lower odds of unmet need for FP compared to women

who married before age 18. This finding is similar to study conducted in Gonji Kolela District, Ethiopia,[57] but it disagrees with another study done in Southern Nations, Nationalities and Peoples Region, Ethiopia.[54] Women who marry at age 18 or later were able to plan and decide their family size because they had more exposure to FP methods. In addition to increased unmet need for FP, child marriage (marriage before their 18th birthday) is associated with early childbearing, low economic status of women, termination of education, negative psychological impact, higher rates of divorce, a number of poor social and physical outcomes for young women and their offspring, complications of pregnancy and an increased risk of both maternal and child mortalities.[58,59] This implies policymakers should strive to create awareness and enforce the legal age for marriage so as to increase the marital age above 18 years to reduce unmet need for FP. However, studies on marital age have resulted in conflicting findings in Ethiopia. Some studies reported that marital age is negatively associated with unmet need for FP[46,57], while one study reported that marital age are positively associated with unmet need for FP[54]. In this regard, a systematic meta-analysis conducted in Ethiopia revealed that the odds of unmet need for FP was 2.3 times higher among women with age at first marriage < 18 years than women marriage at 18 years and above.[60]

Similar to a study conducted in Malawi,[10] this study found that unmet need for FP was greater among women who cited the distance to a health facility as a problem. This finding suggests improving geographical access to health facilities decreases unmet need for FP. This could be explained by women who live closest to health facility being more likely to receive appropriate maternal healthcare services.[61–63]Previous studies revealed that women who received maternal

healthcare services (antenatal and postnatal care) were more likely to use contraception than women who did not receive any maternal healthcare services.[64,65]

Furthermore, the current study reveals that community-level factors were also associated with the unmet need for FP. Unmet need for FP was found to be lower among women from communities with a high percentage of educated women. This is consistent with a study conducted in Malawi.[10] The result of our study further reveals that women who live in communities with high media exposure had decreased odds of unmet need for FP compared to women in low-media exposure communities. This might be due to educated women having higher odds of understanding health messages and experiencing demand for FP services. Additionally, educated women and women from wealthier households are more likely to be empowered to make decisions on their own, which may subsequently increase accessing information and affording private health facilities to access FP services.[66,67] Mass media is an important tool for mobilizing communities to use FP services.[30] Therefore, women from communities with a high percentage of exposure to media and educated women may learn from others about the benefit of using FP services and where these may be accessed.

This study builds literature on both individual and community-level factors associated with unmet need for FP among rural women using EDHS. This has implications for both interventions at the individual and community level. Therefore, we hope this study will help policymakers to make wise decisions to reduce unmet need for FP, and it could be used as a baseline measure for future family planning intervention studies.

Strength and limitations

The main strength of this study was it used large population-based data with a large sample size, which is representative of the entire population of rural Ethiopia. Also using large sample size allows us to more precisely estimate unmet need for family planning and the effect size for associated risk factors. Furthermore, multilevel logistic regression was applied for this study to identify the contextual factors in the occurrence of unmet need for FP among rural women of reproductive age. Despite the study's strengths, it has limitations. Due to the cross-sectional nature of the EDHS data, it does not show a temporal relationship between independent variables and outcome variable. Additionally, due to the use of secondary data essential factors such as knowledge and attitude of FP methods, fear of side effects, health worker training on FP and men's perspectives on contraceptive use were not available in the EDHS; therefore, it was not possible to incorporate these variables in the analysis.

Conclusion

This study has shown that unmet need for family planning among reproductive-aged women in rural Ethiopia was high. Number of children, and working status of women were significantly associated with higher odds of unmet needs for family planning. However, women with primary education, women married at age 18 or later, being higher wealth, distance to a health facility not the big problem, women from communities with a high percentage of educated women and women who live in communities with high media exposure were significantly associated with a lower odds of unmet needs for family planning. Therefore, there is the need to implement consistently effective family planning policies among rural women in Ethiopia. Moreover, public health policies and interventions that will strengthen women's education, improve the existing strategies to increase the marital age of women, improve media exposure of women on family

planning issues and increase the wealth status of households should be designed and implemented to reduce unmet need for FP in rural parts of country.

List of abbreviations

AOR: Adjusted Odds Ratio; CI: Confidence Interval; EDHS: Ethiopian Demographic and Health Survey; ICC: Intraclass Correlation Coefficient; FP: Family Planning; LLR: Loglikelihood Ratio; MOR: Median Odds Ratio; PCV: Proportional Change in Variance

Consent for publication

Not applicable

Availability of data and materials

The datasets used and/or analyzed during the current study is available in a public, open access repository which is accessible online http://www.dhsprogram.com.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

AZA: developed the concept, reviewed literature, carried out the statistical analysis, interpreted the results and prepared the manuscript. CDA: reviewed literature, involved in analysis, interpretation and prepared the manuscript. Both the authors read and approved the manuscript.

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References

1. Ellen Starbird, Maureen Norton RM. Investing in Family Planning: Key to Achieving the Sustainable Development Goals. *Glob Heal Sci Pract*. 2016;4(2):1-20. doi:https://dx.doi.org/10.9745%2FGHSP-D-15-00374

2. Gebremeskel F, Estifanous W, Gizachew Y, Jemal S, Atnafu N, Nuriye K. Utilization of Family Planning Methods and Associated Factors Among Reproductive-Age Women with Disability in Arba Minch Town ,. *J Contracept*. 2020;11:25-32. doi:http://doi.org/10.2147/OAJC.S240817

3. Moreira LR, Ewerling F, Barros AJD, Silveira MF. Reasons for nonuse of contraceptive methods by women with demand for contraception not satisfied : an assessment of low and middle-income countries using demographic and health surveys. *Reprod Health*. 2019;16(148):1-15. doi:https://doi.org/10.1186/s12978-019-0805-7

4. *Central Statistics Agency (CSA) [Ethiopia] and ICF International: Ethiopia Demographic and Health Survey 2016. In. Addis Ababa, Ethiopia and Rockville, Maryland, USA: Central Statistical Agency (CSA) and ICF International; 2016.*; 2016.

5. Mulatu T, Sintayehu Y, Dessie Y, Deressa M. Modern Family Planning Utilization and Its Associated Factors among Currently Married Women in Rural Eastern Ethiopia : A Community-Based Study. *journal, BioMed Res Int*. 2020;2020. doi:https://doi.org/10.1155/2020/6096280

6. United Nations Department of Economic and Social Affairs, Estimates and projections of family planning indicators. Available from: https://www. un.org/en/development/desa/population/theme/family-planning/cp_model. asp. Accessed 17 April. 2020.

7. Sedgh G, Ashford LS HR. Unmet need for contraception in developing countries: examining Women's reasons for not using a method. *New York Guttmacher Institute*. 216AD;2:2015–6.

8. Gahungu J, Vahdaninia M, Regmi PR. The unmet needs for modern family planning methods among postpartum women in Sub - Saharan Africa : a systematic review of the literature. *Reprod Health*. 2021;18:1-15. doi:10.1186/s12978-021-01089-9

9. Wulifan JK, Jahn A, Hien H, et al. Determinants of unmet need for family planning in rural Burkina Faso : a multilevel logistic regression analysis. 2017:1-11. doi:10.1186/s12884-017-1614-z

10. Nkoka O, Mphande WM, Ntenda PAM, Milanzi EB, Kanje V, Guo SJG. Multilevel analysis of factors associated with unmet need for family planning among Malawian women. *BMC Public Health*. 2020;20:1-12. doi:https://doi.org/10.1186/s12889-020-08885-1

11. Edietah EE, Njotang PN, Ajong AB, Essi MJ, Yakum MN, Mbu ER. Contraceptive use and determinants of unmet need for family planning ; a cross sectional survey in the North West Region , Cameroon. *BMC Womens Health*. 2018;18:1-8. doi:https://doi.org/10.1186/s12905-018-0660-7

12. Wemakor A, Garti H, Saeed N, Asumadu O, Anyoka B. Prevalence and determinants of unmet need for contraception in North Gonja. *BMC Womens Health*. 2020;20:1-9. doi:https://doi.org/10.1186/s12905-020-01077-4

13. Mota K, Reddy S, Getachew B. Unmet need of long-acting and permanent family planning methods among women in the reproductive age group in shashemene town , Oromia region , Ethiopia : a cross sectional study. *BMC Womens Health*. 2015:1-8. doi:10.1186/s12905-015-0209-y

14. Gebre G, Birhan N, Kahsay Gebreslasie. Prevalence and factors associated with unmet need for family planning among the currently married reproductive age women in Shire-Enda- Slassie, Northern West of Tigray, Ethiopia : a community based cross-sectional study. *Pan Afr Med J*. 2016;8688:1-9. doi:10.11604/pamj.2016.23.195.8386

15. Solomon T, Nigatu M, Gebrehiwot TT, Getachew B. Unmet need for family planning and associated factors among currently married reproductive age women in Tiro Afeta District , South West Ethiopia , 2017 : cross- sectional study. *BMC Womens Health*. 2019;19:1-9. doi:https://doi.org/10.1186/s12905-019-0872-5

16. Worku SA, Ahmed SM, Mulushewa TF. Unmet need for family planning and its associated factor among women of reproductive age in Debre Berhan Town ,. *BMC Res Notes*. 2019:9-14. doi:10.1186/s13104-019-4180-9

17. Dingeta T, Oljira L, Worku A, Berhane Y. Unmet Need for Contraception Among Young Married Women in Eastern Ethiopia. *J Contracept*. 2019;10:89-101. doi:https://doi.org/10.2147/OAJC.S227260

18. Tadele A, Abebaw D, Ali R. Predictors of unmet need for family planning among all women of reproductive age in Ethiopia. *Contracept Reprod Med*. 2019;6(4):1-9. doi:https://doi.org/10.1186/s40834-019-0087-z

19. Central Statistics Agency (CSA) [Ethiopia] and ICF International: Ethiopia Demographic and Health Survey 2000. In. Addis Ababa, Ethiopia and ORC Macro Calverton, Maryland, USA: Central Statistical Agency (CSA) and ICF International; 2000.

20. Genet E, Abeje G, Ejigu T. Determinants of unmet need for family planning among currently married women in Dangila town administration , Awi Zone , Amhara regional state ; a cross sectional study. *Reprod Health*. 2015:1-5. doi:10.1186/s12978-015-0038-3

21. Bishwajit G, Tang S, Yaya S, Feng Z. Unmet need for contraception and its association with unintended pregnancy in. *BMC Pregnancy Childbirth*. 2017;17:1-9. doi:10.1186/s12884-017-1379-4

22. Id SY, Id BG. Prevalence of unmet need for contraception and its association with unwanted pregnancy among married women in Angola. *PLoS One*. 2018;13(12):1-13. doi:https://doi.org/10.1371/journal.pone.0209801

23. Organization WH: A guide to family planning for community health workers and their clients. 2012.

24. Yalew M, Adane B, Kefale B, Damtie Y. Individual and community-level factors associated with unmet need for contraception among reproductive-age women in Ethiopia ; a multi-level analysis of 2016 Ethiopia Demographic and Health Survey. *BMC Pub Heal*.

