

Spatial Distribution Of Unmet Need for Family Planning among Married Women Aged Between 15-49 Years: Evidence from Ethiopia Demographic and Health Survey 2016

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ABSTRACT

Introduction: Worldwide, 12% of married women with an age range of 15-49 years have an unmet need for contraception. In Ethiopia unmet need for family planning was high when compared to a developed country (24.5% vs 10% respectively). This high unmet need for family planning show gaps between women reproductive desire to avoid pregnancy and contraceptive behavior. This study shows spatial distribution of this unmet need for family planning among zone of Ethiopia.

Objective: The aim of the study was to assess the spatial distribution of unmet need for family planning among married women aged b/w 15 to 49 year in Ethiopia

Methods: Cross-sectional study design was applied using Ethiopia demographic and health survey 2016 data. The sample size was 10,223 married women aged between 15-49 years. Spatial analysis was done using spatial autocorrelation Moran's I and spatial scan statics was applied to local significant clusters based on Bernoulli model.

Results: In Ethiopia, prevalence of unmet need for family planning was 22.3% (95% CI: 21.5%, 23.1%). The highest unmet need for family planning was spatially clustered in Jimma, Arsi, West Arsi, Southwest Shewa, Borena, Guji, West and East Hararge, Agnewak whereas the lowest in Fik, Gode, Afder, Liben Argoba, Afoder, and Sheka zones. Spatial scan statistics identified primary clusters (LLR=55.74, P<0.001) in Arsi, West Arsi, Bale, West Harrarge zone and secondary clusters (LLR=20.26, P<0.001) in Jimma, Southwest Shewa, Gurage, Silti, Hadiya, Yem and Wolayita zone. **Conclusions:** The study finding shows that insured patients perceived with a higher level of quality of care and satisfaction score. However, non-insured patients received high proportion score on objective quality of care measurements. Therefore, to improve patient experiences at health centers and achieve financial risk protection through CBHI, program managers and health care providers should ensure quality of services to the standards at the health facility to insured and noninsured community members.

Conclusions: The prevalence of unmet need in Ethiopia is high. Statistical significant primary and secondary clusters were detected. Unmet need for family planning is important to prioritize family planning strategy, which enables to know about the distribution of unmet need across zone of the nation Therefore, exerting much effort on this area is supreme important as it has significant public health contributions.

Keywords: EDHS, Ethiopia, Married women, Spatial distribution, Unmet need

LIST OF ABBREVIATIONS

LLR: Log Likelihood Ratio; LISA: Local Indicator Spatial Autocorrelations; FP: Family Planning; SNNP: Southern Nations,

Nationalities and Peoples; GPS: Global Positioning System; DHS: Demographic and Health Survey, EDHS: Ethiopian Demographic and Health Survey, RR: Relative Risk

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BACKGROUND

Family planning defined as “the capability of individuals and couples to anticipate and attain their desired number of children, and the spacing and timing of their birth, which is achieved through the use of contraceptive methods” [1]. It is cost-an effective way to reduce maternal mortality by reducing the number of pregnancies, abortions, proportion of at high-risk births, improve health related outcome, and social and economic benefits [2].

Unmet need for family planning (FP) exists when a woman who wants to limiting having children or postpone pregnancy by at least two years in the sum is not using contraception method [3]. Because of complex issue of family planning, especially related to unmet need for family planning, global community has committed to actions by include sexual and reproductive health in Sustainable Development goal (SDG) in 2030 agenda as family planning comprehension of reproductive rights for all people [4]. There are many barriers that restrict contraceptive utilization, if all obstacle are eliminated we can decrease 54 million unintended pregnancies which is a mainly the cause for more than 79,000 maternal and more than a million infant deaths.

More than half (63%) of women worldwide in 2017 were using some type of contraception methods which prevent unintended pregnancy [4,5] but about 12% of worldwide estimated married women aged between 15-49 year wants to delay or avoid pregnancy since 2015 [6].

The globally unmet need for FP rapidly decline since the 1970s and 1980s [5]. Generally unmet need for family planning were lowest below 10% in Eastern Asia, Eastern Europe, Northern America, Northern Europe, South America and Western Europe and the higher above 20 % in most of Africa countries [4,7]. Nevertheless, more than 10 million women had an unmet need for family planning in 2017 compared to 2000 and almost the majority of the burden were from Africa.4 Overall, unmet need of family planning was anticipated to decline worldwide due to declines in Asia and Europe [4].

Ethiopia is one of the sub-Saharan country that has the fastest population grows in the annual rate of 2.6%, in fact fertility declined from the 1990 level of 6.4 to 4.1 births per women in 2014. Ethiopia, Federal Ministry of Health (FMOH) has built an impressive framework for improving the health and control fertility [2,8,9]. As a consequence 99% of facilities and 79% of health posts offer FP services at least five days per week [10] and contraceptive prevalence had been remarkable progress from 15% in 2005 to 29% in 2011 [2]. Unmet need for family planning was declining from 36% in 2000 to 25% in 2010 [11]. However, it was still high about 24.3 % in 2014 [10] and the demand for family planning also increased from 45% to 58 % during the 2000 to 2016 period [12].

Ethiopian demographic and health survey (EDHS) and health management information system (HMIS) reports confirm that unmet need for family planning was decreased, in general and wide variation exists among regions and place of resident [10]. A National survey conducted in India showed that there is geographical variation of unmet need for family planning for spacing and limiting [13].

A national survey conducted in Ethiopia showed that unmet need for family planning was a significant disparity in residence and regional states among married women [14,15]. EDHS reports pointed out geographic and socio-cultural factors affect regional variation [10,16]. Spatial variation of unmet need for family planning was due to geographically related factors in addition to sociodemographic factors [17,18,19]. Ethiopia has also has been planned to reduce unmet need for family planning through health

sector transformation plan (HSTP) and for the success of the plan, designing geographical based intervention is important [12].

Hence investigative the demographic disparities, social and economic inequalities in unmet need for family planning is important to identify the most vulnerable and marginalized populations [5]. Therefore, this study aimed to explore the spatial distribution of unmet need for family planning among married women aged between 15-49 year. This the finding would be important to give information about areas with a higher cluster of the unmet need for family planning.

METHODS AND MATERIALS

Study design period and setting

A population based cross-sectional study design was conducted using secondary data analysis from the Ethiopia demographic health survey (EDHS) 2016. EDHS 2016 was the fourth Demographic and Health Survey conducted in Ethiopia and seventh of demographic and health survey series [20,21]. EDHS data obtained from the nine regions and two administrative cities was used. The data collection from January 18, 2016 to June 27, 2016. The data management and cleaning process carried out from March to April.

Study area

The study was conducted in Ethiopia (30-40N and 330-480E, situated at the eastern tip of Africa which is located at the horn of Africa (one of the tenth largest countries in Africa) [8] (Figure 1). The projections for the 2007 population and housing census estimate the population of nation 108,805,142 in 2018. In the administrative structure of the country, there are nine regional states and two city administrations subdivided into 68 zones, 817 districts and 16,253 kebeles (the lowest local administrative units of the country) [22].

In Ethiopia majority of the population (83.6%) are living in rural areas and the average household size is 4.7 persons [22].in addition, women in the reproductive ages constitute 24% of the population and 7,685 health posts, 392 hospitals and 3,962 health centers have been giving health care services. In all health facilities, family planning service is provided at least five days a week [10,12].

