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Social norm coordination and readiness to change female genital cutting: Evidence from Senegambia

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ABSTRACT

Background: Female genital cutting (FGC), which poses risks to the health of girls, has proved remarkably persistent in many communities in Africa, despite decades of efforts to discourage it. The social coordination norm model of FGC attributes this persistence to high social costs for uncut women, such as exclusion from marriage markets or social support networks.

Objective/methods: To test the social coordination model of FGC decision-making in Senegambia, we examined variation in FGC across communities, attitudes toward FGC, and how attitudes affected readiness to change (abandon) FGC. We used an ethnographically-grounded survey to assess valuation of FGC and readiness to change FGC. We used factor analysis to identify constructs in valuation of FGC and logistic regression models to evaluate hypothesized predictors of cut status and readiness to change FGC drawn from the social coordination norm model.

Results: 1220 women with at least one daughter completed the survey; FGC valuation and readiness to change were characterized in 820 of these women. Findings were generally consistent with the social coordination norm hypothesis: Both locality and ethnicity were associated with cut status, and the prevalence of cutting across communities clustered at high and low levels. Factor analysis identified two distinct concerns in valuation of FGC—social advantages and health costs—and these were distributed differently for cut and uncut women, reflecting distinct normative schema. Further, readiness to change FGC differed in predicted ways with valuation of FGC.

Conclusions: These findings support the social coordination norm model, and reveal distinct normative schema among cut and uncut women. Furthermore, our findings point to a dynamic reassessment of social benefits and health costs underlying FGC decision-making and readiness to change FGC. The reappraisal of social benefits may be an unrecognized opportunity for programs aiming to discourage FGC.

1.0. Introduction

Female genital cutting (FGC) involves cutting or excising tissues of the external female genitalia for non-medical purposes. FGC practices vary tremendously across populations in the extent of tissue removed, circumstances surrounding cutting, and cultural meanings ascribed to being cut. FGC poses dangers to physical and mental health and has been condemned by international organizations, including WHO and UNICEF (World Health Organization, 2008). Despite decades of efforts to discourage cutting, FGC remains common in many communities (Shell-Duncan, Naik, & Feldman-Jacobs, 2016), including some in which support for FGC has reportedly eroded (United Nations Children's Fund, 2013).

The intractability of FGC has puzzled scholars across diverse fields, from public health to evolutionary anthropology. Scholars have offered the game theoretic concept of a *social convention* (Mackie, 1996; Mackie & LeJeune, 2009) or *social coordination norm* (Efferson, Vogt, Elhadi, Ahmed Hel, & Fehr, 2015; Mackie & LeJeune, 2009) to explain the perpetuation of FGC. Social norms are reciprocal expectations of behavior shared by interconnected members of a social network (a reference group) (Bicchieri, 2005). Applied to FGC, the social coordination norm model argues that families' cutting decisions are shaped by anticipated benefits for complying and costs for failure to conform. Decision-making in this model is relational and interdependent; the

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consequences of one family's choice are dependent on the choices of other families within their reference group. If most families in a community choose FGC, and exclude uncut girls and women from marriage markets or social networks, the social costs of not cutting may exceed the health costs of cutting, making it untenable for a family to independently opt out of the practice. Reported social costs for uncut girls and women vary across societies, and include poor marriage prospects (Mackie, 1996), exclusion and harassment (Shell-Duncan, Wander, Hernlund, & Moreau, 2011), and reduced social inclusion and support (Ahmadu, 2000; Shell-Duncan et al., 2011).

Interventions based on the social coordination norm model seek to reduce social costs for uncut girls by coordinating the decision not to cut (nor exclude uncut girls) among a critical mass of families within a reference group, making abandonment viable within this group. Once a threshold, or "tipping point", of abandoning families is reached, it is predicted that a rapid shift from a cutting to non-cutting convention will occur, as the declining social costs to being uncut increase the salience of FGC's costs (Mackie, 1996; Mackie & LeJeune, 2009). This model of FGC decision-making has formed the basis for multiple intervention programs and forms the guiding framework for the Joint UNFPA-UNICEF Programme on Female Genital Mutilation/Cutting (Diop & Askew, 2006; UNFPA-UNICEF joint programme on female genital mutilation/cutting:Accelerating change summary report of phase I, 2014).

Since the social coordination model was proposed, considerable research has been devoted to identifying the constellation of norms associated with FGC, and ways in which they may change (Cloward, 2015; Mackie & LeJeune, 2009; Shell-Duncan, Moreau, Wander, & Smith, 2018). However, the central idea of the original game theoretic model of FGC's perpetuation (Mackie, 1996), that families' decisions are interdependent and coordinated within a community, has been much less thoroughly explored. This is surprising, given the emphasis placed on the concept of coordinated abandonment. A small number of studies have found only inconsistent support for this aspect of the social coordination norm model (Efferson et al., 2015; Hayford, 2005; Howard & Gibson, 2017; Shell-Duncan et al., 2011).

Significant effects of locality or ethnicity (proxies for a reference group) on the probability a woman (or her daughter) is cut are generally reported, consistent with the clustering and interdependent decision-making within a community predicted by the social coordination model (Grose et al., 2019; Hayford, 2005; Howard & Gibson, 2017; Kandala, Nwakeze, & Kandala, 2009). In the East African nation of Kenya, Hayford (2005) documented in Demographic and Health Survey (DHS) data a positive association between the prevalence of FGC in a woman's locality (survey cluster) and the probability her daughter was or would be cut, which suggested that, above and beyond individual characteristics (e.g., ethnicity, education, and wealth), the local social environment influences FGC choices. A similar effect of locality (state) was demonstrated in the West African nation of Nigeria and interpreted as a "surrogate of social convention" (Kandala et al., 2009). Grose and colleagues, using more recent Kenya DHS data, found that prevailing local attitudes toward FGC affected daughters' risk for FGC, independent of the effect of mothers' attitudes toward FGC (2019). Other research has described significant effects of locality on FGC in Egypt (Modrek & Liu, 2013), Burkina Faso (Chikhungu & Madise, 2015), and West Africa (Bellemare, Novak, & Steinmetz, 2015), but these analyses were carried out without specifically addressing the social coordination hypothesis and so their implications must be interpreted with caution. Overall, the significant effect of locality on families' FGC choices may be consistent with the social coordination norm model of FGC. However, significant effects of locality describe only part of the hypothesized dynamic of interdependent choices within a community, and so does not constitute definitive support.

Two recent studies have not found support for a social coordination model of FGC decision-making when examining other predictions. Howard and Gibson (2017), using DHS data from West Africa, defined reference community on the basis of ethnicity, and found no threshold or "tipping point" in FGsC prevalence. Instead, they interpreted a continuous positive association between the prevalence of FGC in a mother's ethnic group and the probability that at least one of her daughters had been cut as evidence that—contrary to the social coordination model—incremental changes in FGC prevalence can and do occur.

