Spatial Distribution of Female Genital Mutilation in Nigeria

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Abstract. The harmful effects of female genital mutilation (FGM) on women are recognized worldwide. Although it is practiced by persons of all socioeconomic backgrounds, there are differences within countries and between communities. The aim of this study was to use the 2003 Nigeria Demographic and Health Survey data to determine the spatial distribution of the prevalence of FGM and associated risk factors. Data were available for 7,620 women; 1,673 (22.0%) interviewed had had FGM and 2,168 women had living children, of whom 485 (22.4%) daughters had undergone FGM. Unmarried women were more likely to report a lower prevalence of FGM. Modernization (education and high socioeconomic status) had minimal impact on the likelihood of FGM, but education plays an important role in the mother’s decision not to circumcise her daughter. It follows from these findings that community factors have a large effect on FGM, with individual factors having little effect on the distribution of FGM.

INTRODUCTION

Female genital mutilation (FGM) is practiced commonly in countries in the northern half of sub-Saharan Africa and more than 25 countries.1 It involves surgically altering the female genitalia for non-medical reasons.2 The procedure is irreversible and the effects last a lifetime. In Nigeria, like many other countries, FGM is forbidden by law.

The harmful health effects of FGM to women are well documented. Laws and campaigns against the practice have not been successful in eliminating the practice, and few success stories have been reported in Senegal where a community-led approach has been effective in eradicating the practice.2 Although it is practiced by persons of all socioeconomic backgrounds, there are differences within countries and between communities.

The objective of this report is to examine the spatial distribution of FGM, including a number of sociodemographic, household, and community characteristics that could confound or mediate the observed prevalence of FGM in Nigeria. It further seeks to highlight patterns that exist within the data, after multiple adjustments of proximate variables. Such estimates illustrate how much can be learned by exploratory analyses and suggest how these data can be used to strategically inform policy.

There is now an increased amount of literature on the practice of FGM. Most of the literature deals with issues of the origin, types, and justifications for the practice but little is devoted to its patterns and spatial distribution. As per its origin, some researchers3 have argued that FGM can be traced to Egypt. The practice of FGM has been justified mostly on social and cultural grounds. Some of the assumptions for the continued practice of FGM in Nigeria have been reported.4 They include custom and tradition, purification, family honor, hygiene, aesthetic reasons, protection of virginity, and prevention of promiscuity. Others include increased sexual pleasure of husband, enhancing fertility, giving a sense of belonging to a group, and increasing matrimonial opportunities. Although most of these claims are not substantiated with empirical data, as many as 85%5 still believe that the practice should be continued.

This finding may be caused by cultural inertia. Limited emphasis has been placed on the economic rationale. It has been argued that FGM provides employment/lucrative business for the practitioners where cut body parts are sold as love charms or medicine. Moreover, an integrative approach to take into account economic, social, cultural, and environmental factors is needed to end this practice.

For policy strategies, there is limited literature available. However, the international community has recognized the human rights implications of FGM. Multilateral agencies, such as the United Nations Children’s Fund and the World Health Organization (WHO)6 have played a crucial role in advocacy of ending FGM. Unfortunately, the efforts have not yielded the desired benefit. However, some community-led approaches have been effective (an example is the case of Senegal) in eradicating the practice.2 Government efforts have not yielded the desired benefit because some governments have not aggressively addressed the issue as it is often viewed as a private act by individuals and family members. In Nigeria, the government has recognized FGM as harmful practice to be eliminated, but no specific federal law is yet in place to ensure strict compliance. However, some state governments have enacted laws against the practice of FGM. Although psychological and health complications have been emphasized, little or no emphasis has been made regarding economic implications, especially, in addressing health complications.

Long-term physical complications include urine retention and associated urinary-tract infections, obstruction of menses and related reproductive-tract infections, infertility, painful intercourse, psychological and sexual problems, and prolonged and obstructed labor (WHO, 2006). Also, the risk of transmission of human immunodeficiency virus (HIV) is considered a factor in FGM, especially if infected infants and girls are cut in group ceremonies where circumcisers use the same instrument on all the initiates. Even after it has healed, the scarred or dry vulva of an excised or infibulated woman can be torn easily during sexual intercourse, increasing the likelihood of HIV transmission by an infected partner.

This report discusses the issue of FGM in Nigeria from the feminist theoretical perspective. In feminist literature, circumcising women is closely linked to control over women’s sexuality.6 Using a representative sample of women from the 2003 Nigeria Demographic and Health Survey (NDHS), we examined the spatial distribution of FGM by quantifying the
effects of geographic locations that might confound the complexity of the practice among ethnic groups within Nigeria, and the role of cultural and demographic factors related to the practice.

Nigeria is located in the sub-Saharan African region of the world. It has borders with Benin, Niger, Chad, and Cameroon. Demographically, it is the most populous country in Africa with an estimated population of 140,003,542 according to the 2006 census figure. Approximately half of the population is women; thus, issues concerning women such as FGM should not be ignored. Economically, Nigeria is not a developed country. With a low per capita income and worsening poverty, the country would find it difficult to bear the cost implications of the health burden arising from the complications of FGM. Therefore, there is strong economic justification to stop the practice of FGM.