2020;20:1-9. doi:https://doi.org/10.1186/s12889-020-08653-1

25. Asif MF. Socio-demographic determinants of unmet need for family planning among married women in Pakistan. *BMC Public Health*. 2019;19:1-8. doi:https://doi.org/10.1186/s12889-019-7487-5

26. Kabagenyi A, Jennings L, Reid A, Nalwadda G, Ntozi J AL. Barriers to male involvement in contraceptive uptake and reproductive health services. A Qualitative Study of Men and Women's Perceptions in Two Rural Districts in Uganda. *Reprod Heal*. 2014;11(21). doi:https://doi.org/10.1186/1742-4755-11-21

27. Mosha I, Ruben R KD. Family planning decisions, perceptions and gender dynamics among couples in Mwanza, Tanzania. A Qualitative Study. *BMC Pub Heal*. 2013;13:523. doi:https://doi.org/10.1186/1471-2458-13-523

28. National Planning Commission, The Federal Democratic Republic of Ethiopia. The second growth and transformation plan (GTP II), 2015/16-2019/20: NPC Addis Ababa, Ethiopia, 2016. http:// dagethiopia.org/new/docstation/com_content.article/100/gtpii__ english.

29. FMOH. Health Sector Development Programme IV-2010/11–2014/15 https://www.healthynewbornnetwork.org/hnn-content/uploads/HSDP-IV-Final-Draft-October-2010.

30. Duressa LT, Getahun A, Regassa T, Babure ZK, Bidu KT. Unmet Need for Family Planning and Related Factors among Currently Married Women in Sibu Sire District. *J Women's Heal Care*. 2016;7(5):1-14.

31. Lamichhane K. Unmet Need for Family Planning among Currently Married Young Women in Nepal. *J Dev Adm Stud*. 2017;25:83-94. doi:https://doi.org/10.3126/jodas.v25i1-2.23446

32. Nzokirishaka A. Determinants of unmet need for family planning among married women of reproductive age in Burundi : a cross-sectional study. *Contracept Reprod Med*. 2018;11(4):1-13. doi:https://doi.org/10.1186/s40834-018-0062-0

33. Alaba OO, Olaomi JO, Olubusoye OE. Spatial pattern and determinants of unmet need of family planning in Nigeria Spatial pattern and determinants of unmet need of family planning in Nigeria. *South African Fam Pract*. 2015;57(5):306-312. doi:10.1080/20786190.2015.1071536

34. Wulifan JK, Brenner S, Jahn A, Allegri M De. A scoping review on determinants of unmet need for family planning among women of reproductive age in low and middle income countries. *BMC Womens Health*. 2016. doi:10.1186/s12905-015-0281-3

35. Solanke BL, Oyinlola FF, Oyeleye OJ, Ilesanmi BB. Maternal and community factors associated with unmet contraceptive need among childbearing women in Northern Nigeria. *Contraception*. 2019;11(14):1-12. doi:https://doi.org/10.1186/s40834-019-0093-1

36. Ajong AB, Njotang PN, Yakum MN, et al. Determinants of unmet need for family planning among women in Urban Cameroon : a cross sectional survey in the Biyem-Assi Health District , Yaoundé. *BMC Womens Health*. 2016:1-8. doi:10.1186/s12905-016-0283-9

37. Workie DL, Zike DT, Fenta HM, Mekonnen MA. A binary logistic regression model with complex sampling design of unmet need for family planning among all women aged (15-49) in Ethiopia . *Afr Health Sci*. 2017;17(3):637-646. doi:https://dx.doi.org/10.4314/ahs.v17i3.6

38. Nyarko SH, Sparks CS, Bitew F. Spatio-temporal variations in unmet need for family planning in Ghana : 2003 – 2014. *J Popul Sci*. 2019;36(3). doi:https://doi.org/10.1186/s41118-019-0069-7

39. Mercer LD, Lu F, Proctor JL. Sub-national levels and trends in contraceptive prevalence , unmet need , and demand for family planning in Nigeria with survey uncertainty. *BMC Public Health*. 2019;19:1-9. doi:https://doi.org/10.1186/s12889-019-8043-z

40. Pal A, Yadav J, Singh KJ. Factors associated with unmet need of family planning in Bihar , India : a spatial and multilevel analysis. *Int J Reprod contraception, Obstet Gynecol*. 2018;7(9):3638-3645. doi:https://dx.doi.org/10.18203/2320-1770.ijrcog20183768

41. Wilopo SA, Setyawan A, Pinandari AW, Prihyugiarto T, Juliaan F, Magnani RJ. Levels , trends and correlates of unmet need for family planning among postpartum women in Indonesia : 2007 – 2015. *BMC Womens Health*. 2017;17(1):1-14. doi:10.1186/s12905-017-0476-x

42. Central Statistics Agency (CSA) [Ethiopia] and ICF International: Ethiopia Demographic and Health Survey 2016. In. Addis Ababa, Ethiopia and Rockville, Maryland, USA: Central Statistical Agency (CSA) and ICF International; 2016.

43. Peugh J.L. A practical guide to multilevel modeling. *J Sch Psychol 2*. 2010;48(1):85– 112. doi:10.1016/j.jsp.2009.09.002.

44. Merlo J. et al. A brief conceptual tutorial of multilevel analysis in social epidemiology: using measures of clustering in multilevel logistic regression to investigate contextual phenomena. *J Epidemiol Community Health*. 2006;60(4):290–297. doi:10.1136/jech.2004.029454.

45. Starbird E, Norton M MR. Investing in family planning: key to achieving the sustainable development goals. *Glob Heal Sci Pr*. 2016;4(2):191–210. doi:https://dx.doi.org/10.9745%2FGHSP-D-15-00374

46. Dejenu G, Ayichiluhm M, Abajobir AA. Prevalence and Associated Factors of Unmet need for Family Planning among Married Women in Enemay District, Northwest Ethiopia: A Comparative Cross-Sectional Study. *Glob J Med Res Interdiscip*. 2013;13(4).

47. Laryea DO, Amoako YA, Spangenberg K, Frimpong E, Kyei-ansong J. Contraceptive use and unmet need for family planning among HIV positive women on antiretroviral therapy in Kumasi , Ghana. *BMC Womens Health*. 2014;14:1-8. doi:https://doi.org/10.1186/1472-6874-14-126

48. Bishwajit G, Tang S, Yaya S FZ. Unmet need for contraception and its association with unintended pregnancy in Bangladesh. *BMC Pregnancy Childbirth*. 2017;17:186. doi:https://doi.org/10.1186/s12884-017-1379-4

49. León FR, Lundgren R, Sinai I, Sinha R, Jennings V. Increasing literate and illiterate women ’

s met need for contraception via empowerment : a quasi-experiment in rural India. *Reprod Health*. 2014;11:1-10. doi:https://doi.org/10.1186/1742-4755-11-74

50. White JS, Speizer IS. Can family planning outreach bridge the urban-rural divide in Zambia? *BMC Health Serv Res*. 2007;9:1-9. doi:10.1186/1472-6963-7-143

51. Riaz S PZ. The impact of women's education and employment on their empowerment: an empirical evidence from household level survey. *Qual Quan*. 2018;52(6):1–6. doi:10.1007/s11135-018-0713-x

52. Tiruneh FN, Chuang K-Y CY-C. Women 's autonomy and maternal healthcare service utilization in Ethiopia. *BMC Heal Serv Res*. 2017;217(1):718. doi:https://doi.org/10.1186/s12913-017-2670-9

53. Viswan SP, Ravindran TKS, Kandala N-B, Petzold MG FS. Sexual autonomy and contraceptive use among women in Nigeria: findings from the demographic and health survey data. *Int J Women 's Heal*. 2017;9:581 –90. doi:https://dx.doi.org/10.2147%2FIJWH.S133760

54. Hailemariam A, Fikrewold Haddis. Factors affecting unmet need for family planning in Southern Nations, Nationalities and people. *Ethiop J Heal Sci*. 2011;21(2):77-89. doi:https://dx.doi.org/10.4314%2Fejhs.v21i2.69048

55. Cleland J, Harbison S SI. Unmet need for contraception: issues and challenges. *Stud Fam Plan*. 2014;45:105–22. doi:https://doi.org/10.1111/j.1728-4465.2014.00380.x

56. Wester KC, Medhanyie AA, Spigt M, Beumer C, Alemayehu M. Best practices for

addressing socio-cultural barriers to reproductive , maternal and neonatal health service utilization among women from pastoralist communities of Afar , Ethiopia : a qualitative study. *Ethiop J Heal Dev*. 2018;32:1-9.

57. Alebel Biadgie AN, Handebo S, Berhe R. Prevalence and Associated Factors of Unmet Need for Family Planning among Married Women in Rural Communities of Gonji Kolela District ,. *J Community Med Health Educ*. 2019;9(1):1-7. doi:10.4172/2161-0711.1000642

58. Herliana BR, Wayan N, Utami A, Putu D, Kurniati Y. Early marriage practices and the health impacts on female adolescent health in Central Lombok : a qualitative study. 2018;6(1):61-67. doi:10.15562/phpma.v6i1.11

59. Groot R De, Kuunyem MY, Palermo T. Child marriage and associated outcomes in northern Ghana : a cross-sectional study. *BMC Public Health*. 2018;18:1-12. doi:https://doi.org/10.1186/s12889-018-5166-6

60. Getaneh T, Negesse A, Dessie G, Desta M, Moltot T. Predictors of unmet need for family planning in Ethiopia 2019 : a systematic review and meta analysis. *Arch Public Heal*. 2020;78(102):1-11. doi:https://doi.org/10.1186/s13690-020-00483-2

61. Tanou, M., Kamiya Y. Assessing the impact of geographical access to health facilities on maternal healthcare utilization: evidence from the Burkina Faso demographic and health survey. *BMC Public Health*. 2019;19:838. doi:https://doi.org/10.1186/s12889-019-7150-1

62. De Allegri M, Tiendrebéogo J, Müller O, Yé M, Jahn A R V. Understanding home delivery in a context of user fee reduction: a cross-sectional mixed methods study in rural Burkina

651 Faso. *BMC Pregnancy Childbirth*. 2015;15:1–13. doi:https://doi.org/10.1186/s12884-015-
652 0764-0

653 63. Soubeiga D, Sia D GK. Increasing institutional deliveries among antenatal clients: effect of
654 birth preparedness counselling. *Heal Policy Plan*. 2014;29(8):1061–70.
655 doi:10.1093/heapol/czt089