In a study in Gezira, Sudan, Efferson et al. (2015) defined community on the basis of locality, and tested the prediction that, if FGC is coordinated at the community level, local prevalences of FGC should cluster at high and low rates of FGC across localities. They further hypothesized that if there are different normative schema among those who do or do not practice FGC, there should be a bimodal distribution in implicit associations (a measure of automatic immediate cognitive attitude toward a construct) with FGC. Neither prediction was supported.

The diversity of study populations, novel measurement techniques, high-quality data sources, and statistical approaches employed to test the social coordination model of FGC are major strengths of the literature on this topic; nonetheless, consensus is lacking regarding coordination models of FGC. Here, we evaluate whether, as has been reported elsewhere, FGC is associated with ethnicity and locality in a mixed-ethnicity setting in Sengambia. Further, we offer additional evidence to assess the social coordination model of FGC in Senegambia, by assessing perceived costs and benefits associated with FGC, and how those perceptions affect future FGC decisions, or readiness to change FGC.

Operationalization of the reference group or community relevant to FGC decision-making within the social coordination norm model is complex (Cloward, 2015; Grose et al., 2019). A family's reference group is made up of their collective social ties (as well as, arguably, their potential future ties). It is often the case throughout sub-Saharan Africa that ethnic groups with different FGC traditions co-exist, and the degree of endogamy varies. In Senegambia, for example, economic interactions, friendships, and marriages across ethnic lines are typically regarded as unproblematic. Nonetheless, ethnicity remains a fundamental component of identity, which likely structures social interactions such that many people interact more, but not exclusively, with other members of their own ethnic group. Because FGC has strong ties to ethnic identity (Shell-Duncan & Hernlund, 2000), rates of FGC and treatment of uncut women in mixed-ethnicity localities are likely to exhibit a great deal of sub-structure by ethnic group. It is families' social ties—those who will (or will not) sanction uncut girls—that influence the social costs to their daughters of remaining uncut. If families' social ties are biased toward those with whom they share ethnic identity, it is possible for some families in mixed-ethnicity localities to face very high cost to not cutting, while others face very low costs, sustaining side-by-side cutting and non-cutting norms, with an overall moderate prevalence of FGC. Side-by-side norms may be more likely if, as we have argued is the case in Senegambia, cut women are actively seeking to exclude uncut women from their social networks (Shell-Duncan et al., 2011).

Our data allow us to connect the social coordination norm model of FGC to the complex dynamics of decision-making around FGC, wherein family members may disagree, and vary in their decision-making power, and may decide against their own preference (for or against FGC), in light of decisions made by other families. We use a "readiness to change" (RTC) (Carey, Purnine, Maisto, & Carey, 1999) framework to characterize the complex nature of FGC decision-making. RTC can be conceptualized as an index of willingness or readiness to change problem behavior such as smoking or substance abuse (Carey et al., 1999). Our qualitative research in Senegambia demonstrated that readiness to change FGC varies along two dimensions: individual preferences (or ideal behavior—participants support FGC, are ambivalent, or oppose FGC) and actual or intended behavior (in participants' families, girls are likely to be cut, they are unsure, or girls are unlikely to be cut; Fig. 1) (Shell-Duncan & Herniund, 2007). Actual FGC decisions can differ from a participant's preference because many family members participate in FGC decision-making, often including some who have greater decision-making power than mothers. This leads to five categories of

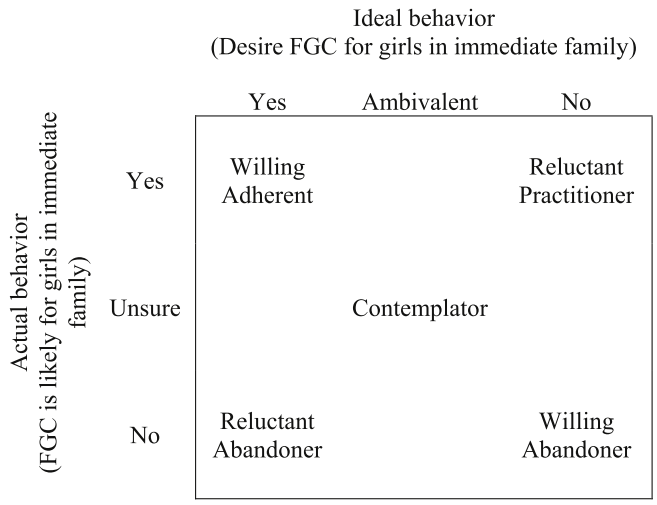

Fig. 1. Readiness to change FGC categories combine a decision-maker's desired outcome for a girl (whether, ideally, she should be cut or not) with what will likely be chosen for her, among a group of decision-makers (whether, in reality, she was/will be cut or not).

readiness to change: 1) **willing adherents** – individuals who support the continuation of FGC and whose daughters will likely be cut; 2) **reluctant adherents** – those who oppose the continuation of FGC but whose daughters will likely be cut; 3) **contemplators** – those who are undecided about their preferences and plans regarding FGC and question the practice; 4) **reluctant abandoners** – those who prefer to continue FGC but whose daughters will likely not be cut; and 5) **willing abandoners** – those who oppose the continuation of FGC and whose daughters are unlikely to be cut (Shell-Duncan & Herniund, 2007; Shell-Duncan, Hernlund, Wander, & Moreau, 2010).

We analyzed data from a study on dynamics of decision-making and behavior change regarding FGC in Senegambia. This mixed-methods study sought to produce rich contextual data and minimize response bias by implementing an ethnographically-informed survey instrument in communities that have had long-term engagement with our study team. We evaluated the extent to which FGC was associated with locality and ethnicity, suggesting coordination within communities; whether and how women varied in their valuation of FGC's costs and benefits; and, whether variation in assessment of FGC's costs and benefits affected future FGC decisions, as reflected by RTC. We expected perceived benefits to FGC to increase participants' probability of being a willing adherent and decrease their probability of being a willing abandoner, and perceived costs to have the opposite effect.

2.0. Materials and methods

2.1. Survey development and sampling

Survey development and administration have been described elsewhere (Shell-Duncan et al., 2011, 2010; Shell-Duncan & Herniund, 2007). Briefly, data collection was carried out in the West African nations of Senegal and The Gambia, often referred to collectively as Senegambia to reflect the fact that they share much in terms of language, religion (over 90% Muslim in both), history, and culture. Data were collected in three areas: peri-urban communities around Banjul, The Gambia, and two rural areas on either side of the Gambian-Senegalese border. The Senegal site included several villages covered in the Tostan anti-FGC program, which hosted public declarations to abandon FGC (Diop & Askew, 2006).