Data source and extraction

The data for this analysis were extracted from EDHS 2016 and accessed from the Measure DHS website (<http://www.dhs.program.com>). It is a secondary data analysis from nationwide community-based survey. The data sets were downloaded in SPSS format with permission from Measure DHS website (<http://www.dhs.program.com>). Data cleaning and recording were carried out in STATA. The family planning related datasets were joined to Global Positioning System (GPS) coordinates of EDHS using the joining variable as recommended by DHS measure. In the DHS surveys, samples were selected using a stratified, two-stage cluster design, using enumeration areas (EAs) as a primary sampling units and households as the secondary sampling units.

Sample size determination and sampling procedures

Ethiopia demographic and health survey 2016 was done by selecting a total of 18,008 households for sample, of which 17,067 were occupied. Of occupied, 16,650 were successfully interviewed, yielding a response rate of 98%. The total household size was 16,650 and from these 16,583 eligible women were identified for individual interviews. The interview completed with 15,583

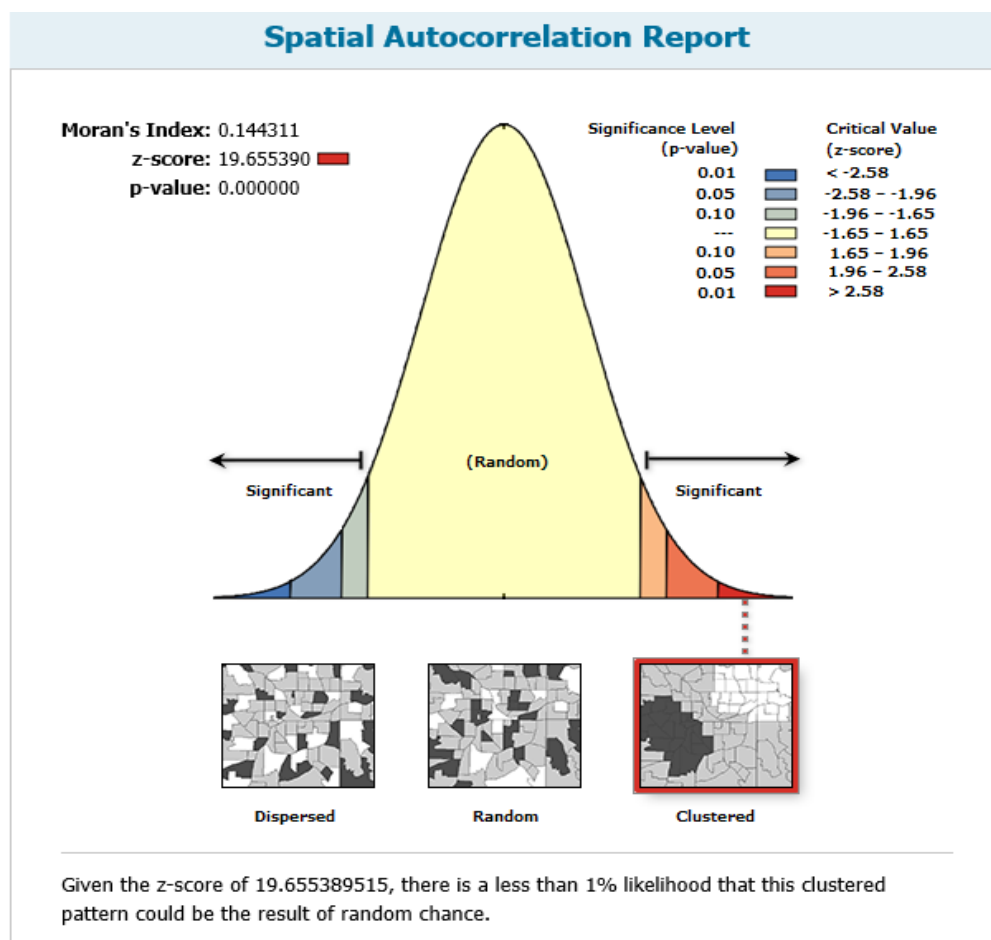


Figure 1. Map of Ethiopia where the study is undertaken 2013.

women yields a response rate of 95%. From 15, 583 women aged between 15-49 years that completed the interview, all married women 10,223 (weighed sample) were included in this study [21]. A two-stage samples technique was employed. The stratified based on geographic region and urban/rural areas. In the first stage of selection, the Primary Sampling Units (PSUs) were selected with probability proportional to size (PPS) within each stratum. The PSU forms the survey cluster a total of 645 EAs (202 in urban areas and 443 in rural areas). Then fixed number of 28 households (25-30) per cluster were selected with an equal probability systematic selection from the newly created household listing in the second stage of survey. The overall probability of selection of a household was differed from cluster to cluster [21].

Population and outcome measurement

All women aged 15 to 49 within randomly selected enumeration areas (EAs) were eligible for family planning as part of EDHS. Unmet need for family planning (yes/no) based on Bradley revised definition of unmet need for family planning. It was categorized as unmet need and no unmet need for family planning [23].

Data management, data processing and analysis methods

Sampling weight was applied to an individual interview unit of analysis to adjust for differences in probability of selection and interview between cases in a sample due to design, happenstance or corrections for differential response rates. Weighing of individual interview produce the proper representation of family planning information and related factor. All of these special codes was careful considered when analyzing DHS datasets.

The data extraction, descriptive and summary statistics were done by STATA 14. Spatial statics was analyzed by ArcGIS version 10.3 and Sat Scan™ version 9.6 software.

Spatial analysis of unmet need for family planning

Spatial autocorrelation: Moran's I is one of spatial autocorrelation methods which was used to assess the extent of clustering of unmet need of family planning in the regions. Moran's I test statistic computed to test the null hypothesis, no significant clustering of unmet need of family planning in the entire study region [24].

The Local Indicator of Spatial Association (LISA): The Local Indicator of Spatial Association (LISA) effectively decomposes a global measure of spatial autocorrelation, enabling assessment of statistical significance of unmet need for family planning for each unit. Local Moran's index was used in order to study the Local Indicator of Spatial Autocorrelation (LISA) since it used to assess local associations by comparing local averages to global average and significance was estimated by generating a reference distribution using 999 random permutations.

Significance map in LISA includes the following output: High-High: Positive spatial autocorrelation that indicates high values clustering. Low-Low: Positive spatial autocorrelation that indicates clustering of low value. Low-high: Negative spatial autocorrelation indicates that low value rates are adjacent to high value rates. High-Low: Negative spatial autocorrelation that indicates that high values are adjacent to low value rates not significant indicates that there is no spatial autocorrelation [25,26].

Getis OrdGi* statistic (Hot spot analysis): Hotspot statistic was computed to measure how spatial autocorrelation varies over the

study location by calculating G_i^* statistics for each area. The Z-score is computed to determine the statistical significance clustering of unmet need for family planning, and the p-value computed for the significance. The p-value associated with a 95% confidence level is 0.05. If the z-score is between -1.96 and +1.96, the p-value would be larger than 0.05, and could not reject the null hypothesis; the pattern exhibited could very likely be the result of random spatial processes. If the z-score falls outside the range, the observed spatial pattern is probably too unusual to be the result of random chance, and the p-value would be small to reflect this. Therefore, it is possible to reject the null hypothesis and proceed with figuring out what might be causing the statistically significant spatial pattern in the data. Generally high G_i^* indicates “hotspot” whereas low G_i^* means a “cold spot” [27,28].

