Spatial distribution and determinant factors of Female Genital Mutilation among reproductive age women in Ethiopia, 2016; Based on Ethiopian National Demographic and Health Survey

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Abstract

Background: Though condemned and considered as a crime by the countries government, Female Genital Mutilation (FGM) remains a common public health problem in Africa and Ethiopia as well. Every year, more than 3 million females undergo FGM and most of them are in Africa. Thus, this study was aimed to assess the spatial distribution and associated factors of female genital mutilation in Ethiopia based on the Ethiopian demographic and Health Survey 2016 data.

Method: This is a secondary data analysis of Ethiopian Demographic and Health Survey (EDHS) 2016 data based on 7,163 women who were included for the FGM interview. The data were weighted using sampling weight as recommended by the program. The MS Excel and ArcGIS 10.3 software were used for data cleaning and spatial analysis respectively. Global and local level clustering was assessed. For the none spatial data and the determinant factors, data cleaning and analysis were done using STATA 14. Since the data has significant clustering with the Intraclass Correlation Coefficient [ICC=0.61(0.56, 0.65)], a multi-level mixed-effect logistic regression model was fitted. Variables with a P-value <0.25 in the bi-variable analysis were fitted in the multi-variable analysis. Finally, variables with p-value <0.05 with 95% CI of adjusted odds ratio were reported as a statistically significant determinant of FGM.

Result: Female genital mutilation was spatially clustered (Global Moran's I: 0.48, p<0.001). Significant hot spot clusters were found in Eastern-Amhara, Oromia, Southern Nations Nationalities and Peoples (SNNP) regions, Dire-Dawa, and Harari. Mothers age >30 (AOR=2.41, 95% CI: 1.78,3.26) years, never in union (AOR=0.31, 95%CI: 0.22, 0.44), currently not working (AOR=0.71, 95%CI: 0.55, 0.92), women who considered FGM to be continued (AOR=2.86, 95%CI: 1.75, 4.68), not heard of FGM (AOR=0.22, 95%CI: 0.08,0.62), had no formal education (AOR=1.67, 95% CI: 1.03, 2.71), Muslim (AOR=3.90, 95%CI:2.5, 6.09) and protestant (AOR=1.76, 95%CI: 1.25, 2.97), and those who thought of FGM required by religion (AOR=1.99, 95%CI: 1.31,2.99) were found to be significant determinants of female genital mutilation.

Conclusion: Female genital mutilation was spatially clustered with hotspot areas found:in Eastern-Amhara, Oromia, and SNNP regions, Dire-Dawa and Harari administrative. Age of the mother, religion, occupation, educational level, marital status, information about Female genital mutilation, and intention about FGM to be stopped or continued were significant determinants of female genital mutilation

Background

Female Genital Mutilation [FGM] is a partial or complete removal of external genitalia of the female for none medical reason (1). Four types of FGMs are practiced in different countries ranging from simple clitoridectomy up to infibulations. Type I (clitoridectomy), is a partial or complete removal of the clitoris and/or prepuce; type II (excision), is a total or partial removal of the clitoris and the labia minoria with or without removal of the labia majora; type III (infibulation), involves the narrowing of the vaginal orifice with the creation of a covering seal by cutting and a positioning the labia minora and/or the labia majora, with or without excision of the clitoris; and type IV (all other), all other forms of harmful traditional practice on the female genitalia for a none-medical purpose (2, 3). Female genital mutilation is mostly practiced on young girls of infancy up to early adolescence period (4, 5).

Globally, more than 200 million women and girls have undergone FGM so far (3). Female genital mutilation is practiced currently in more than 30 countries including Ethiopia (5). Half of the women and girls who undergo FGM lives in three countries including Egypt, Ethiopia and Indonesia (3).According to the Ethiopian Demographic and Health Survey [EDHS] 2016 report, FGM is still a public health problem with a prevalence of 65% (6). Female genital mutilation is considered as child abuse and gross violation of children's and women's human rights (4, 7, 8).