The first phase of this research was qualitative. Six Gambian fieldworkers, all from families that practiced FGC, were trained in the study protocols. One male and one female fieldworker were posted in each of the three study sites, where they resided for 9 months while conducting participant observation, interviews with men, women, community and religious leaders, health professionals, and former circumcisers regarding FGC (focused on experiences, perceptions, and decision-making), and focus group discussions regarding social norms and perceived advantages and disadvantages of FGC. In total, 300 interviews and 28 focus group discussions were conducted, providing tremendously rich information on FGC valuation and decision-making.

In the second phase of the research, qualitative results were used to design an ethnographically-informed survey instrument that assessed FGC experience, explicit valuation of FGC's advantages and disadvantages, and statements of support or opposition to FGC. Illustrative quotes representing the major themes and sub-themes identified in qualitative data analysis were used to generate 69 statements of positive and negative valuation of FGC, as well as support for, ambivalence toward, or opposition to FGC's continuation. Participants responded to these statements with "agree", "unsure", or "disagree". These statements were analyzed in a two-part pretest, which involved cognitive interviews on the clarity and meaning of each statement, and then evaluation of alternate forms of statements, effects of survey item order, and reliability using a test-retest process (further details are in (Shell-Duncan et al., 2010)). Unclear, redundant, or problematic items were revised or removed, leaving seven positive and eight negative valuation statements, as well as nine statements assessing support for FGC (three each for support, ambivalence, and opposition). The survey questionnaire was then translated into Wolof and Mandinka by one linguist, and back-translated by another linguist. Discrepancies were reviewed and used to clarify the final form of the questionnaire.

The third phase of the research involved administration of the final survey. A complete list of all villages in which qualitative work had been completed was compiled and sites for the survey were selected from these though cluster sampling. In Senegal, villages were stratified based on whether they had participated in the Tostan program or not, and if they were large or small, although all were rural. In The Gambia villages were stratified as urban or rural. In Senegal, village maps were created, assigning numbers to each compound, while in The Gambia maps were available from the Gambian Bureau of Statistics. The number of compounds sampled from each site was proportional to the total number of compounds. A random number generator was used to select compounds to be approached for recruitment. Residents were asked to list all women residing there who were between the ages of 18 and 40 who had given birth to at least one girl. From this list of eligible women, one was selected using a random number table. Items for FGC valuation and support were administered to all cut women and any uncut women who responded "Yes" to either of: "Have any of your daughters been circumcised?" or "Is it possible that you or your family will decide to circumcise any of your daughters?"

2.2. Ethics approval

Each phase of research was approved by the Institutional Review Boards of the Gambia College, Brikama Campus, Université Cheikh Anta Diop in Dakar, the University of Washington in Seattle, and the World Health Organization in Geneva. The study protocol was also approved by a community advisory board in The Gambia and by the WHO Office in Dakar. The community advisory board supervised the data collection, and organized validation seminars in both Banjul and Dakar prior to dissemination of research findings. All participants provided both verbal and written informed consent.

2.4. Construct description

This study reports novel calculations of two constructs: 1) explicit positive and negative valuation of FGC; and, 2) categorization of readiness to change FGC. Survey data included responses to 15 valuation statements on advantages or disadvantages of FGC. For these items, we

completed factor analysis using Promax rotation (an oblique rotation) and principle axis factoring, retaining factors with eigenvalues greater than one and comprised of more than one item. Results were confirmed by visually examining scree plots and by calculating Kaiser-Meyer-Okin measures of sampling adequacy. Items for each factor were used to create scales. Responses were scored 0 for "disagree", 1 for "not sure", and 2 for "agree"; scales were created by summing scores across all items for a factor, then dividing by the total number of items. Because the data are ordinal, and not continuous, we examined the correlation between the retained explicit association statements using Spearman's nonparametric correlation, and reliability was assessed by Cronbach's alpha, a measure of internal consistency.

Following methods used in other RTC instruments (Carey et al., 1999), survey items were used to assign categories of readiness to change. Three statements each assessed support, ambivalence, and opposition to FGC (Table 1); responses to these were assigned values (disagree = 0, unsure = 1, agree = 2) and values were summed across items to give a support score, ambivalence score, and opposition score; these scores were used to categorize participants' individual preference for FGC as follows: **supportive** if support score was highest; **opposed** if opposition score was highest or if opposition score was equal to ambivalence score and both were greater than support score; **ambivalent** if ambivalence score was highest or if support and opposition scores were equal and greater than ambivalence score, or if support and ambivalence scores were equal and greater than opposition score, or if all three scores were equal. Actual anticipated FCC behavior was assessed with the item: "Will girls in your immediate family be circumcised?" with responses of "yes", "no", or "not sure". The combination of individual preference and actual behavior was used to assign each respondent to a category of readiness to change as follows: **willing adherents**: supportive and either "yes" or "not sure" to "Will girls in your immediate family be circumcised?"; **reluctant adherents**: opposed and "yes"; **contemplators**: ambivalent and either "yes" or "not sure"; **reluctant abandoners**: supportive or ambivalent and "no"; **willing abandoners**: opposed and either "not sure" or "no". The results from assigned readiness to change were compared to survey results on self-described readiness to change, and showed high concordance; further details on this scale and its validation are described elsewhere (Shell-Duncan et al., 2010).

2.3. Data analysis

Quantitative data analysis was conducted with SAS 9.4 (SAS Institute Inc.) and Stata 14.2/SE (StataCorp). We described the prevalence of FGC across communities, defined by shared village and ethnic group. Bootstrapping was used to calculate confidence intervals for prevalences. Prevalences were only calculated for communities of at least ten women. Kernel density estimation was used to describe distributions of FGC prevalences and valuation. We used multi-level logistic regression to quantify variation in FGC across localities after adjustment for individual-level characteristics, including ethnicity, as a test for independent effects of ethnicity and locality. We used multinomial logistic regression to evaluate associations between readiness to change and explicit positive and negative valuation of FGC.

For all logistic regression models, we calculated average marginal effects (AME), rather than odds ratios (OR), as OR for common outcomes can overstate differences in probability (Deeks, 1998; Kraemer, 2004; Newcombe, 2006); AME can be interpreted as the average impact of a one-unit change in the predictor variable on the probability of the outcome, averaged across values for other variables in the model.

Table 1
Statements of FGC support; participants were asked to respond, "agree," "not sure," or "disagree".

