

Factors Associated with Safe Disposal Practices of Child's Faeces in Nigeria: Evidence from 2013 Nigeria Demographic and Health Survey

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Abstract

Background: Stool disposal practices have been shown to be associated with childhood diarrhea. There exist variations in explanatory variables of safe child's faecal disposal practices depending on the context of the study. Thus, the need for this study to assess factors associated with safe disposal practices of children's faeces in Nigeria. **Methods:** This study utilized the 2013 Nigeria Demographic and Health Survey data. Child's faecal disposal practice was classified as safe and unsafe as defined by the World Health Organization/UNICEF Joint Monitoring Program. Binary and multivariate logistic regression models were used to identify factors associated with safe faecal disposal practices. The analysis was restricted to a weighted sample of 19, 288 youngest children in the households. **Results:** Overall, the prevalence of safe disposal of child's faeces was 59.4%. Safe child's faeces disposal was the highest among older women (64.4%), highly educated women and their husbands (67.1%) and (66.4%), respectively; among rich households (72.3%), Muslim (68.7%), urban areas (68.8%), and in North West zone (78.4%). In multivariate analysis, safe faecal disposal was significantly associated with the age of mother, maternal education level, wealth index, religion, source of water, and type of toilet facility. Marital status, geopolitical zone, having diarrhea in the past 2 weeks before the survey and sex of the child were not significant determinants of safe faecal disposal practice. **Conclusion:** Understanding the prevailing faecal disposal practices is a prerequisite to the formulation of effective intervention strategies. It is pertinent, therefore, that programs and interventions designed to improve safe child's faecal disposal practices need to take into consideration the factors identified in this study.

Keywords: Children, demographic and health survey, Nigeria, practices, safe fecal disposal

INTRODUCTION

Many diseases that lead to increased morbidity and mortality of children under 5 years are largely preventable and related to unavailability of safe water, unhygienic behaviours, poor sanitary facilities, and poor housing conditions. Furthermore, the increased prevalence of diarrheal diseases, cholera and typhoid is seen in situations of unsanitary refuse, excreta disposal, and use of unsafe drinking water. Inappropriate disposal of human faeces, such as the practice of open defaecation promotes the transmission of pathogens that cause enteric diseases including diarrheal diseases.¹⁻⁴ Diarrheal diseases are among the top three killers of children globally⁵ and thus, a major public health problem for children under five (U5) years.^{6,7} At least 20 viral, bacterial and protozoan enteric pathogens including *Salmonella* spp, *Shigella* spp, *Vibrio cholerae* and rotavirus multiply in human gut, exit in

excreta and are transmitted through the environment, causing diarrhea in the new host. Worldwide, about 1 billion people (14% of global population), still engage in open defaecation. It is estimated that 9% of urban population and 34% of rural population in sub-Saharan Africa (SSA) practiced open defaecation in 2012.⁸ Unhygienic disposal of child's faeces is found to be widely practiced in SSA countries^{9,10} and is a major challenge to a child's healthy environment. It has been reported that 1.7 billion cases of diarrhea occur each year causing approximately 800,000 deaths in children under

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five (U5) years globally.^{11,12} Africa and Asia account for more than half of cases of childhood diarrhoea which ranked as the 4th leading cause of mortality among under-five children in Nigeria.¹³ Every day, 2300 children under 5-year-old die in Nigeria. One in seven Nigerian children dies before his/her 5th birthday due to diarrhoeal diseases.¹⁴ According to a report, Nigeria has lost 43 healthy years of life per 1000 from diarrhoeal illnesses.¹⁵ This makes the country the largest contributor to the under-five mortality rate in the world. Furthermore, 15 countries including Nigeria account for 53% of total episodes of diarrhoea and 56% of severe episodes.¹⁶ These illnesses are the second-most common cause of deaths and third main cause of U5 mortality, respectively. Thus, child survival in Nigeria is threatened by diseases that are largely preventable by public health interventions, including diarrhoeal diseases.