Pieces of evidences have noted that female genital mutilation has multitude of health consequences (1, 4, 9-14). Different studies point out that female genital mutilation had different physical consequences like pain during sexual intercourse, psychological disorder including post-traumatic depression disorders (15, 16). For instance, women who were undergone FGM are at high risk of obstetric complications during their childbirth (4). Furthermore, all types of FGM end up with immediate complications like hemorrhage and severe pain that will result in and ultimately death (12). Other short term complications including wound infection, sepsis, tetanus and risk of HIV/AIDS transmissions are also possible causes of death due to FGM (10-12, 14). In addition, women who had undergone type II or III FGM increases the risk of needing cesarean section and suffering from postpartum hemorrhage in Africa (4, 10).

The World Health Organization (WHO) identified six key factors that determine the continuation of FGM in developing countries. These include cultural traditions, sexual morals, marriageability, religion, health benefits, and male sexual enjoyments (4, 8, 14, 17-19).

Different stakeholders were involved to decrease female genital mutilation globally (3, 4, 20). The world has included FGM and other traditional practices as a target to be eliminated by 2030 in support of Sustainable Development Goals (20). Cognizant to this, the government of Ethiopia is struggling to eliminate FGM through prevention, provision, and protection until 2025 (6). Globally, the overall reduction of FGM was observed for the last three decades but the progress is insufficient and uneven over countries for the rapid population growth (3, 4).

The united nations have declared female genital mutilation as an illegal act to make the world free from FGM (21). However, it has remained one of the major public health problems which put countries at the high burden of maternal morbidity and mortality in developing countries including Ethiopia (6). As part of this initiative, Ethiopia has developed prevention, protection and provision strategies, criminalization, and refreshed commitments to end FGM by 2025 (6, 21). Despite the above initiatives and efforts attempted by organizations and countries, a significant number of women and girls are practicing FGM mainly in developing countries including Ethiopia. However, there is a dearth of literature regarding the spatial distribution and determinants of FGM. Therefore it is imperative to explore spatial distribution and identify the determinant factors of FGM.

Methods

Study design and setting

A secondary data analysis was conducted from Ethiopian Demographic and Health Survey 2016 data**.** Ethiopia is located in East Africa at (3°-14° N and 33^0 - 48°E). It has nine regional states (Afar, Amhara, Benishangul-Gumuz, Gambella, Harari, Oromia, Somali, Southern Nations, Nationalities, and People's Region (SNNP), and Tigray) and two administrative cities (Addis Ababa and Dire Dawa). Ethiopia is the 2nd populous country in Africa with a high fertility rate of 4.6 children per woman.

Data source and measurements

Every five years, the Demographic and Health Survey of Ethiopia (EDHS) collects data at the national level based on representative samples and key indicators including maternal health conditions. The interviewer-administered questionnaire was used to collect data on women of reproductive age (15-49) years. The questionnaire included socio-demographic, socioeconomic, pregnancy, and maternal health service-related variables related to women's health. A stratified two-stage cluster sampling with a total of 645 Enumeration Areas (EAs) (202 in Urban and 443 in rural areas) were selected with probability proportional to EA size. A total of 15,683 women were interviewed for maternal health indicators assessment. Among the 15,683 interviewed, 7,163 households were selected for FGM (6).

Geographic coordinate data (latitude and longitude) were collected for selected enumeration areas. The coordinate data and the data set were accessed through an online request from major DHS International (http://www.dhsprogram.com.) after registration as an authorized user. The shape files of all maps were freely accessible from the link below without restrictions (https://africaopendata.org/dataset/ethiopia-shapefiles).