Support	I see no problem with continuing the practice of female circumcision.
	The way I see it, it is not acceptable to stop circumcising our girls.
	It is better if our girls are circumcised.
Ambivalence	I think we need to consider ways of solving problems that do arise from female circumcision.
	Things have changed from the past, and I think it is OK for us to think about making changes in the practice of female circumcision, too.
	People say different thing about female circumcision, and it is hard to know who is correct.
Opposition	I would like to see female circumcision stop in my family.
	I believe there are serious problems with female circumcision.
	The way I see it, female circumcision has no use.

3.0. Results

Characteristics of survey respondents are shown in Table 2. A total of 1220 women completed the survey. Readiness to change and FGC valuation were characterized among 820 women who either self-reported having been cut or responded affirmatively to at least one of two questions: "Have any of your daughters been circumcised?" or "Is it possible that you or your family will decide to circumcise any of your daughters?"

The prevalence of FGC across communities (shared ethnicity and locality) is shown in Fig. 2: about 1/3 of communities had intermediate prevalences of FGC. The distribution of prevalences across communities (Fig. 3) suggests that overall, prevalence of FGC clustered near zero or one, consistent with the social coordination model.

Significant independent associations between FGC and ethnicity (level 1) and FGC and locality (level 2) were clear in multilevel logistic regression (Table 3).

Advantages for FGC cited in interviews centered on morality, training girls to show respect for elders, being considered proper women, allowing inclusion in the community, and controlling sexual

Table 2
Sample characteristics.

Study area (N)	
Rural Senegal	265
Rural Gambia	319
Urban Gambia	636
Total	1220
Age range (years)	18–40
Muslim (%)	96
Ethnicity (%)	
Wollof	22
Fula	19
Mandinka	26
Serahule	4
Jola	9
Aku Marabout	<1
Sereer	14
Manjago	2
Makange	<1
Balanta	<1
Bambara	2
Other	2
School attendance (%)	
None	28
Arabic school only	31
Primary school	21
Secondary school	18
College	2
Marital Status (%)	
Never married	6
Currently married	86
Widowed	2
Divorced	6
Separated	<1
Inter-ethnic parents (%)	15
In inter-ethnic marriage (%)	28
In FGC-incongruent marriage[a] (%)	12

[a] Husband's circumcision tradition does not match respondent's circumcision status.

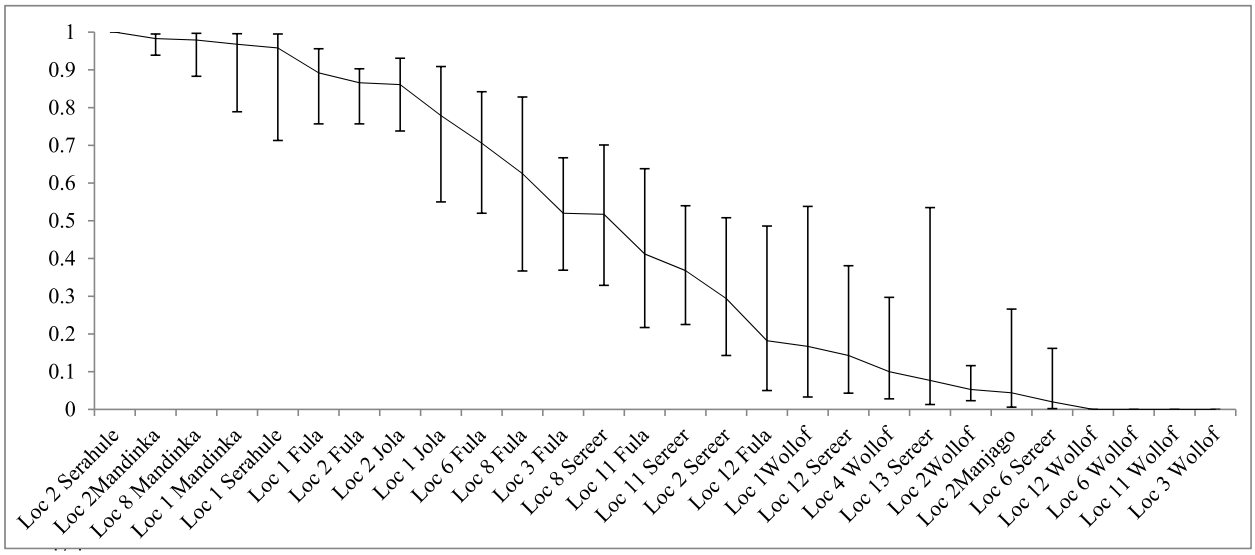

Fig. 2. FGC prevalence across communities defined as shared ethnic group and locality (village). Bars show 95% bootstrapped confidence intervals.

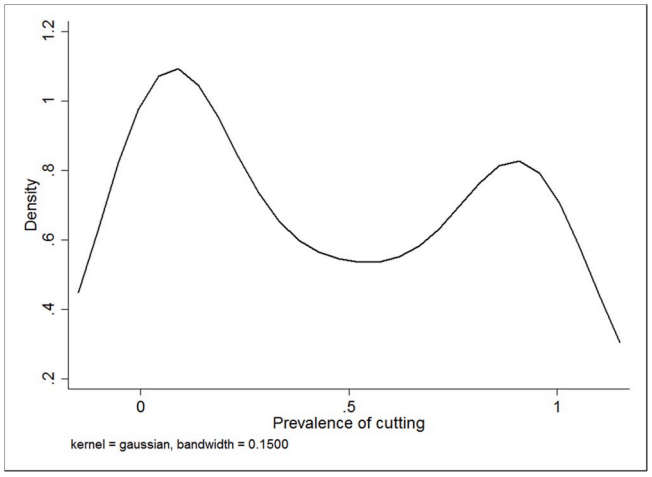

Fig. 3. FGC prevalence across communities (defined by shared ethnicity and locality).

desire. Disadvantages centered on risk for infection and HIV transmission, pain, lack of necessity of performing FGC in order to properly train a young girl, and the expense of ceremonies. These corresponded to 15 statements of FGC valuation in the survey instrument (Table 4). There were high levels of agreement with both positive and negative statements. For example, of 820 women, 690 agreed, "Circumcision is a very important tradition" *and* 680 agreed, "A bad part of the practice of female circumcision is that it is very painful". Factor analysis of all 15 statements produced a 2-factor solution, with factor 1 loading 5 statements, and factor 2 loading 4 statements (Table 4). These factors accord with hypotheses made prior to factors analysis: survey items were categorized in qualitative analysis as either advantages or disadvantages of FGC, and factors 1 and 2 separated similarly. We thus consider these explicit positive valuation of FGC (factor 1—"Advantages"), and negative valuation of FGC (factor 2—"Health Risks"). Items from each factor were positively and significantly correlated (Spearman's rho, $p < 0.01$). Internal consistency was high for the Advantages (Cronbach's alpha: 0.894) and Health Risks (Cronbach's alpha: 0.837) scales created from these items.

