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RESEARCH ARTICLE

Hidden barriers to safe childbirth: Female genital cutting and facility-based delivery in Nigeria

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Abstract

Female genital cutting (FGC) remains a persistent public health and human rights concern, yet its implications for maternal healthcare utilisation are less well understood. This study examines the association between FGC and facility-based delivery in Nigeria using nationally representative data from the 2021 Multiple Indicator Cluster Survey. Guided by a conceptual framework linking sociocultural practices to healthcare utilisation, we analysed data from 10,008 women aged 15–49 who had a live birth within two years preceding the survey. Survey-weighted descriptive statistics, logistic regression models, and average marginal effects were used, with a robustness check based on modified Poisson regression. Approximately 27% of women reported having undergone FGC. While unadjusted differences in facility-based delivery were small, multivariable results showed that women with FGC were less likely to deliver in a health facility (AOR = 0.62; 95% CI: 0.45–0.86). The average marginal effect indicated a 6.7 percentage-point lower probability of facility-based delivery, equivalent to about 7 fewer facility births per 100 deliveries. These findings suggest that FGC is associated with reduced utilisation of institutional childbirth services, highlighting the need for culturally responsive maternity care and integrated interventions that address both access and sociocultural barriers to improve maternal health outcomes.

Keywords: facility-based delivery; female genital cutting; maternal healthcare utilisation; Multiple Indicator Cluster Survey; Nigeria; reproductive health

Abstrak. Praktik pemotongan genital perempuan (FGC) masih menjadi isu kesehatan masyarakat dan hak asasi manusia yang signifikan, namun dampaknya terhadap pemanfaatan layanan kesehatan maternal belum sepenuhnya dipahami. Penelitian ini bertujuan untuk menganalisis hubungan antara FGC dan persalinan di fasilitas kesehatan di Nigeria menggunakan data representatif nasional dari Multiple Indicator Cluster Survey tahun 2021. Berdasarkan kerangka konseptual yang mengaitkan praktik sosial budaya dengan pemanfaatan layanan kesehatan, penelitian ini menganalisis data dari 10.008 perempuan usia 15–49 tahun yang melahirkan dalam 2 tahun sebelum survei. Analisis dilakukan menggunakan statistik deskriptif berbobot, regresi logistik, serta average marginal effects, dengan uji ketahanan menggunakan regresi Poisson termodifikasi. Sekitar 27% responden melaporkan telah mengalami FGC. Meskipun perbedaan tidak teradjust relatif kecil, hasil multivariat menunjukkan bahwa perempuan dengan FGC memiliki kemungkinan lebih rendah untuk melahirkan di fasilitas kesehatan (AOR = 0,62; 95% CI: 0,45–0,86). Efek marginal menunjukkan penurunan probabilitas sebesar 6,7 poin persentase, setara dengan sekitar 7 persalinan di fasilitas per 100 kelahiran. Temuan ini menunjukkan bahwa FGC berkaitan dengan rendahnya pemanfaatan layanan persalinan di fasilitas kesehatan, sehingga diperlukan pendekatan pelayanan maternal yang sensitif secara budaya serta intervensi terpadu untuk mengatasi hambatan akses dan hambatan sosial budaya guna meningkatkan hasil kesehatan ibu.

Kata kunci: kesehatan reproduksi; Nigeria; pemanfaatan layanan kesehatan maternal; persalinan di fasilitas kesehatan; pemotongan genital perempuan; Survei Klaster Indikator Berganda

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INTRODUCTION

Female genital cutting (FGC), also referred to as female genital mutilation, remains a major global public health and human rights concern. Recent estimates indicate that

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more than 230 million girls and women worldwide are living with the consequences of FGC, with millions more at risk each year (UNICEF, 2022; World Health Organisation [WHO], 2025). Despite sustained international efforts, progress toward elimination remains uneven and insufficient to meet the Sustainable Development Goal (SDG) target of ending FGC by 2030. The burden is disproportionately concentrated in sub-Saharan Africa, where deeply embedded sociocultural norms continue to sustain the practice (UNICEF, 2022).