656 64. Linnea A. Zimmerman, Yuanyuan Yi, Mahari Yihdego, Solomon Abrha, Solomon Shiferaw,
657 Assefa Seme 5and Saifuddin Ahmed. Effect of integrating maternal health services and
658 family planning services on postpartum family planning behavior in Ethiopia: results from
659 a longitudinal survey. *BMC Public Health*. 2019;19:1448.
660 doi:https://dx.doi.org/10.1186%2Fs12889-019-7703-3

661 65. Amanu Aragaw Emiru , Getu Degu Alene GTD. The role of maternal health care services
662 as predictors of time to modern contraceptive use after childbirth in Northwest Ethiopia:
663 Application of the shared frailty survival analysis. *PLoS One*. 2020;15(2):e0228678.
664 doi:https://doi.org/10.1371/journal.pone.0228678

665 66. Hameed W, Azmat SK, Ali M, Sheikh MI, Abbas G, Temmerman M AB. Women's
666 empowerment and contraceptive use: the role of independent versus Couples' decision-
667 making, from a lower middle income country perspective. *PLoS One*. 2014;9(8):e104633.
668 doi:https://doi.org/10.1371/journal.pone.0104633

669 67. Samarakoon S PR. Does education empower women? Evidence from Indonesia. *World*
670 *Dev*. 2015;66:428 –42. doi:https://doi.org/10.1016/j.worlddev.2014.09.002

671 **Figure legend**

672 **Figure 1:** Magnitude of unmet need for family planning among rural women in Ethiopia

673 **Table 1:** Background characteristics of respondents in Ethiopia, EDHS 2016

Variables	Frequency	Percent
Marital status		
Ever married	8,158	98.0
Never married	169	2.0
Education of respondent		
No education	5,449	65.4
Primary	2,497	30.0
Secondary	301	3.6
Higher	80	1.0
Educational status of husband		
No education	3,801	50.3
Primary	3,016	39.9
Secondary/above	736	9.8
Wealth index		
Low	3,863	46.4
Middle	2,005	24.1
High	2,459	29.5
Religion		
Orthodox	3,262	39.2
Protestant	1,824	21.9
Muslim	3,011	36.1
Others	230	2.8
Working status		
No	6,067	72.9
Yes	2,260	27.1

Media exposure		
No	6,729	80.2
Yes	1,598	19.8
Knowledge of ovulatory cycle		
Knowledgeable	1,681	20.2
Not knowledgeable	6,646	79.8
Desired number of children		
<5	3,816	45.8
≥5	4,511	54.2
Age at marriage		
<18 years	6,193	75.9
≥18 years	1,964	24.1
Prior pregnancy termination		
No	7,560	90.8
Yes	767	9.2
Child death		
No	7,175	95.7
Yes	372	4.3
Distance from health facility		
Big problem	5,106	61.3
Not big problem	3,221	38.7
Visited by field worker		
No	5,859	70.4
Yes	2,468	29.6
Visited health facility last 12 months		
No	6,068	72.9
Yes	2,259	27.1

674

675 **Table 2:** Multi-level logistic regression analysis for factors associated with unmet need for FP

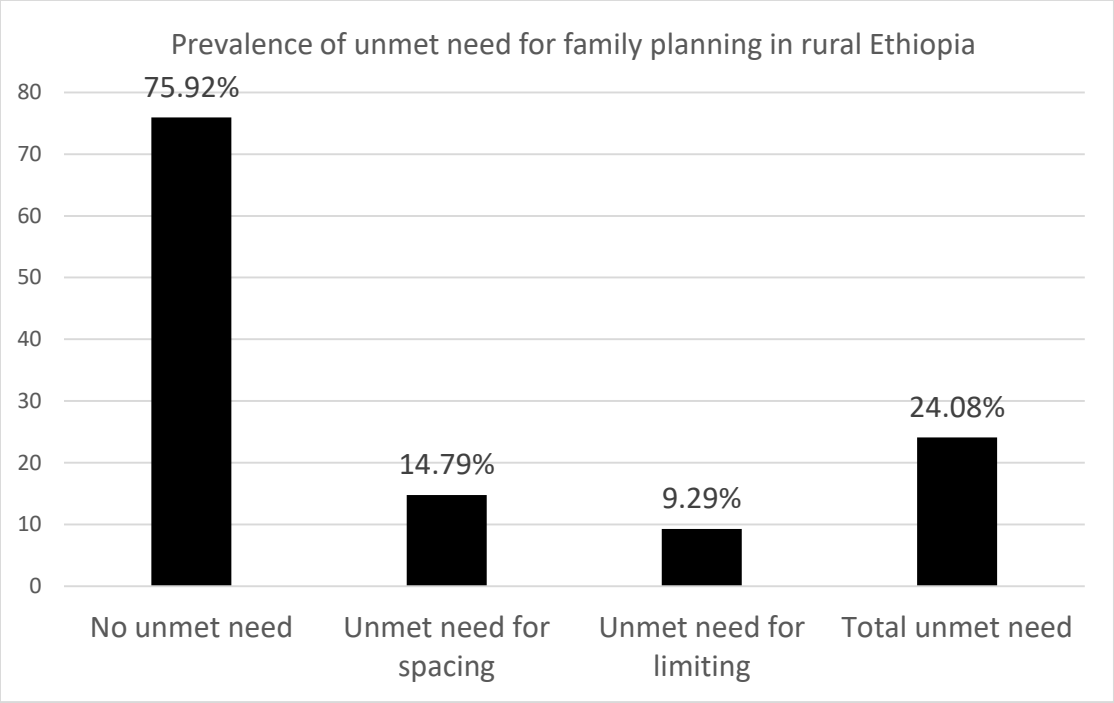
676 among reproductive-age women in Ethiopia, EDHS 2016

Variables	Model 1	Model 2 (AOR with 95 % CI)	Model 3 (AOR with 95 % CI)	Model 4 (AOR with 95 % CI)
Age		1.05 (1.04, 1.06)		1.05 (1.04, 1.06)*
Level of women's education				
No education		1		1
Primary		0.91 (0.80, 0.98)		0.87 (0.74, 0.94)*
Secondary		1.08 (0.71, 1.61)		1.09 (0.73, 1.64)
Higher		0.90 (0.39, 2.09)		0.91 (0.39, 2.11)
Working status of respondents				
Not working		1		1
working		1.21 (1.04, 1.40)		1.18 (1.02, 1.37)*
Type of media exposed				
No		1		1
Yes		0.87 (0.72, 1.05)		0.84 (0.69, 1.02)
Husbands' education				
No education		1		1
Primary		1.28 (1.08, 1.52)		1.23 (0.97, 1.33)
Secondary/above		1.13 (0.88, 1.44)		1.07 (0.84, 1.38)
Wealth Index				
Low		1		1
Middle		0.94 (0.78, 1.12)		0.93 (0.77, 1.11)
High		0.77 (0.64, 0.94)		0.77 (0.64, 0.94)*
Age at marriage				
<18		1		1
≥18		0.82 (0.70, 0.96)		0.82 (0.70, 0.96)*
Religion				

Orthodox	1		1
Protestant	1.08 (0.86, 1.36)		1.01(0.79, 1.2)
Muslim	1.14 (0.94, 1.38)		1.13(0.93, 1.38)
Others	1.64 (1.05, 2.56)		1.60 (1.03, 2.50)
Child death			
No	1		
Yes	1.19 (0.84, 1.69)		1.18 (0.84,1.68)
Pregnancy termination			
No	1		
Yes	0.94 (0.75, 1.17)		0.94 (0.75, 1.17)
Number of alive children	1.16 (1.07, 1.25)		1.15 (1.07, 1.24)*
Desired number of children			
<5	1		1
≥5	0.97 (0.84, 1.13)		0.99 (0.86, 1.15)
Distance from health facility			
Big problem		1	1
Not big problem		0.86 (0.76, 0.98)	0.85 (0.73, 0.99)
Community women's education			
Low		1	1
High		0.78 (0.64, 0.93)	0.73 (0.59, 0.89)*
Community husbands' education			
Low		1	1
High		1.17 (0.97, 1.14)	1.15 (0.94, 1.41)
Community wealth			
Low		1	1
High		0.83 (0.61, 1.12)	0.90 (0.66, 1.24)
Community media exposure			
Low		1	1

High			0.89 (0.75, 1.06)	0.81 (0.68, 0.98)*
Random effects and model comparison				
Community level variance (SE)	0.35(0.056)	0.32 (0.059)	0.30 (0.053)	0.29 (0.057)
ICC (%)	9.6	8.7	8.4	8.1
Deviance (-2LL)	7121.163	6140.094	7078.809	6125.343
PCV (%)	Ref	8.6	14.3	17.2
MOR	1.75	1.71	1.68	1.67

677 *P value <0.05



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Magnitude and associated factors of unmet need for family planning among rural women in Ethiopia: a multilevel cross-sectional analysis

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Abstract

Objective: This study was aimed to assess the magnitude and associated factors of unmet need for family planning among rural women in Ethiopia.

Design: Cross-sectional study.

Setting: Ethiopia.

Participants: Reproductive age group women.

Primary outcome: Unmet need for family planning.

Methods: This study drew data from Ethiopian Demographic and Health Survey (EDHS), which was conducted from January 18 to June 27, 2016. A total of 8,327 rural reproductive-aged (15-49 years) women were included**.** A two-level multivariable logistic regression model was carried out to identify individual and community-level factors associated with unmet need for family planning. Adjusted odds ratio (AOR) with a 95% CI was used to assess the strength of association between independent and dependent variables.

Results: The overall unmet need for family planning among rural women was 24.08% (95% CI: 23.17, 25.01), of which 14.79% was for spacing and 9.29% for limiting. Number of children (AOR=1.15; 95% CI: 1.07, 1.24) and working status of women (AOR=1.18; 95% CI: 1.02,1.37) were significantly associated with a higher odds of unmet need for family planning. However, women with primary education (AOR=0.87; 95% CI: 0.74,0.94), women married at age 18 or later (AOR=0.82; 95% CI: 0.70, 0.96), women from households with high wealth index (AOR= 0.77; 95% CI: 0.64,0.94), women who deem distance to a health facility as not a big problem (AOR=0.85; 95% CI: 0.73, 0.99), women from communities with a high percentage of educated women (AOR=0.73; 95% CI: 0.59, 0.89), and women who live in communities with high media exposure (AOR=0.81, 95% CI: 0.68,0.98) were significantly associated with a lower odds of unmet needs for family planning.

