Spatial distribution and associated factors of female genital cutting among reproductive-age women in Ethiopia: Further analysis of EDHS 2016

Ayenew Engida Yismaw^a, Zemenu Tadesse^b, Dereje Nibret Gessesse^{a,*},
Abebe Ayinalem Tarekegn^c, Yazachew Engida Yismaw^d

^a Department of Clinical Midwifery, School of Midwifery, College of Medicine and Health Sciences and Comprehensive Specialized Hospital, University of Gondar, Gondar, Ethiopia

^b Department of Biostatistics, Institute of Public Health, College of Medicine and Health Sciences and Comprehensive Specialized Hospital, University of Gondar, Gondar, Ethiopia

^c Department of Human Anatomy, School of Medicine, College of Medicine and Health Sciences and Comprehensive Specialized Hospital, University of Gondar, Gondar, Ethiopia

^d Department of Pharmacology, School of Health Science, College of Medicine and Health Sciences, Bahr Dar University, Bahr Dar, Ethiopia

ARTICLE INFO

Keywords:

Ethiopia
Female genital cutting
Reproductive age women
Spatial distribution

ABSTRACT

Background: Female Genital cutting is one of the cultural rituals whose origin can be traced to ancient times. Female genital cutting is still highly prevalent in the developing countries in Asia and many areas Africa including Ethiopia. Determining the distribution of female genital cutting is vital to address the problem and therefore, the aim of this study is to assess Spatial distribution and associated factors of Female Genital Cutting among reproductive-age women in Ethiopia.

Methods: This was a secondary data analysis of the Ethiopian demographic and health survey 2016. About 15,683 women in the reproductive age group were included in the study. Bernoulli model was used to investigate the presence of purely spatial clusters of female genital cutting using SaTScan™ software version 9.6. Both bivariable and multivariable logistic regressions analysis was conducted and the level of statistical significance was determined by a p-value of less than 0.05. Ordinary Kriging spatial interpolation method was used for predictions of female genital cutting in unobserved areas of Ethiopia.

Results: The prevalence of female genital cutting in Ethiopia was 66.9% (95% CI 65.85%–67.93%). Being Muslim Religion follower (AOR = 2.17, 95% CI 1.79 to 2.53), Husbands being primary educated (AOR = 0.51, 95%CI 0.33 to 0.77), Residing in a rural area (AOR = 2.12, 95%CI 1.08 to 4.17), women being wealth index category middle (AOR = 1.55, 95%CI 1.12 to 2.14) and rich (AOR = 1.56, 95%CI 1.07 to 2.25), and being respondents age group of 20–34 (AOR = 1.77, 95%CI 1.10 to 2.85) and 35–49 (AOR = 2.44, 95%CI 1.46 to 4.08) were significantly associated with female genital cutting.

Conclusion: Female genital cutting is found to be high. Increased Respondent's age group, being Muslim Religion follower, residing in a rural area, higher husband education, being in higher Wealth index, and residing in region other than Gambela and Tigray were contributing factors of female genital cutting in Ethiopia. Therefore, the effort shall be towards and promoting the husbands' education to decrease female genital cutting.

1. Introduction

The partial or complete removal of external female genitalia for non-medical reason is female genital mutilation (FGM) or female genital cutting (FGC), also known as female circumcision (1). FGM is one of the cultural rituals whose origins can be traced to ancient times. The female

genital cutting practice has been prevalent among prepubescent girls in Africa and in some in the Middle East and Asian countries.²

FGM does not provide any health benefits and can be detrimental to girls and women. FGM might result immediate complications, such as serious bleeding and urination problems, and long-term childbirth complications. The age at which FGM is performed varies across

* Corresponding author.

E-mail addresses: ayenewe07@gmail.com (A.E. Yismaw), zemenut197@gmail.com (Z. Tadesse), dnibret62@gmail.com (D.N. Gessesse), abebeayinalem877@gmail.com (A.A. Tarekegn), yachewable@gmail.com (Y.E. Yismaw).