Nigeria bears one of the largest absolute burdens of FGC globally, with an estimated 19–20 million women and girls affected (UNICEF, 2022). Although national prevalence has declined, substantial regional and socioeconomic disparities persist, reflecting the enduring influence of cultural traditions, gender norms, and intergenerational transmission (National Population Commission [NPC] & ICF, 2019; Azuonwu & Ezekiel, 2020). At the same time, Nigeria continues to face a high burden of maternal mortality, and increasing the use of facility-based delivery remains central to improving maternal and newborn outcomes (WHO et al., 2025; Onah et al., 2023). While structural determinants such as cost, distance, and education are well-established drivers of maternal healthcare utilisation, comparatively less attention has been paid to how sociocultural practices such as FGC may shape women's engagement with formal health services (Okpara & Tekbas, 2024; Aikpitanyi et al., 2022).

A substantial body of evidence has documented the adverse health consequences of FGC, including obstetric complications, sexual dysfunction, and psychological distress (Banks et al., 2006; Berg et al., 2014; Laleh et al., 2022). However, fewer studies have examined its implications for maternal healthcare utilisation (Luoga et al., 2025; Moshi, 2024). Existing evidence from sub-Saharan Africa suggests that women who have undergone FGC may be less likely to use skilled birth attendance (Seidu et al., 2022). Much of this evidence, however, is derived from multi-country analyses that pool heterogeneous contexts and often lack an explicit theoretical framework to explain the observed patterns. As a result, the mechanisms through which FGC may shape care-seeking behaviour remain insufficiently specified.

To address this gap, this study is guided by the Andersen Behavioural Model of Health Services Use (Andersen, 1995), which conceptualises healthcare utilisation as a function of predisposing, enabling, and need factors. Within this framework, FGC is conceptualised as a predisposing sociocultural factor that may influence women's healthcare-seeking behaviour beyond conventional socioeconomic determinants. To further clarify the mechanisms involved, the study draws on complementary theoretical perspectives, including the Theory of Planned Behaviour (Ajzen, 1991), the Three Delays Model (Thaddeus & Maine, 1994), and the Respectful Maternity Care framework (Bohren et al., 2015).

These frameworks collectively suggest three interrelated pathways linking FGC to facility-based delivery. First, a psychosocial pathway posits that women who have undergone FGC may anticipate pain, stigma, or embarrassment during childbirth in clinical settings, thereby shaping attitudes toward facility-based care (Ajzen, 1991; Bohren et al., 2015). Second, a health system pathway emphasises the role of perceived quality and responsiveness of care; where providers lack training or sensitivity in managing FGC-related conditions, women may anticipate negative experiences, undermining trust in formal services (Bohren et al., 2015; Thaddeus & Maine, 1994). Third, a social norms and gender power pathway reflects the broader sociocultural environment in which FGC is embedded, in which household decision-making, cultural expectations, and gender relations shape the place of delivery (Thaddeus & Maine, 1994; Ntoimo et al., 2020). These pathways are likely to interact, suggesting that the association between FGC and maternal healthcare utilisation may persist even after accounting for socioeconomic and demographic factors.

Building on this conceptual foundation, this study aims to examine whether FGC is associated with facility-based delivery utilisation among women in Nigeria, using nationally representative data. Specifically, the study pursues two objectives: (i) to assess differences in facility-based delivery between women who have undergone FGC and those who have not, and (ii) to determine whether this association persists after adjusting for key socioeconomic, demographic, and geographic factors. We hypothesise that women who have undergone FGC are less likely to utilise facility-based delivery, and that this association remains significant after controlling for relevant covariates. By situating FGC within a broader theoretical framework of healthcare utilisation, this study contributes to a more detailed understanding of how sociocultural practices shape maternal health behaviours and offers policy-relevant insights for improving access to safe childbirth services.

METHODS

Participant characteristics and research design

This study used a cross-sectional design based on secondary analysis of data from the 2021 Nigeria Multiple Indicator Cluster Survey (MICS-6), conducted by the National Bureau of Statistics in collaboration with UNICEF. The MICS program provides nationally representative data on the health and well-being of women and children using standardised questionnaires and protocols. The study population comprised women aged 15-49 years who had a live birth within the two years preceding the survey, consistent with the maternal health module of MICS. The analysis focused on 10,008 eligible women for descriptive analyses. Women with missing information on key variables, including place of delivery, FGC status, or covariates, were excluded from multivariable analyses, resulting in a complete-case analytical sample of 4,715 women. No additional demographic restrictions were imposed.