Data analysis

As recommended by the major DHS program of Ethiopia, the data was weighted 1st using the code for women data and the detail is found in the major DHS report (6). Data cleaning and descriptive statistics were conducted using STATA 14 software for the non-spatial data. Multicollinearity was checked using Variance Inflation Factor (VIF) by considering a cut-off point of VIF>10 to declare as multicollinearity. Geographic Information System (ArcGIS) version10.3 was used for spatial data analysis. We had computed the cluster level observed/expected counts and corresponding standardization ratios. We use this one as an outcome variable for the spatial analysis. Through the whole process of the spatial analysis.. Global and local level spatial autocorrelation analysis techniques were used to test the presence of spatial autocorrelation and for identifying significant clusters. Hot spot analysis was conducted using Getis-Ord Gi* statistics to explore how spatial autocorrelation varies across the study areas. To determine the statistical significance of clustering, the Gi* Z score was computed. A positive z-score >1.96 with significant p-value represents hot spot while negative Z-score <-1.96 with significant p-value represents cold spot. Empirical Bayesian kriging prediction was used to predict the unsampled based on the sampled data and creates a smooth surface to predict the burden of FGM across the regions of the country.

Since the DHS data had hierarchical nature and we got a high and significant clustering [ICC=0.61(0.56, 0.65)], we used a multilevel mixed-effect logistic regression model. Variables having a p-value <0.25 in the bi-variable multi-level mixed-effect logistic regression model were considered for multivariable analysis(22). Finally, variables of a significant level (p<0.05) were reported with Adjusted Odds Ratio (AOR) with 95% CI as independent determinants of female genital mutilation in Ethiopia.

Results And Discussion

Among the reproductive age women, 1,266 (17.46%) have said female genital mutilation should be continued and 1,710 (23.6%) of them believed that FGM is required by their religion. Nearly all women 7,157 (98.66%) were heard about FGM while 5,232 (72.19%) of them had no continuous media exposure (**Table 1 and 2**).

Table 1: Weighted proportion of Socio-demographic and economic variables of women in reproductive age in Ethiopia, EDHS 2016 perspective

ıriable name	Category	Female Genital Mutilation		Total (%)
		No	Yes	
ge in years of respondents				
	15-30	1535	2538	4073(56.19)
	>30	612	2563	3176(43.81)
ace of residence				
	Urban	741	9924	1665(22.97)
	Rural	1406	4177	5583(77.03)
eligion				
	Orthodox	1301	1858	3157(43.56)
	Muslim	346	1942	2288(31.56)
	Protestant	448	1226	1674(23.09)
	Other	52	77	129(1.79)
ırrent occupation				
	Currently not working	1386	3378	4746(65.47)
	Currently working	780	1723	2503 (34.53)
arital status				
	Never in union	885	942	1826(25.19)
	Currently in union	1047	3637	4711 (64.99)
	Formerly in union	188	523	711 (9.82)
ealth index				
	Poor	620	1791	2411(33.27)
	Middle	322	1086	1408(19.43)
	Rich	1205	2223	3429(43.3)
ghest educational level of women				
	No formal education	647	2757	3406(49.99)
	Primary	843	1662	2505(34.56)
	Secondary	437	452	889(12.27)
	Higher	221	227	448(6.19)

Table 2: Weighted proportion of variable associated with female genital mutilation in Ethiopia among reproductive age women, EDHS 2016 perspective.

ıriable name	Category	Female Genital Mutilation(FGM)		Total (%)
		No	Yes	
GM required by religion				
	Yes	198	1521	1710(23.6)
	No	1815	3410	5226(72.09)
	Other	133	179	312(4.31)
GM to be continued				
	Continue	98	1168	1266(17.46)
	Stop	1964	3784	5748(79.3)
	Depends on	88	149	234(3.24)
edia Exposure				
	Non Frequent	1344	3888	5232(72.19)
	Frequent	803	1213	2016(27.81)
ver heard of FGM				
	No	60	37	97(1.34)
	Yes	2087	5064	7151(98.66)

Considering the prevalence of female genital mutilation Our analysis points out, the prevalence of FGM (65%) was lower as compared to previous studies conducted in Ethiopia (23), Burkina Faso (24), Sudan(25) but higher than studies conducted in Senegal(26). Female genital mutilation had spatial dependency at the national and regional levels (Moran's I: 0.48, p<0.001). Thus, further analysis is required to detect specific local level significant clusters. We applied Getis-Ord Gi* statistics to detect hot and cold spot clusters.