It should be noted that the FGM classification of WHO distinguished four different types of FGM. Type I or clitoridectomy is excision of the prepuce, with or without partial or total excision of the clitoris. Type II or excision is excision of the clitoris with partial or total excision of the labia minora. Type III or infibulation is the most severe form of FGM and consists of partial or total excision of the external genitalia and stitching or narrowing of the raw labial surfaces, leaving a small posterior opening for urinary and menstrual flow. Type IV is a residual category of FGM consisting of pricking, piercing, or incising the clitoris and/or labia, cauterization of tissues, scraping of the vaginal orifice, or cutting of the vagina.

The geographic distribution of the prevalence of FGM (all types) by zones and states of Nigeria is shown in Table 1. The results of the 1997 study conducted by the Inter-African

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Mother circumcised, no. (%)</th>
<th>P</th>
<th>Daughter circumcised, no. (%)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Religion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Christian</td>
<td>2,339 (64.3)</td>
<td>&lt; 0.001</td>
<td>968 (74.7)</td>
<td>0.001</td>
</tr>
<tr>
<td>Muslim</td>
<td>3,218 (90.6)</td>
<td>677 (82.7)</td>
<td>142 (17.3)</td>
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</tr>
<tr>
<td>Traditionalist/animist</td>
<td>84 (68.3)</td>
<td>38 (71.7)</td>
<td>15 (28.3)</td>
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<tr>
<td>Place of residence</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>2,052 (70.7)</td>
<td>&lt; 0.001</td>
<td>794 (76.6)</td>
<td>0.29</td>
</tr>
<tr>
<td>Rural</td>
<td>852 (29.3)</td>
<td>889 (78.5)</td>
<td>243 (21.5)</td>
<td></td>
</tr>
<tr>
<td>Final say on health care</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respondent alone</td>
<td>731 (58.0)</td>
<td>&lt; 0.001</td>
<td>358 (63.6)</td>
<td>0.001</td>
</tr>
<tr>
<td>Husband/partner</td>
<td>3,173 (87.2)</td>
<td>985 (85.7)</td>
<td>164 (14.3)</td>
<td></td>
</tr>
<tr>
<td>Someone else</td>
<td>1,266 (77.5)</td>
<td>80 (84.2)</td>
<td>15 (15.8)</td>
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<tr>
<td>Asset index, quintile</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>First</td>
<td>1,208 (83.2)</td>
<td>&lt; 0.001</td>
<td>267 (74.8)</td>
<td>0.39</td>
</tr>
<tr>
<td>Second</td>
<td>1,149 (84.1)</td>
<td>262 (78.2)</td>
<td>73 (21.8)</td>
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<tr>
<td>Third</td>
<td>1,174 (81.1)</td>
<td>298 (77.0)</td>
<td>89 (23.0)</td>
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</tr>
<tr>
<td>Fourth</td>
<td>1,089 (72.9)</td>
<td>373 (76.7)</td>
<td>113 (23.2)</td>
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<tr>
<td>Fifth</td>
<td>1,028 (65.8)</td>
<td>483 (80.1)</td>
<td>120 (19.9)</td>
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</tr>
<tr>
<td>Mother’s education</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>2,677 (90.1)</td>
<td>&lt; 0.001</td>
<td>585 (76.7)</td>
<td>0.43</td>
</tr>
<tr>
<td>Some</td>
<td>2,971 (68.3)</td>
<td>1,098 (78.2)</td>
<td>121 (21.8)</td>
<td></td>
</tr>
<tr>
<td>Partner’s education</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>2,002 (90.4)</td>
<td>&lt; 0.001</td>
<td>455 (78.7)</td>
<td>0.38</td>
</tr>
<tr>
<td>Some</td>
<td>2,169 (70.1)</td>
<td>1,164 (76.9)</td>
<td>349 (23.1)</td>
<td></td>
</tr>
<tr>
<td>States</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>North central: Benue</td>
<td>294 (89.9)</td>
<td>70 (83.3)</td>
<td>14 (16.7)</td>
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</tr>
<tr>
<td>Kwaara</td>
<td>50 (42.4)</td>
<td>29 (43.3)</td>
<td>38 (56.7)</td>
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<tr>
<td>Niger</td>
<td>193 (91.9)</td>
<td>30 (75.0)</td>
<td>10 (25.0)</td>
<td></td>
</tr>
<tr>
<td>Plateau</td>
<td>232 (97.9)</td>
<td>37 (94.9)</td>
<td>2 (5.1)</td>
<td></td>
</tr>
<tr>
<td>Kogi</td>
<td>182 (95.3)</td>
<td>25 (92.6)</td>
<td>2 (7.4)</td>
<td></td>
</tr>
<tr>
<td>Nassarawa</td>
<td>78 (72.2)</td>
<td>33 (91.7)</td>
<td>3 (8.3)</td>
<td></td>
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<tr>
<td>Abuja (FCT)</td>
<td>44 (97.8)</td>
<td>11 (100)</td>
<td>0 (0.0)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1,073 (86.8)</td>
<td>235 (77.3)</td>
<td>69 (22.7)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Northeast: Bauchi</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Borno</td>
<td>266 (97.4)</td>
<td>103 (100)</td>
<td>0 (0.0)</td>
<td></td>
</tr>
<tr>
<td>Adamawa</td>
<td>200 (100)</td>
<td>36 (94.7)</td>
<td>2 (5.3)</td>
<td></td>
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<tr>
<td>Taraba</td>
<td>146 (98.0)</td>
<td>36 (100)</td>
<td>0 (0.0)</td>
<td></td>
</tr>
<tr>
<td>Yobe</td>
<td>148 (99.3)</td>
<td>66 (100)</td>
<td>0 (0.0)</td>
<td></td>
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<tr>
<td>Gombe</td>
<td>165 (97.6)</td>
<td>34 (97.1)</td>
<td>1 (2.9)</td>
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</tr>
<tr>
<td>Total</td>
<td>1,390 (98.7)</td>
<td>358 (99.2)</td>
<td>3 (0.8)</td>
<td>0.021</td>
</tr>
<tr>
<td>North: Kaduna</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kano</td>
<td>428 (98.8)</td>
<td>34 (100)</td>
<td>0 (0.0)</td>
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<tr>
<td>Katsina</td>
<td>424 (99.8)</td>
<td>60 (98.4)</td>
<td>1 (1.6)</td>
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<tr>
<td>Sokoto</td>
<td>277 (100)</td>
<td>58 (100)</td>
<td>0 (0.0)</td>
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<tr>
<td>Jigawa</td>
<td>196 (100)</td>
<td>6 (100)</td>
<td>0 (0.0)</td>
<td></td>
</tr>
<tr>
<td>Kebbi</td>
<td>142 (99.3)</td>
<td>39 (97.5)</td>
<td>1 (2.5)</td>
<td></td>
</tr>
</tbody>
</table>