Conclusion: Unmet need for family planning among reproductive-aged women in rural Ethiopia was high. Number of children, working status of women, women's education, age at first marriage, household wealth, distance to a health facility, community women's education, and community media exposure were significantly associated with unmet needs for family planning. Therefore, to reduce unmet need for family planning public health policymakers should consider both individual and community-level factors when designing FP programs and emphasis should be given to high-risk populations.

Keywords: Unmet need, Family planning, Rural reproductive-aged women, Ethiopia

Strength and limitation of study

- ✓ This study used nationally representative data, which was collected with standardized and validated data collection tools.

- ✓ This study used an advanced model that accounts for the correlated nature of the EDHS data in the determination of estimates.
- ✓ The cross-sectional nature of the survey does not show the temporal or causal relationship between independent variables and outcome variable.
- ✓ Additionally, due to the use of secondary data, essential factors such as knowledge and attitudes about family planning (FP) methods, fear of side effects, health worker training on FP and men's perspectives on contraceptive use were not available in the EDHS; therefore, these factors were not included in our analysis.

Background

Improving family planning (FP) access is fundamental for Sustainable Development Goal (SDG) goals achievement. It is linked to human rights, gender equality, and women's empowerment, and has an impact on maternal, newborn, child, and adolescent health. [1] Additionally, it has a role in enhancing broad socio-economic development, improving environmental preservation, and reducing poverty.[1,2] Despite being sexually active and expressing intention to avoid pregnancy, 40.9% of women in low and middle income countries (LMICs) who don't use any contraceptive methods prefer to space or limit the number of their children.[3] This indicates an unsatisfied demand for family planning, which is commonly referred to as unmet need for family planning. It refers to the percentage of fecund women who are married or living in union and thus presumed to be sexually active but are not using any family planning methods, who either want to space (when the woman would have wished to delay the birth of her next child by at least 2 years) or to limit births (woman who do not want any more children).[4]

Although the Ethiopian government incorporated FP as one of the essential health services provided at the community level by health extension workers, FP utilization is low.[5] In the country, the overall utilization of FP methods among women was 36% (35% were using a modern method and 1% were using a traditional method).[4]

Unmet need for FP is a major public health concern in developing countries, particularly in sub-Saharan Africa.[6–8] In developing countries, 225 million women had unmet need for modern FP methods in 2014, and 230 million women experienced unmet need for modern FP methods in 2019.[6,7] The prevalence of unmet need for FP among reproductive age group women was 18.3% (15.1% for spacing and 3.2% for limiting) in Burkina Faso,[9] 21.0% (12.6% for spacing and 8.4% for limiting) in Malawi,[10] 46.6% (31.1% for spacing and 15.5% for limiting) in Cameroon,[11] and 38. 9% (27.5% for spacing and 12.2% for limiting) in Ghana.[12] In Ethiopia, the magnitude of overall unmet need for family planning varied from 16.2% to 34.6% [13–18] with 10.3% to 15.8 for spacing and 6.0 to 9.8 for limiting.[14,18] According to the Ethiopian Demographic and Health Survey (EDHS), overall unmet need for FP declined from 37% in 2000 to 22% by 2016.[4,19] There was a significant disparity in unmet need by region of residence that varied from 19.1% to 28.0% in rural areas and 7.2% to 15.0% in urban areas.[4,18,19] Despite Ethiopia introducing an ambitious community health program, relying on Health Extension Workers to address limited access to health services including family planning in rural areas, women in rural areas have higher unmet need for FP compared with women in urban areas.[18,20] Therefore, this study investigated factors associated with unmet need for FP among reproductive-age women in rural Ethiopia.

Unmet need for family planning reveals issues in supply and demand for family planning resources that can have serious implications for women, children, the family and the society as a

whole.[9] Reducing unmet need for family planning would significantly reduce unwanted pregnancy, unsafe abortion, closely spaced births, childbearing at a very early age, and physical abuse,[9,21,22] all of which are considered main contributors to preventable high maternal and infant mortality in LMICs.[9] If all women with unmet need for family planning were to use family planning, the World Health Organization (WHO) estimated that maternal mortality could be declined by one-third.[23] Moreover, in Ethiopia, if the unmet need for FP were satisfied, more than 1 million deaths of children under the age of 5 could be prevented and nearly 13,000 maternal mortalities would be avoided over a ten year period.[24] In addition, the use of contraceptives to regulate fertility either for child spacing or limiting childbearing is considered as an effective tool to control population growth[10,25] and is related to higher female literacy, gender equality, and reduced poverty [26,27]. For these reasons, responding to unmet need for family planning has become a crucial global health priority. Ethiopia has adapted sustainable 145 development goals (SDGs), including Goal 3.1 to reduce maternal mortality and Goal 146, 3.7 to ensure universal access to reproductive health services, including family planning.[28] Despite Ethiopia's Health Sector Development Plan's target to reduce maternal mortality to 267 per 100,000 live births by 2015, maternal mortality in the country is 412 per 100,000 live births in 2016.[4,29]

Studies have assessed factors associated with unmet need for FP including educational status of the women and their partner,[13,25,30–35] partner attitudes towards family planning services utilization,[15] frequency of healthcare provider home visits,[30] discussion about family planning with their partner,[16,36] number of desired children,[9,17,32] place of residence,[25,31,32,35] marital status,[10,16,37,38] previous use of family planning,[14] parity,[15,17,18,38,39] age at first marriage,[14] media exposure,[17,25,30,32,40] age,[10,14,17,25,31,32,34,35,41] wealth index/income,[18,25,32,38] number of living

children,[9,25,30,34,35,40] experience of child death,[32,35] knowledge about contraceptive methods,[41] working status,[38] fear of side effects,[25] occupation,[16,31] and the attitude of respondents towards family planning use.[30] However, inconsistent results have been reported in different settings in Ethiopia. For example, a study conducted in Debre Berhan town revealed that women who discuss FP with their husbands were more likely to have unmet need for FP,[16] while a study in Shashemene town district observed that lack of discussion between partners was more likely to have unmet need for FP. [13] In addition, while number of desired children >5 were positively associated with total unmet need for FP in Shire-Enda- Slassie, [14] a negative association was observed in Kersa District.[17] These findings indicate that factors associated with the unmet need to FP are area-specific in Ethiopia, which motivates to conduct this study in rural-areas at the national level.

Unmet need for FP is also associated with household-level and community-level factors.[10,35] Although these previous studies in Ethiopia have assessed individual-level factors, community-level factors remained insufficiently explored. Additionally, unmet need remains high in rural areas, yet there is a scarcity of information on the factors explaining it in rural Ethiopia. Therefore, understanding the factors for unmet need for FP among women residing in rural households will help public health practitioners working in FP programs to the identify, implement, and evaluate evidence-based interventions to tackle the unmet need and expand contraception use by considering the effects of community characteristics.

Methods

Study design, period and setting

This study was a cross-sectional study conducted using secondary data collected in the 2016 Ethiopian Demographic and Health Survey (EDHS). The Ethiopian Demographic and Health Survey (EDHS) drew nationally representative samples for the Ethiopian population, which was collected from January 18, 2016, to June 27, 2016. It is the fourth Demographic and Health Survey conducted in Ethiopia that includes data collected from nine regions and two administrative cities. A detailed explanation of methodological strategies used in the EDHS has been outlined elsewhere.[42]

Data source and extraction

The study used secondary data from the Ethiopian Demographic and Health Survey (EDHS) 2016. The EDHS is a nationally representative survey using a two-stage cluster sampling method. In the first stage, 645 clusters (202 urban areas and 443 rural areas) were randomly selected from the sampling frame (i.e. the 2007 Ethiopian population and housing census) and household listing. The second stage involved a systematic selection of 18,008 households from the selected clusters, of which 17,067 were occupied. Of the occupied cluster, 16,650 were successfully interviewed. The information we used was related to women of reproductive ages (15-49 years). A total of 15,683 eligible women were identified for the survey. Women who had never had sex, were not sexually active or were infecund were excluded from this study. A total of a weighted sample of 8,327 women of reproductive age were included for analysis.

Variables of study

Outcome variable

The main outcome variable was the unmet need for FP, where it composed of both unmet need for spacing and limiting form of unmet need. It refers to the proportion of women who desire to either delay the next pregnancy or limit future pregnancies, but are not using any method of contraception.[11,35] It was a binary variable, women with unmet need for spacing or limiting were recoded as "unmet need", while those using FP methods for spacing or limiting or with no unmet need were recorded as "no unmet need".

Independent variables

Based on the literature, independent variables included in the analysis are broadly categorized as individual and community-level factors that are associated with unmet need for FP.

Individual-level variables considered in the analysis were age, women's level of education (no education, primary, secondary, and higher), religion (recoded as Muslim, Orthodox, Protestant, and others), education level of husband (categorized as no education, primary, and secondary/higher), marital status (categorized as ever married and never married), working status (not working/working), exposure to the media (categorized as "no" if there is no media exposure at all and "yes" if there is media exposure to either radio, magazine/newspaper, internet or television), wealth index (poorest and poorer categorized as "low", middle categorized as "middle" ,and richer and richest categorized as "high"), number of living children, desired number of children (categorized as <5 and ≥5), age at marriage (categorized as <18 and ≥18 years), pregnancy termination (yes/no), child death (yes/no), visited by field worker at home (yes/no), visited health facility last 12 months (yes/no), discussion on women's health care

(categorized as women alone, jointly, husband alone and others), and knowledge of ovulatory cycle recoded as "knowledgeable" if they correctly identified middle of menstrual cycle as fertile window and otherwise recoded as "not knowledgeable".

Community-level factors included in the study were community wealth, community women's educational level, community husband's educational level, community media exposure, and perceived distance to the health facility (big problem and not a big problem). Community wealth was defined as the proportion of women in the poorest and poorer quintile. Community women's educational level was defined as the proportion of women with a minimum of primary level of education. Community husband educational level was defined as the proportion of husbands with a minimum of primary level of education. Community media exposure was defined as the proportion of women exposed to at least one type of media, such as radio, newspaper, television, or internet. Community-level factors, namely, community wealth, community women's educational level, community husband educational level, and community media exposure were constructed by aggregating individual-level variables into community-level variables. Each aggregated community variable was divided into low and high based on the median value because they were not normally distributed.

Statistical analysis

All statistical analysis was performed using Stata version 14.0. Sample weighting was done before doing any statistical analysis, to adjust for the non-proportional allocation of the sample to different regions and their urban and rural areas as well as to adjust for the non-response rates. Sample-based nonresponse adjustments distributed the base weights of the non-respondents to the respondents so that the sum of the adjusted weights over the responding units equals the

sum of the base weights for responding units and non- responding units. Descriptive statistics using frequency and percentage were used to get an overview of the selected variables. Multilevel logistic regression models were used to estimate the effects of unmet need for FP factors at the two specified levels. It allows for the estimation of valid standard errors by adjusting for the intra-cluster correlation of the outcome variable [43].

