

# Trends and Determinants of Female Genital Mutilation in Ethiopia: Multilevel Analysis of 2000, 2005 and 2016 Ethiopian Demographic and Health Surveys

This article was published in the following Dove Press journal:  
*International Journal of Women's Health*

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**Background:** Female genital mutilation (FGM) is a harmful practice that causes health-related problems in the life of the affected women and girls. Though FGM is declared as a human right violation, studies revealed it is being practiced throughout Ethiopia. Therefore, this study was conducted to assess the prevalence, trends, and predictors of FGM among reproductive-aged (15-49 years) women in Ethiopia.

**Methods:** Trends of FGM among reproductive-age women were estimated using the three Ethiopian Demographic and Health Survey (EDHS): 2000 (n=15,367), 2005 (n=14,070) and 2016 (n=7248) data. Multilevel logistic regression analysis was conducted to identify both individual- and community-level factors of FGM using the latest (2016) EDHS. To adjust potential confounders, the analysis was conducted considering sample weighting, clustering, and stratifications using STATA-14 software.

**Results:** The prevalence of FGM among women of reproductive age in Ethiopia decreased from 79.91% in 2000 to 70.37% in 2016. Similarly, FGM among daughters of circumcised mothers decreased from 56.16% in 2000 to 16.76% in 2016. Being Muslim (adjusted odds ratio [AOR] 5.48; 95% confidence interval [CI]: 4.23, 7.09), attending higher education (AOR 0.40; 95% CI: 0.29, 0.54), 45–49 years old (AOR 5.06; 95% CI: 3.38, 7.57), marriage at  $\geq 18$  years (AOR 0.80; 95% CI: 0.66, 0.96), not working (AOR 1.20; 95% CI: 1.02, 1.41), married (AOR 1.41; 95% CI: 1.12, 1.77) and residing in peripheral region (AOR 3.04; 95% CI: 1.96, 4.70) were determinants of FGM.

**Conclusion:** Though the reduction of FGM among women of reproductive age in Ethiopia was minimal, it was encouraging among daughters of circumcised women over the last 16 years. Education, religion, age, age at marriage, occupation, marital status, and geographical regions were determinants of FGM. Combined and integrated interventions based on the identified factors are recommended to abandon FGM in Ethiopia.

**Keywords:** FGM, mutilation, harmful practices, DHS, multilevel analysis, Ethiopia

## Introduction

Female genital mutilation (FGM), also known as female circumcision, is a partial or total removal of external female genitalia including injury of their genital organs for non-medical reasons.<sup>1–3</sup> According to the World Health Organization (WHO), FGM is classified into four types. Type I is a partial or total removal of clitoral glans and prepuce. Type II is the removal of the clitoris and labia minora partially or totally. Type

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III is known as infibulation involves removing and apposing of labia minora with the clitoris, creates a covering seal, and narrowing the vaginal opening. Type IV is when it incorporates all other forms of harmful procedures on female genitalia such as incising the clitoris or labia, cutting the vagina, and inserting substances or herbs with the assumption of narrowing the vault of the vagina.<sup>4</sup>

FGM is a human right violation<sup>4</sup> and a reason for many short-term and long-term negative health impacts. Severe pain, hemorrhage, and infection are among short-term complications<sup>5</sup> that can occur during pregnancy and childbirth,<sup>6,7</sup> whereas sexual dysfunction,<sup>8</sup> depression<sup>6</sup> and gynecologic problems like fistula<sup>9,10</sup> are some of the long-term complications due to FGM. Though FGM is usually performed between infancy and 15 years of age,<sup>11</sup> victims suffer from complications throughout their lives,<sup>4</sup> and the procedure can be even fatal.<sup>1</sup> FGM is also associated with a reduced level of antenatal care<sup>12</sup> and other health-care service utilization<sup>13,14</sup> and increases the risk of Human papillomavirus infection.<sup>15</sup>

Despite many physical, sexual, and psychological problems are associated with FGM, it is still practiced in greater than 30 countries mainly in the west and east Africa including Ethiopia.<sup>2</sup> United Nations Population Fund (UNFPA) and the United Nations Children's Fund (UNICEF) have a program focusing on empowering women through education, community discussion, and national commitments to abandon FGM practice.<sup>16</sup> Likewise, the Ethiopian government planned to end FGM by 2025 through public education campaigns.<sup>17</sup> Though several works have been done in Ethiopia, social obligation<sup>18</sup> and lack of discussion about the harmful effects of FGM are still barriers to its abatement.<sup>11</sup> Ethiopia stipulated a proclamation no. 414/2004 called the criminal code of the federal democratic republic of Ethiopia 2004 which makes FGM a criminal offense.<sup>19</sup> This was a part of FGM prevention and to address which was not directly addressed by the 1995 constitution.<sup>20</sup>