(continued)
Table 1
Continued

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Mother circumcised, no. (%)</th>
<th>Daughter circumcised, no. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Zamfara</td>
<td>154</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>1,776</td>
<td>100</td>
</tr>
<tr>
<td>Southeast: Anambra</td>
<td>96</td>
<td>111</td>
</tr>
<tr>
<td>Ilo</td>
<td>81</td>
<td>90</td>
</tr>
<tr>
<td>Abia</td>
<td>72</td>
<td>52</td>
</tr>
<tr>
<td>Enugu</td>
<td>129</td>
<td>115</td>
</tr>
<tr>
<td>Ebonyi</td>
<td>58</td>
<td>114</td>
</tr>
<tr>
<td>Total</td>
<td>436</td>
<td>452</td>
</tr>
<tr>
<td>South: Akwa-Ibom</td>
<td>132</td>
<td>43</td>
</tr>
<tr>
<td>Edo</td>
<td>60</td>
<td>59</td>
</tr>
<tr>
<td>Cross River</td>
<td>78</td>
<td>45</td>
</tr>
<tr>
<td>Rivers</td>
<td>199</td>
<td>86</td>
</tr>
<tr>
<td>Delta</td>
<td>66</td>
<td>96</td>
</tr>
<tr>
<td>Bayelsa</td>
<td>21</td>
<td>30</td>
</tr>
<tr>
<td>Total</td>
<td>556</td>
<td>359</td>
</tr>
<tr>
<td>Southwest: Lagos</td>
<td>199</td>
<td>161</td>
</tr>
<tr>
<td>Ogun</td>
<td>122</td>
<td>20</td>
</tr>
<tr>
<td>Ondo</td>
<td>26</td>
<td>71</td>
</tr>
<tr>
<td>Oyo</td>
<td>31</td>
<td>179</td>
</tr>
<tr>
<td>Osun</td>
<td>19</td>
<td>137</td>
</tr>
<tr>
<td>Ekiti</td>
<td>20</td>
<td>60</td>
</tr>
<tr>
<td>Total</td>
<td>417</td>
<td>640</td>
</tr>
<tr>
<td>Total of all states</td>
<td>5,648</td>
<td>1,673</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Mother FGM, mean (SD)</th>
<th>Daughter FGM, mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Current age in years</td>
<td>27.4 (9.4)</td>
<td>30.4 (10.0)</td>
</tr>
<tr>
<td>Maternal age at FGM, years</td>
<td>2.5 (5.8)</td>
<td></td>
</tr>
</tbody>
</table>

*Chi-square test was used for categorical data and Mann-Whitney test was used for continuous data in bivariate analysis. FCT = Federal Capital Territory.