<https://doi.org/10.1016/j.cegh.2021.100858>

Received 25 June 2021; Received in revised form 23 July 2021; Accepted 11 August 2021

Available online 16 August 2021

2213-3984/© 2021 The Author(s). Published by Elsevier B.V. on behalf of INDIAACLEN. This is an open access article under the CC BY license

(<http://creativecommons.org/licenses/by/4.0/>).

cultures, but commonly practiced with age of 0- and 15-years girls. The form of FGC differs between ethnic groups within a country.¹

Globally, there has been a decline in the prevalence of FGM over the last three decades due to different efforts to intervene the problems FGC. However, in many areas of Africa countries including Ethiopia the prevalence of FGC remains high.³

A national population-based study done in Nigeria revealed that the prevalence of FGM was 23.9%.⁴ Another study done in Nigeria also showed that FGM was 59.2%.⁵ A study done in Burkina Faso on trends of FGM reported that the prevalence was decreased from 83.6% to 76.1%.⁶

Different cross-sectional studies reported that FGC is highly prevalent in Oromia Regional State, (77.8%),⁷ Northwest Ethiopia (77.7%),⁸ Southern Ethiopia (82.2%),⁹ Southern Nations, Nationalities, and Peoples' Region (92.2%),¹⁰

Amhara Region (77.7%),¹¹ Eastern Ethiopia (82.6%),¹² Western Ethiopia (48%).¹³ Bale zone, Ethiopia (78.5%).¹⁴

Different studies conducted in different areas of Ethiopia and some African countries reported different risk factors for FGM. In many studies, the place of residency was significantly associated with FGM.^{4-10,12-15} Women's age older than 24 years was positively associated with FGM as compared with those younger than 24 years old.^{8,11,13-21} As women's and husband's educational status increases from none educated to higher education the risk of experiencing FGM for their daughters and themselves decreases.^{4-13,15-21} Richer in terms of wealth index was a preventive factor for FGM.^{4,16,17,19,21} Many studies showed that being Muslim in religion was associated with experiencing FGM.^{6,7,12-14,16,17,21} Some studies reported that being exposed to media was a preventive factor for FGM.^{17,21} Being a government-employed in women's occupation was also a preventive factor from FGM in some studies.^{7,18,19}

All of the above studies do not show overall distribution of FGM in Ethiopia and each region of Ethiopia. Another thing is that the government of Ethiopia and its stakeholders took different interventions to tackle the practice of FGM to improve the health status of women and girls as well to the community at large in line with sustainable development goals. Therefore, the aim of this study is to assess progress of prevalence and spatial distribution FGM as well as to identify associated factors of Female Genital Cutting among reproductive-age women in Ethiopia to make appropriate intervention.

2. Methods

2.1. Study design and settings

Cross-sectional study design was employed using the Ethiopian Demography and Health Surveys (EDHS) 2016. Spatial distribution and associated factor of FGC was assessed in this study. It has a total area of 1,100,000 km² and is located between 3° and 15°N latitudes, and 33° and 48°E longitudes. Ethiopia has been split into nine ethnic-based and politically independent regional states (Afar, Amhara, Benishangul Gumuz, Gambela, Harari, Oromia, Somali, Southern Nations, Nationalities, and People's Region (SNNP) and Tigray) and two cities (Addis Ababa and Dire Dawa). The Regions are subdivided into sixty-eight zones, followed by 817 districts, further subdivided into around 16,253 Kebeles (the smallest local administrative units (Fig. 1)).

2.2. Study population, sample size, and sampling technique

The source population was all women aged 15 to 49 in Ethiopia. Whereas, in the selected enumeration regions, the sample population was all women aged 15–49. The research included all women aged 15–49 who were ordinary members of the selected households, and those who spent the night before the survey in the selected households.