According to the World Health Organization (WHO)/UNICEF Joint Monitoring Program (JMP) for water supply and sanitation definition, safe child faeces disposal practices include defaecation into a latrine and disposal of child's stools in a latrine or burial.¹⁷ The improper disposal of child's faeces was reported as one of the factors associated with a high incidence of enteric infections.¹⁸⁻²² A meta-analysis study reported that unsafe disposal practices of child's faeces such as open defaecation, stool disposal in open, stool not removed from soil and stools seen in a household soil increased the risk of diarrhoeal diseases by 23%.²² Because diarrhoeal diseases are of faecal origin, interventions that prevent faecal matter entering the domestic environment of the susceptible child are likely to be of greatest significance for public health.²³

Key primary barriers to transmission of enteric pathogens are safe stool disposal and adequate hand washing, especially after contact with faecal material during anal cleansing of adults and children.¹⁹ Even though Nigeria has made some remarkable gains in the provision of these amenities/services, the prevalence of diarrhoeal diseases has not changed appreciably. According to Nigeria's Demographic and Health Survey (NDHS) reports²⁴ access to safe drinking water increased from 56% in 2008 to 61% (77.6% for urban and 47.7% rural) in 2013. While sanitation over the same period marginally increased from 21% to 31% even though there were marked regional variations. The prevalence of diarrhoeal diseases did not show any wide difference, 20.5% (urban 9.2% and rural 10.8%) in 2013 and 20.05 (urban 7.9% and rural 11.1%) in 2008, respectively. While for the majority, access to sanitation facilities has not improved in both rural and urban areas over the years. Importantly, factors associated with safe disposal practices of children's faeces have not been well investigated. Thus, the need for this study which aimed to identify factors associated with safe disposal practices of children's faeces that will assist public health physicians and professionals to design an effective and sustainable intervention to curtail this menace. For policymakers, this will go a long way in making our environment safe and healthier for Nigerian children.

METHODS

The study adopted the same methodology by Azage and Haile.³ In the conduct of this study, an in-depth secondary analysis of population-based cross-sectional survey of NDHS 2013 was utilized. The survey provides population and health indicators that are nationally representative at urban and rural levels and regional/geo-political zones. The NDHS samples were drawn through a three-stage stratified clustered sampling from a total of 904 clusters (372 urban and 532 rural areas) in all the 36 states of Nigeria and the Federal Capital Territory. The analysis involved a weighted sample of 19,288 children who are the youngest among all the under five children to their mothers out of 99,034 under-five children in the households. The practice of child's faeces disposal was categorized into safe and unsafe as defined by the WHO/UNICEF JMP for water supply and sanitation. Binary and multivariate logistic regression models were employed to identify factors associated with safe child faeces disposal practices. Other details of the methodology of the survey are provided in the final report of the survey.²⁴

Explanatory variables

Independent variables from NDHS data set such as mother/caregiver educational level, partner educational level, age of the mother, place of residence (urban/rural), child's age, number of U5 years old children, marital status, religion, and wealth index were included in the study. The wealth index was measured using principal component analysis. Variables included in the construction of wealth index were ownership of selected household assets, size of agricultural land, quantity of livestock, and materials used for house construction, other factors such as exposure to mass media (radio, television and newspaper), environmental health (availability of latrine, potable drinking water), child diarrhoea morbidity in the past 2 weeks preceding the survey and health service-related factors (visited by health workers in the past 1 year and visit health institution in the past 1 year) were included.

Outcome measures

The outcome variables for the study were child faecal disposal practices. Faecal disposal practices were assessed using the WHO/UNICEF JMP for water supply and sanitation definition by asking: the last time child passed stools (indexed for youngest under 5 years old child) what was done to dispose off the stools? The list of disposal options includes: did the child use the toilet/latrine, were the faeces put/rinsed into the toilet or latrine, pit/rinsed into a drain or ditch, thrown into the garbage, buried, and left in the open. Finally, child faeces disposal practices were recoded into a binary outcome: "safe" (i.e., defaecation into a latrine, disposed into a latrine or buried) and unsafe (i.e., put/rinsed into a drain or ditch, thrown into garbage, and left in the open) based on the WHO/UNICEF JMP for water supply and sanitation definition.¹⁷

Statistical analysis

Statistical analysis was restricted to 19,288 children who were the youngest among the under-five children to their mothers. Descriptive statistics were generated such as the prevalence

of child faeces disposal practices, safe and unsafe faecal disposal practices by some background sociodemographic characteristics. Bivariate and multivariate logistic regression models were then generated to determine factors associated with faecal disposal practices. However, before multivariate logistic regression, we conducted step-wise forward elimination process and variables that significantly associated with safe/unsafe faecal disposal at 20% were entered in the final model. During this process, the age of the child was dropped from the final model due to collinearity. The final multivariate logistic regression model has a mean-variance inflation factor of 2.20. The analysis was carried out using Stata version 13 (Stata Corp., College Station, Texas, United States).²⁵

Ethical statement

This study is a secondary analysis of the 2013 NDHS, so does not require ethical approval. We were 2015 Demographic and Health Survey (DHS) Fellows, we registered and requested for access to NDHS datasets from DHS on-line archive and received approval to access and download the de-identified DHS data files.