Committee of Nigeria on Harmful Traditional Practices Affecting the Health of Women and Children indicated the following geographic distribution of FGM by states and types of FGM: Adamawa (60–70%, type IV); Akwa Ibom (65–75%, type II); Anambra (40–60%, type II); Bauchi (50–60%, type IV); Benue (90–100%, type II); Borno (10–90%, types I, III, and IV); Delta (80–90%, type II); Edo (30–40%, type II); Ilo (40–50%, type II); Jigawa (60–70%, type IV); Kaduna (50–70%, type IV); Kebbi (90–100%, type IV); Kogi (1%, type IV); Kwara (60–70%, types I and II); Lagos (20–30%, type I); Ogun (35–45%, types I and II); Ondo (90–98%, type II); Osun (80–90%, type I); Oyo (60–70%, type I); Plateau (30–90%, types I and IV); Rivers (60–70%, types I and II); and Yobe (0–1%, type IV). States such as Abia, Taraba, Cross River, Enugu, Katsina, Kano, Niger, Sokoto, and the federal capital of Abuja have no prevalence reported because no study was carried out in these states. However, the actual incidence may be much higher than the reported figures according to some Nigerian experts in the field.

It has also been reported that type III, the most severe form, has a higher incidence in the northern states. Types I and II are more predominant in the southern region but type IV is rare in Nigeria. Of the six largest ethnic groups (the Yoruba, Hausa, Fulani, Ibo, Ijaw, and Kanuri), only the Fulani do not practice any form of FCM. The Yoruba practice mainly types I and II. The Hausa and Kanuri practice type III. The Ibo and Ijaw, depending upon the local community, practice one of the three forms.

Legally, there is no federal law banning FGM in Nigeria, although the 1999 Constitution shuns any act of torture or inhuman treatment or violence against any person. However, some states have passed laws against the practice. These states include Bayelsa, Cross River, Delta, Ebonyi, Edo, Ekiti, Ogun, Ondo, and Rivers. In most cases, the persons convicted under the law are liable to fine and imprisonment. Enforcement of the law is not satisfactory and many believe this poor enforcement is the result of low fines and short duration of imprisonment. For instance, Edo State banned this practice in October 1999 and convictions are subject to a fine of approximately (US $10) and imprisonment of only six months. It is important to note that legal enforcement is necessary but not sufficient to eradicate FGM. Involvement of all persons involved in the implementation process is equally necessary. When the practice is abandoned, communities use laws to enforce new norms.

The sociocultural factors are often given as reasons for the practice of FGM more than the economic reasons. However, there are instances in which those perform the cutting get paid in cash and that the cut parts are either buried or sold. However, there is no empirical evidence to support these facts and this is why further research is needed. Although some organizations have focused on retraining cutters to stop the practice, a community-led organization in Senegal (TOSTAN) has used intra-marrying groups to eradicate the practice, arguing that FGM is linked to marriage opportunities and stopping this practice requires a collective decision. By helping to foster collective abandonment, the TOSTAN program enables villagers to share the knowledge they gain with their neighbors, friends, and family members with far reaching results for the entire community.

A WHO study group on FGM and obstetric outcome analyzed data from 28,373 women giving birth to one baby
each from November 2001 through March 2003 at 28 obstetric centers in Burkina Faso, Ghana, Kenya, Nigeria, Senegal, and Sudan. The results confirmed that FGM has very severe consequences ranging from immediate and long-term health complications to adverse obstetric and perinatal outcomes and physical and emotional health of girls and women (WHO, 2006).

Immediate physical health consequences of FGM include severe pain; injury to adjacent tissue of urethra, vagina, perineum, and rectum; heavy bleeding; shock; acute urinary retention; fracture or dislocation caused by restraints; pelvic inflammatory disease; risk of contracting infections such as HIV and hepatitis B; failure to heal; and death. Long-term consequences are difficulty in passing urine; recurrent urinary tract infection; pelvic infections; forming of scar tissue and keloids; loss of normal sexual function; possible infertility; genital cysts and abscess; difficulty in menstruation; painful intercourse; and problems during child birth. Physical and emotional health problems include fear; submission; inhibition and suppression of feelings; repeated pain during intercourse and menstruation; constant feeling of betrayal, bitterness, and anger; mental and psychosomatic disorder; social stigmatization and rejection of uncircumcised girls by communities; and painful and difficult labor during birth. Serious complications during childbirth include the need to have a caesarian section, dangerously heavy bleeding after the birth of the baby, and prolonged hospitalization after birth. The study showed that the degree of complications increased according to the extent and severity of FGM.

Although, the international community has recognized the human rights implications of FGM, many countries have yet to implement laws to ban the practice. Community-led initiatives such as those in Senegal are encouraging, in addition to the effort made by multilateral agencies, such as the United Nations Children’s Fund and WHO. Unfortunately, there are few instances of success because only one approach cannot eliminate the practice. There is need to extend the coverage of TOSTAN work in West Africa.

In 1994, Nigeria joined other members of the 47th World Health Assembly to resolve to eliminate FGM (resolution 47.10). Nigeria has since taken several initiatives, including establishing a multi-sectoral Technical Working Group on Harmful Traditional Practices (HTPs), conducting various studies and national surveys on HTPs, launching a Regional Plan of Action, and formulating a national policy and plan of action, which was approved by the Federal Executive Council for the elimination of FGM in Nigeria.