Spatial interpolation: Spatial interpolation technique was applied to predict the un-sampled /unmeasured value of unmet need for family planning from sampled measurements. Spatial interpolation map created by continuous images produced by interpolating (Kriging Interpolation method) of unmet need for family planning cases [29].

Spatial scan statistic: Spatial scan statistic is based on Bernoulli model which applied by Kuldorff methods using the SaTScan™ software to analyze the purely spatial and clusters of unmet need of family planning. A Bernoulli-based model was used in which events at particular places analyzed if married women were unmet need of family planning or not represented by a 0/1. A spatial scan statistic used a scan window (the population at risk) in the shape of a circle, which moves across the study region. The size of the scan window was adjusted to scan for small clusters up to 25%. It also used to examine a large number of distinct geographical windows to test for the presence of unmet need for family planning. For each window Monte Carlo simulation used to test the null hypothesis that there was no statistically cluster of unmet need of family planning cases within the window.

The cluster with the greatest maximum likelihood ratio was considered as the primary cluster of unmet need for family planning. Other statistically clusters that did not overlap with the primary cluster was identified as secondary clusters of unmet need of family planning, and ranked according to their likelihood ratio test statistic. ArcGIS software used to map the cluster and attribute of unmet need of family planning which SaTScan™ software need export to it [24,30].

Operational definitions

Unmet need for family planning: it refers to woman who wants to avoid becoming pregnant but not using any modern method of contraception including all fecund women, who either do not want any more children or who wish to postpone the birth of their next child for at least two more years but are not using any method of contraception. The unmet need group also includes all pregnant women whose pregnancies were unwanted or mistimed or who unintentionally became pregnant because they were not using contraception [23].

Ethical consideration

The data was accessed by registration on the DHS website (www.dhsprogram.com) and getting approval from the measure DHS. Prior to the actual interview, informed consent was obtained from the participants, their guardian or household heads. Data was used only for the purpose of statistical reporting and analysis, and for the proposed research project. The data treated as confidential, and no effort should be made to identify any household or individual respondent interviewed in the survey. Ethical clearance

was obtained from the institutional ethical review board of the Institute of Public Health, College of medicine and health sciences, University of Gondar, Ethiopia.

RESULTS

Socio-demographic characteristics

A total of (n=10,223) married women were interviewed in 2016 EDHS. Among these married women 4451 (43.54%) were within the age group of 25-34 years. The mean age of the respondents was 27 years (SD ± 9 years). More than half of the respondent 6253 (61.2%) were not educated. About 3,401 (33.26%) of respondents had more than four children and large proportion of respondents 7400 (72.39%) had cohabitation before age of 18 years. Regarding to partner's education level, 4,685(45.82%) were not educated (Table 1).

Family planning knowledge and other characters of married women

Almost all of respondent 10091 (98.71%) had the family planning knowledge and nearly half of respondents 4254 (41.61%) discussed family planning issues in the community. About 2795 (27.34%) respondents heard about family planning by mass media. More than half of respondents 5582 (54.6%) and 5775 (56.49%) were difficult to access health facility and prefer to have another child respectively. Regarding to decision making about family planning, 5824(56.97%) married women decided with their partner (Table 2).

Unmet need of family planning among married women

Out of the 10,223 participants, 2280 (22.3%) had unmet need for family planning 1329 (13%) for spacing, 951 (9.3%) for limiting among currently married women. Most of respondents 1732 (76%) with unmet need were before 18 years of cohabitations. Married women who had a number of children above four had 1063 (46.61%) unmet need for family planning. About 1528 (67%) and 1619 (71.0%) unmet need was among respondents with no education and no working status respectively. Those married women who were difficult to access health services had 1469 (64.42%) unmet need for family planning (Table 3).

Regional prevalence of unmet need family planning

The prevalence of unmet need for family planning varied across the regions of the country. The highest unmet need for family planning was found in Oromia region (28.6%) and the lowest unmet need for family planning was in Addis Ababa (10.48%) (Figure 2).

Spatial distribution of unmet need for family planning

Spatial analysis of unmet need for family planning: Unmet need for family planning, spatial variation was found at zonal levels. The analysis of spatial autocorrelation indicated that the spatial distribution of unmet need for family planning was non-random in the Ethiopia. The Global Moran's I values 0.31 (p value <0.001) indicated that there was significant clustering of unmet need for family planning in the study area (Figure 3). The spatial distribution analysis also indicated significant variations of unmet need for family planning across Ethiopia. The highest unmet need for family planning was spatially clustered in Jimma, Arsi, West Arsi, Southwest Shewa, Borena, Guji, and West and East Hararge zone of Oromia region, an Agnewak zone of the Gambela region whereas lowest in Fik, Gode, Afder, Liben zone of Somali region, Argoba zone of Amhara region, Afoder zone of Afar region, and Sheka zone of Souther Nations and Nationality People region (SNNPR) (Figure 4).

Table 1: Socio demographic characteristics of married women in EDHS, 2016 (n=10,223).

Variable	Frequency (N)	Percentage (%)
Age		
15-24	2298	22.47
25-34	4451	43.54
35-49	3474	33.99
Age first cohabitation		
<18	7400	72.39
>18	2823	27.61
Women education level		
No education	6253	61.2
Primary	2895	28.3
Secondary	654	6.4
Higher	421	4.1
Religion		
Orthodox	4,139	40.49
Muslin	3,540	34.63
Protestant	2,289	22.39
Other	255	2.49
Wealth index		
Poorest	1953	19.1
Poorer	2074	20.29
Middle	2126	20.79
Richer	2070	20.25
Richest	2000	19.57
Number of living children		
0	925	9.05
1-2	3,137	30.68
3-4	2,761	27.01
>4	3,400	33.26
Partners education		
No education	4,685	45.82
Primary	3,772	36.9
Secondary	975	9.54
Higher	713	6.97
Don't know	78	0.77
Respondent working status		
No	7060	69.1
Yes	3163	30.9
Partner occupation		
No	807	7.89
Services	1628	15.92
Agricultural	6327	61.89
Manual	1013	9.91
Other	448	4.39

Table 2: Family planning knowledge and other characters of married women in EDHS, 2016 (n=10,223).

Variable	Frequency (N)	Percentage (%)
Knowledge about family planning		
No	132	1.29
YES	10091	98.71
Exposure to family planning message		
NO	7428	72.66
YES	2795	27.34
Discussion of family planning in community		
NO	5969	58.39
YES	4254	41.61
Field workers visit in last 12 month		
NO	7183	70.3
YES	3040	30.7
Health facility visit in last 12 month		
No	5224	51.1
Yes	4999	48.9
Health facility distance		
Big problem	5582	54.6
Not big problem	4641	45.4
Desire more children		
Have another	5775	56.49
Undecided	529	5.17
No more	3713	36.32
Sterilized	43	0.42
Declared infecund	163	1.6
Husband desire more children**		
Both want same	3991	39.2
Husband wants more	2637	25.9
Husband wants fewer	726	7.13
Don't know	2827	27.77
Decisions making for contraceptive use**		
MAINLY RESPONDENTS	2434	23.81
MAINLY HUSBAND	768	7.52
JOINT DECISIONS	5824	56.97
OTHER	101	0.98
**42 missing husband desire more children.		
**1096 missing decisions for using contraceptive.		