RESULTS

Table 1 shows the prevalence of different forms of child's faeces disposal. Disposal through use of latrine or toilet accounts for the highest faecal disposal practice of approximately 52%. This is followed by throwing into garbage (24%) and left in the open (6.8%). Overall, 59.4% of child's faeces are disposed in safe manner, while the rest are disposed in unsafe manner. Table 2 shows prevalence of safe child's disposal practices by some selected sociodemographic characteristics. Safe child's faeces disposal is found to be the highest among the oldest women aged 45–49 years (64.4%), among the highly educated women and their husbands (67.1%) and (66.4%), respectively. Safe disposal practices are also the highest among children in the richest households (72.3%), in Muslim homes (68.7%), among divorced women (64.5%), among eldest children (91.6%), in households with four or more under-five children (65.7%), in urban areas (68.8%), in North West (78.1%), and in households with improved

Table 1: Prevalence of child faeces disposal practices, 2013 Nigeria Demographic and Health Survey

Faecal disposal practice	Frequency (%)
Used toilet/latrine	1049 (5.4)
Put/rinsed in toilet/latrine	10,015 (51.9)
Put/rinsed into drain or ditch	839 (4.4)
Thrown into garbage	4627 (24.0)
Buried	394 (2.0)
Left in the open	1315 (6.8)
River/river banks	323 (1.7)
Others	726 (3.8)
Safe disposal practice	11,458 (59.4)
Unsafe disposal practice	7830 (40.6)
Total	19,288 (100.0)

Table 2: Prevalence of safe faecal disposal practices by sociodemographic characteristics, 2013 Nigeria Demographic and Health Survey

Sociodemographic characteristic	Unsafe (%)	Safe (%)
Mother's age (years)		
15-19	41.6	58.4
20-24	42.7	57.3
25-29	41.8	58.2
30-34	39.3	60.7
35-39	38.2	61.8
40-44	40.6	59.4
45-49	35.6	64.4
Mother's education		
No education	36.8	63.2
Primary	48.7	51.3
Secondary	43.4	56.6
Higher	32.9	67.1
Father's education		
No education	37.7	62.3
Primary	44.5	55.5
Secondary	43.8	56.2
Higher	33.6	66.4
Wealth index		
Poorest	43.3	56.7
Poor	42.6	57.4
Middle	48.3	51.8
Rich	39.2	60.8
Richest	27.7	72.3
Religion		
Christianity	55.0	45.0
Islam	31.3	68.7
Traditional/other	57.7	42.3
Marital status		
Never married/single	61.0	39.0
Married/living with partner	40.0	60.0
Widowed	48.5	51.5
Divorced	35.5	64.5
Separated	53.8	46.2
Age of child (months)		
0-5	43.7	56.3
6-11	44.7	55.3
12-23	44.7	55.3
24-35	41.8	58.3
36-47	8.4	91.6
Number of under-five children		
One	40.7	59.3
Two	41.9	58.1
Three	41.5	58.5
Four and more	34.3	65.7
Place of residence		
Urban	31.2	68.8
Rural	45.8	54.2
Zone		
North Central	71.9	28.1
North East	34.7	65.3
North West	21.9	78.1

Contd...

Table 2: Contd...

Sociodemographic characteristic	Unsafe (%)	Safe (%)
South East	54.0	46.0
South South	58.9	41.1
South West	43.8	56.3
Water source		
Improved	40.0	60.0
Nonimproved	48.6	51.4
Diarrhea last 2 weeks		
Yes	43.4	56.6
No	43.8	56.2
Total	40.6	59.4

water source (60.0%). There appears to be no difference in safe disposal practices between children who had diarrhea in the previous 2 weeks before the survey and those with no history of diarrhea. Safe child faecal disposal practices are the lowest among affiliates of traditional religion (42.3%), those children residing in North Central zone (28.1%) and children of never-married women (39.0%).