A total of 15,683 women in the reproductive age group (15–49 years) were included. The response rate was 97.8%. Using 2-stage stratified cluster sampling, the 2016 EDHS samples were picked. The detailed

Fig. 1. Nine regions and two-city administration of study area, EDHS 2016.

methodologies of the survey can be found elsewhere.²²

2.3. Study variables

Further data recoding was performed after comprehension of the comprehensive dataset and coding. From the EDHS 2016 datasets, all possible social determinants and FGC predictor variables were extracted. The datasets for socio-economic, demographic, and geographic coordinates were combined and analyzed.

2.4. Outcome variable

We applied the definition of female genital cutting adopted by the 2016 EDHS.²² We considered three parameters, whether respondents practice FGC or Respondents support the continuation of FGC or respondents' daughter practice FGC coded as 1 otherwise 0.

2.5. Independent variable

For this study we consider independent variables such as sex of household headed, respondents' education, respondent's age group, religion, residence, husband's education, wealth index, region, media exposure occupation of husband, and occupation of respondents after reviewing different kinds of literature.

2.6. Statistical analysis

Weighted data were used for analysis and descriptive analysis was conducted. Survey sets were performed to conduct logistic analysis since the data were large survey data set. Crude odds ratios (OR) and 95% confidence intervals (CI) were used to evaluate the relationship between the various demographic determinants and women whether herself practice FGC or supported the continuation of FGC or her daughter practice FGC. Multiple logistic regression analysis was carried out and the adjusted odds ratio was determined after correcting for the effects of the identified confounding. Using STATA version 14, statistical analyses were performed. Spatial analysis was carried out using ArcGIS version 10.1 software.

2.7. Spatial analysis

2.7.1. Spatial autocorrelation analysis

The statistic measures of spatial autocorrelation (Global Moran's I) whether FGC patterns in the study region were scattered, clustered, or randomly distributed.²³ By taking the entire data set and generating a single output value from −1 to +1, Moran's I is a spatial statistic used to measure spatial autocorrelation. Moran's I Values close to −1 indicate scattered disease; while Moran's I close to +1 indicate clustered disease

and if Moran's I value is zero, the disease is randomly distributed. A significant statistical Moran's I ($p < 0.05$) lead to rejection of the null hypothesis (random distribution of home delivery) and reveals the existence of spatial autocorrelation.

2.7.2. Incremental autocorrelation

Measures spatial autocorrelation for a sequence of distances and generates a line graph of those distances and their corresponding z-scores. Z-scores represent spatial clustering strength, and statistically significant peak z-scores indicate distances where clustering-promoting spatial processes are most pronounced. For tools with a Distance Band or Distance Radius parameter, these peak distances are also acceptable values to use. For instruments that have these parameters, such as hot spot analysis, this tool can help you pick an acceptable distance threshold or radius.²³

2.7.3. Hot spot analysis (Getis-OrdGi* statistic)

In order to measure how spatial autocorrelation differs across the location of the study by calculating Gi* statistics for each region, Getis-OrdGi* statistics were computed. To evaluate the statistical significance of clustering, the Z-score is calculated and the p-value was calculated for the significance. High Gi* Statistical performance suggests a "hotspot" while low Gi* means a "cold spot".

2.7.4. Spatial scan statistical analysis

A Bernoulli-based model was used in which incidents were evaluated whether women had an FGC or not represented by a 1/0 variable at specific locations. To recognize the existence of solely spatial FGC clusters, the scan statistics generated by Kulldorff and SaTScan™ software version 9.6 were used. To determine the number of observed and expected observations inside the window at each site, Scan statistics were progressively scanned. The most probable high-performance cluster was the scanning window with the highest chance, and this cluster was given a p-value.

2.7.5. Spatial interpolation

To understand the burden of such incidents, it is very costly and laborious to collect accurate data in all areas of the country. Therefore, by using observed data using a technique called interpolation, part of a certain region can be predicted. The technique spatial interpolation is used to predict FGC based on sampled EAs on un-sampled areas in the country. Various deterministic and geostatistical methods of interpolation exist. Among all of the methods, ordinary Kriging and empirical Bayesian Kriging are considered the best approach because it integrates spatial autocorrelation and optimizes the weight statistically. For this analysis, the Ordinary Kriging spatial interpolation method was used for FGC prediction in unobserved areas of Ethiopia. To estimate the burden of FGC in unstamped areas, the ordinary Kriging method was used.