Several studies were conducted to estimate the prevalence of FGM in Ethiopia.<sup>18,21–23</sup> However, most of them were not nationwide studies in which different geographical areas were not considered. This study, therefore, aimed to assess the trend and determinants of female genital mutilation among women of reproductive age in Ethiopia using 2000, 2005, and 2016 EDHS. The findings of this study will be an input to clarify the actual situation at the national level and to identify factors associated with FGM at the individual and community level. Moreover, it will

help to design interventional policies and strategies to reduce the problem and related complications.

## Methods

### Study Setting

The study was conducted in Ethiopia, the second-most populous nation in Africa next to Nigeria, with about 109 million people (2018) and with a 2.5% annual fertility rate.<sup>24,25</sup> Ethiopia has nine regional states and two city administrations.<sup>26</sup> Its economy depends mainly on agriculture.<sup>27</sup>

### Data Source and Sample Size

The study was conducted among 15–49 years old women using data extracted from the 2000 (n=15,367), 2005 (n=14,070),<sup>28</sup> and 2016 (n=7248).<sup>29</sup> Ethiopian Demographic and Health Surveys (EDHS) datasets with their respective sample size. However, the EDHS 2011 dataset was excluded due to the absence of data on FGM.<sup>30</sup> All the included surveys were conducted considering the nine regions and two administrative cities of the country. This study utilized the most recent 2016 EDHS to assess the individual- and community-level determinants of FGM among 15–49 years old women in Ethiopia. The data utilized in this study were obtained from the MEASURE DHS. <http://www.dhs.program.com>.

### Sampling and Data Collection Methods

The sampling of all EDHS surveys considered all regions and administrative cities of the country. A two-stage sampling method was implemented to select the study participants. In the first stage, enumeration areas (EAs) were selected after stratifications of the region into urban and rural areas. In the second stage, households from each EAs were selected. The sample size in each stage was estimated through probability proportion to size. Based on this, a total of 539 EAs (138 Urban & 401 Rural) from EDHS 2000,<sup>31</sup> 540 EAs (145 Urban & 395 Rural) from EDHS 2005<sup>28</sup> and 645 EAs (202 urban and 443 rural) from EDHS 2016<sup>29</sup> were included. All women of reproductive age who were permanent inhabitants or stayed at least one night in the selected households were eligible for EDHS. Data were collected through face-to-face interviews.<sup>28,29,32</sup>

### Data Collection Instrument and Period

All EDHS had three questionnaires, namely, the household's questionnaire, women's questionnaire, and men's

questionnaire. However, this study utilized EDHS 2000, EDHS 2005, and EDHS 2016 data collected through women's questionnaire. The data collection tool was first prepared in English and then translated into the three main local languages – Amharic, Oromiffa, and Tigrigna languages. After intensive training for data collectors and supervisors, a pretest was conducted before the actual data collection.<sup>26,28,29</sup> The 2000 EDHS, 2005 EDHS, and EDHS 2016 were conducted from February to May 2000,<sup>31</sup> April to August 2005,<sup>28</sup> and January to June 2016,<sup>29</sup> respectively.

## Variables of the Study

### Outcome Variable

FGM was the outcome variable of this study. It was categorized and coded as 0 if a woman has not been circumcised and 1 if a woman has been circumcised. It was known from the response of the participants to the question “Have you been circumcised?”<sup>28,29,32</sup>