The distribution of Advantages scores was clearly bimodal; two modes for Health Risk scores were less distinct (Fig. 4). For both,

Table 3
Multilevel mixed-effects logistic regression models of the outcome FGC status.

Model 1: Ethnicity alone	Coefficient	*p*	AME	*p*
Level 1/fixed effects:				
Ethnicity[a]				
Mandinka	Reference		Reference	
Wollof	−6.02	0.000	−0.87	0.000
Fula	−1.85	0.000	−0.26	0.000
Serahule	−0.05	0.950	−0.00	0.951
Jola	−1.82	0.000	−0.26	0.000
Aku Marabout	−3.52	0.000	−0.61	0.000
Sereer	−3.75	0.000	−0.65	0.000
Manjago	−6.70	0.000	−0.89	0.000
Balanta	−2.57	0.012	−0.42	0.059
Bambara	−1.15	0.082	−0.13	0.175
Other	−1.14	0.044	−0.13	0.107
Level 2/random effect: Locality				
Variance	0.606			
Likelihood ratio test (*p*)	0.000			
Model 2: Controlled for age				
Level 1/fixed effects:	Coefficient	*p*	AME	*p*
Ethnicity[a]				
Mandinka	Reference		Reference	
Wollof	−6.02	0.000	−0.87	0.000
Fula	−1.85	0.000	−0.26	0.000
Serahule	−0.06	0.941	−0.00	0.942
Jola	−1.81	0.000	−0.25	0.000
Aku Marabout	−3.50	0.000	−0.61	0.000
Sereer	−3.75	0.000	−0.66	0.000
Manjago	−6.70	0.000	−0.89	0.000
Balanta	−2.57	0.012	−0.42	0.060
Bambara	−1.17	0.078	−0.14	0.170
Other	−1.15	0.042	−0.13	0.104
Age	0.01	0.696	0.00	0.696
Level 2/random effect: Locality				
Variance	0.603			
Likelihood ratio test (*p*)	0.000			

[a] Coefficients and standard errors were inestimable for Mankange women due to small group size.

distributions of scores divided for cut and uncut women were clearly unimodal, with modes near opposite ends of the scale. Advantages scores and Health Risk scores were weakly inversely associated (Spearman's rho −0.38; $p < 0.0001$). This suggests distinct cutting and non-cutting norms.

Regarding RTC, 44% of participants were willing adherents; <1% reluctant adherents; 22% contemplators; 24% willing abandoners; and,

Table 4
Responses to positive and negative FGC valuation survey items and factor loading.

	Agree	Unsure	Disagree	Factor 1	Factor 2
Circumcision shows respect to our grandmothers.	643	63	114	**0.66567**	0.01150
Female circumcision makes a girl be clean.	556	106	158	**0.67772**	−0.07250
Female circumcision helps a girls stay a virgin until she marries.	351	175	293	**0.54879**	−0.05233
A benefit of female circumcision is that it teaches girls to obey and respect their elders.	543	93	184	**0.91635**	0.11201
A benefit of female circumcision is that a girl will know the eye.	559	81	180	**0.92348**	0.09672
Female circumcision does not cause any problems.	490	110	220	0.27109	−0.55339
Circumcision is a very important tradition.	690	60	69	0.34768	−0.14182
A bad part of the practice of female circumcision is that it is very painful.	680	71	69	0.01152	0.21650
Men prefer sex with uncircumcised women.	131	441	248	0.05589	0.28961
Girls can be trained even without being circumcised.	658	63	99	−0.16285	0.20800
When you are circumcising your daughters, you have to spend too many resources.	373	159	288	0.09108	0.31326
Female circumcision can cause serious problems with childbirth	179	167	474	−0.19439	**0.59537**
Female circumcision can spread HIV/AIDS	224	295	302	−0.04588	**0.73115**
Female circumcision can cause a person to bleed too much	402	179	240	−0.01006	**0.60757**
Female circumcision can cause tetanus	260	277	284	−0.01771	**0.76165**

Items related to positive (top seven) and negative (bottom eight) valuation of FGC. For all items, participants were asked to respond, "agree," "not sure," or "disagree". Factor analysis using Promax rotation yielded the factor loadings above. Coefficients ≥0.5 are shown in bold and were retained in calculating valuation scores; the Factor 1 score was labeled "Advantages" and Factor 2 "Heath Risks".

10% reluctant abandoners. The reluctant adherent group was not evaluated due to small group size. In multinomial logistic regression, RTC was strongly associated with FGC valuation (Table 5), with independent effects of Advantages and Health Risks scores: higher Advantages score was associated with lower probability of being a willing abandoner or reluctant abandoner, compared to a willing adherent, while higher Health Risks score was associated with higher probability of being a contemplator, willing abandoner, or reluctant abandoner, compared to a willing adherent. All models controlled for ethnic group, age, FGC status (cut *vs*. not), education, and marital status. Average marginal effects of Advantages and Health Risks scores from the full model are shown in Fig. 5. These patterns clearly suggest a dynamic of assessment of FGC's costs and benefits in decision-making, consistent with the social coordination model: as the balance between Advantages and Health Risks shifts, so does readiness to abandon FGC.

4.0. Discussion

Our findings add to a growing body of empirical research aimed at testing predictions of the social coordination model of FGC. The theory itself is dynamic and evolving, moving away from strict focus on marriageability (Hernlund, 2003; Johnson, 2000; Shell-Duncan et al., 2011); recognizing differences (and conflicts) between social, moral, and legal norms (Mackie & LeJeune, 2009; Shell-Duncan, Wander, Hernlund, & Moreau, 2013) and subtleties in reference groups (Cloward, 2016; Grose et al., 2019); and, recognizing that "tipping points" for abandonment may vary (Novak, 2016) or be unidentifiable (Howard & Gibson, 2017).

The social coordination model predicts that within reference groups, the prevalence of FGC should cluster near zero or one. Using both ethnicity and locality to define a reference group, our data show that, while such clustering was apparent, intermediate rates of FGC were not uncommon, appearing in about one-third of communities. This may reflect the dynamic nature of FGC in Senegambia. Coordinated abandonment programs and the 1999 criminal ban on FGC in Senegal may have motivated at least partial abandonment in some study sites (Shell-Duncan et al., 2013); past shifts from a cutting to a non-cutting norm could produce the intermediate prevalences we observed, consistent with the social coordination model. These intermediate prevalences may also reflect distinct cutting and non-cutting norms within a community; many Fula and Jola respondents explained that FGC traditions vary across lineages within their ethnic groups.