3. Results

Most of the participants were in the age group of 20–34 years and about three-fourth of them were males as household heads. More than three-fourths of the participants were rural by residency. About 48% and 47% of women and men participants had no formal education respectively. Around three fourth of the participants had no media exposure. About 36% of participants were in Oromia region followed by Amhara and SNNP which is about 23% and 21% respectively. About 43%, 30%, and 23% of respondents were Orthodox, Muslim, and Protestant religious followers respectively and the rest of the respondents were Catholic and Traditional religion followers. More than one-third of respondents found to be economically poor (Table 1).

3.1. Factors associated with female genital cutting

The outcome of the bi-variable study showed that all explanatory

Table 1

Socio-demographic and economic characteristics of the study population, in Ethiopia, EDHS 2016.

Variables	Categories	Frequency	Percent (%)
Age	15–19	1670	21.36
	20–34	3965	50.69
	35–49	2186	27.95
Sex of household head	Male	1933	75.28
	Female	5888	24.72
Religion	Orthodox	3423	43.77
	Muslim	2362	30.20
	Protestant	1861	23.80
	Catholic & traditional	174	2.23
Residence	Urban	1714	21.91
	Rural	6108	78.09
Mothers Education	No education	3787	48.41
	Primary	2679	34.25
	Secondary	906	11.59
	Higher	449	5.74
Husbands' education	No education	2423	47.48
	Primary	1648	36.20
	Secondary	467	9.16
	Higher	365	7.16
Media Exposure	No	5749	73.50
	Yes	2073	26.50
Wealth Index	Poor	2725	34.84
	Middle	1520	19.44
	Rich	3576	45.72
Region	Tigray	539	6.90
	Afar	66	0.85
	Amhara	1826	23.34
	Oromia	2880	36.83
	Somalia	228	2.92
	Benishngul	74	0.95
	SNNP	1652	21.13
	Gambela	21	0.28
	Harari	18	0.23
	Addis Ababa	466	5.96
	Dire Diwa	46	0.60

variables were correlated with the issue of female genital cutting at a 20% significance scale. The final multivariable logistic regression model showed that variables such as respondent's age group, religion, residence, husband's education, wealth index, and region were important determinants of female genital cutting at a 5% level of significance. The women being age group 20–34 and 35–49 increases the likelihood of female genital cutting by a factor of 1.77 and 2.44 times higher than women in the age group 15–19. (AOR = 1.77, 95%CI 1.10 to 2.85) and (AOR = 2.44, 95%CI 1.46 to 4.08) respectively. Being a Muslim religion follower increases the odds of female genital cutting by a factor of 2.17 times higher than Orthodox religion follower does (AOR = 2.17, 95% CI 1.79 to 2.53). Those women living in rural areas were 2.12 times high to had female genital cutting as compared to their counterparts (AOR = 2.12, 95%CI 1.08 to 4.17). Husbands being primary educated decreases the odds of female genital cutting by 49% as compared to husbands with no education (AOR = 0.51, 95%CI 0.33 to 0.77). Women being wealth index category middle and rich decreases the odds of female genital cutting by 45% and 44% as compared to poor women (AOR = −1.55, 95%CI 1.12 to 2.14) (AOR = −1.56, 95%CI 1.07 to 2.25) respectively. Women living in the following region increases the likely of female genital cutting, afar (AOR = 40.44, 95%CI 17.92 to 92.05), Amhara (AOR = 4.42, 95%CI 2.40 to 8.12), Oromia (AOR = 10.30, 95%CI 5.36 to 19.78), Somalia (AOR = 175.65, 95%CI 53.13 to 580.75), Benishangul (AOR = 3.72, 95%CI 1.83 to 7.58) SNNP (AOR = 3.98, 95%CI 1.72 to 9.19), Harari (AOR = 17.48, 95%CI 8.32 to 36.70), Addis Ababa (AOR = 6.72, 95%CI 3.25 to 13.87), Dire Dawa (AOR = 16.83 95%CI 7.88 to 35.94) as compared to women living in Tigray Region respectively (Table 2).