To date, many campaigns have been conducted to promote awareness of the problem by educating the policy/decision makers, the general public, health workers, and those who carry out the practice on its health and psychosocial consequences. However, these campaigns require active involvement of political leaders, professionals, development workers, local communities and their leaders, and women’s group and organizations.

This study is part of the effort to compliment work of campaigns against FGM that have existed in Nigeria since the 1980s. These campaigns have been conducted by the media (the Nigerian Council of Women broadcasts), the Inter-African Committee of Nigeria (community meetings), and medical professionals. It has been suggested that Nigeria has a strong social convention for supporting FGM. We examine how this social convention varies across states and the role that individual factors play in influencing this convention.

METHODS

Participants. The data for this report are for 7,620 women 15–49 years of age who were interviewed in the 2003 NDHS. Response rates by state were at least 90%. Women interviewed were representative of the populations of the different states of Nigeria. The minimum average number of women sample in a state was 915 and the maximum number was 1,786. For samples of daughters, the minimum sample in a state was 265 and the maximum sample was 429. The NDHS enabled a comprehensive picture of the current global prevalence rates among women and their daughters to be constructed. It provided valid data on the occurrence of FGM at national and state levels. The survey results can also suggest associations between prevalence and ethnicity, religion or other background variables, indicate how the practice is distributed, help identify girls at risk, and enable monitoring trends over time.

The NDHS focused on two types of prevalence indicators. The first addressed FGM prevalence levels among women and represented the proportion of women 15–49 years of age who have undergone FGM. The second type of indicator measured the status of daughters and calculated the proportion of women 15–49 years of age with at least one daughter who has undergone FGM. The methods, objectives, organization, sample design, and questionnaires used in the 2003 NDHS survey for Nigeria and an overview report have been described in detail elsewhere. Briefly, this survey involved a random probability sample of households designed to provide estimates of health, nutrition, water and environmental sanitation, education, and FGM practices at the national level for urban and rural areas, 36 states, and the Federal Capital Territory. The survey used a two-stage cluster sampling design to collect data on a wide range of health issues. Personal (face-to-face) interviews were conducted with participants after obtaining their consent. The questionnaire collected information on whether the participant had undergone FGM and, if so, at what age and the type of practitioner and cutting, on attitudes and beliefs about FGM, and the sexual and marital history of the woman. The survey procedures and instruments were validated by the Institutional Review Board at ORC Macro (Calverton, MD).

Dependent variables. The two outcomes or dependent variables we considered in these analyses were whether a woman had had FGM and whether she had daughters, any had had FGM. We define FGM in a way to include all types of FGM respondents had undergone. In the 2003 NDHS nationwide sample among women who could identify the type of procedure, types I and II were the most common form of FGM (42.3% [708 of 1,673] of the women and 68.7% [333 of 485] of the daughters). The most severe form of FGM, type III, was reported by 3.3% (56 of 1,673) of the women and 6.0% (29 of 485) of the daughters. Type IV was rare among daughters; 2.2% (36 of 1,673) of the women reported this type. A total of 17.3% (290 of 1,673) of the women and 25.4% (123 of 485) of the daughters reported not knowing the form of FGM performed or did not respond to the question.

Independent variables. The exposure variable investigated is the respondent geographic location (state of residence) in addition to various control variables on sociodemographic factors associated with FGM. The respondent’s age at assess-
ment was included as an indicator of the birth cohort of the participant.

Other variables included were education of the respondent and of her partner (no education versus some education), religion (Christian, Traditionalist versus Muslim), residence (rural versus urban), final say on health care (respondent alone, respondent and partner, partner alone versus someone else), marital status (single versus married), and a principal component-based assets index as an indicator of household wealth.12

Nigeria is divided into 36 states and the Federal Capital Territory of Abuja. The prevalence of FGM is aggregated and known at a national level. We accounted simultaneously for geographic location effects on FGM at the disaggregated level of states, thereby highlighting the spatial distribution of FGM. We recognize that the state is still a large unit but disaggregating to this level represents a considerable advance over the use of national averages and our analysis provides state-level information on FGM.

Conversely, one cannot assume that the clusters selected in each district are fully representative of the states in which they are located because surveys only attempted to generate a fully representative sample at the regional level. Consequently, the spatial analysis will be affected by some random fluctuations. Some of this random variation can be reduced through structured spatial effects because it includes neighboring observations in the analysis. However, it should be pointed out that such a spatial analysis should preferably be applied to census data, where the precision of the spatial analysis would be much higher. Unfortunately, most censuses do not collect data on FGM and often the full dataset is not available for such analyses. We used geo-additive Bayesian modeling, with dynamic and spatial effects, to assess temporal and geographic variation in FGM. The model used also allows for non-linear effects of covariates on FGM. The modeling approach is described in more detail in the next section.