The combination of high rates of agreement with positive *and* negative valuation statements suggests cognizance of both costs and benefits to FGC. Factor analysis identified women's most divergent concerns, which accord with the payoff considerations Mackie originally hypothesized (1996): social advantages and health costs. Moreover, the bimodal distributions of social advantages valuation is consistent with distinct normative schema among cut and uncut women. Social advantages related to important social norms: by demonstrating their respect for tradition, deference to older women, feminine virtue, and piety, FGC enhances cut women's social inclusion and support. Health costs related to the practical aspects of cutting genital flesh—bleeding, infection with tetanus or HIV, and complications of childbirth. This reflects the reality of FGC: its benefits are social while its costs are physiological. Both are salient to families acting in the overall best interest of a child.

Both positive and negative valuation scores varied across women, reflecting a dynamic process of evaluation of the relative costs of cutting and benefits of being a cut woman. Although the cutting norm may appear to be unchanging, or "locked" in place (Mackie, 1996), this dynamic suggests that FGC is subject to re-evaluation by our participants, as reflected in patterns in readiness to change FGC: Higher valuation of health costs or lower valuation of social advantages was associated with RTC in the direction of abandoning FGC.

This contrasts with previous findings in Senegambia that messages regarding obstetrical risks from FGC held little credence with women (Hernlund, 2003), and is consistent with the consideration of both health costs and social benefits described in the social coordination model. This finding may also reflect concerns among our participants regarding HIV: unlike messaging regarding obstetric risks associated with FGC, concerns about risk of transmitting HIV via contaminated blades during cutting resonated widely. Health risks associated with FGC may be used by willing or reluctant abandoners to bolster the decision to abandon FGC—that is, add it to an arsenal of reasons for maintaining their decision. This finding has important implications for those designing intervention messaging: education campaigns that emphasize FGC's immediate health risks (rather than obstetric complications) may contribute to sustained abandonment of FGC.

Overall, our findings suggest that abandonment in many

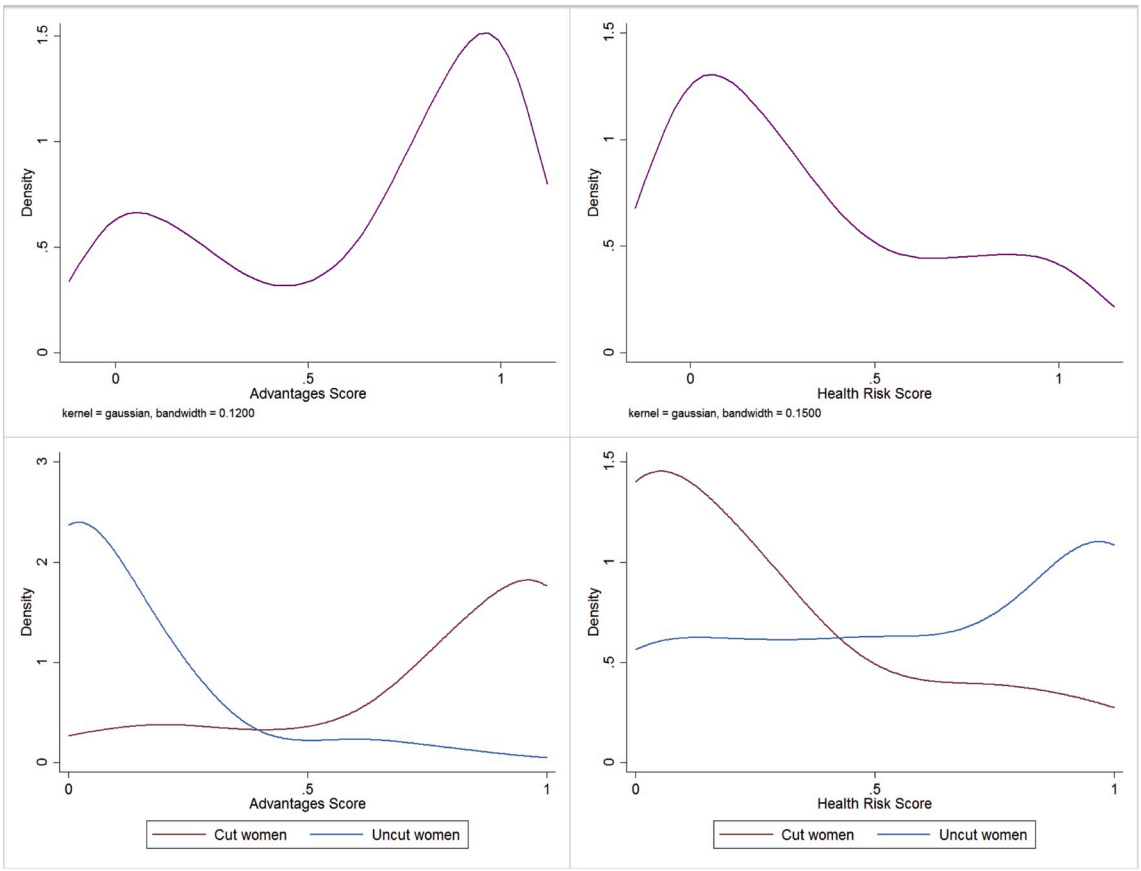

Fig. 4. Distribution of positive (Advantages) and negative (Health Risk) valuation scores for FGC. Upper panels show the overall distribution; lower panels show the distribution among cut and uncut women.

participants' families could occur if their estimate of either the social advantages of a girl being cut or the health costs of cutting changed. While anti-FGC messaging often seeks to increase appreciation of the health costs of FGC as a means to motivate abandonment, the social costs to remaining uncut are more rarely a target for interventions. Our findings suggest that coordinated abandonment programs are the not the only way to facilitate FGC abandonment by changing the social costs to uncut girls. It is possible that lowering these costs could be a valuable complement to health messaging. This will be an important area of future research.

Our findings are consistent with Howard and Gibson (2017), inasmuch as both studies suggest abandonment need not be coordinated at the community level, but can happen at the family level as well. However, we see this as largely consistent with the core assertion of the social coordination model of FGC, that the costs and benefits to one family's FGC decisions are dependent on the decisions of other families regarding whether their girls will be cut and how to treat uncut women. In settings with mixed traditions, where cut women are actively trying to maintain separation from uncut women by excluding them from social circles, we posit that abandonment by individual families can occur if families' estimation of costs and benefits for FGC change (due, for example, to changes in the estimated social costs to not cutting from their current and anticipated social ties). Factors that lead to diminished social advantages of cutting remain to be explored.

