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Research Paper

Knowledge and management practices for disposable baby diapers among child caregivers in informal urban settlements in Uganda

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ABSTRACT

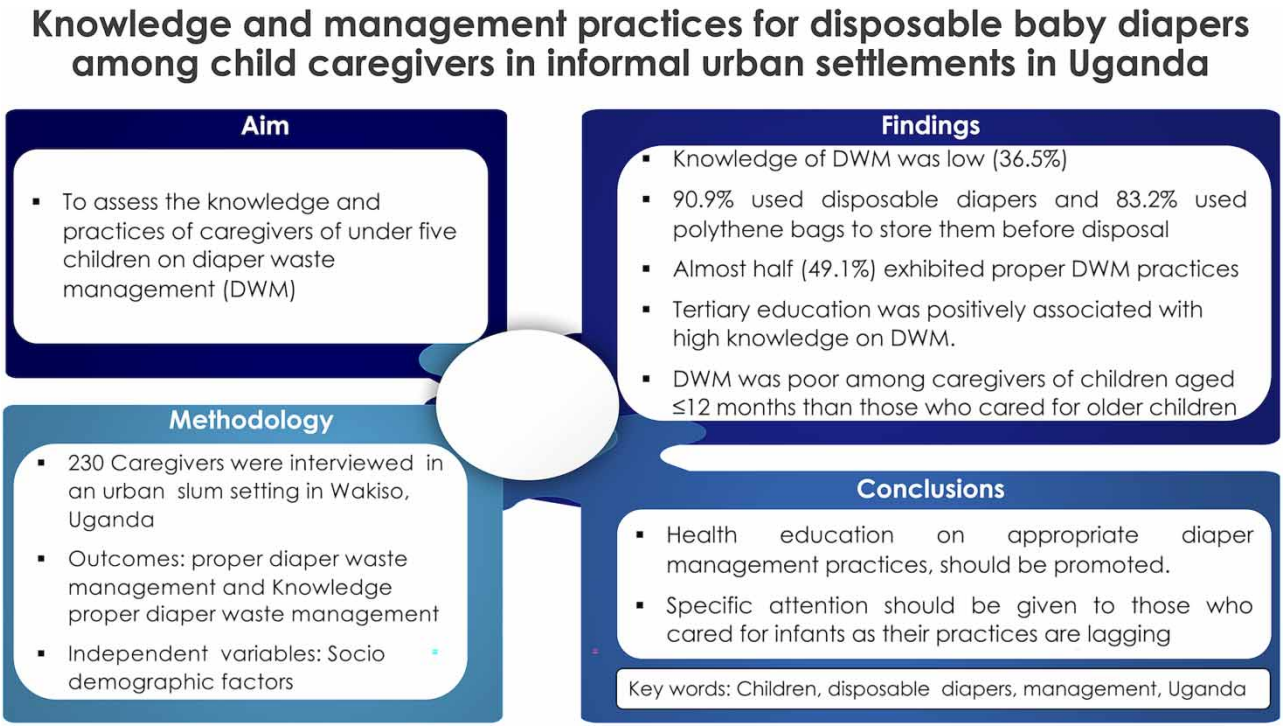
Proper handling of child faeces is essential in reducing exposure to pathogens in homes and the environment. The exponential rise in usage of disposable baby diapers requires understanding of caregivers' knowledge and management practices of disposable diapers. We interviewed 230 caregivers of under-five children in an informal settlement in Uganda about their knowledge and practices on used disposable baby diaper management and used logistic regression to assess factors associated with proper management of used diapers. Only 36.5% (84) of caregivers had high knowledge of proper used diaper management practices, and this was associated with having a child ≤12 months [Prevalence Ratio, PR = 1.78, 95% CI 1.04-3.01] and having tertiary education [PR = 2.09, 95% CI 1.12-3.92]. Most caregivers (63.5%, 146) indicated that diapers can be mixed with other general waste. Among the 173 who stored diapers before disposal, 83.2% (144) used polythene bags for storage. Overall, only 49.1% (113) caregivers had proper diaper waste management practices, which was inversely associated with having a young child (≤12 months) [PR = 0.68, 95% CI 0.48–0.95]. Findings highlight deficiencies in knowledge and diaper management practices and underscore the need to intensify awareness and education programmes on the best used diaper management practices.

Key words: child faeces, disposable baby diapers, exposure, pathogens, Uganda

HIGHLIGHTS

- Knowledge and practices regarding management of used baby diapers are suboptimal.
- Higher educational attainment was associated with better knowledge of proper diaper management practices while having children under 12 months was associated with poor diaper handling practices.
- Regular health education of child caregivers may lead to improved management practices for used baby diapers.
- Multisectoral stakeholder collaboration is key to improving proper management of used baby diapers.