Table 2

Multivariable logistic regression analysis of factors associated with female genital cutting/mutilation in Ethiopia, EDHS 2016.

Variables	FGM Practice		COR (95% CI)	AOR (95% CI)
	No	Yes		
Age group				
15–19	839	831	1	1
20–34	1244	2720	2.2(1.86,2.60)	1.77(1.10,2.85) ^a
35–49	505	1681	3.35(2.63,4.28)	2.44(1.46,4.08) ^a
Sex of household head				
Male	1244	689	1	1
Female	3988	1900	0.86(0.71,1.03)	0.91(0.65,1.28)
Religion				
Orthodox	1485	1938	1	1
Muslim	393	1968	3.83(2.81,5.22)	2.17(1.42,3.33) ^a
Protestant	615	1245	1.54(1.05,2.26)	1.08(0.53,2.19)
Catholic & traditional	93	80	0.66(0.36,1.18)	0.26(0.12,0.108)
Residence				
Urban	779	934	1	1
Rural	1809	4298	1.98(1.48,2.63)	2.12(1.08,4.17) ^a
Mothers Education				
No education	955	2831	1	1
Primary	1968	1711	0.29(0.47,0.74)	1.17(0.88,1.55)
Secondary	446	460	0.34(0.26,0.46)	0.79(0.50,1.25)
Higher	219	229	0.35(0.25,0.49)	0.74(0.39,1.40)
Husbands' education				
No education	559	1865	1	1
Primary	500	1347	0.80(0.63,1.02)	0.80(0.62,1.02)
Secondary	193	274	0.42(0.30,0.59)	0.51(0.33,0.77) ^a
Higher	131	233	0.53(0.34,0.82)	0.83(0.46,1.50)
Media Exposure				
No	1746	4003	1	1
Yes	1230	842	0.63(0.52,0.77)	1.01(0.85,1.45)
Wealth Index				
Poor	858	1866	1	1
Middle	412	1108	1.23(0.97,1.57)	1.55(1.12,2.14) ^a
Rich	1318	2257	0.78(0.62,0.99)	1.56(1.07,2.25) ^a
Region				
Tigray	390	149	1	1
Afar	5	61	31.93 (16.31,57.89)	40.44(17.92,92.05) ^a
Amhara	643	1182	4.80(2.87,8.01)	4.42(2.40,8.12) ^a
Oromia	672	2208	8.56(5.22,14.04)	10.30(5.36,19.78) ^a
Somalia	3	225	179.3 (55.93,193.57)	175.65 (53.13,580.75) ^a
Benishngul	26	47	4.64(2.60,8.29)	3.72(1.83,7.58) ^a
SNNP	608	1044	4.48(2.53,7.92)	3.98(1.72,9.19) ^a
Gambela	14	8	1.43(0.84,2.45)	1.65(0.81,3.36)
Harari	3	15	11.87(7.09,19.87)	17.48(8.32,36.7) ^a
Addis Ababa	211	254	3.14(2.00,4.93)	6.72(3.25,13.87) ^a
Dre Diwa	10	36	9.40(5.65,15.79)	16.83(7.88,35.94) ^a

^a Indicated significance at p-value 0.05; SNNP: South Nations, Nationalities and People.

3.2. Spatial analysis result

3.2.1. Spatial distribution of female genital cutting

For the spatial analysis of FGC, 366 clusters were chosen. Due to a lack of geographical coordination data, 21 clusters were dropped and 256 clusters were dropped due to the zero prevalence of FGC. Each point on the map represents one location of enumeration in each cluster with a prevalence of FGC. The red color shows areas with a high proportion of FGC while the green color shows EAs with a lower proportion of FGC. The proportion of FGC appears to be distributed uniformly throughout the country's regions (Fig. 2).