Figure 1: Global spatial autocorrelations of Female genital mutilation among reproductive age women in Ethiopia. Data from Ethiopian Demographic and Health Survey 2016. The shape file of the map is from https://africaopendata.org/dataset/ethiopia-shapefiles.

Female genital mutilation is spatially clustered in Ethiopia (Moran's I=0.48, P<0.001). Accordingly, significant hotspot clusters of FGM were detected in Eastern Amhara, West and North-east Oromia, and East and North-east SNNP regions, Harari, Dire Dawa while cold spot clusters were found in most parts of Tigray, and Gambela, including Central and South-West Afar regions (Figure 2). This finding is supported by other studies conducted in Ethiopia where FGM was spatially clustered with high spot clusters found in Central and East Amhara, North part of SNNP, East Oromia (23). This might be due to different cultural beliefs; in some regions of Ethiopia people believes FGM can reduces sexual hyperactivity, circumcised women are more faithful for their husbands(14, 27). Gambela and Tigray regions were cold spots most of the people in this region live in urban areas and being urban residence reduces the chance and support of female genital mutilations(28). Other studies conducted in Kenya(29), Senegal(26),Nigeria(30) all showed that FGM has significant spatial variation (See **Figure 2**).

Figure 2: Spatial clustering of Female genital mutilation among reproductive age women in Ethiopia. Data from Ethiopian Demographic and Health Survey 2016. The shape file of the map is from https://africaopendata.org/dataset/ethiopia-shapefiles. A single dot represents one enumeration area. Z-score >1.96 implies hotspot, <-1.96 cold spot and others none significant.

Based on the ordinary kriging interpolation, regions like Afar and Somali were estimated to be the high risk regions which were non-significant regions by the hot-spot analysis using the Getis-Ord Gi* statistics. This difference might be due to variation in sample size. As we witnessed from the report Amhara and Oromia regions account largest sample sizes while Afar and Somali were the lowest. While most part of Tigray and Gambela regions were low risks as compared to other regions **(See Figure 3).**

Figure 3: Empirical Bayesian kriging interpolations of Female genital mutilation among reproductive age women in Ethiopia. Data from Ethiopian Demographic and Health Survey 2016. The shape file of the map is from https://africaopendata.org/dataset/ethiopia-shapefiles.

Determinant factors of female genital mutilation in Ethiopia

The fourth Model that includes both the individual and community level variables was the better fit as compared to others with high LLR (Table 3).

Table 3: Multi-level mixed effect logistic regression analysis output of Female genital mutilation in Ethiopia, EDHS 2016 perspective