Table 3: Socio-demographic and other characteristics of married women with unmet need for family planning in EDHS, 2016 (n=2280).

Characters	Unmet need for FP (N,%)		X ²
	Yes	No	
Age			18.7 [*]
15-24	437(19.2)	1,860 (23.42)	
25-34	1014(44.5)	3,437(43.27)	
35-49	829(36.3)	2,646(33.32)	
Age at first cohabitation			18.2 [*]
<18	1,732(76.0)	5,667(71.36)	
>18	548(24.0)	2,275 (28.64)	
Highest level education			78.6 ^{***}
No education	1528(67.00)	4,726(59.49)	
Primary	622(27.26)	2,273(28.62)	
Secondary	85(3.75)	568(7.16)	

Higher	45(1.99)	375(4.73)	
Religion			166.9**
Orthodox	749(32.84)	3,391(42.69)	
Muslim	1033(45.31)	2,506(31.56)	
Protestant	418(18.31)	1,871(23.56)	
Other	80(3.54)	174(2.19)	
Wealth index			145.2***
Poorest	473(19.1)	1,479(18.63)	
Poorer	543(20.3)	1,531(19.28)	
Middle	452(20.8)	1,673(21.07)	
Richer	430(20.3)	1,640(20.65)	
Richest	382(19.5)	1,618(20.37)	
Number of living children			279.5***
0	115(5.03)	810(10.20)	
1-2	489(21.44)	2,647(33.33)	
3-4	613(26.92)	2,147(27.03)	
>4	1063(46.61)	2,338(29.43)	
Partners education			67.3***
No education	1159(50.85)	3,525(44.38)	
Primary	854(37.46)	2,917(36.74)	
Secondary	145(6.34)	830(10.46)	
Higher	107(4.7)	605(7.63)	
Don't know	15(0.65)	63(0.80)	
Respondent working status			5.08*
No	1619(71.0)	5,440(68.50)	
Yes	661(29.0)	2,502(31.50)	
Partner occupation			102.1***
No	179(7.85)	627(7.91)	
Services	234(10.26)	1,394(17.55)	
Agricultural	1585(69.5)	4,742(59.70)	
Manual	170(7.46)	842(10.61)	
Other	112(4.93)	336(4.23)	
Knowledge about family planning			6.87*
No	20(0.88)	112(1.41)	
Yes	2260(99.12)	7,830(98.59)	
Heard FP by mass media			53.6***
No	1797(78.81)	5,631(70.90)	
Yes	483(21.19)	2,311(29.10)	
Heard FP community events			0.72
No	1349(59.18)	4,619(58.16)	
Yes	931(40.82)	3,323(41.84)	
Field workers visit in last 12 month			2.74
No	1,635(71.69)	5,549(69.85)	
Yes	645(28.31)	2,394(30.15)	
Health facility visit in last 12 month			15.5*
No	1,250(54.81)	3,974 (50.03)	
Yes	1,030(45.19)	3,969(49.97)	
Health facility distance			109.6***
Big problem	1469(64.42)	4,113(51.79)	
Not big problem	811(35.58)	3,829(48.21)	

Desire more children			268.0***
Have another	1012(44.37)	4,763(59.97)	
Undecided	170(7.47)	358(4.51)	
No more	1098(48.16)	2,614(32.92)	
Husband desire more children			43.4**
Both want same	778(34.13)	3,212(40.44)	
Husband wants more	631(27.67)	2,005(25.25)	
Husband wants fewer	169(7.43)	556(7.01)	
Don't know	702(30.77)	2,124(26.75)	
Decisions maker for family planning**			187.8***
Mainly respondents	684(30)	1,749(22.03)	
Mainly husband	246(10.8)	522(6.57)	
Joint decisions	1012(44.38)	4,811(60.58)	
Other	31(1.34)	70(0.88)	

*p<0.05, **p<0.01, ***p<0.001

307 Decisions maker for family planning

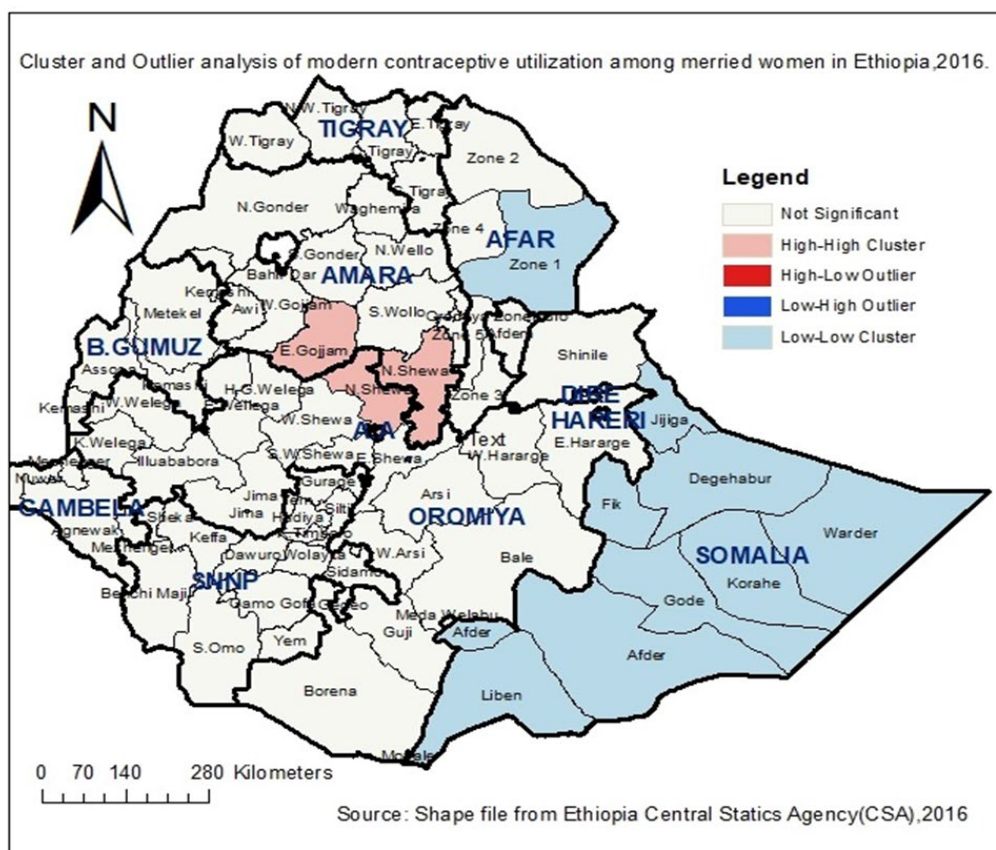


Figure 2. Regional prevalence of unmet need for family planning, EDHS 2016.

Gettis-OrdGi* statistics identification of unmet need for family planning: Hot and cold spots analysis point out risk areas of unmet need for family planning. The hot spot (high risk) regions in unmet need for family planning were detected in the Jimma, Borena, Western Arsi, a Bale zone of Oromia region, Hadiya, Sidama, Wolayita and Gedio zone of (SNNP) region. One the other hand, East Gojjam, Northern Shewa and Argoba zone of Amhara region, Afedel, zone 1 and 3 of Afar region were cold spot regions (Figure 5). The hotspot analysis indicates significance high prevalence areas of unmet need for family planning and Z-score increases in both directions which quantify significant low and high unmet need for family planning.