### Independent Variables

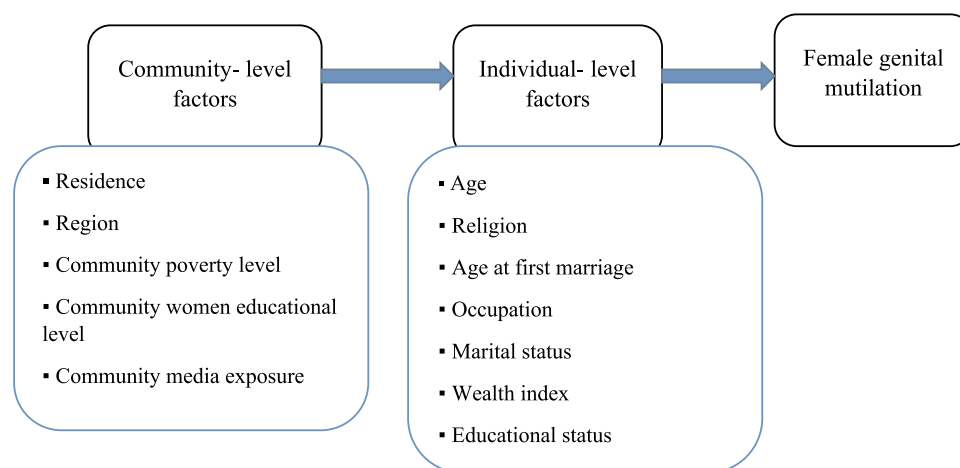
The independent variables were grouped into individual- and community-level independent variables. Religion, educational level, age, occupation, age at first marriage, marital status, and wealth index were the individual-level factors, whereas place of residence, community media access, community poverty, community women educational level, and region were community-level variables (Figure 1). The variables were selected based on previous studies which revealed factors affecting the outcome variable.<sup>31,33–36</sup> EDHS had a total of two community-level variables (residence and region). In this study, regions were recoded as large central (Tigray, Amhara, Oromia, and SNNPR), small

peripheral regions (Gambela, Somalia, Benishangul, and Afar), and Metropolitans (Addis Ababa, Dire Dawa, and Harari), similar to previous studies.<sup>37,38</sup> Additionally, individual-level variables were aggregated concerning their clusters (EAs) to create community-level variables. The aggregated variables were categorized into low or high based on the national median value of the proportions of participants in each characteristic. Community media exposure, community poverty level, and community educational level were community-level variables derived by aggregating individual-level variables.

## Data Processing and Analysis

The EDHS data utilized in this study were weighted to ensure its representativeness at the national and regional levels. Data analysis was conducted using STATA-14 software (STATA Corporation, College Station, TX, USA). Descriptive statistics (ie, frequency and percentage) were used to show the trends of FGM in Ethiopia. Similarly, both individual- and community-level factors affecting FGM were identified through multilevel logistic regression analysis.<sup>39</sup> The association of each predictor and the outcome variable was checked with a 5% significance level and 95% CI. The presence of multicollinearity was checked among independent variables using the Variance Inflation Factor (VIF) at a cut-off point of 10. Variables with a VIF value of less than 10 indicate the absence of multicollinearity.

A total of four modelings were conducted to identify determinants of FGM. The first model was an empty model, which was conducted to estimate the random variability in the intercept. The second model was conducted to estimate the effect of individual-level factors on FGM. The



**Figure 1** Conceptual framework showing factors associated with female genital mutilation.

third model assessed the effect of community-level factors on FGM. Finally, model four estimated the effect of both individual- and community-level factors on FGM. The Intra-Cluster Correlation (ICC) between clusters within each model was determined using the following formula.<sup>40,41</sup>

$$ICC = \frac{VA}{VA + \frac{\sum_{j=1}^3 \pi_j^2}{3}}$$

where ICC is the magnitude of variations explained by the clusters (community), VA is community variance and  $\frac{\sum_{j=1}^3 \pi_j^2}{3}$  is individual-level variance in standard logistic distribution = 3.29.<sup>40</sup> Similarly,

Proportional Change in Variance (PCV) was calculated to determine the power of variables predicting FGM in each model. However, Akaike Information Criterion (AIC) was chosen to select the final model that explains the data best. The AIC value for each subsequent model was compared and the model with the lowest value was considered to be the best fit model.<sup>41–43</sup>

Moreover, variables with a p-value of less than 0.05 were considered as significant factors.

## Ethics Approval and Consent to Participate

Ethical clearance was obtained from Ethiopia Health and Nutrition Research Institute Review.

Board for all EDHS, the Ministry of Science and Technology, the Institutional Review Board of ICF International, and the CDC. Data were collected after taking informed consent from all study participants and were kept confidential.<sup>28,29,31</sup> This study was conducted after getting permission DHS Program. The datasets were used confidentially during processing and analysis.