Variable name	Category	Female Genital Mutilation		COR(95% CI)	Model 1	Model 2	Model 3	Model 4
		No	Yes					
Age of respondent								
	15-30	1535	2538	1		1		
	>30	612	2563	4.62 (3.50,6.11)		2.32(1.71,3.09)		**2.41(1.78,3.26)**
Current occupation								
	Currently not working	1386	3378	0.71(0.54,0.93)		0.75(0.58,0.96)		**0.71(0.55,0.92)**
	Currently working	780	1723	1		1		
Marital status								
	Never in union	885	942	0.16(0.12,0.23)		0.31(0.22,0.42)		0.31(0.22,0.44)
	Currently in union	1047	3637	1		1		
	Formerly in union	188	523	1.06(0.76,1.48)		0.93(0.65,1.33)		0.92(0.63,1.32)
Wealth index								
	Poor	620	1791	1.23(0.94,1.66)		0.87(0.62,1.21)		0.75(0.53,1.08)
	Middle	322	1086	1.35(0.99,1.84)		1.12(0.78,1.62)		1.07(0.74,1.55)
	Rich	1205	2223	1		1		1
FGM to be continued or stopped								
	Continue	98	1168	4.87(3.11,7.65)		4.36(2.73, 6.96)		**2.86(1.75,4.68)**
	Stop	1964	3784	1		1		1
	Depends on	88	149	0.94(0.55,1.63)		0.61(0.34,1.07		**0.52(0.27,0.98)**
Media Exposure								
	Non Frequent	1344	3888	1.67(1.27,2.20)		1.30(0.94,1.81)		1.30(0.91,1.85)
	Frequent	803	1213	1		1		1
Ever heard of FGM								
	No	60	37	0.27(0.10,0.72)		0.25(0.08,0.76)		**0.22(0.08,0.62)**
	Yes	2087	5064	1		1		1
Highest educational level of women								
	No education	647	2757	4.93(3.20,7.60)		1.96(1.21,3.17)		**1.67(1.03,2.71)**
	Primary	843	1662	1.40(0.98,2.00)		1.23(0.82,1.85)		1.10(0.73,1.66)
	Secondary	437	452	0.94(0+.66,1.35)		1.17(0.79,1.74)		1.12(0.74,1.67)
	Higher	221	227	1	1			1
Place of residence								
	Urban	741	9924	1			1	1
	Rural	1406	4177	2.79(1.99,3.92)			1.89(1.36,2.63)	1.32(0.83,2.09)
Religion								
	Orthodox	1301	1858	1			1	1
	Muslim	346	1942	4.69(3.15,7.000			3.70(2.48,5.50)	**3.90(2.50, 6.09)**
	Protestant	448	1226	1.64(1.10,2.45)			1.63(1.09,2.46)	**1.76(1.05,2.97)**
	Other	52	77	1.57(0.76,3.24)			1.40(0.69, 2.87)	1.42(0.53, 3.77)
FGM required by religion								
	Yes	198	1521	3.25(2.30,4.77)			2.79(1.98, 3.94)	**1.99(1.32,2.99)**
	No	1815	3410	1			1	1
	Other	133	179	0.99(0.66,1.48)			1.03(0.69,1.52)	1.00(0.61,1.65)
Random coefficient								
	Variance					4.58(3.62,5.80)	2.85(2.25,3.59)	3.81(3.00,4.82)
	ICC				0.61(0.56,0.65)	0.57(0.52,0.62)	0.60(0.55,0.64)	0.47(0.42,0.53)
Model comparison	AIC					6263	6505.916	5794.48
	LLR					-2947.0897	-3244.958	-2876.2411

Model 1: null model; model 2: individual level variables; Model 3: community level variables; Model 4: final model with both individual and community level variables; AIC: Akakie Information Criteria; BIC: Bayessian Information Criteria; LLR: Log Likelihood Ratio

Women older than 30 years had more than double (AOR=2.41, 95% CI: 1.78, 3.26) odds of having FGM compared to women of age ≤30 years. This finding was supported by different studies conducted in Ethiopia (23, 31), and Ghana (32). This might be due to the strong emphasis is given by the government of Ethiopia in the late 20th and early 21st century to eliminate the practice of FGM through empowering women in different strategies including providing access to mass media and education. This would mean that women

who were older have missed access to media exposure, health education, and other opportunities by health extension workers that can condemn female genital mutilation.

With regard to occupation, women who are not currently working had 29 %(AOR=0.71, 95% CI: 0.55, 0.92) less odds of having FGM as compared to their counterpart. A number of studies, however, have reported that women who have occupation/are working had lesser odds of practicing FGM than those who have no occupation (27, 33, 34). To best of our knowledge, there is no clear justification for this finding.