**Statistical analysis.** In the analysis of survey data, the commonly adopted models are probit or logistic, and the standard measure of effect is the odds ratio (OR).11,11 The NDHS data use cluster sampling to draw upon women respondents by multistage sampling. At the first stage, a stratified sample of enumeration areas (villages/communities) is taken; at the second stage, a sample of households within the selected communities is taken; and at the third stage, all women respondents (15–49 years of age) in the sample households are included. These respondents have at least one child. Although cluster sampling is a cost-saving measure, without the need to list all the households, statistically, it creates analytical problems in that observational units are not independent. Thus, statistical analyses that rely upon the assumption of independence are no longer valid.

In the present study, however, the NDHS data contain geographic or spatial information, such as the state of residence of persons in the study. The presence of non-linear effects for some covariates indicates that strictly linear predictors cannot be assumed. Analyzing and modeling geographic patterns for the prevalence of FGM, in addition to the impact of other covariates, is of obvious interest in many studies. In a novel approach, the geographic patterns of FGM and the possibly non-linear effects of other factors were therefore explored within a simultaneous, coherent regression framework, using a geo-additive, semi-parametric, mixed model that simultaneously controlled spatial dependence and possibly nonlinear or time-varying effects of covariates and the complex sampling design.14–16 Briefly, the strictly linear predictor

\[ \eta = x^T \beta + w^T \gamma + \epsilon \]  

is replaced with a logit link function with dynamic and spatial effects, \( \Pr(y_i = 1 | \eta_i) = e^{\eta_i} / (1 + e^{\eta_i}) \), and a geo-additive semi-parametric predictor \( \eta_i = h(\eta_i) \):

\[ \eta_i = f_1(x_{i1}) + \ldots + f_p(x_{ip}) + f_{spat}(s_i) + w_i^T \gamma + \epsilon_i \]

where \( h \) is a known response function with a logit link function, \( f_1, \ldots, f_p \) are non-linear smoothed effects of the metrical covariates (daughter’s and mother’s age), and \( f_{spat}(s_i) \) is the effect of the spatial covariate \( s_i \in \{1, \ldots, 36\} \) labeling the state in Nigeria. Covariates in \( w_i \) are categorical variables such as education and urban–rural residence. Regression models with predictors such as those in equation 2 are sometimes referred to as geo-additive models. P-spline priors were assigned to the functions \( f_1, \ldots, f_p \), and a Markov random field prior was used for \( f_{spat}(s_i) \).14–16 Although the estimation process with this model is complex, the estimated posterior ORs that were produced could be interpreted as similar to those of ordinary logistic models.

The analysis was carried out using version 9.0 of the BayesX software package,19 which enables Bayesian inference based on Markov chain Monte Carlo simulation techniques. The statistical significances of apparent associations between potential risk factors and the prevalence of FGM were explored by using chi-square and Mann-Whitney U tests, as appropriate. Multivariate analysis was used to evaluate the significance of the posterior OR determined for the fixed, non-linear effects and spatial effects. A \( P \) value < 0.05 was considered indicative of a statistically significant difference.

**RESULTS**

The overall prevalence of the FGM in Nigeria in 2003 was 22.0% (1,673 of 7,620). However, this national prevalence and the aggregated regional prevalence concealed important spatial variation in the FGM rates recorded at state level. In the north central region, for example, the overall prevalence of FGM investigated was 13.2%, but the corresponding state-level prevalence varied from 2.2% (in Abuja) to 57.6% (in Kwara). A total of 2,177 women had living children, of whom 2,168 (28.5%) had a daughter with an FGM prevalence of 22.4% (485 of 2,168). Of the remaining women with uncircumcised daughters (1,666 who answered this question), 127 (7.7%) said that they intended their daughters be circumcised in the future, 36 (2.2%) did not know, and 1,503 (19.7%) said that they did not intend to have them be circumcised.

Among 1,673 women who had undergone FGM, 26.4% (442 of 1,673) at the same time had also at least a daughter with FGM. Preliminary results show that they were older (mean [SD] = 37.8 [8.0] versus 27.8 [9.1] for the remaining women), had no education (55.6%), most lived in the north central region (39.3%) and were of Muslim religion (38.5%), were among the poorest (33.6%), and were responsible for making their own healthcare decisions (36.0%).

The raw (unsmoothed) prevalence rate of FGM in women and daughters is shown in Figure 1. For women and daughters, the prevalence of FGM was more clustered in the states in the southwest region of the country. As expected, smoothing and
control of confounders generally uncovered the actual prevalence rate, which is difficult to see in crude raw (unsmoothed) prevalence rates. This finding shows the importance of multiple adjustments of confounders. The general patterns seen in the unsmoothed maps remained unchanged. The smoothed results after adjustment for the state of residence and other confounders are shown in Figures 2 and 3. The prevalence of FGM among women and daughters was most affected by adjustment for the state of residence and clearly showed a north-south divide of the spatial distribution of FGM across the country, and the concentration of high-prevalence states in the southern and southwest regions. Adjustment for the state of residence resulted in a similar change for daughter’s sample, but to a larger extent. Therefore, these adjustments resulted in a large difference in the spatial distribution of FGM for women and daughters.

