Unsafe disposal of faeces and its correlates among children under three years in Eswatini

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Background. It has long been established that human excreta contain over 50 pathogens that are transmitted via the faecal route, yet the common practice of unsafe disposal of children’s faeces still persists in developing countries.

Objective. To identify the factors associated with unsafe disposal of children’s faeces among children under three years of age in Eswatini.

Methods. The study was based on combined data for the 2010 and 2014 Eswatini Multiple Indicator Cluster Surveys, from which 2 765 children aged less than three years were included in the analysis. The analysis was based on logistic regression using weighted survey data.

Results. Overall, 41.8% of the children’s faeces were disposed of unsafely. In the final multivariable logistic regression analysis, the odds of unsafe disposal of children’s faeces were lower for households whose children were aged 12 months and older, compared with households whose children were under six months. Households with a pit latrine were less likely to dispose of child faeces unsafely, while the practice of unsafe disposal of children’s faeces was more common in households with no toilet facility compared with those from households with a flush toilet. The practice of unsafe disposal of children’s faeces was more common in urban areas than in rural areas. Regionally, lower odds of unsafe disposal of children’s faeces were observed among households from the Manzini and Shiselweni regions, compared with those from the Lubombo region.

Conclusion. The study demonstrated that child age, toilet facilities, place of residence, and region of residence were associated with unsafe disposal of children’s faeces.

The World Health Organization (WHO) has declared that sanitation is a basic human right.[1] In the year 2012, over 2.5 billion people had poor sanitation and, of those, 1 billion practised open defecation.[2] Nine out of 10 people who practise open defecation reside in rural areas.[2,3] The problems of open defecation and unsafe faeces disposal pose many ramifications and affect all developing countries.[3] It has long been established that human excreta contain over 50 pathogens that are transmitted via the faecal route.[2,3] Therefore the practice of open defecation is a major cause of diarrhoeal diseases, especially among children <5 years old.[4] In 2013, over 800 000 children <5 years died of related diarrhoeal diseases; in 2015, ~688 million children <5 were reported to be sick from diarrhoea, and almost half a million died as a result of diarrhoea.[5,6] Even though a decline of child mortality owing to diarrhoea has been noted globally, sub-Saharan countries still lag behind.[7]

Regardless of the known risks posed by unsafe disposal of child faeces, the issue has received less attention from public health programmes and interventions aimed at eliminating diarrhoea.[5,6] There is a wide misconception that child faeces contain less or no pathogens relative to adults.[4,6] Children are in fact more susceptible to faecal infections owing to their behaviour; they crawl and ingest contaminated substances, which include stools.[8,9]

There should be more efforts and programmes that prioritise child faeces disposal (as toilet facilities are not designed to be used by young children), which is in line with the global agenda on Sustainable Development Goals (SDGs), item 6, that by 2030 there should be improved access to sanitation and hygiene for all and an end to open defecation.[10] The WHO classifies child stool disposal as safe if the child uses a toilet or latrine and the faeces are put/rinsed into a toilet or latrine; child stools that are left in the open or buried, rinsed in a drain or ditch or put in the garbage are classified as disposed of unsafely.[11]

Among the studies that investigated child faeces disposal, many found that the age of the child, maternal age, maternal education, household wealth index, number of children <5 years in the household, availability of toilet facilities, region, and place of residence were associated with child faeces disposal practices.[12,13] In Eswatini, few or no inferential studies have been conducted to ascertain the factors associated with child faeces disposal, apart from descriptive reports that demonstrate the magnitude of the problem.[7,14] In 2010, only 60% of households reported disposing of child faeces safely while, in 2014, about 55% of children aged <2 years had their faeces disposed of safely.[14,15] The factors associated with child faeces disposal in Eswatini have not yet been investigated and, to be able to address the problem through proper interventions, it is essential that they are. Therefore, the present study aimed to identify the factors associated with unsafe disposal of children’s faeces to assist public health specialists in designing evidence-based programmes and policies.