Sampling procedures

The MICS-6 employed a two-stage stratified cluster sampling design based on the national sampling frame derived from the most recent population census. In the first stage, enumeration areas (EAs) were selected within each of the 36 states and the Federal Capital Territory using probability proportional to size. In the second stage, households were systematically selected within each EA. All eligible women aged 15-49 years within selected households were invited to participate. The survey achieved a high response rate (typically above 95% in MICS surveys). Data were collected through face-to-face interviews conducted in respondents' homes by trained interviewers using standardised questionnaires.

Ethical approval for the MICS survey was obtained by the implementing agencies, and informed consent was obtained from all participants prior to data collection. The

dataset used in this study is anonymised and publicly available. Permission to use the data was granted by the UNICEF MICS program. No financial incentives were provided to participants.

Sample size, power, and precision

The intended sample size for the MICS survey was determined to ensure national and subnational representativeness across key indicators. The present study used all available eligible cases (n = 10,008) for descriptive analyses. The complete-case sample for regression analyses (n = 4,715) reflects exclusions due to missing data. No formal a priori power calculation was conducted for this secondary analysis. However, the large sample size provides sufficient statistical power to detect modest associations and ensures reasonably precise parameter estimates, as reflected in the narrow confidence intervals. No interim analyses or stopping rules were applicable.

Measures and covariates

Outcome measure: The primary outcome was facility-based delivery, derived from the MICS variable on place of childbirth (MN20). Deliveries occurring in public or private health facilities, including hospitals, health centres, clinics, and maternity homes, were coded as 1 (facility-based delivery), while deliveries occurring at home or other non-facility locations were coded as 0. This operationalisation is consistent with prior MICS-based studies and reflects access to institutional childbirth care.

Exposure variable: The main explanatory variable was female genital cutting (FGC), measured using self-reported responses to whether the respondent had ever been circumcised (FG3). Responses were coded as 1 (yes) and 0 (no). Respondents with missing or "don't know" responses were excluded from regression analyses.

Covariates: Covariates were selected in line with the study's conceptual framework, which integrates health service utilisation theory with sociocultural determinants of maternal health behaviour. Specifically, the analysis adjusted for women's educational attainment, place of residence, and household wealth quintile as key structural factors; maternal age and parity as individual and reproductive characteristics; and region, operationalised as state-level fixed effects (covering the 36 states and the Federal Capital Territory) to account for geographic heterogeneity. These variables have been consistently identified in prior literature as important correlates of both FGC and maternal healthcare utilisation and were therefore included to minimise potential confounding.

Data quality and measurement: MICS data are collected using standardised and validated survey instruments developed by UNICEF, with rigorous interviewer training and field supervision procedures to ensure data quality and consistency. Data collection protocols include pretesting, translation into local languages, and the administration of structured questionnaires by trained personnel. While the measures used in this study are widely validated in large-scale surveys, FGC status and place of delivery are self-reported and may be subject to recall or reporting bias.

Data analysis

All analyses accounted for the complex survey design using sampling weights, clustering, and stratification. The survey design was specified using the svyset command in Stata version 19 (StataCorp, College Station, TX), incorporating the primary sampling unit (PSU), stratification variable, and sampling weights provided in the MICS dataset. Descriptive analyses were performed on the full sample (n = 10,008) to summarise participant characteristics using weighted percentages and corresponding 95% confidence intervals. Cross-tabulations were used to examine differences in facility-based delivery by FGC status and other covariates, with statistical significance assessed using design-based chi-square (F) tests.

Multivariable analysis was conducted on the complete-case sample (n = 4,715). A survey-weighted logistic regression model was estimated to assess the association between FGC and facility-based delivery, adjusting for all covariates. Results are presented as adjusted odds ratios (AORs) with 95% confidence intervals. Given the relatively high prevalence of the outcome, average marginal effects (AMEs) were computed to facilitate interpretation in terms of absolute probabilities. In addition, a robustness check was performed using modified Poisson regression with robust standard errors to estimate prevalence ratios (PRs), addressing potential overestimation of effects in common outcomes. All analyses were prespecified based on the conceptual framework. Statistical significance was set at $p < 0.05$.