Those mothers who are never in the union had 69% (AOR=0.31, 95% CI: 0.22, 0.44) reduced odds of having FGM compared to women who are currently in Union. This finding is in agreement with studies conducted in Sudan where not currently married women had less odds of having FGM (25). In Somali and Harari regional states of Ethiopia the communities circumcise the women to increase marriageability, to make them calm and sexually faithful for their husbands(27). The reason for being never in union reduces the odds of having FGM in Ethiopia might be the different cultural barriers like being circumcised makes females more faithful to their husbands (35). In African countries including Ethiopia, some communities believe that practicing FGM as a pre-request for marriage (19, 36, 37). Additionally, if women do not practice FGM, they might be excluded from the community (36).

Those women whose intention about FGM to be continued had nearly 3 (AOR= 2.86, 95%CI: 1.75, 4.68) times more odds of having FGM compared to those who think FGM to be stopped while those who think of FGM to be continued conditionally had 48% (AOR=0.52, 95% CI: 0.27,0.98) less odds of having FGM compared to those whose intention is FGM to be stopped. This might be due to mothers who support that FGM should be continued are old aged, and uneducated. Even if FGM is declared as an illegal act, male attitude (37), lack of female autonomy and older people's beliefs of FGM as a source to keep virginity make some older people have intentions as FGM to be a continued arena (32). Those mothers living in a community where FGM is required by religion had 2 (AOR=1.99, 95% CI: 1.32, 2.99) times the odds of having FGM as compared to women where FGM is not required by religion. Uncircumcised women were considered as breaching the Muslim religion and they believe as one prerequisite for being a Muslim religion follower (35). "*In the Muslim religion, we believe that if we are not circumcised, we feel that we are totally against our religion. Allah will never accept us whatever we pray. This is the reason we allow our daughters to practice FGM"(27).*

In contrast to findings from other studies, mothers who had ever heard about FGM had nearly 3/4th (AOR=0.22, 95%CI: 0.08, 0.62) reduced odds of having FGM compared to their counterparts. This finding is against in studies conducted in Sudan where having more formal education reduces the odds of having FGM (25), Ghana (32). Many scholars have documented that religion and different traditional and cultural factors could affect the practice of FGM. Accordingly, our study noted that Muslim and protestant religious followers had nearly four [AOR= 3.90, 95%CI: 2.5, 6.09) and nearly two times (AOR=1.76, 95%CI: 1.05, 2.97) increased odds of being circumcised as compared to orthodox religion followers. This finding is supported by studies conducted in South Ethiopia(31), the Somali region of Eastern Ethiopia(33), Ethiopia(23). In addition, those mothers living in a community where FGM is required by religion had 2 (AOR=1.99, 95% CI: 1.32, 2.99) times the odds of having FGM as compared to women where FGM is not required by religion. This finding was supported by different studies conducted elsewhere in South Ethiopia (31), Ethiopia (23). The main reason for the increased practice of FGM in such a religious community is related to the strong belief and attitude of the community that practicing FGM has a religious basis. For instance, a girl who undergo circumcision is considered to be pure and can go for pray and it is considered as an obligation in Islamic religion (35).

In the context of women education, women who had no education had more than one and a half (AOR=1.67, 95%CI: 1.03, 2.71) odds of having FGM as compared to those who had above secondary education. Similar results have been reported by different studies in South Ethiopia (31), and Ghana(32). It is evidenced that more educated women can save their daughters form circumcision (38). Mostly, women circumcised their children to get social acceptance and marriage prospects which might be related to the women's self-autonomy that would mean more educated women had better decision-making ability (39).

Conclusions

Female genital mutilation was spatially clustered. And hotspot clusters were found in Amhara, Oromia and SNNPR regions. Age of the mother, religion, occupation, educational level, marital status, information about female genital mutilation, and intention about FGM to be stopped or continued were significantly associated to Female genital mutilation. It is recommended to give more emphasis on hot spot regions and consider the above-listed variables to reduce the magnitude of female genital mutilation in Ethiopia. Researchers are

also recommended to consider the qualitative aspects related with cultural, social and religious perspectives related to FGM as these variables were not well addressed by our study

List Of Abbreviations

FGM: Female Genital Mutilation, AOR: Adjusted Odds Ratio, EDHS: Ethiopian Demographic and Health Survey, EA: Enumeration Area, LLR: Log Likelihood Ratio, RR: Relative Risk

Declarations

Ethics approval and consent to participate

Permission for data access was obtained from Major DHS program after registered as authorized user. All the data used for this manuscript are publically available and confidentiality was maintained anonymously.