GRAPHICAL ABSTRACT



INTRODUCTION

Diaper management is a growing public health challenge, especially in urban settings of low- and middle-income countries (LMICs). Globally, 8.41 billion kilograms of diapers are produced annually and are expected to amount to 9.48 billion kilograms by 2027 (Alda 2023). In the United States and Europe alone, the estimated daily disposable diaper waste is 20 billion and 18,000 tons, respectively (ZWE 2021; Statista 2024) and that of South Africa is approximated to be 1.1 million tons per year (Khanyile *et al.* 2020). Baby diapers are widely used to accommodate infant's metabolic waste (urine and faeces). The global diaper market is expected to grow exponentially over the coming years due to the increased awareness of their relevance to child health (AMR 2022). It is estimated that before becoming potty trained, a baby goes through about 6,000 disposable diapers (Sheila 2016; Nicki 2023). Disposable baby diapers are widely used due to the convenience they accord to mothers and their babies and eliminates the need to wash them (Kimani *et al.* 2015; Kusumawati & Mangkoedihardjo 2021; Kordecki *et al.* 2022). In LMICs, volumes of disposable baby diapers imported continue to rise and increased volume of diaper waste is projected (Mlangeni 2021). Increase in diaper waste generation is often associated with management challenges such as lack of adequate means to dispose them in an ecofriendly manner (Leaska 2016; Muia 2018). It is recommended that used diapers should be rinsed before getting discarded to ensure that raw human waste does not reach disposal sites (Chimhandamba 2019). The faecal matter in the diaper should be dumped into the toilet, diaper wrapped into a tight ball, and stored in a sealed diaper container waiting for final disposal (Umesi 2023).

Several methods are used to dispose of used diapers including landfilling, burning, burying, and composting (Mudau *et al.* 2023). Approximately 92% of global disposable diaper waste ends up in landfills, contributing to about a third of the landfills taking up space for other solid waste (Zauderer 2023) as well as negatively affecting the environment such as through air and water pollution, soil erosion, and the greenhouse effect (Khoo *et al.* 2019). Although developed countries are now shifting from inorganic to organic diaper series that can degrade easily, developing countries still heavily rely on plastic diapers whose composition takes up to 500 years to decompose completely (Morganti & Febo 2017; GVR 2022). In a few African settings where biodegradable diapers are being used, they are quite expensive compared to other types and are mostly used by higher socioeconomic households. Burning and disposal with other garbage are the common diaper waste disposal

practices in LMICs (Bain & Luyendijk 2015). However, they are sometimes deliberately thrown away in open spaces or illegal dump sites, becoming a nuisance in the process (Rabaji 2019).

In Uganda, the National Bureau of Standards indicates that over 80 diaper brands exist on the market, which is all advertised and packaged with persuasive packaging to attract users (URN 2022). Uganda's baby diaper volume is expected to reach 23.7 million kilograms by 2027 (Alda 2023). With this projected increase, there is an urgent need for more sustainable options to properly handle used diapers (Mlangeni 2021). However, most households lack basic diaper waste storage means which encourages mixing with other household waste for disposal. Sometimes these wastes are disposed of along the streets or in illegal dumping sites which eventually contaminate the communities (Mugambe *et al.* 2022).

Poorly stored and disposed of soiled diapers can cause public health hazards including environmental pollution, unpleasant odours, and contamination of both surface and groundwater sources, together with harbouring malaria vectors and spreading waterborne diseases such as cholera and diarrhoea (Ssemugabo *et al.* 2020; Kusumawati & Mangkoedihardjo 2021; Kordecki *et al.* 2022). There is limited literature on the knowledge and practices regarding the management of used diapers in different LMIC settings. A few studies conducted so far have focused on the management of general household solid waste (Byamukama & Nuwamanya 2020; Tumuramye 2021), for which there are already proper guidelines for its management. Little is known about the extent of knowledge of proper management of diapers among child caregivers as well as the associated individual and sociodemographic factors. Our hypothesis is that when child caregivers are equipped with adequate knowledge and positive attitudes, they will have better practices towards proper management of used disposable baby diapers, and this may consequently reverse the current trend of sanitation-related diseases.