Four models were fitted. Firstly, model I, the empty or unconditional model, without covariates was analyzed. This model was used to estimate the random intercept at cluster level and the variation in the odds of unmet need for FP experience between communities. Secondly, model II was constructed by adding individual-level factors. Thirdly, model III was constructed by adding community-level factors. Finally, model IV including both individual-level community-level factors was constructed. Then, the appropriate model was selected using deviance and the model with the lowest deviance was fitted to estimate the association between independent factors and unmet need for FP. In addition, the measure of variance (random effects), which is the measure of residual errors at the individual level and community variation, was reported in terms of the intra-class correlation coefficient (ICC)[43] and proportional change in variance (PCV).[44]

Firstly, bivariable multilevel logistic regression models were fitted and all variables with a p-value < 0.20 at bi-variable analysis were entered into the multivariable analysis. Then multivariable multilevel logistic regression model was performed to control for possible confounders. In multivariable multilevel logistic regression models, odds ratios together with 95% confidence interval (CI) were calculated and statistical significance was declared at p-value <0.05.

Ethical Consideration

The data was accessed from the Demographic Health Survey Program at http://www.dhsprogram.com. Ethical approval was not needed because the study used publicly available data. However, permission to use the data for the study was obtained from the Demographic Health Survey program. Informed consent was obtained at the beginning of each interview by the EDHS data collectors.

Patient and public involvement statement

In this study, patients and the public were not involved in the study design or planning of the study. Furthermore, as we used secondary analysis, EDHS data patients were not consulted to interpret the results and were not invited to contribute to the writing or editing of this document for readability or accuracy.

Results

In this study, a total weighted sample of 8,327 women in reproductive age was included. The mean age of the study participants was 29.08 ± 7.71 years. Most of them were Orthodox (n = 3,262, 39.2%), had ever been married (n = 8,158, 98.0%), married before 18 years of age (n = 6,193, 75.9%), desired to have five or more children (n = 4,511, 54.2), and were not exposed to media (n = 6,729, 80.2%). Regarding educational status, nearly two-third (n = 5,449, 65.4%) of women and nearly half of their parents (n =3,801, 50.3%) had no formal education (**Table 1**).

Magnitude of unmet for family planning

In this study overall unmet need for FP among rural women was 24.08% (95%CI: 23.17, 25.01) of which 14.79% (95%CI: 14.04, 15.57) was for spacing and 9.29% (95%CI: 8.68, 9.93) for limiting (**Figure 1**).

Factors associated with unmet need for FP.

Random effect model

As presented in table 2, in the null model, about 9.6% of the total variance in the unmet need for FP was at the community level and may be attributable to other unobserved community factors (ICC = 0.096). In the final model (model IV), as indicated by the PCV, 17.2% of the variation in unmet need for FP across communities was explained by both individual and community-level factors. Additionally, the final model indicates that the lowest MOR value (1.67) which showed the effects of community heterogeneity. This means if we randomly select women from different clusters, women at the cluster with higher risk of unmet need for FP had 1.67 times higher odds of unmet need for FP as compared with those women at cluster with the lowest risk of unmet for FP. Besides, model fitness was checked using deviance and model IV with the lowest deviance (deviance= 6125.343) was used to identify significantly associated factors with unmet need for FP. Therefore, all interpretations and conclusions of results were thus based on model IV.

Fixed effect model

After adjusting for possible confounders, age, women's education level, wealth of household, number of children, age at first marriage, working status, distance from the health facility, community husband education level, and community media exposure were significantly associated with unmet need for FP in Ethiopia.

As age of women increases the odds of unmet need for FP increases (AOR=1.05; 95% CI: 1.04,1.06). The odds of unmet need for FP among women who attend primary education was 13% (AOR=0.87; 95% CI: 0.74,0.94) lower as compared with women with no formal education. As the number of children increases, the odds of unmet need for FP increases (AOR=1.15; 95% CI:

1.07, 1.24). Women who had been working within the 12 months preceding the survey had higher odds of having unmet need for FP (AOR=1.18; 95% CI: 1.02,1.37) compared to women who do not work. Women married at age 18 or later had 18% (AOR=0.82; 95% CI: 0.70, 0.96) lower odds of unmet need for FP as compared to marital age less than 18. Additionally, considering the wealth index, the odds of unmet need for FP among women from high wealth class was 23% (AOR= 0.77; 95% CI: 0.64,0.94) lower as compared with women from the poorer/poorest class. Among community factors, the odds of unmet for FP among women reporting distance to a health facility as not the big problem was decreased by 15% (AOR=0.85; 95% CI: 0.73, 0.99) compared with their defined counterparts. Moreover, women from communities with a high percentage of educated women (AOR=0.73; 95% CI: 0.59, 0.89) were less likely to have unmet need for FP compared with women from communities with a low percentage of educated women. Similarly, this study further reveals that women who live in communities with high media exposure were associated with decreased odds of unmet need for FP compared to women in low-media exposure communities (AOR=0.81, 95% CI: 0.68,0.98) (**Table 2**).

Discussion

This study was conducted to investigate the magnitude and factors for unmet need in FP among rural women in the reproductive age group. This study contributes to the literature on unmet need for FP by focusing on rural women, who have high unmet need for FP. Few studies of unmet need in rural areas have looked at this population. Identifying specific factors associated with unmet need for family planning in a rural area has therefore been brought further to the fore of national family planning awareness and improving access to reproductive health services, as this is critical for achieving the fifth SDG goal.[45] Additionally, this study extended factors associated

with unmet need for FP by considering community-level factors that may shape the level of unmet need for family planning in Ethiopia. This provides information on a wider range of factors to be targeted by family planning policymakers in the country.

The current study revealed that 24.08% (95%CI: 23.17, 25.01) of rural women in reproductive age in Ethiopia had total unmet need for FP. The result is lower than a study conducted in Ethiopia,[13,15–17,46] Ghana,[47] and Cameroon.[11] This discrepancy could be explained by the fact that the previous studies conducted in Ethiopia[13,15–17] were small scale surveys compared to the EDHS which is a nationally representative survey and covered more women in the region. It could be due to the differences in studied populations and background characteristics differences among participants. For example, assessing unmet need of long-acting and permanent family planning methods [13] and among young married women [17] in Ethiopia, and unmet need among HIV positive women in Ghana[47] versus assessing unmet need for FP among reproductive-age group women in our study. In terms of background characteristics differences among participants, the proportion of women who were married in this study was 98.0%, and in the Cameroon study, it was 61.1%.[11] In this regard, the previous study implies that married women had 59% lower odds of unmet need for FP compared to never married women.[10] Therefore, having large proportions of women who are married in our study may reduce the odds of unmet need for FP.

However, the magnitude of unmet need for FP in this study was higher than studies conducted in Ethiopia,[14,18] Burkina Faso,[9] Malawi,[10] Cameroon,[36] and Nigeria.[35] This variation might be attributed to the differences in study population and study setting. The current study exclusively includes rural women. In most parts of Ethiopia, rural residents have usually low health services coverage and decreased awareness of FP due to low education, low socioeconomic status, and

have limited access to FP services this may lead to a higher prevalence of unmet need in rural areas. Therefore, this provides information on rural residents to be targeted by family planning policymakers in the country because the high unmet need for FP further exposes women to unintended pregnancies and unsafe abortion, which raises the risk of maternal and child death.[9,48] Another possible explanation for the difference in the prevalence of unmet need could be the difference in the educational level of study participants. For instance, a previous study done in Ethiopia reported that 41.6% of women have no formal education which was lower than that of this study (65.4%). Moreover, a study conducted in Sudan reveals that 51.1% of women had secondary education which was higher than that of the current study (3.6%). Previous literature documented that educational level has a negative relationship with unmet need for FP.[10,13,30,32,34,35,37] Therefore, expansion of women's education, which is currently poor as found in the current study, is recommended to increase awareness and to reduce unmet need for FP among women in rural areas. Besides, empowering illiterate women to know about and use FP, and its promotion of men and couples through increasing outreach in the form of household visits by a community health worker may reduce unmet need for FP in rural areas.[49,50] A higher proportion was observed for unmet need for spacing in comparison with that for limiting (14.79% Vs 9.28%). This finding is in line with other studies conducted in different parts of Ethiopia[14,18] and Cameroon [11,36] where unmet need for spacing contributed to a higher proportion of the total unmet need.

In this study age of women was statistically significant that as age of women increased, the magnitude of unmet need also increased. Similarly, a study conducted in Ethiopia[14,17] and Malawi[10] reveals that unmet need for family planning was higher among older women than

younger women. This could be because older women near to menopause may be perceived as low risk for pregnancy and younger women may have better awareness of FP due to recently attending school. Moreover, this association may be explained by the fact that older women tend to have higher numbers of children than younger women.

In this study, women's education is another important variable which significantly associated with unmet need for FP. That is women with primary education were less likely to report having an unmet need for FP as compared to women without education. This is congruent with the study conducted in Ethiopia,[13,30,37] Nigeria,[35] Malawi,[10] Burundi,[32] and other LMICs .[34] This might be due to women who attained education being more exposed to family planning through media and other modes of exposure, which improves access to FP alternatives and helps them to understand the health benefits of the FP to reduce fertility, maternal and child morbidity and mortality. It suggests that educated women are more likely to gain family planning services because they are more empowered in decision making regarding contraceptive use.[51] Furthermore, the educational status of women is directly related to economic and social empowerment which increased exposure to resources such as access to media and utilization of desired health care delivery services. Our study contradicts the finding of studies conducted in Ethiopia,[18,37] Burundi,[32] Nigeria,[33] and Nepal,[31] which have reported educated women have higher odds of unmet need for FP. These findings indicate that the need to take the context into account when assessing factors associated with unmet need for FP.

A lower proportion of unmet need for FP was observed among women in the high wealth quantile. Results of this study show that women who were in the high wealth quintile were 23% less likely to have unmet need for FP than women who belong to the low quintile; this is in line

with the results of other studies conducted in Ethiopia,[18,24] Burundi,[32] Nigeria,[33] and Pakistan.[25] This may be due to our result reveals women in the high wealth category were most of them attend higher education but those in the low wealth category were most of them are not educated. Additionally, most of the women in the high wealth category are exposed to media (54.0%) as compared with women in the low wealth category (23.7%). Education and mass media exposure could probably give women a better chance to understand the uses of family planning and the negative effects of family planning methods thereby increased their consistent use.