## Results

### Characteristics of Participants

The mean age ( $\pm$  standard deviation (SD)) of participants in 2016 EDHS was  $28.14 \pm 9.16$  years. More than three fourth (77.03%) of them were from rural areas. The majority (43.56%) of participants were Orthodox followed by Muslims (31.56%). There was a significant reduction of uneducated women from 75.17% in 2000 EDHS to 47% in 2016 EDHS. However, the percentage of participants married before the age of 18 years increased from 55.87% in 2000 EDHS to 62.05% in 2016 EDHS (Table 1).

## Prevalence of Female Genital Mutilation

The percentage of FGM was increased with age in all three surveys. It was increased from 70.72% among 15–19 years old to 86.79% among 45–49 years old in 2000 EDHS and from 64.22% among 15–19 years old to 83.68% among 45–49 years' old in 2005 EDHS. Similarly, it was increased from 51.64% among 15–19 years old to 81.53% among 45–49 years old in 2016 EDHS. FGM among those who were working decreased from 79.57% in 2000 EDHS to 76.13% in 2005 EDHS then to 72.94% in 2016 EDHS. Similarly, FGM was decreased from 85.46% in 2000 EDHS to 58.11 in 2005 EDHS then to 50.74% in 2016 EDHS among participants who attended higher education. Moreover, it was decreased among participants in urban areas from 79.79% in 2000 EDHS to 72.53% in EDHS 2005 then to 55.49% in 2016 EDHS (Table 1).

## Trends of Female Genital Mutilation in Ethiopia

The prevalence of FGM among women of reproductive age was 79.91% (95% CI: 79.27, 80.54), 74.26% (95% CI: 73.53, 74.98) and 70.37% (95% CI: 69.31, 71.43) in 2000 EDHS, 2005 EDHS and 2016 EDHS, respectively. Likewise, the prevalence of FGM among daughters of circumcised women was 56.16% (95% CI: 54.98, 57.33), 45.42% (95% CI: 44.18, 46.66) and 16.75% (95% CI: 15.73, 17.80) in 2000 EDHS, 2005 EDHS and 2016 EDHS, respectively. It was decreased by 39.41% from 2000 to 2016 among daughters of circumcised women (Figure 2).

## Factors Associated with Female Genital Mutilation

The most recent survey (2016 EDHS) data were utilized to identify individual- and community-level determinants of FGM. Based on the crude multilevel modeling, religion, educational level, age, occupation, age at first marriage, marital status, wealth index, residence, region, and mass media access were variable associated with FGM. However, religion, educational level, age, occupation, age at first marriage, marital status, residence, and region were variables significantly associated with FGM in the final multilevel logistic regression in which individual- and community-level variables were fitted simultaneously.

The odds of FGM were 5.48 times higher 5.48 (95% CI: 4.23, 7.09) among Muslims compared to Orthodox