Other factors associated with higher prevalence of FGM were examined. Urban areas and education are strong predictors of a higher prevalence of FGM. The mean age of the women in the sample was 28.01 years; 28.5% were never (or not yet) married. The mean level of education was low. Women had average of only 1.5 years of education. Nearly 40% reported no formal education, and only 18% had completed secondary and higher education. Forty percent of participants lived in rural areas, approximately 14.2% in cities, and the remainder in smaller towns. Forty-seven percent of the sample was Muslim.

Selected characteristics of respondents and their daughters by FGM status are shown in Table 1. For both outcomes (i.e., women or daughter had undergone FGM), there were significant consistent associations for several potential correlates of FGM. The results showed that age, religion, place of residence, wealth, education, state of residence, and who in the household had responsibility for healthcare decisions were all significantly related to the two outcomes ($P < 0.01$). Female genital mutilation was prevalent among older respondents. Women from urban areas were significantly more likely to have undergone FGM and have circumcised their daughters (Table 1) than women from rural areas. There were significant differences between states with respect to the two outcome variables (Table 1). The higher level of education attained by the respondent and her partner, the (significantly) lower the prevalence of FGM in women and daughters (Table 1).

There were significant differences between religions for the two outcomes. The proportion of women circumcised was significantly higher among Christian women, followed by women with a traditional/animist religion, and lower among Muslim women. The same trend was observed with the outcome for circumcision among daughters. Wealth index was significantly related to FGM only in women, not daughters. Women from

![Figure 1](https://www.ajtmh.org)

**Figure 1.** Map of the raw (unsmoothed) prevalence rates of female genital mutilation for women **(left)** and daughters **(right)** in Nigeria (2003 Nigeria Demographic and Health Survey). This figure appears in color at www.ajtmh.org.

![Figure 2](https://www.ajtmh.org)

**Figure 2.** Posterior odds ratio for likelihood of a women having daughter with female genital mutilation (FGM) **(left)** and posterior probabilities **(right)** of FGM in Nigeria. This figure appears in color at www.ajtmh.org.
the fifth quintile (richest group) had the greatest proportion of circumcised women. Women from the second quintile (poor) had the lowest proportion of women circumcised. There were statistically significant differences between final say on healthcare for the two outcomes. A higher proportion of circumcised women were associated with decision on their own healthcare being made by the respondent and her partner, followed by the women themselves. For the two outcomes, there were statistically significant differences within states. North central, Kwara, Nassarawa and Niger were associated with a higher proportion of circumcised women and daughters. The Federal Capital Territory of Abuja was among states with the lowest proportion of women circumcised. In general, for both outcomes, states in the northeast and northwest regions were associated with the lowest prevalence of FGM.

Estimates of spatial effects of FGM were also mapped. Before adjustment for geographic location, which was acting as a surrogate for cultural, ethnic, and environmental differences, a higher prevalence of FGM was concentrated in the southwest regions in areas around Lagos and in the southern part of the country (Figure 1). After adjustment, the effect normalized data from around Lagos but became more pronounced in the southeastern part of the country. Figures 2 and 3, show estimated posterior OR of residual spatial state effects (i.e., adjusted ORs after multiple adjustment for geographic location, taking into account the auto-correlation structure in the data and other risk factors) for FGM in women and daughters. The Federal Capital Territory of Abuja was among states with the lowest proportion of women circumcised. In general, for both outcomes, states in the northeast and northwest regions were associated with the lowest prevalence of FGM.

Table 2

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Mother circumcised, OR (95% CI)</th>
<th>Daughter circumcised, OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Religion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Christian</td>
<td>1.18 (0.99–1.40)</td>
<td>0.79 (0.62–1.00)</td>
</tr>
<tr>
<td>Muslim</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Traditionalist/animist</td>
<td>0.95 (0.67–1.35)</td>
<td>0.74 (0.46–1.15)</td>
</tr>
<tr>
<td>Place of residence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>1.26† (1.10–1.45)</td>
<td>1.26† (1.05–1.50)</td>
</tr>
<tr>
<td>Rural</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Final say on health care</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respondent alone</td>
<td>1.20 (0.93–1.55)</td>
<td>0.85 (0.56–1.37)</td>
</tr>
<tr>
<td>Respondent and husband</td>
<td>1.35† (1.04–1.78)</td>
<td>0.75 (0.48–1.25)</td>
</tr>
<tr>
<td>Husband/partner</td>
<td>1.07 (0.84–1.39)</td>
<td>0.75 (0.49–1.23)</td>
</tr>
<tr>
<td>Someone else</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Asset index, quintile</td>
<td></td>
<td></td>
</tr>
<tr>
<td>First</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Second</td>
<td>1.06 (0.88–1.29)</td>
<td>1.00 (0.76–1.32)</td>
</tr>
<tr>
<td>Third</td>
<td>0.95 (0.79–1.15)</td>
<td>0.87 (0.67–1.12)</td>
</tr>
<tr>
<td>Fourth</td>
<td>1.07 (0.87–1.31)</td>
<td>0.76 (0.58–1.00)</td>
</tr>
<tr>
<td>Fifth</td>
<td>0.85 (0.69–1.05)</td>
<td>0.56† (0.42–0.75)</td>
</tr>
<tr>
<td>Mother’s education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Some</td>
<td>1.07 (0.92–1.24)</td>
<td>0.78† (0.64–0.96)</td>
</tr>
<tr>
<td>Partner’s education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Some</td>
<td>1.13 (0.96–1.32)</td>
<td>1.12 (0.91–1.39)</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Single</td>
<td>0.76† (0.61–0.95)</td>
<td>0.67† (0.49–0.91)</td>
</tr>
</tbody>
</table>