Consent for publication

Not applicable

Availability of data and material

The data used for preparation of this manuscript are available from http://www.dhsprogram.comand anyone can access through online request as authorized user. The authors prepared the data that was used for preparation of this manuscript can be shared if required. The shape files of the maps were freely available without any restriction at Open Africa (https://africaopendata.org/dataset/ethiopia-sha.pefiles).

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

AG, GM and MW developed the proposal, extracted the data, worked on analysis, interpreted the results and prepared the manuscript. All authors were contributing equally for the development of this research work.

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Figures

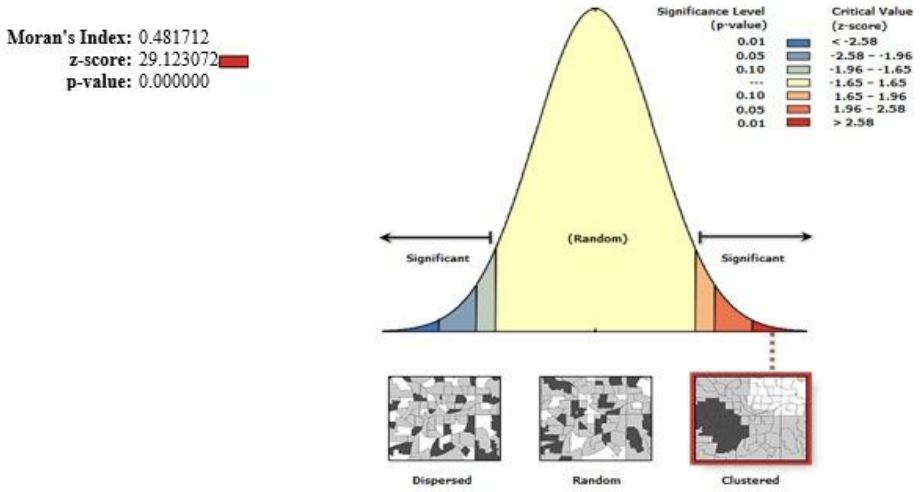

Figure 1

Global spatial autocorrelations of Female genital mutilation among reproductive age women in Ethiopia. Data from Ethiopian Demographic and Health Survey 2016. The shape file of the map is from https://africaopendata.org/dataset/ethiopia-shapefiles.