3.2.2. Spatial autocorrelation of FGC

The study showed that the spatial distribution of FGC with Global Moran's I 0.01 ($p = 0.47$) was found to be random in Ethiopia. Over the study region, the clustered patterns (on the right sides) indicate FGM

Fig. 2. Spatial distribution of FGC in each region across the country, EDHS 2016.

existed. The outputs on the right and left sides of each panel have automatically created keys. Taking into account the z-score of 0.76, the pattern does not appear substantially different from random. The bright red and blue colors at the ends of the tails show an increased significance level. The table indicates that the observed value is not higher than the predicted value and P-value is 0.47, it is statistically insignificant. We cannot proceed with further spatial analysis like (Hot Spot Analysis, Cluster and Outlier Analysis, Interpolation, and Scan statistics) because the spatial distribution of FGC was random throughout the regions across the country (Fig. 3).

4. Discussion

In Ethiopia, the prevalence of female genital cutting (FGC) was 66.9% (95% CI 65.85%–67.93%). This result was greater than the study conducted in Hababo Guduru District, Western Ethiopia, and Nigeria.^{4,5,13} The possible reason for this difference might be the cultural of the study populations towards FGC and that a study population with good culture which undervalues FGM might have lower prevalence FGC. The study includes Somalia and Afar regions that have the highest prevalence FGM that can increase the prevalence of the country as compared to Western Ethiopia study. This result was, however; lower than the study done in Burkina Faso, and different parts of Ethiopia.^{6–12,14} This low finding might be the difference in time and study settings. In terms of time, the present study is recent as compared to some other studies which may decrease the prevalence of the problem. This might be explained by information access by the community

Fig. 3. Spatial autocorrelation of FGC in each region across the country, EDHS 2016.

about malpractices which will create awareness towards female genital cutting. Regarding study settings, other studies were done in different parts of Ethiopia but the present study was done in Ethiopia which includes the urban areas and those areas might have information access to have awareness about female genital cutting that might decrease the prevalence.

The odds of circumcision among the respondents were increased as the age increases in this study. As a result, respondents who are in the age group of 20–34 and 34–49 were more likely to be circumcised as compared to the age group of 15–19. This is similar to the results obtained from other studies.^{8,11,13–21} The possible reason might that 15–19 age groups are young groups that benefit from government and different partners that intervene to stop FMG and improve the health status of girls as compare to older age groups and the most recent age groups have less FGM prevalence due to most communities aware the disadvantage of harmful traditional practices.

Religion is an important determinant factor for Female Genital Cutting. Being a Muslim religious follower increases the odds of circumcision by a factor of 2.17 times higher than the Orthodox religion follower does. In line with this observation, similar results were obtained from different studies^{6,12,14,16,17}, and ¹⁹(6,12,14,16,17,21).

The residence of the respondents is also another factor that is associated with Female Genital Cutting. Those women living in rural areas were 2.12 times more likely to had female genital cutting as compared to their counterparts. This result is in line with other similar studies.^{4–10,12–15} This is the fact that people living in urban areas have better information access which will increase awareness of the importance of female genital cutting.

Primary educated husbands decrease the likelihood of female genital cutting by 49% as compared to husbands with no education. This result is consistent with the study done in different part of the world.^{4–13,15–21} This is the fact that education increases the awareness of the population about benefit of healthy life and condemns harmful traditional practices. Not only getting updated information through reading and Mass Medias but also educated people have better exposure to FGC intervention.^{24,25}

Wealth index is another variable that is negatively associated with female genital cutting. Those women being wealth index category middle and rich decreases the likely of female genital cutting by 45% and 44% as compared to poor women. This result is reported by similar studies done elsewhere.^{4,16,17,19,21} This might be linked with the women's living better economic status have decision-making power. Exposure to mass media and participating paternal and maternal schooling associate with complains that condemned harmful traditional practices including FGC.