METHODS

Study area and design

This was a cross-sectional study that employed quantitative data collection approaches to capture data from child caregivers in Nansana Municipality in September 2022. Nansana Municipality is located in the Wakiso district, in the central region of Uganda. It is one of the five municipalities in the Wakiso district, located along the Kampala-Hoima highway. It is approximately 12 km north-west of Kampala Capital City and bordered by Kampala City and Kasangati Town Council in the east, Mende and Masulita Sub counties to the west, Wakiso Town Council to the South, and Luwero District to the North. Nansana Municipality was purposively selected because it is one of the rapidly growing urban areas in Uganda. It has a population of 365,857 people (Statistics 2016) and is divided into four divisions, Gombe, Busukuma, Nabweru, and Nansana, where the study was conducted. Major economic activities include trade, auto mechanics repair, agriculture, large-scale production such as crisps processing industries, and small-scale businesses such as welding, carpentry, and car washing bays.

Study population, sample size, and sampling

This study was conducted among caregivers of children under 5 years. All caregivers (usually mothers) who had a baby or had taken care of a baby in the previous 3 months were eligible. The Kish Leslie formula for cross-sectional studies was used to estimate the sample size (Kish 1965) taking into consideration an alpha of 0.05, a desired precision of 5% and a proportion of caregivers with appropriate diaper disposal practices of 17.24% from a previous study (Muia 2018). This yielded a minimum sample size of 230 participants.

Nansana division was purposively selected due to its high population. Two urban settlements of Nansana East IA and Nansana East IIB were purposively selected as these slums were reported by the municipal leaders to have bigger waste management challenges. In each of these urban slums, a list of households with under-five children was obtained with the help of the slum leadership. Approximately 115 respondents were expected from each of the slums using a systematic random sampling method. In each slum, the number of households was divided by the sample size ($n = 115$) to get the sampling interval. Households were sampled following the estimated sampling interval starting from the LCI place north and in the clockwise direction until all 115 households were sampled per settlement. One participant was selected from the household and where more than one person was eligible for the survey, random sampling was used to select only one for the household.

Data collection tools and procedures

Face to face surveys were conducted with caregivers using a semi-structured questionnaire uploaded on a mobile device application (Kobo Collect). The questionnaire consisted of predefined closed and prompt questions to capture information on

sociodemographic characteristics, knowledge and practices regarding management of used disposable diapers among the respondents. Questionnaires were designed in English but translated into the main local language (*Luganda)* for the people who did not speak English. However, the interviewer used the language that the respondent preferred and back-translated the responses where necessary. The data collection process took an average of 30 min. Before data collection, tools were pretested among caregivers in Katanga, another slum setting in Kampala, which had similar characteristics to the urban settlements in Nansana Municipality. The pretest helped to identify and correct any inconsistencies or errors in the questionnaire. During field work, the principal investigator checked the data to ensure its quality before storage.

Variables and measurements

Outcome

The outcome is proper diaper management practice. This was based on four binary questions related to:

- Type of storage container: The choice between polythene or other leakproof containers versus non-leakproof containers is critical. Leakproof containers are essential to prevent spillage and contain odours, thereby maintaining hygiene standards and reducing potential health risks associated with exposure to waste.
- Storage before disposal: Affirmative storage before disposal is imperative. Proper storage minimizes the risk of contamination and facilitates the efficient handling of diaper waste, ensuring that it does not become an environmental nuisance.
- Mixing diaper waste with household waste: It is advised against mixing diaper waste with the general solid waste stream. Diaper waste often contains biohazards that require specialized disposal methods distinct from those used for regular household waste to mitigate environmental impact and health hazards.
- Appropriateness of disposal method: Disposal methods such as latrines, composite pits, or pails are deemed appropriate due to their ability to contain and potentially treat waste. In contrast, methods like burning or open dumping are inappropriate because they pose significant environmental and health risks, including air pollution and contamination of water sources.

The respondents who had at least three of the four appropriate practices were classified as having proper/satisfactory practices, otherwise the others as unsatisfactory practices.

We also collected data on knowledge of diaper waste management. This was a composite variable created from three binary questions about the knowledge of the effects (health and environment) of poor diaper waste handling and on proper methods of diaper disposal. The respondents who answered at least two of the three questions correctly were classified as having high knowledge, otherwise the rest had low knowledge.

Covariates

These included sociodemographics: marital status (married or cohabiting, separated or divorced, single), age in years (later categorized as 17–24, 25–34, and $\geq$35), education attainment of caregiver (none or primary, secondary, tertiary), and age of child in months (later categorized as $\leq$12, 13–24, $\geq$ 25). Information on household monthly income was also collected (the categories were $<$27.8, 27.8–138.9, and $>$138.9). Knowledge on diaper management was also a covariate for proper diaper management outcomes.