Two models of binary logistic regression were run: univariate (unadjusted) and multivariate (adjusted) [Table 3]. From the unadjusted model, age of the women (with the exception of age 15–19 years), maternal level of education, wealth index, religion, marital status, number of under-five children in the household, place of residence (rural/urban), zone, type of water source (improved/non-improved), diarrhea in the previous 2 weeks, type of toilet facility, and sex of the child are the significant factors associated with safe faecal disposal of the child; only older children (aged 36–47 months) is significantly associated with safe child faecal disposal practice. In the multivariate model, age of child and number of under-five children in the household were dropped in the model due to collinearity. Again, age of mother, maternal level of education, wealth index, religion, source of water, and type of toilet facility are the uniform and consistent determinants of safe faecal disposal practice. Marital status, geopolitical zone, diarrhea in the past 2 weeks and sex of child are not significant determinants of safe faecal disposal practices. With regard to maternal age, a pattern emerged: younger women are less likely to practice safe faecal disposal (for age 15–19: odds ratio (OR) = 0.80; 95% confidence interval (CI): 0.68–0.94, for age 20–24: OR = 0.82; 95% CI: 0.71–0.91, for age 25–29: OR = 0.63; 95% CI: 0.57–0.73) than their older counterparts (for age 35–39: OR = 1.22; 95% CI: 1.06–1.39, for age 40–44: OR = 1.28; 95% CI: 1.07–1.51, for age 45–49: OR = 2.54; 95% CI: 1.83–3.53). The OR of safe faecal disposal associated with maternal education and wealth index show a dose-response relationship. The OR increases from 1.38 (95% CI: 1.22–1.57) for those with primary education to 2.03 (95% CI: 1.75–2.37) for those with secondary education and to 3.54 (95% CI: 2.82–4.44) for those with higher education. Similarly, the OR of safe faecal disposal increased from 1.22 (95% CI: 1.09–1.37) for those children in poor wealth quintile to 2.35 (95% CI: 2.02–2.74)

Table 3: Unadjusted and adjusted odds ratio for the determinants of safe child's faeces disposal, 2013 Nigeria Demographic and Health Survey

Variable	OR (95% CI)	
	Unadjusted	Adjusted
Mother's age (years)		
15-19	1.05 (0.98-1.11)	0.80 (0.68-0.94)**
20-24	0.77 (0.74-0.81)***	0.82 (0.71-0.91)***
25-29	0.77 (0.74-0.81)***	0.63 (0.57-0.73)***
30-34	1.00	1.00
35-39	1.42 (1.34-1.50)***	1.22 (1.06-1.39)**
40-44	1.12 (1.04-1.20)***	1.28 (1.07-1.51)**
45-49	1.43 (1.26-1.62)***	2.54 (1.83-3.53)***
Mother's education		
No education	1.00	1.00
Primary	0.75 (0.72-0.78)***	1.38 (1.22-1.57)***
Secondary	1.01 (0.97-1.05)	2.03 (1.75-2.37)***
Higher	1.88 (1.73-2.04)***	3.54 (2.82-4.44)***
Wealth index		
Poorest	1.00	1.00
Poor	1.20 (1.16-1.26)***	1.22 (1.09-1.37)***
Middle	1.12 (1.07-1.18)***	2.35 (2.02-2.74)***
Rich	1.53 (1.46-1.61)***	2.80 (2.34-3.35)***
Richest	2.97 (2.81-3.15)***	3.40 (2.69-4.30)***
Religion		
Christianity	1.00	1.00
Islam	2.96 (2.86-3.06)***	2.36 (2.07-2.68)***
Traditional/other	1.14 (1.02-1.28)**	2.97 (2.22-3.95)***
Marital status		
Never married/single	1.00	1.00
Married/living with partner	3.56 (3.18-3.99)***	1.17 (0.90-1.53)
Widowed	3.76 (3.14-4.51)***	1.92 (1.22-3.01)**
Divorced	5.53 (3.93-7.78)***	0.82 (0.36-1.86)
Separated	3.42 (2.65-4.42)***	5.14 (2.74-9.62)***
Age of child (months)		
0-5	1.00	
6-11	0.96 (0.92-1.00)	
12-23	0.96 (0.92-1.01)	
24-35	1.05 (0.98-1.13)	
36-47	7.86 (1.00-62.07)\$	
Number of under-five children		
None	1.00	
One	0.43 (0.33-0.57)***	
Two	0.35 (0.27-0.46)***	
Three	0.37 (0.28-0.49)***	
Four and more	0.70 (0.53-0.92)***	
Place of residence		
Urban	1.00	1.00
Rural	0.60 (0.58-0.62)***	1.08 (0.97-1.21)
Zone		
South West	1.00	1.00
North Central	0.45 (0.42-0.48)***	0.60 (0.51-0.71)***
North East	1.18 (1.11-1.25)***	1.95 (1.62-2.34)***
North West	1.90 (1.80-2.01)***	2.50 (2.08-3.00)***