RESULTS OF STUDY

Descriptive characteristics of the study population

Table 1 presents the weighted sociodemographic and reproductive characteristics of women aged 15–49 years who had a live birth within the two years preceding the survey (n = 10008). The mean age of respondents was 29.7 years (SD = 7.4). More than half resided in rural areas (73.6%), and approximately one-third had no formal education (31.6%). Overall, 27.1% of women reported having undergone female genital cutting (FGC).

Facility-based delivery was reported by 62.4% of women, while 37.6% delivered outside a health facility. Utilisation of facility-based delivery varied substantially across socioeconomic and demographic groups. For example, facility-based delivery was higher among women in urban areas (79.0%) than in rural areas (47.0%), and among women in the richest households (91.0%) than in the poorest households (38.0%). Similarly, women with higher or tertiary education had markedly higher rates of facility-based delivery (91.0%) than women with no formal education (36.0%). Table 1 presents overall population characteristics, while subsequent analyses focus on associations within the complete-case analytical sample.

Bivariate association between FGC and facility-based delivery

Bivariate and multivariable analyses were conducted on the complete-case sample (n = 4715) to ensure consistency across analytical models. The characteristics of the complete-case sample were comparable to those of the full sample (results not shown), suggesting limited risk of selection bias. Table 2 presents the association between FGC and facility-based delivery. At the descriptive level, 62.8% of women without FGC delivered in a health facility compared with 61.1% of women with FGC. This difference was not statistically significant (p = 0.56).

Table 1. Sociodemographic and reproductive characteristics of women with a recent live birth (n = 10008)

Characteristic	Unweighted n	Weighted % (95% CI)
Age (years)		
15–24	2860	28.4 (26.9–29.9)
25–34	4610	46.1 (44.5–47.8)
35–49	2538	25.5 (24.0–27.1)
Place of residence		
Urban	2635	26.3 (25.1–29.3)
Rural	7373	73.6 (70.7–76.9)
Education level		
No education	3180	31.6 (29.8–33.5)
Primary	1980	19.8 (18.3–21.3)
Secondary	3720	37.2 (35.5–38.9)
Higher/tertiary	1128	11.4 (10.3–12.6)
Wealth quintile		
Poorest	2120	21.1 (19.5–22.8)
Second	1980	19.7 (18.1–21.3)
Middle	2010	20.0 (18.4–21.7)
Fourth	2040	20.2 (18.7–21.8)
Richest	1858	19.0 (17.5–20.6)
Female genital cutting (FGC)		
Yes	2710	27.1 (25.6–28.7)
No	7298	72.9 (71.3–74.4)
Facility-based delivery		
Yes	6248	62.4 (60.7–64.1)
No	3760	37.6 (35.9–39.3)
Parity		
1–2	4130	41.3 (39.6–43.0)
3–4	3470	34.7 (33.1–36.4)
5+	2408	24.0 (22.5–25.5)

Table 2. Bivariate association between FGC and facility-based delivery (complete-case sample, n = 4715)

FGC status	Unweighted n	Non-facility (%)	Facility (%)	p-value
No FGC	3412	37.2	62.8	
FGC	1303	38.9	61.1	0.5609

Note: Weighted percentages reported. Based on the complete-case sample used for regression analysis. p-value from design-based Pearson F-test.

Multivariable analysis

The multivariable analysis (Table 3) shows that, after adjusting for education, household wealth, place of residence, maternal age, parity, and regional variation, FGC was significantly associated with lower odds of facility-based delivery. Women who had undergone FGC had 38% lower odds of delivering in a health facility compared with those who had not (AOR = 0.62; 95% CI: 0.45–0.86; p = 0.004). Education and household wealth were strong predictors of facility-based delivery. Women with higher or tertiary education had substantially higher odds of facility-based delivery compared with women with no formal education. Similarly, women in the richest households had nearly six times the odds of facility-based delivery compared with those in the poorest households. Urban residence was positively associated with facility-based delivery; however, this association did not reach statistical significance at the 5% level (p = 0.063).

To assess the robustness of the findings to alternative model specifications, a modified Poisson regression with robust standard errors was estimated to obtain prevalence ratios (PRs). The results were consistent with those from the logistic regression model, indicating that women who had undergone FGC had a lower likelihood of facility-based delivery (adjusted PR < 1; results not shown). Given the relatively high prevalence of facility-based delivery in the study population, odds ratios should be interpreted with caution, as they may overestimate relative effects. However, the consistency of findings using prevalence ratios and average marginal effects supports the robustness of the observed association.