Local Indicator Spatial Autocorrelations (LISA) of unmet need for family planning: Local Indicator Spatial Autocorrelations (LISA) indicated that low outlier clusters were more common than high outlier clusters. These low outliers were found on the Fike zone of Somali region, Sheka zone of SNNP, the Meda Walabu of Oromia region. But high outliers found in Borena and West Arsi zone of Oromia regions (Figure 6).

Spatial interpolation for prediction of unmet need for family planning in Ethiopia: The spatial kriging interpolation, analysis predicted high risk regions for unmet need for family planning. Arsi, East Harrage, Guji zone of Oromia region, Central Tigray,

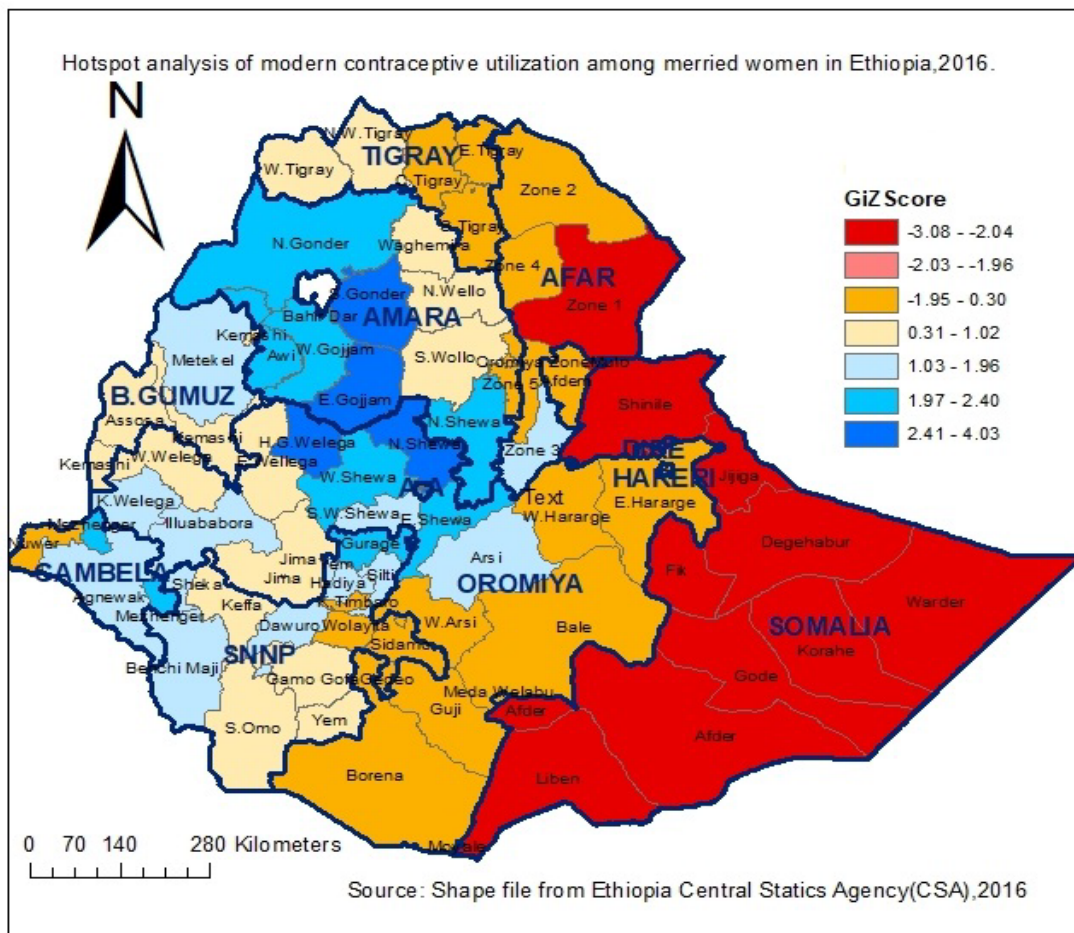


Figure 3. Spatial autocorrelation report, EDHS 2016.

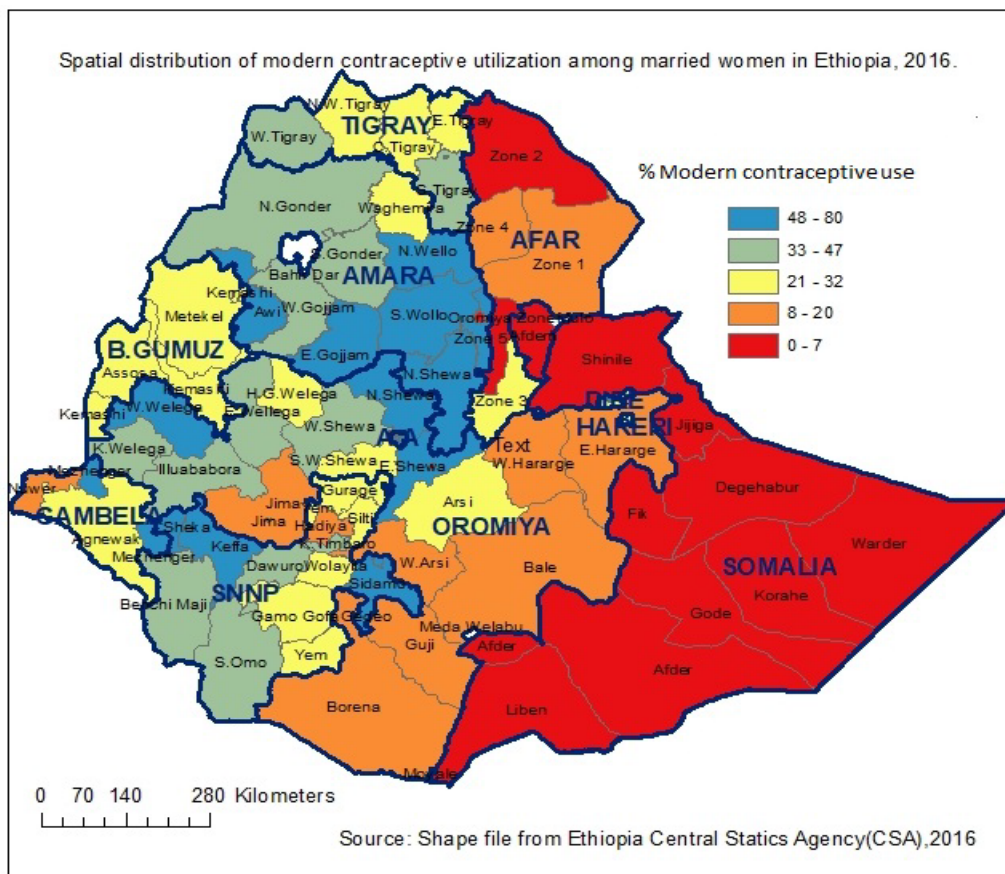


Figure 4. Spatial distribution of unmet need for family planning in Ethiopia, EDHS 2016.