The current study found that women who had been working within the 12 months preceding the survey had higher odds of having unmet need for FP. This finding is supported by study conducted in Malawi [10]. The possible explanation for this association might be because women who were working can have a good income so they may be able to afford private health facilities compared with their counterparts.[52] Moreover, women who were working would have a great deal of trust and decision-making ability on health services including FP.[52,53]

Consistent with previous studies,[9,14,15,31–35] our study indicates that unmet need for FP is positively associated with having more children. Even though women with many children may actually want to either delay the birth of their next child or to limit births, they are not empowered to use family planning by the socio-cultural setting in rural areas [54,55]. Therefore, it is important to address socio-cultural barriers to reproductive health services in rural areas by strengthening the traditional governance structure, forming volunteer groups and committees, promoting male involvement in reproductive health services and engaging religious, and clan leaders in reproductive health services.[56]

We also identified that as the first marital age increased, the level of unmet need decreased. Women married at age 18 or later had lower odds of unmet need for FP compared to women who married before age 18. This finding is similar to study conducted in Gonji Kolela District, Ethiopia,[57] but it disagrees with another study done in Southern Nations, Nationalities and Peoples Region, Ethiopia.[54] Women who marry at age 18 or later were able to plan and decide their family size because they had more exposure to FP methods. In addition to increased unmet need for FP, child marriage (marriage before their 18th birthday) is associated with early childbearing, low economic status of women, termination of education, negative psychological impact, higher rates of divorce, a number of poor social and physical outcomes for young women and their offspring, complications of pregnancy and an increased risk of both maternal and child mortalities.[58,59] This implies policymakers should strive to create awareness and enforce the legal age for marriage so as to increase the marital age above 18 years to reduce unmet need for FP. However, studies on marital age have resulted in conflicting findings in Ethiopia. Some studies reported that marital age is negatively associated with unmet need for FP[46,57], while one study reported that marital age are positively associated with unmet need for FP[54]. In this regard, a systematic meta-analysis conducted in Ethiopia revealed that the odds of unmet need for FP was 2.3 times higher among women with age at first marriage < 18 years than women marriage at 18 years and above.[60]

Similar to a study conducted in Malawi,[10] this study found that unmet need for FP was greater among women who cited the distance to a health facility as a problem. This finding suggests improving geographical access to health facilities decreases unmet need for FP. This could be explained by women who live closest to health facility being more likely to receive appropriate

maternal healthcare services.[61–63]Previous studies revealed that women who received maternal healthcare services (antenatal and postnatal care) were more likely to use contraception than women who did not receive any maternal healthcare services.[64,65]

Furthermore, the current study reveals that community-level factors were also associated with the unmet need for FP. Unmet need for FP was found to be lower among women from communities with a high percentage of educated women. This is consistent with a study conducted in Malawi.[10] The result of our study further reveals that women who live in communities with high media exposure had decreased odds of unmet need for FP compared to women in low-media exposure communities. This might be due to educated women having higher odds of understanding health messages and experiencing demand for FP services. Additionally, educated women and women from wealthier households are more likely to be empowered to make decisions on their own, which may subsequently increase accessing information and affording private health facilities to access FP services.[66,67] Mass media is an important tool for mobilizing communities to use FP services.[30] Therefore, women from communities with a high percentage of exposure to media and educated women may learn from others about the benefit of using FP services and where these may be accessed.

This study builds literature on both individual and community-level factors associated with unmet need for FP among rural women using EDHS. This has implications for both interventions at the individual and community level. Therefore, we hope this study will help policymakers to make wise decisions to reduce unmet need for FP, and it could be used as a baseline measure for future family planning intervention studies.

Strength and limitations

The main strength of this study was it used large population-based data with a large sample size, which is representative of the entire population of rural Ethiopia. Also using large sample size allows us to more precisely estimate unmet need for family planning and the effect size for associated risk factors. Furthermore, multilevel logistic regression was applied for this study to identify the contextual factors in the occurrence of unmet need for FP among rural women of reproductive age. Despite the study's strengths, it has limitations. Due to the cross-sectional nature of the EDHS data, it does not show a temporal relationship between independent variables and outcome variable. Additionally, due to the use of secondary data essential factors such as knowledge and attitude of FP methods, fear of side effects, health worker training on FP and men's perspectives on contraceptive use were not available in the EDHS; therefore, it was not possible to incorporate these variables in the analysis.

Conclusion

This study has shown that unmet need for family planning among reproductive-aged women in rural Ethiopia was high. Number of children, and working status of women were significantly associated with higher odds of unmet needs for family planning. However, women with primary education, women married at age 18 or later, being higher wealth, distance to a health facility not the big problem, women from communities with a high percentage of educated women and women who live in communities with high media exposure were significantly associated with a lower odds of unmet needs for family planning. Therefore, there is the need to implement consistently effective family planning policies among rural women in Ethiopia. Moreover, public health policies and interventions that will strengthen women's education, improve the existing strategies to increase the marital age of women, improve media exposure of women on family

planning issues and increase the wealth status of households should be designed and implemented to reduce unmet need for FP in rural parts of country.

List of abbreviations

AOR: Adjusted Odds Ratio; CI: Confidence Interval; EDHS: Ethiopian Demographic and Health Survey; ICC: Intraclass Correlation Coefficient; FP: Family Planning; LLR: Loglikelihood Ratio; MOR: Median Odds Ratio; PCV: Proportional Change in Variance

Consent for publication

Not applicable

Availability of data and materials

The datasets used and/or analyzed during the current study is available in a public, open access repository which is accessible online http://www.dhsprogram.com.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

AZA: developed the concept, reviewed literature, carried out the statistical analysis, interpreted the results and prepared the manuscript. CDA: reviewed literature, involved in analysis, interpretation and prepared the manuscript. Both the authors read and approved the manuscript.

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References

1. Ellen Starbird, Maureen Norton RM. Investing in Family Planning: Key to Achieving the Sustainable Development Goals. *Glob Heal Sci Pract*. 2016;4(2):1-20. doi:https://dx.doi.org/10.9745%2FGHSP-D-15-00374

2. Gebremeskel F, Estifanous W, Gizachew Y, Jemal S, Atnafu N, Nuriye K. Utilization of Family Planning Methods and Associated Factors Among Reproductive-Age Women with Disability in Arba Minch Town ,. *J Contracept*. 2020;11:25-32. doi:http://doi.org/10.2147/OAJC.S240817

3. Moreira LR, Ewerling F, Barros AJD, Silveira MF. Reasons for nonuse of contraceptive methods by women with demand for contraception not satisfied : an assessment of low and middle-income countries using demographic and health surveys. *Reprod Health*. 2019;16(148):1-15. doi:https://doi.org/10.1186/s12978-019-0805-7

4. *Central Statistics Agency (CSA) [Ethiopia] and ICF International: Ethiopia Demographic and Health Survey 2016. In. Addis Ababa, Ethiopia and Rockville, Maryland, USA: Central Statistical Agency (CSA) and ICF International; 2016.*; 2016.

5. Mulatu T, Sintayehu Y, Dessie Y, Deressa M. Modern Family Planning Utilization and Its Associated Factors among Currently Married Women in Rural Eastern Ethiopia : A Community-Based Study. *journal, BioMed Res Int*. 2020;2020. doi:https://doi.org/10.1155/2020/6096280

6. United Nations Department of Economic and Social Affairs, Estimates and projections of family planning indicators. Available from: https://www. un.org/en/development/desa/population/theme/family-planning/cp_model. asp. Accessed 17 April. 2020.

7. Sedgh G, Ashford LS HR. Unmet need for contraception in developing countries: examining Women's reasons for not using a method. *New York Guttmacher Institute*. 216AD;2:2015–6.

8. Gahungu J, Vahdaninia M, Regmi PR. The unmet needs for modern family planning methods among postpartum women in Sub - Saharan Africa : a systematic review of the literature. *Reprod Health*. 2021;18:1-15. doi:10.1186/s12978-021-01089-9

9. Wulifan JK, Jahn A, Hien H, et al. Determinants of unmet need for family planning in rural Burkina Faso : a multilevel logistic regression analysis. 2017:1-11. doi:10.1186/s12884-017-1614-z

10. Nkoka O, Mphande WM, Ntenda PAM, Milanzi EB, Kanje V, Guo SJG. Multilevel analysis of factors associated with unmet need for family planning among Malawian women. *BMC Public Health*. 2020;20:1-12. doi:https://doi.org/10.1186/s12889-020-08885-1

11. Edietah EE, Njotang PN, Ajong AB, Essi MJ, Yakum MN, Mbu ER. Contraceptive use and determinants of unmet need for family planning ; a cross sectional survey in the North West Region , Cameroon. *BMC Womens Health*. 2018;18:1-8. doi:https://doi.org/10.1186/s12905-018-0660-7

12. Wemakor A, Garti H, Saeed N, Asumadu O, Anyoka B. Prevalence and determinants of unmet need for contraception in North Gonja. *BMC Womens Health*. 2020;20:1-9. doi:https://doi.org/10.1186/s12905-020-01077-4

13. Mota K, Reddy S, Getachew B. Unmet need of long-acting and permanent family planning methods among women in the reproductive age group in shashemene town , Oromia region , Ethiopia : a cross sectional study. *BMC Womens Health*. 2015:1-8. doi:10.1186/s12905-015-0209-y

14. Gebre G, Birhan N, Kahsay Gebreslasie. Prevalence and factors associated with unmet need for family planning among the currently married reproductive age women in Shire-Enda- Slassie, Northern West of Tigray, Ethiopia : a community based cross-sectional study. *Pan Afr Med J*. 2016;8688:1-9. doi:10.11604/pamj.2016.23.195.8386

15. Solomon T, Nigatu M, Gebrehiwot TT, Getachew B. Unmet need for family planning and associated factors among currently married reproductive age women in Tiro Afeta District , South West Ethiopia , 2017 : cross- sectional study. *BMC Womens Health*. 2019;19:1-9. doi:https://doi.org/10.1186/s12905-019-0872-5

16. Worku SA, Ahmed SM, Mulushewa TF. Unmet need for family planning and its associated factor among women of reproductive age in Debre Berhan Town ,. *BMC Res Notes*. 2019:9-14. doi:10.1186/s13104-019-4180-9

17. Dingeta T, Oljira L, Worku A, Berhane Y. Unmet Need for Contraception Among Young Married Women in Eastern Ethiopia. *J Contracept*. 2019;10:89-101. doi:https://doi.org/10.2147/OAJC.S227260

18. Tadele A, Abebaw D, Ali R. Predictors of unmet need for family planning among all women of reproductive age in Ethiopia. *Contracept Reprod Med*. 2019;6(4):1-9. doi:https://doi.org/10.1186/s40834-019-0087-z

19. Central Statistics Agency (CSA) [Ethiopia] and ICF International: Ethiopia Demographic and Health Survey 2000. In. Addis Ababa, Ethiopia and ORC Macro Calverton, Maryland, USA: Central Statistical Agency (CSA) and ICF International; 2000.