The region that the respondents reside in is also another factor affecting female genital mutilation. Thus, Women living in afar, Amhara, Oromia, Somalia, Benishangul, SNNP, Harari, Addis Ababa, and Dire Dawa increases FGC by the odds of 40.44, 4.42, 10.30, 175.65, 3.72, 3.98, 17.48, 6.72, and 16.83 respectively as compared to women living in Tigray Region. The possible reason might be cultural difference of these different ethnic groups about FGM. This is also supported by other studies done in Nigeria.²⁶

5. Conclusion

Female genital cutting is still found to be high as compared to developed countries despite many efforts done to stop harmful traditional practices. Increased respondent's age group, being Muslim Religion follower, residing in a rural area, higher husband education, being in higher Wealth index, and residing in region other than Tigray was the factor that associated female genital cutting in Ethiopia. Therefore, the effort shall be towards increasing community awareness specially over the highly prevalent areas, promoting the husbands' education and trained religious leaders to decrease female genital cutting.

Declaration of competing interest

The authors declare no competing interests.

Acknowledgment

We acknowledge the DHS Program, ICF International for their online provision of the Ethiopian DHS data set.

Abbreviations

AOR	Adjusted Odds Ratio
CI	Confidence Interval
COR	Crude Odds
FGC	Female Genital Cutting
DHS	demographic health survey
EDHS	Ethiopian Demographic Health Survey

Funding

The author(s) received no specific funding for this work.

Availability of data and materials

The dataset was analyzed during the current study available from the corresponding author on a reasonable request.

Authors' contributions

All authors contributed to data analysis, drafting or revising the article, gave final approval of the manuscript to be published, and agree to be accountable for all aspects of the work.

Ethics approval and consent to participate

An authorization letter for data access was obtained from the DHS program. The 2016 EDHS protocol was reviewed and approved by the national ethics review committee of the Federal Democratic Republic of Ethiopia, Ministry of Science and Technology, and the institutional review board of ICF International. Written informed consent was obtained from all women who participated in the EDHS.

Consent for publication

Not applicable.

References

- 1 World health organization(WHO). *Eliminating Female Genital Mutilation: An Interagency Statement*. 2008.
- 2 UNICEF. United Nations Children's Fund. Female Genital Mutilation/Cutting: a statistical overview and exploration of the dynamics of change. Available from http://data.unicef.org/wpcontent/uploads/2015/12/FGMC_Lo_res_Final_26.pdf; 2013.
- 3 UNICEF. United Nations children's Fund. Female genital mutilation/cutting: a global concern. Available from https://www.unicef.org/ia/files/FGMC_2016_brochure_final_UNICEF_SPREAD.pdf; 2016.
- 4 Ossai EN, Aniwaada EC, Ibiok NC, Amaechi E. *Maternal factors associated with female genital cutting of daughters in Nigeria : A national population based study*. 2. 2019:1–10, 1.
- 5 Ibrahim BS, Ahmed ZD, Ya A, et al. *Prevalence and Determinants of Female Genital Mutilation Among Women in a Rural Settlement of Kano State Nigeria*, 2016. vol. 5. 2017:72–77, 2.
- 6 Chikhungu LC, Madise NJ. *Trends and Protective Factors of Female Genital Mutilation in Burkina Faso : 1999 to 2010. ??? [Internet]*. 2015:1–10. Available from: ???
- 7 Shiiferaw D, Deyessa N, Fufa G, Kinati T, Desalegn M. *Prevalence and associated factors of female genital mutilation among high school students in Dale Wabera Woreda , Oromia Regional State , Ethiopia*. 9. 2017:72–78. June.
- 8 Ejigu Y, Tiruneh G, Mekonnen M, Kibret GD. *Clinics in mother and child health prevalence and contributing factors of female genital cutting in debaytilatgin*. 11. 2014: 2–7, 2.