**Table I** Female Genital Mutilation by Background Characteristics in Ethiopia, Findings from 2000 to 2016 EDHS

Percentage of Participants Who Had Been Circumcised						
	2000 EDHS (N=15,367)		2005 EDHS (N=14,070)		2016 EDHS (N=7248)	
Age (Mean $\pm$ SD)	28.13 $\pm$ 9.64		28.90 $\pm$ 9.44		28.14 $\pm$ 9.16	
Characteristics	FGM%	Total (%)	FGM%	Total (%)	FGM%	Total (%)
Age (years)						
15–19	70.72	3710 (24.14)	64.22	3566 (23.21)	51.64	1523 (21.01)
20–24	78.34	2859 (18.61)	75.26	2547 (18.10)	63.3	1194 (16.47)
25–29	81.42	2585 (16.82)	79.59	2517 (17.89)	73.44	1356 (18.71)
30–34	86.15	1841 (11.98)	79.55	1808 (12.85)	82.21	1124 (15.50)
35–39	83.56	1716 (11.17)	82.86	1602 (11.39)	80.77	939 (12.95)
40–44	85.84	1392 (9.06)	84.23	1187 (8.44)	77.16	610 (8.42)
45–49	86.79	1264 (8.22)	83.68	1143 (8.12)	81.53	502 (6.93)
Religion						
Orthodox	76.77	7763 (50.52)	70.71	6920 (49.19)	58.79	3157 (43.56)
Catholic	66.87	175 (1.14)	77.69	173 (1.23)	73.71	52 (0.72)
Protestant	71.87	2433 (15.83)	71.57	2654 (18.87)	73.23	1674 (23.09)
Muslim	91.80	4456 (29.00)	90.28	4009 (28.49)	84.87	2288 (31.56)
Traditional	66.85	503 (3.27)	49.16	189 (1.34)	62.14	55 (0.76)
Others	73.46	37 (0.24)	74.35	123 (0.87)	20.86	22 (0.30)
Occupation						
Working	79.57	5657 (36.82)	76.13	9266 (65.86)	72.94	3516 (48.51)
Not working	80.11	9705 (63.18)	76.78	4804 (34.14)	67.96	3732 (51.49)
Age at first marriage						
Early (<18)	82.21	8585 (55.87)	79.07	7475 (53.13)	78.53	3364 (46.05)
$\geq 18$	77	6781 (44.13)	73.28	6595 (46.87)	63.31	2058 (28.95)
Marital status						
Never in union	70.91	3688 (24)	65.17	3516 (24.99)	51.53	1826 (25.19)
Married/ Had partner	82.63	9789 (63.70)	80.75	9066 (64.44)	77.2	4711 (64.99)
Divorced/ Widowed/ separated	83.40	1890 (12.30)	75.67	1487 (10.58)	73.53	711 (9.82)
Wealth index						
Poorest	75.92	2885 (21.1)	74.81	2428 (17.26)	75.56	1127 (15.55)
Poorer	76.63	806 (5.9)	78.03	2643 (18.78)	73.15	1284 (17.71)
Middle	80.47	2731 (19.9)	76.91	2732 (19.42)	77.14	1408 (19.43)
Richer	79.21	2553 (18.7)	78.79	2646 (18.81)	73.56	1445 (19.93)
Richest	72.36	4684 (34.3)	73.89	3621 (25.73)	58.51	1984 (27.37)
Educational level						
No education	80.44	11,551 (75.17)	79.22	9271 (65.89)	81.02	3406 (46.99)
Primary	78.42	2425 (15.78)	72.61	3123 (22.20)	66.34	2505 (34.56)
Secondary	77.68	1304 (8.49)	68.43	1482 (10.53)	50.89	889 (12.27)
Higher	85.46	87 (0.56)	58.11	194 (1.38)	50.74	448 (6.19)
Residence						
Urban	79.79	2791 (18.17)	72.53	2499 (17.76)	55.49	1665 (22.97)
Rural	79.94	12,576 (81.83)	77.15	11,571 (82.24)	74.81	5583 (77.03)
Region						
Central regions	79.48	14,011 (91.18)	73.77	12,405 (88.17)	70.28	6345 (87.54)
Peripheral regions	87.74	552 (3.59)	87.76	801 (5.69)	89.85	378 (5.22)

(Continued)

Table 1 (Continued).

Percentage of Participants Who Had Been Circumcised						
	2000 EDHS (N=15,367)		2005 EDHS (N=14,070)		2016 EDHS (N=7248)	
Metropolitans	82.04	804 (5.23)	68.71	864 (6.14)	57.47	525 (7.24)
Community media access						
Low	80.44	14,681 (95.54)	74.18	10,063 (71.52)	72.97	4575 (63.12)
High	66.55	686 (4.46)	74.46	4007 (28.48)	65.93	2673 (36.88)
Community poverty						
Low	75.47	9587 (62.39)	74.11	8989 (63.96)	68.43	4837 (66.73)
High	69.10	5780 (37.61)	74.51	5071 (36.04)	74.28	2411 (33.27)
Community women educational level						
Low	80.44	11,551 (75.17)	77.28	9271 (65.89)	81.02	3406 (46.99)
High	78.32	3816 (24.83)	68.42	4799 (34.11)	60.94	3842 (53.01)

followers. Women who attended secondary and higher education were 43% less likely 0.57 (95% CI: 0.44, 0.74) and 60% less likely 0.40 (95% CI: 0.29, 0.54) to be found circumcised, respectively. Participants aged 45–49 and 40–44 years were 5.06 times 5.06 (95% CI: 3.38, 7.57) and 4.11 times 4.11 (95% CI: 2.90, 5.85) more likely to be found circumcised, respectively, compared to women aged 15–19 years. Similarly, participants who were not working were 1.20 times 1.20 (95% CI: 1.02, 1.41) more likely to be found circumcised (Table 2).