20. Genet E, Abeje G, Ejigu T. Determinants of unmet need for family planning among currently married women in Dangila town administration , Awi Zone , Amhara regional state ; a cross sectional study. *Reprod Health*. 2015:1-5. doi:10.1186/s12978-015-0038-3

21. Bishwajit G, Tang S, Yaya S, Feng Z. Unmet need for contraception and its association with unintended pregnancy in. *BMC Pregnancy Childbirth*. 2017;17:1-9. doi:10.1186/s12884-017-1379-4

22. Id SY, Id BG. Prevalence of unmet need for contraception and its association with unwanted pregnancy among married women in Angola. *PLoS One*. 2018;13(12):1-13. doi:https://doi.org/10.1371/journal.pone.0209801

23. Organization WH: A guide to family planning for community health workers and their clients. 2012.

24. Yalew M, Adane B, Kefale B, Damtie Y. Individual and community-level factors associated with unmet need for contraception among reproductive-age women in Ethiopia ; a multi-level analysis of 2016 Ethiopia Demographic and Health Survey. *BMC Pub Heal*.

2020;20:1-9. doi:https://doi.org/10.1186/s12889-020-08653-1

25. Asif MF. Socio-demographic determinants of unmet need for family planning among married women in Pakistan. *BMC Public Health*. 2019;19:1-8. doi:https://doi.org/10.1186/s12889-019-7487-5

26. Kabagenyi A, Jennings L, Reid A, Nalwadda G, Ntozi J AL. Barriers to male involvement in contraceptive uptake and reproductive health services. A Qualitative Study of Men and Women's Perceptions in Two Rural Districts in Uganda. *Reprod Heal*. 2014;11(21). doi:https://doi.org/10.1186/1742-4755-11-21

27. Mosha I, Ruben R KD. Family planning decisions, perceptions and gender dynamics among couples in Mwanza, Tanzania. A Qualitative Study. *BMC Pub Heal*. 2013;13:523. doi:https://doi.org/10.1186/1471-2458-13-523

28. National Planning Commission, The Federal Democratic Republic of Ethiopia. The second growth and transformation plan (GTP II), 2015/16-2019/20: NPC Addis Ababa, Ethiopia, 2016. http:// dagethiopia.org/new/docstation/com_content.article/100/gtpii__ english.

29. FMOH. Health Sector Development Programme IV-2010/11–2014/15 https://www.healthynewbornnetwork.org/hnn-content/uploads/HSDP-IV-Final-Draft-October-2010.

30. Duressa LT, Getahun A, Regassa T, Babure ZK, Bidu KT. Unmet Need for Family Planning and Related Factors among Currently Married Women in Sibu Sire District. *J Women's Heal Care*. 2016;7(5):1-14.

31. Lamichhane K. Unmet Need for Family Planning among Currently Married Young Women in Nepal. *J Dev Adm Stud*. 2017;25:83-94. doi:https://doi.org/10.3126/jodas.v25i1-2.23446

32. Nzokirishaka A. Determinants of unmet need for family planning among married women of reproductive age in Burundi : a cross-sectional study. *Contracept Reprod Med*. 2018;11(4):1-13. doi:https://doi.org/10.1186/s40834-018-0062-0

33. Alaba OO, Olaomi JO, Olubusoye OE. Spatial pattern and determinants of unmet need of family planning in Nigeria Spatial pattern and determinants of unmet need of family planning in Nigeria. *South African Fam Pract*. 2015;57(5):306-312. doi:10.1080/20786190.2015.1071536

34. Wulifan JK, Brenner S, Jahn A, Allegri M De. A scoping review on determinants of unmet need for family planning among women of reproductive age in low and middle income countries. *BMC Womens Health*. 2016. doi:10.1186/s12905-015-0281-3

35. Solanke BL, Oyinlola FF, Oyeleye OJ, Ilesanmi BB. Maternal and community factors associated with unmet contraceptive need among childbearing women in Northern Nigeria. *Contraception*. 2019;11(14):1-12. doi:https://doi.org/10.1186/s40834-019-0093-1

36. Ajong AB, Njotang PN, Yakum MN, et al. Determinants of unmet need for family planning among women in Urban Cameroon : a cross sectional survey in the Biyem-Assi Health District , Yaoundé. *BMC Womens Health*. 2016:1-8. doi:10.1186/s12905-016-0283-9

37. Workie DL, Zike DT, Fenta HM, Mekonnen MA. A binary logistic regression model with complex sampling design of unmet need for family planning among all women aged (15-49) in Ethiopia . *Afr Health Sci*. 2017;17(3):637-646. doi:https://dx.doi.org/10.4314/ahs.v17i3.6

38. Nyarko SH, Sparks CS, Bitew F. Spatio-temporal variations in unmet need for family planning in Ghana : 2003 – 2014. *J Popul Sci*. 2019;36(3). doi:https://doi.org/10.1186/s41118-019-0069-7

39. Mercer LD, Lu F, Proctor JL. Sub-national levels and trends in contraceptive prevalence , unmet need , and demand for family planning in Nigeria with survey uncertainty. *BMC Public Health*. 2019;19:1-9. doi:https://doi.org/10.1186/s12889-019-8043-z

40. Pal A, Yadav J, Singh KJ. Factors associated with unmet need of family planning in Bihar , India : a spatial and multilevel analysis. *Int J Reprod contraception, Obstet Gynecol*. 2018;7(9):3638-3645. doi:https://dx.doi.org/10.18203/2320-1770.ijrcog20183768

41. Wilopo SA, Setyawan A, Pinandari AW, Prihyugiarto T, Juliaan F, Magnani RJ. Levels , trends and correlates of unmet need for family planning among postpartum women in Indonesia : 2007 – 2015. *BMC Womens Health*. 2017;17(1):1-14. doi:10.1186/s12905-017-0476-x

42. Central Statistics Agency (CSA) [Ethiopia] and ICF International: Ethiopia Demographic and Health Survey 2016. In. Addis Ababa, Ethiopia and Rockville, Maryland, USA: Central Statistical Agency (CSA) and ICF International; 2016.

43. Peugh J.L. A practical guide to multilevel modeling. *J Sch Psychol 2*. 2010;48(1):85– 112. doi:10.1016/j.jsp.2009.09.002.

44. Merlo J. et al. A brief conceptual tutorial of multilevel analysis in social epidemiology: using measures of clustering in multilevel logistic regression to investigate contextual phenomena. *J Epidemiol Community Health*. 2006;60(4):290–297. doi:10.1136/jech.2004.029454.

45. Starbird E, Norton M MR. Investing in family planning: key to achieving the sustainable development goals. *Glob Heal Sci Pr*. 2016;4(2):191–210. doi:https://dx.doi.org/10.9745%2FGHSP-D-15-00374

46. Dejenu G, Ayichiluhm M, Abajobir AA. Prevalence and Associated Factors of Unmet need for Family Planning among Married Women in Enemay District, Northwest Ethiopia: A Comparative Cross-Sectional Study. *Glob J Med Res Interdiscip*. 2013;13(4).

47. Laryea DO, Amoako YA, Spangenberg K, Frimpong E, Kyei-ansong J. Contraceptive use and unmet need for family planning among HIV positive women on antiretroviral therapy in Kumasi , Ghana. *BMC Womens Health*. 2014;14:1-8. doi:https://doi.org/10.1186/1472-6874-14-126

48. Bishwajit G, Tang S, Yaya S FZ. Unmet need for contraception and its association with unintended pregnancy in Bangladesh. *BMC Pregnancy Childbirth*. 2017;17:186. doi:https://doi.org/10.1186/s12884-017-1379-4

49. León FR, Lundgren R, Sinai I, Sinha R, Jennings V. Increasing literate and illiterate women ’

s met need for contraception via empowerment : a quasi-experiment in rural India. *Reprod Health*. 2014;11:1-10. doi:https://doi.org/10.1186/1742-4755-11-74

50. White JS, Speizer IS. Can family planning outreach bridge the urban-rural divide in Zambia? *BMC Health Serv Res*. 2007;9:1-9. doi:10.1186/1472-6963-7-143

51. Riaz S PZ. The impact of women's education and employment on their empowerment: an empirical evidence from household level survey. *Qual Quan*. 2018;52(6):1–6. doi:10.1007/s11135-018-0713-x

52. Tiruneh FN, Chuang K-Y CY-C. Women 's autonomy and maternal healthcare service utilization in Ethiopia. *BMC Heal Serv Res*. 2017;217(1):718. doi:https://doi.org/10.1186/s12913-017-2670-9

53. Viswan SP, Ravindran TKS, Kandala N-B, Petzold MG FS. Sexual autonomy and contraceptive use among women in Nigeria: findings from the demographic and health survey data. *Int J Women 's Heal*. 2017;9:581 –90. doi:https://dx.doi.org/10.2147%2FIJWH.S133760

54. Hailemariam A, Fikrewold Haddis. Factors affecting unmet need for family planning in Southern Nations, Nationalities and people. *Ethiop J Heal Sci*. 2011;21(2):77-89. doi:https://dx.doi.org/10.4314%2Fejhs.v21i2.69048

55. Cleland J, Harbison S SI. Unmet need for contraception: issues and challenges. *Stud Fam Plan*. 2014;45:105–22. doi:https://doi.org/10.1111/j.1728-4465.2014.00380.x

56. Wester KC, Medhanyie AA, Spigt M, Beumer C, Alemayehu M. Best practices for

addressing socio-cultural barriers to reproductive , maternal and neonatal health service utilization among women from pastoralist communities of Afar , Ethiopia : a qualitative study. *Ethiop J Heal Dev*. 2018;32:1-9.