Table 3. Survey-weighted logistic regression of facility-based delivery (complete-case sample, n = 4715)

Variable	AOR	95% CI	p-value
FGC (ref: No FGC)			
Yes	0.62	0.45–0.86	0.004
Education (ref: No education)			
Primary	1.51	1.08–2.10	0.015
Secondary	3.15	2.19–4.54	<0.001
Higher/tertiary	5.47	3.14–9.51	<0.001
Residence (ref: Rural)			
Urban	1.35	0.98–1.85	0.063
Wealth (ref: Poorest)			
Second	1.51	1.09–2.08	0.013
Middle	2.33	1.67–3.26	<0.001
Fourth	2.50	1.65–3.77	<0.001
Richest	5.87	3.43–10.04	<0.001
Maternal age (continuous)	1.04	1.02–1.07	<0.001
Parity (continuous)	0.90	0.85–0.96	0.002

Note: Model adjusted for all listed covariates and includes state-level fixed effects (36 states and the Federal Capital Territory), not reported for brevity. Results were robust to alternative specifications using prevalence ratios (not shown).

Average marginal effects

To aid interpretation, average marginal effects (AMEs) were estimated as shown in Table 4. Holding other variables constant, women who had undergone FGC had a 6.7 percentage-point lower probability of delivering in a health facility compared with those who had not (AME = −0.0667; 95% CI: −0.1125 to −0.0209; p = 0.004), corresponding to approximately 7 fewer facility-based deliveries per 100 births among women with FGC.

Table 4. Average marginal effects of FGC on facility-based delivery (n = 4715)

Variable	AME	Std. Error	95% CI	p-value
FGC (Yes vs No)	−0.0667	0.0234	−0.1125 - −0.0209	0.004

DISCUSSION

This study examined the association between female genital cutting (FGC) and facility-based delivery using nationally representative data. The findings indicate that

women who have undergone FGC are less likely to deliver in a health facility compared with those who have not, even after adjusting for socioeconomic, demographic, and geographic factors. This supports the study hypothesis and suggests that FGC is associated with patterns of maternal healthcare utilisation beyond conventional structural determinants. Essentially, while the unadjusted differences were modest, the adjusted models revealed a statistically significant association, highlighting the role of confounding factors that may mask underlying disparities.

These findings are consistent with prior evidence from sub-Saharan Africa, which has reported lower utilisation of skilled or facility-based childbirth services among women with FGC (Seidu et al., 2022; Zenbaba et al., 2025). However, much of the existing literature relies on multi-country analyses that pool heterogeneous settings. By focusing on a single-country context and applying a clear conceptual framework, this study provides more context-specific insight into how FGC may be associated with maternal healthcare behaviour and complements earlier work that has primarily emphasised the biomedical consequences of FGC (Banks et al., 2006; Berg et al., 2014; Ahinkorah, 2021) by highlighting its relevance for health service utilisation.

The interpretation of these findings is guided by the proposed conceptual pathways, though it is important to distinguish these from directly observed mechanisms. The persistence of the association after adjustment suggests that sociocultural and experiential factors associated with FGC may shape care-seeking behaviour. For instance, previous qualitative studies have documented that women with FGC may anticipate stigma, discomfort, or negative treatment in health facilities (Obiora et al., 2021). Similarly, perceived or actual gaps in provider preparedness to manage FGC-related complications may influence trust in formal care. At the broader level, social norms and household decision-making dynamics may also shape preferences for place of delivery (Ntoimo et al., 2020; Akpitanyi & Ehigiator, 2025). While these mechanisms are theoretically plausible and supported by prior literature, they were not directly measured in this study and should therefore be interpreted cautiously.

From a theoretical perspective, the findings support the relevance of integrating sociocultural determinants into models of healthcare utilisation. While the Andersen Behavioural Model emphasises predisposing, enabling, and need factors, this study highlights the importance of explicitly considering culturally embedded practices such as FGC as part of the predisposing context. The results also align with insights from the Theory of Planned Behaviour and the Three Delays Model, which emphasise the role of perceptions, social norms, and anticipated experiences in shaping health-seeking decisions. Together, these perspectives provide a more comprehensive understanding of maternal healthcare utilisation in contexts where cultural practices remain influential.