Our findings are inconsistent with those of Efferson and colleagues' (2015); while their exploration of attitudes toward cut girls in cutting and non-cutting conventions represents an important novel approach to testing the social coordination model, their dismissal of the hypothesis was premature. Efferson and colleagues used implicit association tests (IAT) to describe normative attitudes toward FGC: participants were asked to respond negatively or favorably to images of cut or uncut girls (differentiated by the fabric of their clothing: cut girls were depicted dressed in fabric typically worn after cutting, uncut girls depicted in fabric worn during participation in an anti-FGC program). Because IAT require a series of rapid judgments, they are thought to capture cognitive processes of which respondents do not have conscious awareness, and so to be free from the types of response bias that can influence explicit, survey-based measures (e.g., lack of awareness, reactivity, or social desirability bias). However, IATs' freedom from bias has become the subject of debate as research finds that implicit attitudes may be influenced by the context of the test administration (Fazio & Olson, 2003, 2014; Han, Czellar, Olson, & Fazio, 2010). Further, in the context of FGC and the social coordination model, IAT may not capture the complexity of attitudes and decision-making, including awareness of *both costs and benefits* to cutting. These complex and conflicting concerns may not be best captured by a test designed to avoid conscious and careful consideration of the question at hand.

Our data rely on participants' self-report of their agreement with statements regarding FGC, which can suffer from a number of limitations. These include lack of awareness, reactivity, or social desirability bias. With the goal of producing rich contextual data, as well as reducing social desirability bias, we grounded our survey collection in long-term ethnographic research. Our fieldworkers were trained and experienced in qualitative methods, were fluent in local languages and English, and lived in our study sites for 9 months while collecting qualitative data. Our survey drew on the findings of the qualitative work, and used exemplar quotes to create items in our informants' vernacular. They survey was implemented after thorough training of our fieldworkers and extensive pre-testing, and in communities in which we had built strong ties. We have confidence that biases, such as social desirability bias, were minimized by these data collection methods.

Our findings point toward important avenues for future research to

Table 5
Multinomial logistic regression models of explicit valuation of FGC (advantages and health risk scores) and readiness to change FGC.

	Coefficient	p	AME	p
Model 1: Positive valuation of FGC				
Willing Adherent (base outcome)				
Advantages score			0.30	0.000
Contemplator				
Advantages score	−0.62	0.086	0.05	0.310
Willing Abandoner				
Advantages score	−3.74	0.000	−0.26	0.000
Reluctant Abandoner				
Advantages score	−2.88	0.000	−0.09	0.003
Model 2: Health risk valuation				
Willing Adherent (base outcome)				
Health risks score			−0.39	0.000
Contemplator				
Health risks score	1.15	0.002	−0.01	0.773
Willing Abandoner				
Health risks score	5.30	0.000	0.31	0.000
Reluctant Abandoner				
Health risks score	4.01	0.000	0.09	0.000
Model 3: Combined positive and health risk valuations [1]				
Willing Adherent (base outcome)				
Advantages score			0.20	0.000
Health risks score			−0.33	0.000
Contemplator				
Advantages score	−0.57	0.127	0.02	0.666
Health risks score	1.10	0.004	0.01	0.888
Willing Abandoner				
Advantages score	−3.35	0.000	−0.17	0.000
Health risks score	5.02	0.000	0.26	0.000
Reluctant Abandoner				
Advantages score	−2.50	0.000	−0.05	0.084
Health risks score	3.72	0.000	0.07	0.004

		Ideal behavior (Desire FGC for girls in immediate family)		
Actual behavior (FGC is likely for girls in immediate family)	Yes	Willing Adherent	Ambivalent	No Reluctant Practitioner
	Unsure		Contemplator	
	No	Reluctant Abandoner		Willing Abandoner

All models included ethnic group, age, cut status, education, and marital status as control variables. The outcome Reluctant Adherent was not evaluated due to small group size (N = 3). Participants from the ethnic groups Aku Marabout, Mankange, and Balanta were excluded from models due to small group sizes.
[1] Model 3 psuedo R^2: 0.3262.

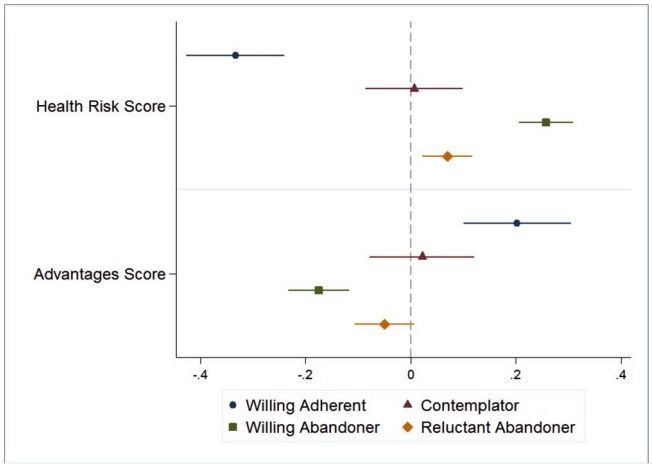

Fig. 5. Average marginal effects of positive (Advantages) and negative (Health Risk) valuation of FGC on readiness to change FGC.

test the social coordination model of FGC. Our respondents clearly perceive social benefits to FGC; additional research is needed to more thoroughly understand how girls and women realize these social benefits. FGC has been hypothesized to benefit women in marriage markets (Howard & Gibson, 2019; Mackie, 1996). We have posited that FGC enhances women's ability to accrue social capital (Shell-Duncan et al., 2011, 2018). It is likely that these social advantages translate to real benefits to the reproductive success of cut women (Howard & Gibson, 2017). Additional investigations into whether and how cut women have enhanced social capital or other social benefits, and whether this translates to enhanced reproductive success, will be critical to integrating social norms theory, game theory, and evolutionary theory to explain the persistence of FGC.

Ethics approval

Each phase of research was approved by the Institutional Review Boards of the Gambia College, Brikama Campus, Université Cheikh Anta Diop in Dakar, the University of Washington in Seattle, and the World Health Organization in Geneva. The study protocol was also approved by a community advisory board in The Gambia and by the WHO Office in Dakar. The community advisory board supervised the data collection, and organized validation seminars in both Banjul and Dakar prior to dissemination of research findings. All participants provided both verbal and written informed consent.

Data and materials availability

De-identified data can be made available upon request to either kath erinewander@binghamton.edu or bsd@uw.edu.

Declaration of competing interest

The authors have no competing interests to declare.

CRediT authorship contribution statement

K. Wander: Formal analysis, Writing - original draft. **B. Shell-Duncan:** Funding acquisition, Formal analysis, Writing - original draft.