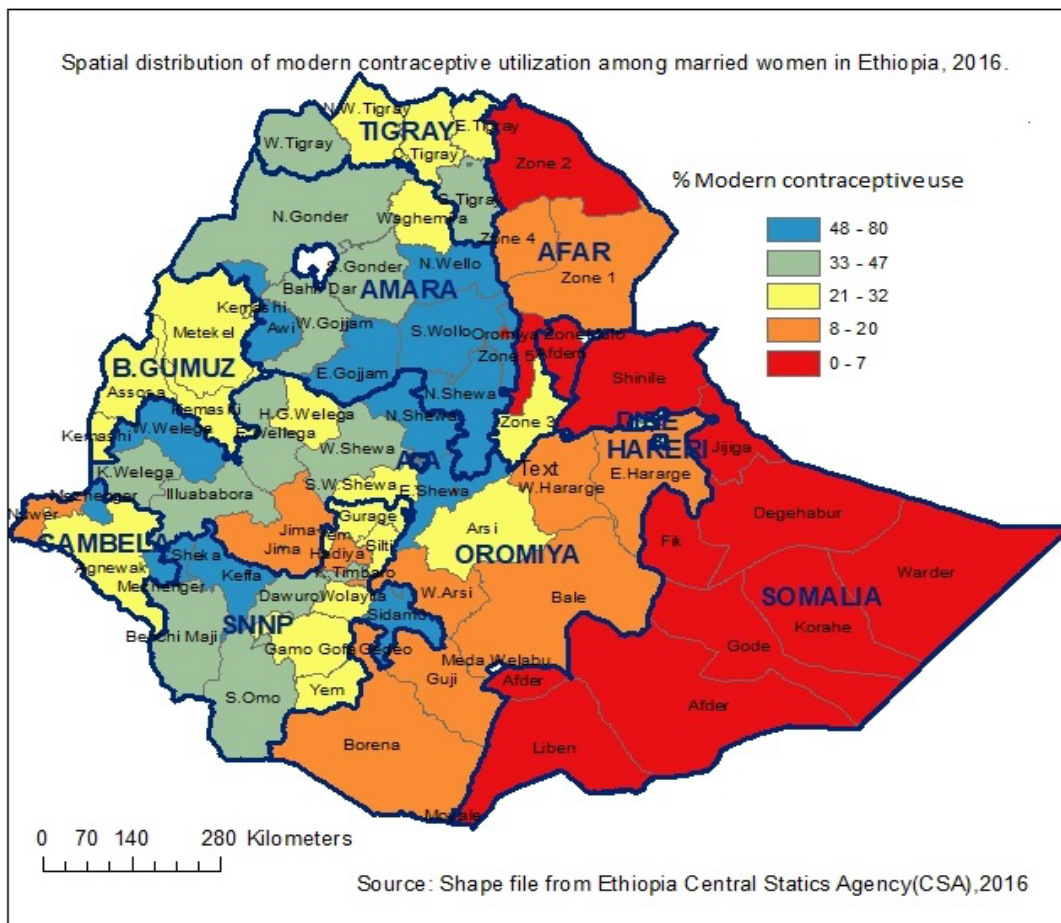
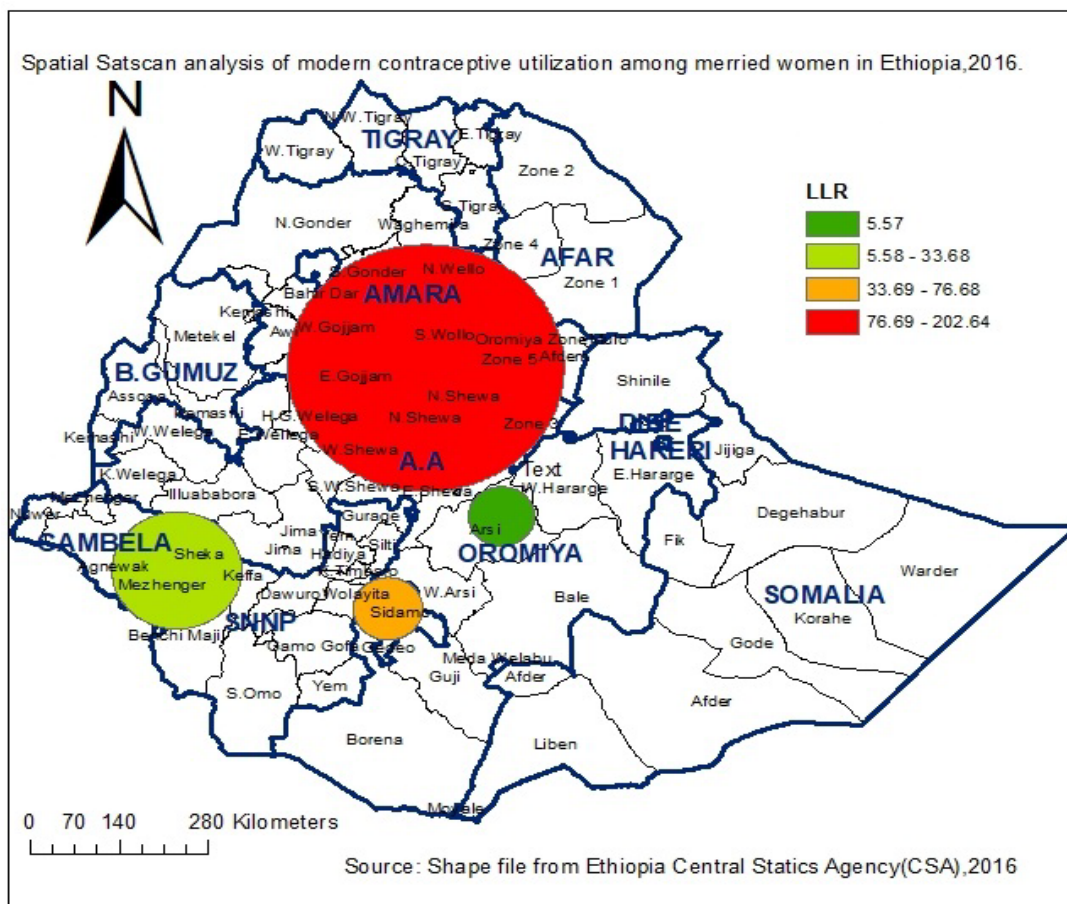


Figure 5. Hot spot analysis of unmet need for family planning in Ethiopia, EDHS 2016.



Cluster and outlier analysis of unmet need family planning in Ethiopia, EDHS 2016.

Table 4: List of unmet need for family planning significant cluster for Ethiopia in EDHS, 2016.

Type of cluster	Total # of population	Total # case	Relative risk	Case in area	LLR	Radius km	P-value
Most likely cluster	1412	472	1.65	33.4	55.74	225.44	0.00001**
Secondary cluster	1394	403	1.37	28.9	20.26	124.89	0.001*

Kemashi zone of Benishangule region, Southern and Northern Wollo region of Amhara region were predicted risky areas when compared to other regions. To the opposite of this East Tigray, West Shewa zone of Oromia region and Jijiga zone of Somali region were predicated as having least risky for unmet need for family planning.