## Random Effect Results

The ICC value in the null model was (ICC = 0.598,  $P < 0.001$ ). Based on ICC value, 60% of the variation on FGM

is attributable to community-level factors. This higher ICC indicates multilevel modeling was better than single/individual-level analysis. However, ICC was reduced to 51% in the combined final model of regression. The highest value of PCV (30.5%) was also shown in the final model which indicates 30.5% of the variations on FGM is explained by individual- and community-level variables (Table 3).

## Discussion

FGM is one of the major causes of reproductive health problems,<sup>44</sup> particularly in low-income countries where medical care access is poor.<sup>45,46</sup> This study aimed to assessed trends and determinants of FGM among 15–49

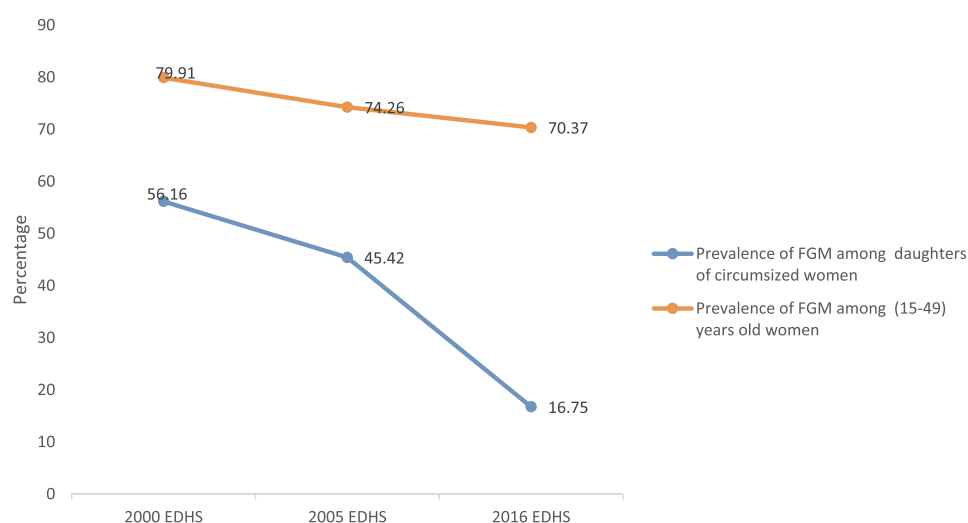


Figure 2 Trend of female genital mutilation in Ethiopia using 2000, 2005, and 2016 EDHS data.

**Table 2** Findings of the Multilevel Logistic Regression to Identify the Factors Associated with Female Genital Mutilation in Ethiopia Using Data from 2016 EDHS

Background Characteristics	COR (95% CI)	AOR (95% CI)
Religion		
Orthodox	1.00	1.00
Catholic	1.86 (0.72,4.82)	1.79(0.69,4.65)
Protestant	1.16 (0.90,1.51)	1.14(0.87,1.48)
Muslim	6.51(5.04,8.39)***	5.48(4.23,7.09)***
Traditional	0.68(0.14,3.34)	0.61(0.13,2.88)
Others	1.06(0.29,3.82)	1.06(0.29,3.88)
Educational level		
No education	1.00	1.00
Primary	0.88(0.71,1.09)	0.87(0.71,1.09)
Secondary	0.56(0.43,0.73)***	0.57(0.44,0.74)***
Higher	0.39(0.29,0.54)***	0.40(0.29,0.54)***
Respondent's age (Years)		
15–19	1.00	1.00
20–24	1.72(1.36,2.18)***	1.72(1.36,2.18)***
25–29	2.32(1.78,3.03)***	2.36(1.80,3.09)***
30–34	3.67(2.72,4.96)***	3.73(2.76,5.05)***
35–39	4.42(3.22,6.07)***	4.55(3.31,6.25)***
40–44	4.03(2.84,5.72)***	4.11(2.90,5.85)***
45–49	4.94(3.31,7.38)***	5.06(3.38,7.57)***
Occupation		
Working	1.00	1.00
Not working	1.20(1.02,1.41)*	1.20(1.02,1.41)*
Age at first marriage(years)		
Early (<18)	1.00	1.00
≥18	0.80(0.66,0.96)*	0.80(0.66,0.96)*
Marital status		
Never in union	1.00	1.00
Married/ Living with partner	1.43(1.14,1.80)**	1.41(1.12,1.77)**
Divorced/ Widowed/ separated	1.32(0.96,1.79)	1.33(0.97,1.83)
Wealth index		
Poorest	1.00	1.00
Poorer	0.71(0.52,0.97)*	0.86(0.58,1.09)
Middle	1.04(0.75,1.44)	1.18(0.85,1.63)
Richer	1.03(0.74,1.45)	1.17(0.83,1.66)
Richest	0.89(0.63,1.26)	1.13(0.74,1.73)
Residence		
Urban	1.00	1.00
Rural	5.35(3.34,8.56)***	2.57(1.50,4.38)**
Region		
Central regions	1.00	1.00
Peripheral regions	5.75(3.71,8.92)	3.04(1.96,4.70)***
Metropolitans	5.30(3.04,9.22)	3.43(2.00,5.86)***
Community media access		
Low	1.00	1.00
High	1.05(0.91,1.22)	1.15(0.98,1.35)