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References

Ahmadu, F. (2000). Rites and wrongs: An insider/outsider reflects on power and excision. In *Female "circumcision" in Africa: Culture, controversy, and change* (pp. 283–312). Lynne Rienner Publishers.

Bellemare, M. F., Novak, L., & Steinmetz, T. L. (2015). All in the family: Explaining the persistence of female genital cutting in west Africa. *Journal of Development Economics, 116*, 252–265.

Bicchieri, C. (2005). *The grammar of society: The nature and dynamics of social norms*. Cambridge University Press.

Carey, K. B., Purnine, D. M., Maisto, S. A., & Carey, M. P. (1999). Assessing readiness to change substance abuse: A critical review of instruments. *Clinical Psychology: Science and Practice, 6*(3), 245–266.

Chikhungu, L. C., & Madise, N. J. (2015). Trends and protective factors of female genital mutilation in Burkina Faso: 1999 to 2010. *International Journal for Equity in Health, 14*(1), 42.

Cloward, K. (2015). Elites, exit options, and social barriers to norm change: The complex case of female genital mutilation. *Studies in Comparative International Development, 50*(3), 378–407.

Cloward, K. (2016). *When norms collide: Local responses to activism against female genital mutilation and early marriage*. Oxford University Press.

Deeks, J. (1998). When can odds ratios mislead?: Odds ratios should be used only in case-control studies and logistic regression analyses. *BMJ British Medical Journal, 317*(7166), 1155.

Diop, N., & Askew, I. (2006). Strategies for encouraging the abandonment of female genital cutting: Experiences from Senegal, Burkina Faso and Mali. *Female Circumcision*, 125–141.

Efferson, C., Vogt, S., Elhadi, A., Ahmed Hel, F., & Fehr, E. (2015). BEHAVIOR. Female genital cutting is not a social coordination norm. *Science (New York, N.Y.), 349*(6255), 1446–1447.

Fazio, R. H., & Olson, M. A. (2003). Implicit measures in social cognition research: Their meaning and use. *Annual Review of Psychology, 54*(1), 297–327.

Fazio, R. H., & Olson, M. A. (2014). The MoDe model. *Dual-Process Theories of the Social Mind, 155*.

Grose, R. G., Hayford, S. R., Cheong, Y. F., Garver, S., Kandala, N., & Yount, K. M. (). Community influences on female genital mutilation/cutting in Kenya: Norms, opportunities, and ethnic diversity. *Journal of Health and Social Behavior, 60*(1), 4–100.

Han, H. A., Czellar, S., Olson, M. A., & Fazio, R. H. (2010). Malleability of attitudes or malleability of the IAT? *Journal of Experimental Social Psychology, 46*(2), 286–298.

Hayford, S. R. (2005). Conformity and change: Community effects on female genital cutting in Kenya. *Journal of Health and Social Behavior, 46*(2), 121–140.

Hernlund, Y. K. (2003). *Winnowing culture: Negotiating female 'circumcision* (The Gambia).

Howard, J. A., & Gibson, M. A. (2017). Frequency-dependent female genital cutting behaviour confers evolutionary fitness benefits. *Nature Ecology & Evolution, 1*, 0049.

Howard, J. A., & Gibson, M. A. (2019). Is there a link between paternity concern and female genital cutting in west Africa? *Evolution and Human Behavior, 40*(1), 1–11.

Johnson, M. C. (2000). *Becoming a Muslim; becoming a person: Female 'circumcision', religious identity, and personhood in Guinea-Bissau*.

Kandala, N., Nwakeze, N., & Kandala, S. N. I. (2009). Spatial distribution of female genital mutilation in Nigeria. *The American Journal of Tropical Medicine and Hygiene, 81*(5), 784–792.

Kraemer, H. C. (2004). Reconsidering the odds ratio as a measure of 2× 2 association in a population. *Statistics in Medicine, 23*(2), 257–270.

Mackie, G. (1996). Ending footbinding and infibulation: A convention account. *American Sociological Review*, 999–1017.

Mackie, G., & LeJeune, J. (2009). Social dynamics of abandonment of harmful practices: A new look at the theory. Special series on social norms and harmful practices. *Innocenti Working Paper, 6*.

Modrek, S., & Liu, J. X. (2013). Exploration of pathways related to the decline in female circumcision in Egypt. *BMC Public Health, 13*(1), 921.

Newcombe, R. G. (2006). A deficiency of the odds ratio as a measure of effect size. *Statistics in Medicine, 25*(24), 4235–4240.

Novak, L. (2016). *Persistent norms and tipping points: Female genital cutting in Burkina Faso*.

Shell-Duncan, B., & Herniund, Y. (2007). Are there "stages of change" in the practice of female genital cutting? Qualitative research finding from Senegal and the Gambia. *African Journal of Reproductive Health, 10*(2), 57–71.

Shell-Duncan, B., & Hernlund, Y. (2000). *Female "circumcision" in Africa: Culture, controversy, and change lynne*. Boulder, CO: Lynne Rienner Publishers, Inc.

Shell-Duncan, B., Hernlund, Y., Wander, K., & Moreau, A. (2010). Contingency and change in the practice of female genital cutting: Dynamics of decision making in Senegambia. Summary Report.Available at: Http://Csde.Washington.Edu/Bsd Accessed may 2013.

Shell-Duncan, B., Moreau, A., Wander, K., & Smith, S. (2018). The role of older women in contesting norms associated with female genital mutilation/cutting in Senegambia: A factorial focus group analysis. *PloS One, 13*(7), e0199217.

Shell-Duncan, B., Naik, R., & Feldman-Jacobs, C. (2016). *A state-of-the-art synthesis on female genital mutilation/cutting. what do we know now?*.

Shell-Duncan, B., Wander, K., Hernlund, Y., & Moreau, A. (2011). Dynamics of change in the practice of female genital cutting in Senegambia: Testing predictions of social convention theory. *Social Science & Medicine, 73*(8), 1275–1283.

Shell-Duncan, B., Wander, K., Hernlund, Y., & Moreau, A. (2013). Legislating change? Responses to criminalizing female genital cutting in Senegal. *Law & Society Review, 47*(4), 803–835.

United Nations Children's Fund. (2013). *Female genital mutilation/cutting: A statistical overview and exploration of the dynamics of change*. New York: UNICEF.

United Nations Population Fund and United Nations Children's Fund. (2014). *UNFPA-UNICEF joint programme on female genital mutilation/cutting:Accelerating change summary report of phase I*. United Nations Population Fund and United Nations Children's Fund.

World Health Organization. (2008). *Eliminating female genital mutilation: An interagency statement-OHCHR, UNAIDS, UNDP, UNECA, UNESCO, UNFPA, UNHCR, UNICEF, UNIFEM*. WHO.