Spatial scan statistics of unmet need for family planning: Spatial scan statistics identified primary (LLR=55.74, $P<0.001$) and secondary (LLR=20.26, $P<0.001$) clusters of unmet need for family planning using the maximum spatial circular windows $\geq 25\%$ of the total population (Table 4). The large primary clusters spatial window encompasses in Arsi, West Arsi, Bale, a West Harrarge zone of Oromia region and Fik zone of Somali region. It was centered at 7.125013 N, 40.717800 E with 225.44 km with a relative risk (RR) of 1.65. Married women within the spatial window had 1.65 times more likely to be unmet need for family planning than married women outside the window. While the relatively small secondary clusters spatial windows were located Jimma, southwest Shewa zone of Oromia and Gurage, Silti, Hadiya, Yem, Wolayita, Kemashi zone of SNNPR region. It was centered at 7.701180 N, 37.486550 E with 124.89 km with a relative risk (RR) of 1.37. Married women within the spatial window had 1.37 times more likely to be unmet need for family planning than married women outside the window.

DISCUSSION

Reducing unmet need for family planning has a major role of improving health by decrease child and maternal health. To reduce unmet need for family planning, knowing its prevalence and geographical variation is very important. This study was based on the data from a nationally representative survey on currently married women to indicate distribution of unmet need for family planning across country and its spatial distribution.

The prevalence of unmet need for family planning in this study was 22.3 % (95 % CI: 21.5%,23.1%) which mean one in five or more women experiences an unmet need for family planning. It was still high despite the trend of unmet need for family planning reduced in previous national level study [31]. But this magnitude was the lowest value of unmet need for family planning range in low and middle income countries [32]. This was in line with studies done in Shire Enda Selassie in Tigray and Sibu Sire in Oromia showed that unmet need for family planning were 21.4% and 20.94% respectively [33,34]. It was comparable with survey done in Mexico, which was 19.2% [35]. This might be due to similar emphasize given by the local health programmers on unmet need for family planning.

There was a discrepancy with a national level survey conducted in Ethiopia by performance monitoring and accountability (PMA 2020) which was 16.2% [15]. There was also a discrepancy with studies done in Dangil and Kenya, which was 17.4% and 11.5% among married women respectively [18,36]. But lower than survey conducted in India, Ghana and Cameroon revealed that prevalence was 39%, 35.17% and 46.6 % respectively [13,37,38]. This discrepancy might be due to the difference in the provision of health service and scaling up of health extension workers

or difference of the study population [39-41]. It also has a large discrepancy from study conducted in Butajira showed that unmet need of contraception was 74.8% [42]. The reason for the high unmet need for family planning mentioned as stock out of contraceptives, absence of client preferred methods in facilities, religious pressure, service provider incompetence, side effects of contraceptive and optimum work load [43-45].

The spatial distribution of unmet need for family planning across the Ethiopia region showed significant variation and clustering. The Global Moran's I values 0.31 (p value <0.001) indicated that there was significant clustering of unmet need for family planning in the study area. The spatial distribution analysis also indicates significant variations of unmet need for family planning across Ethiopia. The highest unmet need for family planning was spatially clustered in Jimma, Arsi, West Arsi, Southwest Shewa, Borena, Guji, and West and East Hararge zone of Oromia region, Agnewak zone of Gambela region whereas the lowest in Fik, Gode, Afder, Liben zone of Somali region, Argoba zone of Amhara region, Afoder zone of Afar region, and Sheka zone of SNNP region. The Local Indicator of Spatial Association (LISA) identify statistical significance each unit of unmet need for family planning and extent of neighborhoods clustering of unmet need for family planning across cluster.

Low outliers were found on Fike zone of Somali region, Sheka zone of SNNP, Meda walabu of Oromia region which was low unmet need for family planning surrounded by high unmet need for family planning. But high outliers found in Borena and West Arsi zone of Oromia regions which was high unmet need for family planning surrounded by low unmet need for family planning. Hot and cold spot analysis point out risk areas for unmet need for family planning.

The hot spot (high risk) regions for unmet need for family planning were detected in the Jimma, Borena, Western Arsi, a Bale zone of Oromia region, Hadiya, Sidama, Wolayita and Gedio zone of (SNNP) region. One the other hand, East Gojjam, Northern Shewa and Argoba zone of Amhara region, Afedel, zone 1 and 3 of Afar region were cold spot regions. It supports by Spatial scan statistics that identify primary clusters region which married women within 25% spatial window had 1.65 times more likely to be unmet need for family planning than married women outside the window encompasses in Arsi, West Arsi, Bale, West Harrarge zone of Oromia region and Fik zone of Somali region. Additional, significant secondary cluster indicate married women within the spatial window had 1.37 times more likely to be unmet need for family planning than married women outside the window located Jimma, Southwest Shewa zone of Oromia and Gurage, Silti, Hadiya, Yem, Wolayita K. Kemashi zone of SNNP region. In opposing of this, hotspot analysis identified East Gojjam, Northern Shewa and Argoba zone of Amhara region, Afedel, zone 1 and 3 of Afar region were cold spot regions.

Generally, study conducted in different county show most of country had spatial variation of unmet need for family planning distribution. There is also study done in Nigeria, Kenya and

India indicate unmet need for family planning across districts were significant variation and clustering [13,18]. Similar study in Rajasthan district in India showed that regional variations in unmet need of family planning was observed [46]. This implies different in socio-demographic characteristics of respondents, health service delivery capacity and community awareness about family planning is possible explanation for regional variations of unmet need for family planning [47-49]. In Ethiopia, Arsi, East Harrage, Guji zone of Oromia region, Central Tigray, Kemashi zone of Benishangule region, Southern and Northern Wollo region of Amhara region were predicted high risky areas when compared to other regions whereas the opposite of this East Tigray, West Shewa zone of Oromia region and Jijiga zone of Somali region were predicated as having least risky for unmet need for family planning.

LIMITATION OF THE STUDY

Clusters were excluded from this study due to the incompleteness of the GPS coordinate data. Since unmet need for family planning among unmarried sexually active woman were excluded from the study, further mixed approach study designs are recommended.

CONCLUSION

In this study, high prevalence of unmet need for family planning was obtained. In addition, statistical significant primary and secondary clusters were also detected using SatScan analysis. Unmet need for family planning is a valuable indicator for national family planning programs because it shows how well achieving a key mission therefore observing statistics of unmet need for family planning may understate the true demand for family planning. Therefore, intervention to reduce unmet need for family planning by considering the prevalence and spatial distribution should be considered.

DECLARATIONS

Ethics Approval and consent to participate

Ethical clearance was obtained from the ethical review board of University of Gondar. Written consent was obtained from Measure DHS International

Program which authorized the data-sets and GPS coordinate files. All the data which used in this study are publicly available. The data treated as confidential, and no effort should be made to identify any household or individual respondent interviewed in the survey that was maintained through identification number rather than names.

Consent to Publication

Not applicable

Availability of data and materials

The data is available from DHS program. All relevant data are included in the manuscript. However, the minimal data underlying all the findings in the manuscript will be available upon request.

Competing interest

The authors declare that they have no competing interest.

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Authors' contributions

K.A.; acquired the data, performed the analyzed the study, interpreted the results and drafted the manuscript. A.Y and A.M; participated in the conceptualization and design of the study and reviewed the manuscript critically. All authors read and approved the final manuscript.