57. Alebel Biadgie AN, Handebo S, Berhe R. Prevalence and Associated Factors of Unmet Need for Family Planning among Married Women in Rural Communities of Gonji Kolela District ,. *J Community Med Health Educ*. 2019;9(1):1-7. doi:10.4172/2161-0711.1000642

58. Herliana BR, Wayan N, Utami A, Putu D, Kurniati Y. Early marriage practices and the health impacts on female adolescent health in Central Lombok : a qualitative study. 2018;6(1):61-67. doi:10.15562/phpma.v6i1.11

59. Groot R De, Kuunyem MY, Palermo T. Child marriage and associated outcomes in northern Ghana : a cross-sectional study. *BMC Public Health*. 2018;18:1-12. doi:https://doi.org/10.1186/s12889-018-5166-6

60. Getaneh T, Negesse A, Dessie G, Desta M, Moltot T. Predictors of unmet need for family planning in Ethiopia 2019 : a systematic review and meta analysis. *Arch Public Heal*. 2020;78(102):1-11. doi:https://doi.org/10.1186/s13690-020-00483-2

61. Tanou, M., Kamiya Y. Assessing the impact of geographical access to health facilities on maternal healthcare utilization: evidence from the Burkina Faso demographic and health survey. *BMC Public Health*. 2019;19:838. doi:https://doi.org/10.1186/s12889-019-7150-1

62. De Allegri M, Tiendrebéogo J, Müller O, Yé M, Jahn A R V. Understanding home delivery in a context of user fee reduction: a cross-sectional mixed methods study in rural Burkina

Faso. *BMC Pregnancy Childbirth*. 2015;15:1–13. doi:https://doi.org/10.1186/s12884-015-0764-0

63. Soubeiga D, Sia D GK. Increasing institutional deliveries among antenatal clients: effect of birth preparedness counselling. *Heal Policy Plan*. 2014;29(8):1061–70. doi:10.1093/heapol/czt089

64. Linnea A. Zimmerman, Yuanyuan Yi, Mahari Yihdego, Solomon Abrha, Solomon Shiferaw, Assefa Seme 5and Saifuddin Ahmed. Effect of integrating maternal health services and family planning services on postpartum family planning behavior in Ethiopia: results from a longitudinal survey. *BMC Public Health*. 2019;19:1448. doi:https://dx.doi.org/10.1186%2Fs12889-019-7703-3

65. Amanu Aragaw Emiru , Getu Degu Alene GTD. The role of maternal health care services as predictors of time to modern contraceptive use after childbirth in Northwest Ethiopia: Application of the shared frailty survival analysis. *PLoS One*. 2020;15(2):e0228678. doi:https://doi.org/10.1371/journal.pone.0228678

66. Hameed W, Azmat SK, Ali M, Sheikh MI, Abbas G, Temmerman M AB. Women's empowerment and contraceptive use: the role of independent versus Couples' decision-making, from a lower middle income country perspective. *PLoS One*. 2014;9(8):e104633. doi:https://doi.org/10.1371/journal.pone.0104633

67. Samarakoon S PR. Does education empower women? Evidence from Indonesia. *World Dev*. 2015;66:428 –42. doi:https://doi.org/10.1016/j.worlddev.2014.09.002

674 **Figure legend**

675 **Figure 1:** Magnitude of unmet need for family planning among rural women in Ethiopia

676 **Table 1:** Background characteristics of respondents in Ethiopia, EDHS 2016

Variables	Frequency	Percent
Marital status		
Ever married	8,158	98.0
Never married	169	2.0
Education of respondent		
No education	5,449	65.4
Primary	2,497	30.0
Secondary	301	3.6
Higher	80	1.0
Educational status of husband		
No education	3,801	50.3
Primary	3,016	39.9
Secondary/above	736	9.8
Wealth index		
Low	3,863	46.4
Middle	2,005	24.1
High	2,459	29.5
Religion		
Orthodox	3,262	39.2
Protestant	1,824	21.9
Muslim	3,011	36.1
Others	230	2.8
Working status		
No	6,067	72.9
Yes	2,260	27.1

Media exposure		
No	6,729	80.2
Yes	1,598	19.8
Knowledge of ovulatory cycle		
Knowledgeable	1,681	20.2
Not knowledgeable	6,646	79.8
Desired number of children		
<5	3,816	45.8
≥5	4,511	54.2
Age at marriage		
<18 years	6,193	75.9
≥18 years	1,964	24.1
Prior pregnancy termination		
No	7,560	90.8
Yes	767	9.2
Child death		
No	7,175	95.7
Yes	372	4.3
Distance from health facility		
Big problem	5,106	61.3
Not big problem	3,221	38.7
Visited by field worker		
No	5,859	70.4
Yes	2,468	29.6
Visited health facility last 12 months		
No	6,068	72.9
Yes	2,259	27.1

677

678 **Table 2:** Multi-level logistic regression analysis for factors associated with unmet need for FP

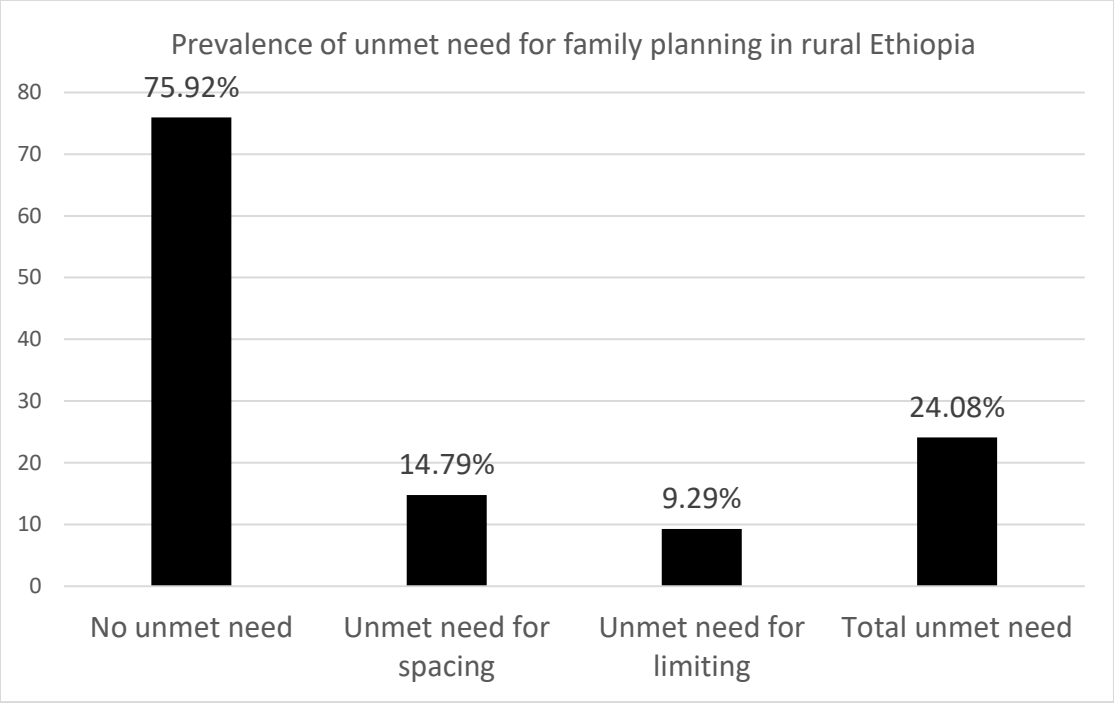
679 among reproductive-age women in Ethiopia, EDHS 2016

Variables	Model 1	Model 2 (AOR with 95 % CI)	Model 3 (AOR with 95 % CI)	Model 4 (AOR with 95 % CI)
Age		1.05 (1.04, 1.06)		1.05 (1.04, 1.06)*
Level of women's education				
No education		1		1
Primary		0.91 (0.80, 0.98)		0.87 (0.74, 0.94)*
Secondary		1.08 (0.71, 1.61)		1.09 (0.73, 1.64)
Higher		0.90 (0.39, 2.09)		0.91 (0.39, 2.11)
Working status of respondents				
Not working		1		1
working		1.21 (1.04, 1.40)		1.18 (1.02, 1.37)*
Type of media exposed				
No		1		1
Yes		0.87 (0.72, 1.05)		0.84 (0.69, 1.02)
Husbands' education				
No education		1		1
Primary		1.28 (1.08, 1.52)		1.23 (0.97, 1.33)
Secondary/above		1.13 (0.88, 1.44)		1.07 (0.84, 1.38)
Wealth Index				
Low		1		1
Middle		0.94 (0.78, 1.12)		0.93 (0.77, 1.11)
High		0.77 (0.64, 0.94)		0.77 (0.64, 0.94)*
Age at marriage				
<18		1		1
≥18		0.82 (0.70, 0.96)		0.82 (0.70, 0.96)*
Religion				

Orthodox	1		1
Protestant	1.08 (0.86, 1.36)		1.01(0.79, 1.2)
Muslim	1.14 (0.94, 1.38)		1.13(0.93, 1.38)
Others	1.64 (1.05, 2.56)		1.60 (1.03, 2.50)
Child death			
No	1		
Yes	1.19 (0.84, 1.69)		1.18 (0.84,1.68)
Pregnancy termination			
No	1		
Yes	0.94 (0.75, 1.17)		0.94 (0.75, 1.17)
Number of alive children	1.16 (1.07, 1.25)		1.15 (1.07, 1.24)*
Desired number of children			
<5	1		1
≥5	0.97 (0.84, 1.13)		0.99 (0.86, 1.15)
Distance from health facility			
Big problem		1	1
Not big problem		0.86 (0.76, 0.98)	0.85 (0.73, 0.99)
Community women's education			
Low		1	1
High		0.78 (0.64, 0.93)	0.73 (0.59, 0.89)*
Community husbands' education			
Low		1	1
High		1.17 (0.97, 1.14)	1.15 (0.94, 1.41)
Community wealth			
Low		1	1
High		0.83 (0.61, 1.12)	0.90 (0.66, 1.24)
Community media exposure			
Low		1	1

High			0.89 (0.75, 1.06)	0.81 (0.68, 0.98)*
Random effects and model comparison				
Community level variance (SE)	0.35(0.056)	0.32 (0.059)	0.30 (0.053)	0.29 (0.057)
ICC (%)	9.6	8.7	8.4	8.1
Deviance (-2LL)	7121.163	6140.094	7078.809	6125.343
PCV (%)	Ref	8.6	14.3	17.2
MOR	1.75	1.71	1.68	1.67

*P value <0.05



STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	1 & 2
Introduction			**3-6**
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-6
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			**7-10**
Study design	4	Present key elements of study design early in the paper	7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8 & 9
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	8 & 9
Bias	9	Describe any efforts to address potential sources of bias	-
Study size	10	Explain how the study size was arrived at	7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Not applicable
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	9 & 10
		(*b*) Describe any methods used to examine subgroups and interactions	Not Applicable
		(*c*) Explain how missing data were addressed	-
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	Not applicable
		(*e*) Describe any sensitivity analyses	Not Applicable
Results			11-13
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility,	11

		confirmed eligible, included in the study, completing follow-up, and analysed	
		(b) Give reasons for non-participation at each stage	Not Applicable
		(c) Consider use of a flow diagram	Not Applicable
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	11
		(b) Indicate number of participants with missing data for each variable of interest	-
Outcome data	15*	Report numbers of outcome events or summary measures	11
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	12 & 13
		(*b*) Report category boundaries when continuous variables were categorized	7
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Not Applicable
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Not Applicable
Discussion			13-20
Key results	18	Summarise key results with reference to study objectives	13 & 14
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	20
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	14-19
Generalizability	21	Discuss the generalisability (external validity) of the study results	20
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	21

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.