**Notes:** Significant levels at p-value: \*\*\*< 0.001; \*\*< 0.01; \*< 0.05.

**Table 3** Community-Level Variance Two Level Mixed Effects Logit Models Predicting Female Genital Mutilation, Ethiopia, 2016

Random Effects	Null Model	Final Model
Community variance (SE)	2.22*** (0.10)	1.85*** (0.09)
ICC (%)	60	51
PCV (%)	Reference	30.5
Model Fit Statistics		
Log-likelihood	−3453.6586	−3046.5592
AIC	6911.317	6149.118

**Note:** Significant levels at p-value: \*\*\*< 0.001.

**Abbreviations:** PCV, proportional change in variance, was calculated for successive models with reference to null model to look at relative contribution of each model to explain FGM; ICC, intra-community correlation coefficient; AIC, Akaike Information Criterion; SE, standard error.

years old women using data from 2000, 2005, and 2016 EDHS.

According to this study, the prevalence of FGM was slightly decreased over time from 79.91% in 2000 to 70.37% in 2016. This was in line with a study in Burkina Faso which declined from 83.6% to 76.1% over 11 years.<sup>47</sup> Moreover, the current study indicated a reduction of FGM by 39.1% among daughters of circumcised participants over the last 16 years. Though the risk of getting circumcised daughters is higher among daughters whose mothers are circumcised,<sup>44</sup> the recent activities on increasing educational coverage<sup>48</sup> might be the possible reason for its reduction. Similarly, the legal frameworks for the prevention of FGM might have a role in the reduction of FGM in Ethiopia.

This multilevel analysis identified different individual- and community-level determinants of FGM using EDHS 2016 data. Age, religion, educational level, occupation, age at first marriage, and marital status of participants were significant determinants of FGM at the individual level.

Likewise, region and residence were determinants of FGM at the community level.

In this study, the chance of women to be found mutilated was higher among Muslims compared to Orthodox Christians. The result was in line with previous studies conducted in Ethiopia,<sup>32</sup> Burkina Faso,<sup>47,49</sup> Somalia,<sup>50</sup> Egypt,<sup>5</sup> Cote d'Ivoire,<sup>51</sup> and Senegal.<sup>35</sup> Though FGM is not recommended by Islam,<sup>47</sup> a study in Somali where 99% of the population is Sunni Muslim revealed that FGM was supported by 98% of Somali females.<sup>6</sup> Similarly, a higher magnitude of FGM was shown in parts of Ethiopia where most of

the populations were Muslims (ie, Somalia and afar regions).<sup>29</sup> This might be due to Muslims might accept it is supported by the religion. According to previous studies, FGM was supported to attenuate women's sexual desire which helps women to agree with the moral view of Islam<sup>52</sup> and keep their virginity before marriage.<sup>22</sup>

In this study, education had a strong negative association with FGM. There was a reduction in the percentage of FGM with increasing women's educational level. This finding was consistent with previous studies conducted in Somaliland,<sup>55</sup> Nigeria,<sup>56,57</sup> Egypt,<sup>58</sup> Sudan,<sup>59</sup> and Ghana.<sup>60</sup> This could be due to the positive effect of education in changing the attitude of women towards FGM.<sup>48</sup> Additionally, FGM was not a common practice among educated women,<sup>61</sup> they usually oppose the practice.<sup>48</sup> However, women who experienced FGM had lower school attendance and a higher dropout rate.<sup>62</sup> Due to the above reasons, educating women is a known strategy to reduce FGM practice.<sup>63</sup>