Contd...

Table 3: Contd...

Variable	OR (95% CI)	
	Unadjusted	Adjusted
South East	0.71 (0.65-0.76)***	1.02 (0.85-1.24)
South South	0.40 (0.37-0.43)***	0.50 (0.42-0.60)***
Water source		
Improved	1.00	1.00
Nonimproved	0.61 (0.59-0.63)***	1.12 (1.03-1.23)**
Diarrhea last 2 weeks		
No	1.00	1.00
Yes	1.12 (1.01-1.24)**	1.03 (0.91-1.67)
Toilet facility		
Flush system	1.00	1.00
Pit system	1.29 (1.21-1.36)***	1.48 (1.25-1.76)***
No facility/bush/ open field	0.10 (0.09-0.11)***	0.18 (0.15-0.21)***
Other forms	0.11 (0.10-0.12)***	0.26 (0.20-0.34)***
Sex of child		
Male	1.00	1.00
Female	1.03 (1.00-1.07)**	1.04 (0.97-1.13)

***Significant at $P < 0.001$; **Significant at $P < 0.025$; ^sMarginally significant at $P < 0.05$. OR – Odds ratio; CI – Confidence interval

among children in middle wealth quintile, to 2.80 (95% CI: 2.34–3.35) in rich wealth quintile and to 3.40 (95% CI: 2.69–4.30) in richest wealth quintile.

DISCUSSION

The study identified key significant and consistent determinants of safe disposal practices as follows: maternal age, maternal level of education, wealth index, religion, source of water, and type of toilet facility. Approximately, two-third of mothers practiced safe faeces disposal, whereas remaining one-third did not thereby posing a threat to the environment and the population being at risk of exposure to pathogens in disposed faecal matter. Safe disposal practice of child's faeces is crucial in breaking the vicious cycle of faeco-oral transmission of diseases. This has become important as children generally defaecate within the households, in or around the vicinity of the compound and the surrounding environment (the child's principal habitat) all of which are areas where they play or the child eating faecally contaminated earth.³ The adults are also liable to come into contact with the faeces in this environment. In this context; what does the environment mean? The F diagram of Wagner and Lanoux²⁶ shown below is still relevant today and summarizes the routes that faecal pathogens take through the environment to reach the new susceptible host [Figure 1].

Most excreted enteric pathogens usually die, however some get onto fingers, food items, or fluids to reach a new host. Furthermore, flies (mechanical carriers) landing on excreta can carry pathogens to food items or surfaces used for food preparation or eating. Finally, excreta can contaminate water sources which can be drunk directly or used in food preparation.

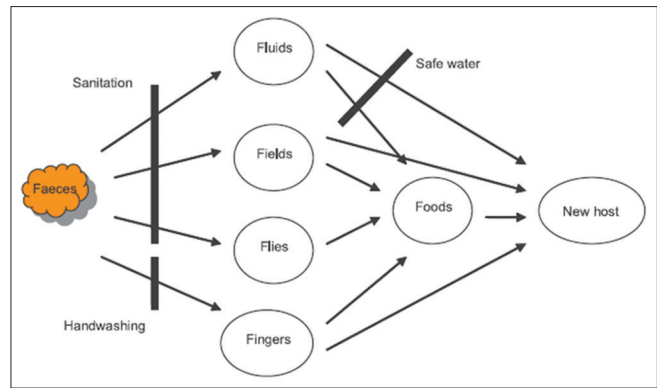


Figure 1: The F diagram and interventions to break transmission

The consequence of unsafe practice of faecal disposal is the potential of transmission of many infectious organisms that can cause enteric diseases such as childhood diarrhea.^{2,27} As shown in the diagram, all the transmission routes can be blocked by changes in domestic hygiene practice.²³ Thus, the promotion of hygiene behaviours has been identified as a public health intervention likely to have considerable impact in the reduction of diarrheal diseases in young children in developing countries.²⁸ Furthermore, WHO has emphasized that sanitary disposal of human faeces is one of the three key water-related behaviours for promotion.²⁹ The role of latrines for safe disposal of child's faeces has also been highlighted in controlling *Musca sorben* flies that carry Chlamydia pathogens between children's faeces.³⁰