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REFERENCES

1. Federal Democratic Republic of Ethiopia:Ministry of Health :Basics in Family Planning & Short Acting Family Planning. 2012.
2. U.S. Agency for International, Development Family planning in Ethiopia November 2012.
3. Westoff C. New Estimates of Unmet Need and the Demand for Family Planning. DHS Comparative Reports 2006.
4. United nation: Department of Economic and Social Affairs:World Family Planning 2017.
5. UNFPA :Universal acces to reproductive health: Progress and challenge. 2016.
6. United nations: The Millennium Development Goals Report 2015 new York, . 2015.
7. John Bongaarts JC, John W. Townsend, Jane T. Bertrand, Monica Das Gupta Family Planning Programs for the 21st Century Rationale and design 2012.
8. Federal Democratic Republic of Ethiopia Ministry of Health:Health Sector Development Programme IV 2010/11 - 2014/15 October 2010.
9. Agency CS. Ethiopia mini demographic and health survey 2014. 2014.
10. Federal Democratic Republic of Ethiopia Ministry of Health:Health sector transformation plan 2015/16 - 2019/20(2008-2012 EFY). August 2015.
11. Kimo K, Makuria K. Adolescents' Reproductive Health Problems, Service Preferences, and Accessibility. Pakistan J Psychol Res. 2017; 32(2): 407-427.
12. Federal Democratic Republic of Ethiopia Ministry of Health: Annual performance report, October 2018.
13. Kumar A, Singh A. Trends and determinants of unmet need for family planning in Bihar (India): evidence from National Family Health Surveys. Adv Applied Sociol. 2013; 3(2):157-163.
14. 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. African Health Sci. 2017; 17(3): 637-646.
15. 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; 4(1): 6.
16. Macro O, Measure D. Ethiopia Demographic and Health Survey, 2011: Preliminary Report: Central Statistical Agency, 2011.
17. MacQuarrie K. Unmet need for family planning among young women: Levels and trends. ICF International. 2014; 34.

18. Ettarh RR. Spatial analysis of contraceptive use and unmet need in Kenya. USAID. 2011: 1-28
19. Starbird E, Norton M, Marcus R. Investing in family planning: key to achieving the sustainable development goals. *Global Health: Science and Practice*. 2016; 4(2): 191-210.
20. Rutstein S, Rojas G. Guide to dhs statistics: Demographic and Health Surveys Methodology. USAID, 2006.
21. Central Statistical Agency Addis Ababa. Ethiopia demographic and health survey 2016: Key Indicators Report . DHS Program, ICF 2016.
22. Health Sector Transformation Plan. Hstp-I Annual Performance Report. Federal Ministry of Health, 2015/2016.
23. Bradley SE, Croft TN, Fishel JD, Westoff CF. Revising unmet need for family planning. *DHS Analytical Studies* 25, 2012.
24. Pfeiffer DU, Stevenson M, Stevens KB, Rogers DJ, Archie CA. *Clements Spatial Analysis in Epidemiology*, 2008.
25. Anselin L. Local indicators of spatial association-LISA. *Geographical analysis*. 1995; 27(2): 93-115.
26. Anselin L. Local Indicators of Spatial Association-ISA. *Geographical Analysis*. 2010; 27(2): 93-115.
27. Chainey S. Advanced hotspot analysis: spatial significance mapping using Gi*. UCL Jill Dando Institute of Crime Science, University College London, London, 2010.
28. Grubestic TH, Murray AT, editors. Detecting hot spots using cluster analysis and GIS. Proceedings from the fifth annual international crime mapping research conference; 2001.
29. Mitas L, Mitasova H. Spatial interpolation. *GIS Book Abridged*. 2005; 481-492.
30. Kulldorff M. SaTScanTM User Guide, March, 2018.
31. New JR, Cahill N, Stover J, Gupta YP, Alkema L. Levels and trends in contraceptive prevalence, unmet need, and demand for family planning for 29 states and union territories in India: a modelling study using the Family Planning Estimation Tool. *Lancet Global Health*. 2017; 5(3): e350-e358.
32. Wulifan JK, Brenner S, Jahn A, De Allegri M. A scoping review on determinants of unmet need for family planning among women of reproductive age in low and middle income countries. *BMC Women's Health*. 2015; 16(1): 2.
33. Gebre G, Birhan N, Gebreslasie K. 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 2015: A community based cross-sectional study. *Pan African Medical J*. 2016; 23: 195.
34. Duressa L, Getahun A, Regassa T, Babure Z, Bidu K. Unmet Need for Family Planning and Related Factors among Currently Married Women in Sibu Sire District, 2016. *J Women's Health Care*. 2018; 7(446): 1-14.
35. Juarez F, Gayet C, Mejia-Pailles G. Factors associated with unmet need for contraception in Mexico: evidence from the National Survey of Demographic Dynamics 2014. *BMC Public Health*. 2018; 18(1): 546.
36. 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. *Reproductive health*. 2015; 12(1): 42.
37. Wulifan JK, Mazalale J, Kambala C, Angko W, Asante J, Kpinpua S, et al. Prevalence and determinants of unmet need for family planning among married women in Ghana-A multinomial logistic regression analysis of the GDHS, 2014. *Contracept Reprod Med*. 2019; 4: 2.
38. 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 women's health*. 2018; 18(1): 171.
39. Koblinsky M, Matthews Z, Hussein J, Mavalankar D, Mridha MK, Anwar I, et al. Going to scale with professional skilled care. *The Lancet*. 2006; 368(9544): 1377-1386.
40. Black RE, Levin C, Walker N, Chou D, Liu L, Temmerman M, et al. Reproductive, maternal, newborn, and child health: key messages from Disease Control Priorities 3rd Edition. *The Lancet*. 2016; 388(10061): 2811-2824.
41. Lakew Y, Reda AA, Tamene H, Benedict S, Deribe K. Geographical variation and factors influencing modern contraceptive use among married women in Ethiopia: evidence from a national population based survey. *Reproductive health*. 2013; 10(1): 52.
42. Mekonnen W, Worku A. Determinants of low family planning use and high unmet need in Butajira District, South Central Ethiopia. *Reprod Health*. 2011; 8: 37.
43. Mekonnen W, Worku A. Determinants of low family planning use and high unmet need in Butajira District, South Central Ethiopia. *Reproductive Health*. 2011; 8(1): 37.
44. Deus O. Barriers To Uptake Of Family Planning Services Among Women Of Reproductive Age (18-45 Years) In Mfangano Island, Homabay County, Kenya: Pwani University; 2017.
45. Sedgh G, Hussain R. Reasons for contraceptive nonuse among women having unmet need for contraception in developing countries. *Studies in family planning*. 2014; 45(2): 151-69.
46. Sherin Raj T, Tiwari V, Singh J. Regional Variations In Unmet Need Of Family Planning In Rajasthan.
47. Sedgh G, Ashford LS, Hussain R. Unmet need for contraception in developing countries: examining Women's reasons for not using a method. New York: Guttmacher Institute. 2016; 2: 2015-2016.
48. Wafula SW. Regional differences in unmet need for contraception in Kenya: Insights from survey data. *BMC women's health*. 2015; 15(1): 86.
49. Wulifan JK, Jahn A, Hien H, Ilboudo PC, Meda N, Robyn PJ, et al. Determinants of unmet need for family planning in rural Burkina Faso: A multilevel logistic regression analysis. *BMC pregnancy and childbirth*. 2017; 17(1): 426.