Methods
Study design and data source
The present study was a secondary analysis of combined data from the Eswatini 2010 and 2014 Multiple Indicator Cluster Surveys (MICSs). The MICS is a global cross-sectional study design with a nationally representative sample conducted by the United Nations
The literature was used to select the survey covariates in the model. In the final model, results were reported using logistic regression model was used to control for the effects of other factors (VIF) of greater than 10. Furthermore, bivariable logistic regression was used. At this stage, the study computed crude odds ratios (CORs) and their 95% confidence interval (CI). All variables that were significant at 5% in the bivariable models were included in the multivariable model. Finally, a weighted multivariable binary logistic regression model was used to control for the effects of other covariates in the model. In the final model, results were reported using adjusted odds ratios (aORs) and 95% CIs.

**Ethical considerations**

The study dataset is publicly available on the UNICEF website and participants’ identifiers were de-identified before being posted in the UNICEF data repository. Ethical compliance was obtained by the Eswatini Central Statistics Office during implementation of the survey, including an application for protocol approval from the Eswhatini health and human research review board (EHHRRB).

**Results**

**Socio-demographic characteristics**

Of the total children included in the analysis, about half (50.9%) were female and 21.5% had had diarrhoea in the previous two weeks before the survey. A majority (41.2%) of the children were born to mothers aged 25 - 34, married (56%), with secondary education (34.2%). About seven out of 10 were from households that used a pit latrine, and a majority (67.8%) from households that used unimproved water sources and were from rural areas (75.3%) and residents in the Manzini region (35.6%) (Table 1).

**Prevalence of child faeces disposal sites in Eswatini**

Overall, 41.8% of the children’s faeces were disposed of unsafely. A majority (48.9%) of the children's faeces were put or rinsed into a toilet or latrine, while only 9.3% of the children's faeces were disposed of in a toilet or latrine, and 15.5% were put into the garbage. About 8.9% of the children's faeces were buried, while 8.5% were left in the open (Table 2).

**Prevalence of unsafe child faeces disposal by characteristics**

Table 3 shows the prevalence of child faeces disposal by explanatory variables. The results show a significantly higher proportion (34.5%) of unsafe disposal of children's faeces among children aged 12 - 24 months v. 18.8% among children aged 6 - 11 months (p=0.006). A significantly higher proportion (48.9%) of unsafe disposal of children's faeces among children was from households with a pit latrine v. only 19% with a flush toilet (p<0.001). Slightly below a third (31.4%) of child faeces were disposed of unsafely by mothers with secondary education, while 8% had no level of formal education (p=0.001). A majority of the households (64.3%) that disposed of child faeces unsafely had improved water sources v. those with unimproved water sources (35.7%) (p<0.001). Consideration of the households’ wealth index revealed that a higher proportion (44.5%) of poor households disposed of child faeces unsafely v. 13.5% among households classified under the middle quintile (p<0.001). The practice was more prevalent in the Manzini region, where the majority (29.9%) of children’s stools were reported to be disposed of unsafely v. 19.8% in the Shiselweni region (p<0.001) (Table 3).

**Factors associated with unsafe disposal of children’s faeces**

Table 4 shows the results of the bivariable and multivariable logistic regression. The bivariable model results (Table 4) show that child age, maternal education, toilet facility, source of water supply, household wealth index, and region of residence were associated with unsafe disposal of children’s faeces. In the multivariable logistic regression analysis, the odds of disposing of child faeces unsafely were lower for households whose children were aged 12 - 24 months (aOR=0.61; 95% CI 0.46 - 0.82) and aged 25 - 35 months (aOR=0.49; 95% CI 0.34 - 0.70) compared with households whose children were aged <6 months. Households with a pit latrine were less likely to dispose of child faeces unsafely.
(aOR 0.31; 95% CI 0.21 - 0.47), while those from households with no toilet facility were more likely to dispose of child faeces unsafely (aOR 5.61; 95% CI 3.15 - 9.99) compared with households with a flush toilet. Child faeces were more likely to be disposed of unsafely in households located in urban areas (aOR 1.47; 95% CI 1.12 - 1.97) compared with households in rural areas. This study further showed a statistical association between region of residence and unsafe disposal of children’s faeces. For example, lower odds of unsafe disposal of children’s faeces were observed among households from the Manzini region (aOR 0.62; 95% CI 0.47 - 0.83) and the Shiselweni region (aOR 0.69; 95% CI 0.53 - 0.93) compared with those from the Lubombo region.