The practical implications of these findings are particularly relevant for maternal health policy and practice. Efforts to increase facility-based delivery in high-burden settings cannot rely solely on improving physical access or reducing financial barriers. There is a need to strengthen maternity services' responsiveness to the specific needs of women affected by FGC. This includes enhancing provider training in the management of FGC-related conditions, promoting respectful, culturally sensitive maternity care, and fostering trust between communities and health systems (Bamikole et al., 2025). Integrating FGC-related considerations into maternal health programmes may improve service uptake and the overall quality of care.

Several limitations should be considered when interpreting the findings. First, the cross-sectional design precludes causal inference, and the observed associations should be interpreted as correlational. Second, the outcome was derived from the place of delivery and used as a proxy for facility-based care; although widely applied in survey-based research, this may not fully capture the presence of a skilled birth attendant, potentially leading to outcome misclassification. Third, the use of complete-case analysis may introduce selection bias if excluded observations differ systematically from those included. Fourth, FGC status was self-reported and may be subject to underreporting due to social desirability or legal sensitivities. Finally, unmeasured confounding factors, such as cultural beliefs, partner influence, or prior healthcare experiences, may affect both FGC status and care-seeking behaviour. These factors were not captured in the dataset and may affect the observed associations.

Future research should build on these findings by incorporating longitudinal designs to better assess temporal relationships and potential causal pathways. There is also a need for mixed-methods studies that directly examine the psychosocial and health system mechanisms linking FGC to maternal healthcare utilisation. Including measures of women's experiences of care, perceived quality, and decision-making autonomy would provide deeper insight into the processes underlying observed patterns. Additionally, comparative analyses across different sociocultural contexts may help identify context-specific and generalisable drivers of maternal healthcare utilisation.

The findings of this study demonstrate that FGC is associated with lower utilisation of facility-based delivery in a nationally representative sample. By situating this relationship within a broader conceptual framework, the findings highlight the importance of moving beyond structural explanations of maternal healthcare utilisation to incorporate sociocultural dimensions. Addressing these factors is essential for achieving equitable improvements in maternal health outcomes.

CONCLUSION

This study set out to examine whether female genital cutting is associated with the utilisation of facility-based delivery. The findings show that women who have undergone FGC are less likely to deliver in health facilities, even after accounting for socioeconomic, demographic, and geographic factors. This suggests that FGC represents an important sociocultural determinant of maternal healthcare utilisation, extending beyond its well-documented biomedical consequences. By applying a theory-informed approach and using nationally representative data, this study contributes to a more nuanced understanding of how culturally embedded practices shape health-seeking behaviour.

These findings highlight the need for maternal health strategies that go beyond improving access and affordability to also address the sociocultural and experiential dimensions of care. Strengthening respectful maternity care, improving provider competence in managing FGC-related needs, and fostering community engagement are critical steps toward increasing the utilisation of facility-based delivery. Aligning FGC prevention and maternal health interventions may further

enhance their effectiveness and support progress toward global health targets.

Future research should focus on elucidating the mechanisms underlying this association and on exploring context-specific interventions to mitigate the barriers faced by women affected by FGC. Expanding the evidence base in this area will be essential for informing policies and practices that improve maternal health outcomes and promote equitable access to quality care.

DECRALATION

Ethics approval and consent to participate

This study analysed secondary data from a nationally representative household survey. Ethical approval for the original data collection was obtained by the implementing institutions, and informed consent was secured from all participants at the time of data collection. The anonymised datasets used in this study were accessed with permission and did not contain any identifiable information. As such, no additional ethical approval was required for this analysis.

Artificial Intelligence-Assisted Technology

Artificial intelligence–assisted technology was used to improve language clarity during manuscript preparation. All substantive content, analyses, interpretations, and conclusions are the sole responsibility of the author.

Consent for publication

Not Applicable

Availability of data and materials

The data used in this study are publicly available from the UNICEF MICS program upon reasonable request and subject to standard data access procedures. Details on how to obtain the data are available on the data provider's official website.

Conflicts of interest Statement

The authors declare that they have no conflicts of interest.

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Authors' contributions

JA conceptualised the study, led the drafting of the paper with significant contributions from JB, and supervised the study. JA and HE conducted the data analysis and interpretation. JB, GD and JA prepared the main manuscript text. All authors supervised the study, critically reviewed and approved the final manuscript for publication.

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