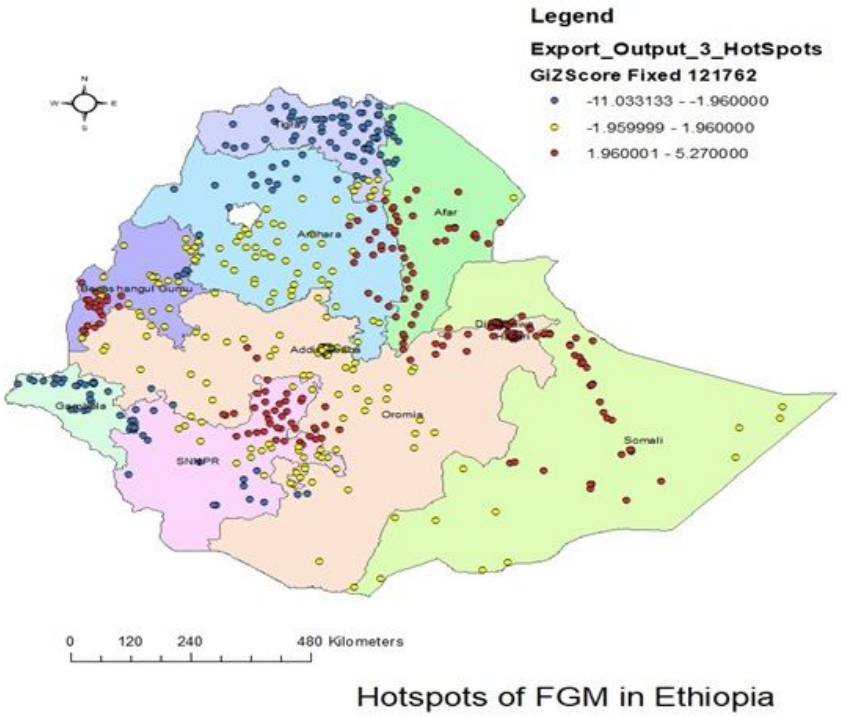

Figure 2

Spatial clustering of Female genital mutilation among reproductive age women in Ethiopia. Data from Ethiopian Demographic and Health Survey 2016. The shape file of the map is from https://africaopendata.org/dataset/ethiopia-shapefiles. A single dot represents one enumeration area. Z-score >1.96 implies hotspot, <-1.96 cold spot and others none significant.

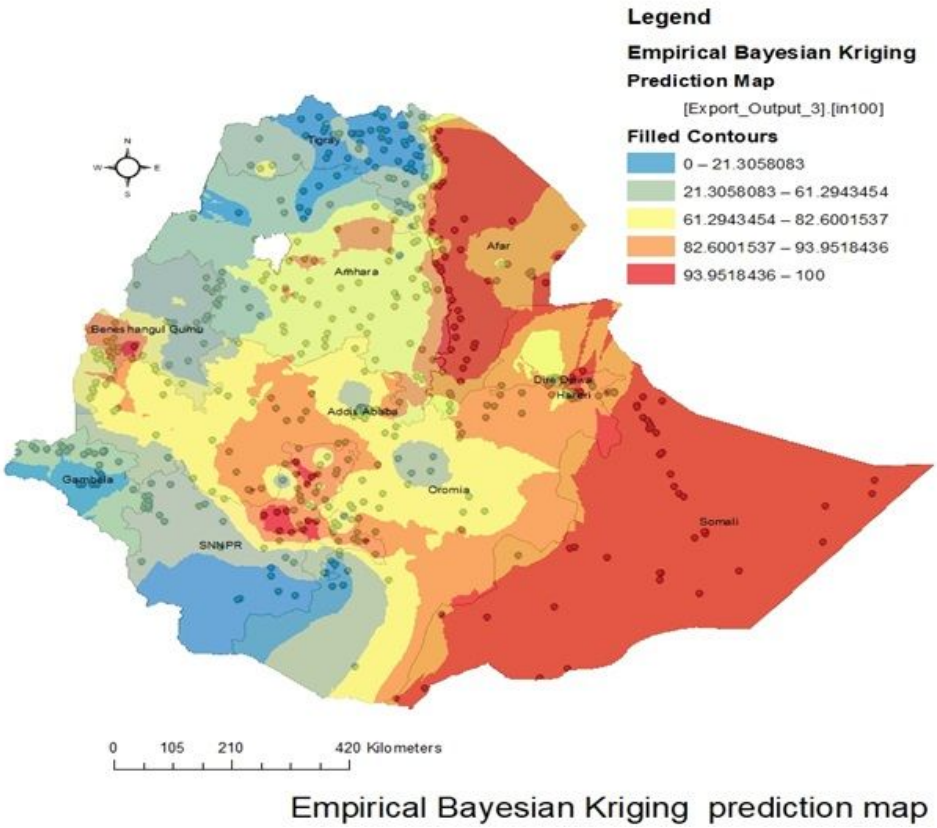

Figure 3

Empirical Bayesian kriging interpolations of Female genital mutilation among reproductive age women in Ethiopia. Data from Ethiopian Demographic and Health Survey 2016. The shape file of the map is from https://africaopendata.org/dataset/ethiopia-shapefiles.