Discussion

The study found that, overall, 41.8% of the children had their stools disposed of unsafely and that several determinants accounted for the practice. The high practice of disposing of child faeces unsafely requires careful attention and effective programmes if SDG number 6 of achieving improved access to sanitation and hygiene for all and an end to open defecation is to be realised by 2030.

The prevalence of unsafe disposal of children’s faeces is relatively similar to the prevalence reported in Nigeria; however, it is lower in Kenya and higher in Madagascar. The present study found that the most common method of disposing child faeces unsafely was in garbage, which implies that a significant volume of child faeces disposed of unsafely in garbage may come into contact with humans and animals. Other studies have reported that waste disposal in garbage was common. Human excreta carry over...
## Table 3. Prevalence of child faeces disposal by characteristics

| Characteristics                        | Unsafe, n(%) | Safe, n(%) | p-value* |
|----------------------------------------|--------------|------------|----------|
| **Age of child (months)**              |              |            |          |
| <6                                     | 234 (21.1)   | 252 (15.7) | 0.006 (12.49) |
| 6 - 11                                 | 224 (18.8)   | 262 (16.3) |          |
| 12 - 24                                | 419 (34.5)   | 558 (35.0) |          |
| 25 - 35                                | 318 (25.6)   | 498 (33.0) |          |
| **Sex**                                |              |            |          |
| Male                                   | 591 (50.2)   | 769 (48.3) | 0.804 (0.06) |
| Female                                 | 604 (49.8)   | 801 (51.7) |          |
| **Diarrhea last two weeks**            |              |            |          |
| Yes                                    | 273 (23.5)   | 328 (20.1) |          |
| No                                     | 922 (76.5)   | 1242 (79.9)|          |
| **Maternal age (years)**               |              |            | 0.798 (0.45) |
| 15 - 24                                | 457 (39.2)   | 616 (38.2) |          |
| 25 - 34                                | 489 (40.8)   | 623 (41.4) |          |
| ≥35                                    | 249 (20.0)   | 331 (20.3) |          |
| **Marital status**                     |              |            | 0.173 (3.51) |
| Married                                | 667 (55.9)   | 874 (56.2) |          |
| Formerly married                       | 101 (8.7)    | 105 (6.7)  |          |
| Never married                          | 427 (35.5)   | 591 (37.2) |          |
| **Toilet facility**                    |              |            | <0.001 (567.96) |
| Flush toilet                           | 217 (19.0)   | 145 (10.3) |          |
| Pit latrine                            | 574 (48.9)   | 1371 (86.7)|          |
| No facility                            | 404 (32.1)   | 54 (3.0)   |          |
| **Share toilet with neighbours**       |              |            | 0.382 (0.764) |
| Yes                                    | 313 (42.1)   | 572 (40.4) |          |
| No                                     | 478 (57.9)   | 945 (59.6) |          |
| **Maternal education**                 |              |            | <0.001 (37.13) |
| None                                   | 103 (8.0)    | 69 (4.3)   |          |
| Primary                                | 367 (30.4)   | 433 (27.6) |          |
| Secondary                              | 366 (31.4)   | 594 (36.4) |          |
| High school                            | 268 (22.1)   | 385 (25.8) |          |
| Tertiary                               |              |            |          |
| **Listen to radio**                    |              |            | 0.088 (2.91) |
| Yes                                    | 431 (67.8)   | 552 (73.0) |          |
| No                                     | 204 (32.2)   | 214 (27.0) |          |
| **Read newspaper**                     |              |            | 0.497 (0.46) |
| Yes                                    | 324 (59.8)   | 417 (62.6) |          |
| No                                     | 255 (40.2)   | 304 (37.4) |          |
| **Watch television**                   |              |            | 0.105 (2.63) |
| Yes                                    | 294 (50.4)   | 388 (55.2) |          |
| No                                     | 341 (49.6)   | 378 (44.8) |          |
| **Children <5 years, n**               |              |            | 0.873 (0.27) |
| 1                                      | 570 (49.1)   | 761 (49.5) |          |
| 2 - 3                                  | 543 (44.1)   | 698 (43.5) |          |
| ≥4                                     | 82 (6.8)     | 111 (7.0)  |          |
| **Source of water supply**             |              |            | <0.001 (14.36) |
| Improved                               | 734 (64.3)   | 1073 (70.4)|          |
| Unimproved                             | 461 (35.7)   | 497 (29.6) |          |
| **Household wealth index**             |              |            | <0.001 (15.81) |
| Poor                                   | 537 (44.5)   | 531 (32.9) |          |
| Middle                                 | 163 (13.5)   | 274 (16.7) |          |
| Rich                                   | 495 (42.0)   | 765 (50.4) |          |