The prevalence (59.4%) of safe child's faecal disposal practice found in this study is lower than the 67% in Zambia, 70% in Kenya, and 75% in Uganda,³⁰⁻³² respectively, but higher than 38% reported from Ethiopia.²⁴ This is not surprising as most of these countries have better health indices compared to Nigeria as a result of prudent management of resources. A fact further buttressed by the relationship between health indicators and economic status that is supported in all dimensions by public policies (good governance, education and economics, etc.).³³ The most common methods of unsafe faecal disposal were thrown into garbage and left in the open which is consistent with report of other studies.³⁴ The association between unsafe faecal disposal and child diarrhea has been reported in a number of epidemiological studies as indiscriminate defaecation within the household compound or in living areas was found to be associated with increased incidence of diarrhea.³⁵ Mertens *et al.*³⁶ reported that unsafe faecal disposal was associated with a 54% greater diarrhea risk in Sri Lanka and deduced that if such practices were reduced from 91% to 50% of the population then 12% diarrheal episodes could be prevented. In a case-control study of risk factors for diarrhea in children under 3 years in Burkina Faso, it was reported that unsafe disposal of child's faeces (left open on the ground, thrown onto a heap or outside the compound) was associated with a 50% increased risk of hospitalization with diarrhea.³⁷

In this study, safe faecal disposal practices were associated with increased maternal age and level of maternal education.

The older the woman, the more likely she has had many children and has gained experience in child rearing including safe disposal of child's faeces. The woman is also likely to have benefited from repeated health education information received while attending health facility for child welfare. This study revealed that the odds of practicing safe child's faeces disposal increased with increased level of mothers' education (adjusted OR-3.54, 95% CI: 2.82–4.44) which is in agreement with other studies.³⁸⁻⁴⁰ Educated mothers are more likely to understand causes of childhood illnesses⁴¹ and hence that they practice hygiene behaviour to protect their children from illness. Wealth index (or household socioeconomic status) determines the practice of safe faeces disposal is consistent with earlier studies.^{2,42} Those households that are better off (rich) will have better sanitation facilities associated with high standard of living and high motivation to dispose child's faeces safely. Religion was also associated with high odds of safe faecal disposal practice. This is not surprising as the two dominant religions in Nigeria (Islam and Christianity) teach its adherents to imbibe and practice cleanliness. Source of water is related to safe faecal disposal is consistent with report of a study that showed consistent relationship between the water source and all three hygiene outcome variables.⁴³ The importance of water to safe faecal disposal practice cannot be over emphasized. Water is a basic necessity of life that is required for proper personal hygiene including cleaning the child after defaecation and disposing the faeces. Finally, the possession of toilet facility is associated with safe practice of faecal disposal because it is an important motivator to good hygiene behaviour. An earlier study from South Africa⁴⁴ reported similar finding. As mentioned above, toilet ownership is a prerequisite to adopt safe faeces disposal practices.^{45,46}

CONCLUSION

The study has shown important determinants of safe child's faecal disposal practices where two-third of mothers disposed faecal matter safely. There are opportunities to improve this practice since safe faecal disposal practice in this study is lower compared to the values reported from other African countries.³⁰⁻³² It is suggested that programs and interventions designed to improve safe child's faecal disposal practices take into consideration factors identified in this study. Further, research is needed to design intervention that will improve safe child's faeces disposal.

Study limitations

DHS is a cross-sectional descriptive study; thus cannot establish cause and effect relationship. We used secondary data for this study, and hence, all the variables that influence practice of safe disposal of child's faeces were not exhaustively included in the analysis. For example, the attitude, perception, and knowledge of mothers about consequences of child faeces were not included in the DHS. The issue of social desirability bias need to be noted that decreases the likelihood that people will report poor child faecal disposal practices.^{47,48}

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Conflicts of interest

There are no conflicts of interest.

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