* OR = odds ratio; CI = confidence interval.
† P < 0.05.
which FGM operates. Specifically, studies have shown that religious or cultural evidence on plausible mechanisms by potential of confounding by other factors and lack of robust the true nature and causality of these associations because of the large amount of data, much uncertainty remains about the syndrome.4

(Figure 4). Shown are the posterior logits within 95% and 80% credible intervals.

appears to be almost linearly positively related to the prevalence of FGM in women and daughters. As expected, as age increased, the likelihood of respondents circumcised per age also significantly increased, as did the percentage with any of their daughters circumcised (Figure 4).

This report demonstrates the importance of quantifying the residual effects of geographic location on the prevalence of FGM in Nigeria. The spatial effects have no causal impact, but careful interpretation can identify latent and unobserved factors that directly influence the prevalence of FGM. These factors can also be interpreted as surrogates of social convention, ethnic, and cultural factors that might confound the observed high prevalence of FGM. For instance, by highlighting the effects of geographic location, diffusion theory,17 which looks at change from the perspective of groups rather than individuals, might clarify community influences on FGM. Residual spatial effects of FGM have enabled us to see the inherent spatial patterns of the prevalence of FGM because the variability or noise has been removed. A more precise spatial pattern of the prevalence of FGM emerged with the estimated residual state effects compared with the crude prevalence without the control of geographic location effects.

Using the 2003 NDHS, we have attempted to examine the geographic distribution and include a number of sociodemographic, household, and individual conditions that are likely to represent important determinants of FGM in the general population. This analysis may help to better understand the complex interplay between geographic milieu or environment and traditional practices such as FGM and to explore potential mechanisms underlying these associations. Over the past few years, an increasing number of studies have documented that FGM affects the well-being of women and children, including increasing the risk of HIV/acquired immunodeficiency syndrome.4

The observed associations for women and children with increased risks for morbidity and mortality have generated the current move by various states to ban FGM.4 However, despite the large amount of data, much uncertainty remains about the true nature and causality of these associations because of potential of confounding by other factors and lack of robust religious or cultural evidence on plausible mechanisms by which FGM operates. Specifically, studies have shown that FGM habits in the general population are the result of a complex interaction of different factors (e.g., social, behavioral, psychological, and environmental).

The prevalence rate of FGM was higher in the southern states than in northern states, even though the level of education was relatively higher in southern areas. This finding suggests that FGM is deeply rooted in population culture, which has been difficult to change.

The result of asset (wealth) index and decision making supports the view that women have limited power in decision making. According to Nwakeze,18 a women’s sexuality is influenced by their limited decision-making power, and decision-making power is a function of their economic independence.

The effect of education or the effects of household socio-economic status and religion did not have a strong negative impact on FGM. The results for religion did not support the view that the practice may be more prevalent in certain religions (such as Islam). These findings support previous findings in Nigeria,3 which considered FGM as a social convention and reconfirm that modernization (education or religion) has minimal impact on the likelihood of FGM in Nigeria. Other factors such as influence on social conventions may play a major role in the likelihood of women having FGM.

It is important to mention that the use of NDHS data has limitations. Identification of FGM depended on mother’s report (recall), as is common in retrospective surveys. However, accuracy and completeness of mother’s recall in 19 national demographic and health surveys found that highly educated women were more accurate in reporting and identification of illnesses.19 One might also argue that an event such as FGM cannot be forgotten by individual women. This bias may only affect the classification of type of FGM. To provide a consistent sample, we did not analyze the data by type of FGM.

Mapping of residual spatial effects indicated that the prevalence of FGM varied at the state level. Individual factors such as education and community factors such as area and state of residence were strongly associated with FGM. The prevalence of FGM maps generated could be a useful tool for policy design, monitoring, and targeted intervention to eradicate this harmful practice in sub-Saharan Africa. Also important is considering the economic implications of FGM in policy designs.

Identifying and understanding environmental factors associated with state differences in FGM prevalence represents an important investigation to disentangle the influences of communities and ethnic and cultural factors on FGM. Novel and less conventional methods, including various data sources, are required to broaden the view of environment at the levels of individual women and communities. Understanding where a person or community is in the process is important in program research, design, and evaluation.

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