...continued
50 pathogens and predispose children to several infections such as diarrhoea. A cross-sectional study in Indonesia found that the odds of diarrhoea were higher among children whose stools were disposed of unsafely than among those whose stools were disposed of safely.

### Table 3. Prevalence of child faeces disposal by characteristics

| Characteristics | Unsafe, n(%) | Safe, n(%) | p-value ($\chi^2$)* |
|-----------------|-------------|-----------|---------------------|
| Place of residence |             |           |                     |
| Rural           | 896 (74.1)  | 1,223 (76.1) | 0.072 (3.23)         |
| Urban           | 299 (25.9)  | 347 (23.9)  |                     |
| Region          |             |           | <0.001 (57.48)      |
| Hhohho          | 287 (24.3)  | 371 (24.1)  |                     |
| Manzini         | 263 (29.9)  | 492 (39.6)  |                     |
| Shiselweni      | 307 (19.8)  | 431 (21.7)  |                     |
| Lubombo         | 338 (26.0)  | 276 (14.6)  |                     |

*Significance at $p<0.05$.

### Table 4. Bivariable and multivariable analysis of factors associated with unsafe disposal of children’s faeces

#### Table 4. (continued) Bivariable and multivariable analysis of factors associated with unsafe disposal of children’s faeces

| Characteristics | cOR (95% CI) | aOR (95% CI) |
|-----------------|-------------|-------------|
| Age of child (months) |             |             |
| <6              | 1           | 1           |
| 6 - 11          | 0.86 (0.64 - 1.14) | 0.80 (0.57 - 1.10) |
| 12 - 24         | 0.73 (0.57 - 0.94)* | 0.61 (0.46 - 0.82)* |
| 25 - 35         | 0.58 (0.43 - 0.78)* | 0.49 (0.34 - 0.70)* |
| Sex             |             |             |
| Male            | 1           |             |
| Female          | 0.93 (0.77 - 1.11) |             |
| Diarrhoea last 2 weeks |             |             |
| Yes             | 1           |             |
| No              | 0.82 (0.66 - 1.02) |             |
| Maternal age (years) |             |             |
| 15 - 24         | 1           |             |
| 25 - 34         | 0.96 (0.76 - 1.21) | 0.96 (0.74 - 1.24) |
| ≥35             |             |             |
| Marital status  |             |             |
| Married         | 1           |             |
| Formerly married| 1.31 (0.88 - 1.93) |             |
| Never married   | 0.96 (0.79 - 1.17) |             |
| Maternal education |             |             |
| None            | 1           |             |
| Primary         | 0.60 (0.40 - 0.91)* | 0.88 (0.55 - 1.42) |
| Secondary       | 0.47 (0.30 - 0.72)* | 0.95 (0.58 - 1.55) |
| High school     | 0.47 (0.30 - 0.72)* | 1.00 (0.60 - 1.67) |
| Tertiary        | 0.75 (0.44 - 1.26) | 1.12 (0.60 - 2.08) |
| Toilet facility  |             |             |
| Flush toilet    | 1           | 1           |
| Pit latrine     | 0.31 (0.23 - 0.40)* | 0.31 (0.21 - 0.47)* |
| No facility     | 5.78 (3.74 - 8.92)* | 5.61 (3.15 - 9.99)* |
| Share toilet with neighbours |             |             |
| Yes             | 1           |             |
| No              | 0.93 (0.75 - 1.15) |             |

*Significance at $p<0.05$.