- 9 Tamire M, Molla M. *Prevalence and Belief in the Continuation of Female Genital Cutting Among High School Girls : A Cross - Sectional Study in Hadiya Zone*. Southern; 2013.
- 10 Degefa H, Samuel KTL, DT. *Reproductive system & sexual Disorders : current research prevalence of female genital mutilation and its association with birth complications among women attending delivery service in Nigist Eleni*. 6. 2017:4–11, 4.
- 11 M A. *Informatics Female Genital Mutilation and Associated Factors in GonchaSiso-Enessie*. vol. 4. 2013, 2012.
- 12 Gebremariam K, Assefa D, Weldegebreal F. *Prevalence and Associated Factors of Female Genital Cutting Among Young Adult Females in Jigjiga District , Eastern Ethiopia : A Cross-Sectional Mixed Study*. 2016:357–365.
- 13 Gajaa M, Wakgari N, Kebede Y, Derseh L. *Prevalence and associated factors of circumcision among daughters of reproductive aged women in the Hababo Guduru District , Western Ethiopia : a cross- sectional study*. *BMC Womens Health*. 2016:1–9. <https://doi.org/10.1186/s12905-016-0322-6>. Available from.
- 14 Bogale D, Markos D, Kaso M. *Prevalence of Female Genital Mutilation and its Effect on Women ' S Health in Bale Zone , Ethiopia : A Cross-Sectional Study*. vols. 1–10. 2014.
- 15 Raheem TAA, Eltahalawi SMR, Raia NMA, Elsary AY, Ibrahim KM. *The effect of female genital mutilation on couple sexual function*. 5. 2018:905–911, 3.
- 16 Ossai EN, Aniwada ECNE, Ezeoke UE. *Prevalence and predictors of female genital cutting in Nigeria : an analysis of 2013 Nigeria demographic and health Survey*. 3. 2018: 1–8, 1.
- 17 Achia TNO. *Spatial Modelling and Mapping of Female Genital Mutilation in Kenya*. 2014.
- 18 Abdisa B, Desalegn M, Tesew A. *iMedPub Journals Assessment of the Prevalence of FGM and Associated Factors Among Women ' S of Reproductive Age Group in Kebirbayah Town , Somali Region Eastern Study Period and Area*. vols. 1–9. 2017.
- 19 Sakeah E, Debpuur C, Oduro AR, et al. *Prevalence and Factors Associated with Female Genital Mutilation Among Women of Reproductive Age in the Bawku Municipality and Pusiga District of Northern Ghana*. vols. 1–10. 2018.
- 20 Sileshi Garoma Abeya BGC, DDG. *Factors associated with female genital mutilation among women of reproductive age in Gewane Woreda*. *Afar*. 2017;2:1–5.
- 21 Setegn T, Lakew Y, Deribe K. *Geographic Variation and Factors Associated with Female Genital Mutilation Among Reproductive Age Women in Ethiopia : A National Population Based Survey*. vols. 1–17. 2016. <https://doi.org/10.1371/journal.pone.0145329>. Available from.
- 22 ETHIOPIA Demographic and Health Survey. *Ethiopian Demographic and Health Survey 2016 Key Indicators Report*. Ethiopians Water Sector Development Program; 2016: 1–49.
- 23 Waldh. *The spatial autocorrelation coefficient Moran's I under heteroscedasticity*. *Stat Med*. 1996;15:887–892. o T. r.
- 24 Kathryn MYount. *Symbolic Gender Politics , religious group identity , and the decline in female genital symbolic Gender Politics , religious group identity , and the decline in female genital cutting in Minya , Egypt **. Available from <https://www.jstor.org/stable/3598366>; 2004, 82,3,1063,1090.
- 25 UNICEF. *Female Genital Mutilation/Cutting: A Statistical Overview and Exploration of the Dynamics of Change*. 20013;.
- 26 Ignatius D, Osuorah C. *Sociodemographic Predictors of Genital Mutilation (Circumcision) of the Girl Child in Nigeria : A Population-Based Study*. 2015. <https://doi.org/10.15296/ijwhr.2015.30>. Available from.