Similar to studies conducted in Nigeria<sup>56</sup> and Iraq,<sup>64</sup> the current study identified that women who had not occupation were more likely to be found circumcised than those who had an occupation. This could be due to most women have an occupation when they are more educated. Their occupation helps them to decide independently on the practice.<sup>65</sup> Similarly, their occupation might help them not to be poor. Another study revealed the magnitude of FGM was higher among the more poor women.<sup>59</sup>

According to this study, age was one of the determinants of FGM. An increase in women's age was associated with higher odds of FGM. Similar findings were also identified in different studies conducted in Egypt,<sup>66</sup> Ghana,<sup>60</sup> and Nigeria.<sup>63,67</sup> This could be due to the recent improved activities against FGM such as creating awareness on women's sexual and reproductive health rights<sup>68</sup> and strict laws against FGM practice.<sup>69</sup> Moreover, the awareness of the effects of FGM could also be the reason for its lower odds among younger women than older.<sup>44</sup>

Marital status was also found to be determinants of FGM, in this study. Married women were higher likely to be found circumcised than divorced/widowed/ separated women. Studies done in Ghana<sup>60</sup> and Finland<sup>10</sup> showed a similar result. Surprisingly, in line with studies from Burkina Faso<sup>47</sup> and Iraq,<sup>70</sup> women who were married before their eighteenth birthday were more likely to be found circumcised than women married at age of 18 years or later. This might be due to the preference of their partners to get a circumcised wife<sup>50,71</sup> There is a community belief that FGM is a means of keeping women from promiscuity<sup>72</sup>

and became a prerequisite for marriage in several sub-Saharan African countries including Ethiopia.<sup>73,74</sup> For this reason, several women were forced to be found circumcised.<sup>75</sup>

In the current multilevel logistic regression, the geographical region was one of the determinants of FGM. Women from the metropolitans and peripheral regions were more likely to be found circumcised as compared to women from central regions. Similarly, women residing in rural areas were more likely to be found circumcised than urban residents. Similar results were revealed in different studies conducted in Burkina Faso,<sup>47,76</sup> Somaliland,<sup>55</sup> and Nigeria.<sup>77</sup> This could be because of the better education coverage and better awareness creation activities towards the effects of FGM in urban areas. Likewise, it could be also due to better access to sexual and reproductive health services in urban areas.

## Strength and Limitations of the Study

This study has limitations and strengths. First, the study used nationally representative DHS data collected from 2000 to 2016. This helps to provide better representative data as all regions and administrative cities in the country were included in all the surveys. Second, all three surveys used uniform and standardized survey instruments which allowed a better comparison of FGM across individual- and community-level variables across the consecutive surveys. However, it has limitations of cross-sectional studies. It does not show the fortitude cause and effect relationship between the variables.

## Conclusions

Seven in ten reproductive-age women were found to be circumcised in Ethiopia. Similarly, around two of ten daughters of circumcised women were circumcised. Though FGM reduction from 2000 to 2016 among reproductive-aged women was unsatisfactory, it was significant among daughters of circumcised women. Age, religion, residence, region, age at first marriage, marital status, occupation, and educational level were determinants of FGM. Therefore, future interventions on FGM should target the metropolitan and peripheral regions. The interventions should also consider the roles of religious leaders, empowering, and educating women. Future experimental studies on the effectiveness of the intervention programs the country is considering to prevent FGM are recommended.

## Abbreviations

AIC, Akaike Information Criterion; AOR, adjusted odds ratio; CI, confidence interval; COR, crude odds ratio; SD, standard deviation; FGM, female genital mutilation; SNNPR, Southern Nations Nationalities and Peoples region; DHS, Demographic and Health Survey; EDHS, Ethiopian Demographic and Health Survey; EAs, enumeration areas; ICC, intra-cluster variance; PCA, principal components analysis; PCV, proportional change in variance; SD, standard deviation; UNFPA, United Nations Population Fund; UNICEF, United Nations Children's Fund; VIF, variance inflation factor; WHO, World Health Organization.

## Data Sharing Statement

The data for this study are found on the DHS website <http://www.dhsmeasures>.

## Acknowledgment

I acknowledge the DHS program for providing the data.

## Author Contributions

The author made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis, and interpretation, or in all these areas; took part in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; agreed on the journal to which the article has been submitted; and agreed to be accountable for all aspects of the work.

## Funding

There was no funding for this study.

## Disclosure

The author declares that he has no competing interests.

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