In the present study, the odds of child faeces disposed of unsafely were lower with increased age of the children. For example, children aged ≥12 months had lower odds of their faeces being disposed of unsafely. The study finding is consistent with the literature which could be because younger children’s faeces...
are regarded as being less harmful and containing less visible food residuals, which may be less repellent than those of older children and adults, and hence not disposed of properly.

Several studies have shown that households with an improved type of toilet facility were less likely to unsafely dispose of child faeces.\(^{11,22,24}\) The present study found that households with a pit latrine had lower odds of disposing of child faeces unsafely, and those with no toilet facility were more likely to dispose of child faeces unsafely than those with a flush toilet. This behaviour could be because lack of toilet facilities results in undisposed child faeces.\(^{17}\)

Evidence suggests a positive relationship between improved household water supply and the practice of disposing of child faeces unsafely.\(^{23,25}\) However, our study found no significant association between the type of water source and the unsafe disposal of child faeces after controlling for other factors. The availability of improved water in the household may be a great motivation for mothers to maintain good hygiene, including safe child faeces disposal and handwashing behaviour. Similarly, other studies found no association between improved water sources and child faeces disposal.\(^{12,13}\)

The urban-rural disparity in hygiene behaviour has long been established in the literature.\(^{13,20}\) Other studies reported lower odds of the practice of disposing of child faeces unsafely in urban areas compared with rural areas.\(^{12,13}\) In contrast, we found higher odds of unsafe disposal of children’s faeces in urban areas than in rural areas; this could be explained by the fact that in Eswatini, the majority of households that disposed of child stools in a pit latrine are in rural areas, compared with flush toilets in urban areas. In our study, households with a pit toilet were less likely to dispose of child faeces unsafely than did households with a flush toilet (Table 4). A higher proportion of households used pit latrines to dispose of waste material.\(^{14}\)

Several studies found a significant variation in the disposal of child faeces unsafely across the regions of residence.\(^{13,15}\) The present study found lower odds of the disposal of child faeces unsafely in the Manzini and Shiselweni regions compared with the Lubombo region. A possible explanation could be that the two regions are better developed with better sanitation facilities and educated mothers/caregivers than in the Lubombo region.

**Study limitations**

Our study had several limitations. It is cross-sectional and therefore more prone to confounding. However, the study controlled for several confounders in the multivariable model. Generally, cross-sectional studies, including this one, lack evidence on temporality; hence, the study cannot establish if the exposure caused the outcome.\(^{12}\)

Desirability bias can also not be ruled out, as participants may have misreported the practice of child faeces disposal. However, the limitations of the study could not outweigh the strength of the study, as the data were sourced from the international MICS programme.

**Conclusion**

The unsafe disposal of child faeces remains a public health problem in Eswatini. The present study demonstrated that child age, type of toilet facility, place of residence, and region of residence were associated with unsafe disposal of children’s faeces. Programmes that aim to address the problem of unsafe disposal of children’s faeces and improve sanitation in Eswatini should target children younger than six months from households with no toilet facility, residents in urban areas, and those from the Lubombo region. The findings also campaign for further research to identify effective strategies to reduce unsafe disposal of children’s faeces in Eswatini.

**Declaration.** None.

**Acknowledgements.** The authors would like to thank the Multiple Indicator Cluster Survey team for providing access to the datasets.

**Author contributions.** MSS conceived the research idea, performed the statistical analysis, and prepared the initial draft of the manuscript. GBC, TM and EZ critically reviewed the manuscript and contributed to the study design and manuscript writing. All authors reviewed and approved the final manuscript.

**Funding.** None.

**Conflicts of interest.** None.

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Accepted 9 June 2020.