Data management and analysis

Data was captured into the Kobo Collect Mobile data collection tool, downloaded in Excel format, and then exported to STATA 14.1 software for cleaning and statistical analysis. Descriptive statistics such as frequencies and percentages were used to highlight categorical data while means and standard deviations were used for numerical data. Multivariable analysis was used to determine the predictors of high knowledge on diaper management and satisfactory diaper management practices. A generalized linear model (modified Poisson regression) was used instead of logistic regression (Fu *et al.* 2021) to estimate the prevalence ratios (PRs) and 95% confidence intervals (CIs) of the predictors of the outcomes. A *p*-value less than 0.05 was considered statistically significant.

Ethical considerations

The study was approved by Makerere University School of Public Health prior to the commencement of data collection. Clearance was also sought from the Nansana Municipal Council and local leaders in the selected study areas. Participants

gave consent before participating in the study by signing on the informed consent form and only those willing to participate in the study were involved. Data collected was kept confidential and under lock and key.

RESULTS

Sociodemographic characteristics of participants

The participants were predominantly female (98.7%, 227/230), young (mean age of 25.8 [SD = 5.7]) and ranged from 17 to 24 years. Nearly half of them (43.4%, 100/230) had completed tertiary education. The children they cared for were mostly toddlers (mean age of 15.7 [SD = 10.3] months) and 32.6% (75/230) were in the range of 13–24 months (Table 1).

Knowledge and practices of caregivers on used baby diaper management

Most of the participants (75.2%, 173/230) acknowledged their responsibility for the consequences of improper used diaper disposal. They were aware of the potential risk of improper used diaper disposal such as disease outbreaks (87.4%, 201/230) and soil pollution (63.5%,146/230). Overall, 36.5% (84/230) were considered to have high knowledge of diaper management practices.

Table 1 | Sociodemographic characteristics of participants

Characteristics	Number of participants ($n = 230$)	Percentage (%)
Sex of participant: Female	227	98.7
Marital status		
Married or cohabiting	124	53.9
Separated or divorced	34	14.8
Single	72	31.3
Parental age (years)		
Mean (SD)	25.8 (5.7)	
17–24	102	44.4
25–34	113	49.1
≥35	15	6.5
Highest education level of caregiver		
None or primary	33	14.4
Secondary	97	42.2
Tertiary	100	43.4
Age of the child (in complete months)		
Mean (SD)	15.7 (10.3)	
≤12	109	47.4
13–24	75	32.6
≥25	46	20.0
Caregiver occupation		
Employed	111	48.3
Housewife	78	33.9
Not employed	41	17.8
Household monthly income (USD)[a]		
<27.8	146	63.5
27.8–138.9	59	25.7
>138.9	25	10.9

[a]USD 1 = UGX 3600.

Regarding practices, most of the participants (90.9%, 209/230) used disposable diapers. They also stored used diapers before final disposal (75.2%, 173/230), mostly in polythene bags (83%, 144/173) for a mean duration of 7 days. The majority disposed of used diapers along with other household garbage (65.2%, 150/230). Overall, 49.1% (113/230) were considered to have satisfactory diaper management practices (Table 2).

Factors associated with high knowledge and proper management of used baby diapers

Participants who had attained a tertiary level of education had a 2.09 times higher likelihood of having high knowledge of disposable baby diaper management compared to those who had not or only attained primary education (adjusted prevalence ratio [aPR] = 2.09, 95% confidence interval [CI] (1.12–3.92), p = 0.021). The participants with children aged 1 year and younger were also more likely to have good knowledge of managing used diapers compared to those with older children (aPR = 1.78, 95%CI (1.04–3.01), $p = 0.034$).

Participants who had children 1 year or younger had 32% less likelihood to manage used baby diapers properly compared to those with children older than 2 years of age (aPR = 0.68, 95%CI (0.48–0.95), $p = 0.024$.) (Table 3).

DISCUSSION

Our study assessed the knowledge and management practices for used disposable baby diapers among caregivers of under-five children in an urban informal settlement in Wakiso district, Uganda. Our findings highlight a low proportion of caregivers had high knowledge of used disposable baby diaper management, while less than half had satisfactory management practices. This shows that caregivers have limited information and literature regarding proper used diaper management practices. This study will therefore contribute to the limited available literature on used diaper management. A high level of education and having a younger child was significantly associated with high knowledge of used diaper management while having an older child was associated with proper management of used diapers. Interventions on improving caregivers' knowledge on used disposable baby diaper management should therefore target those with a low level of education and having younger children, while those aiming at improving management practices should mainly target caregivers with older children.

Knowledge of caregivers on used disposable baby diaper management was generally very low and this is not surprising since it is a common trend in most low-resource settings (Jesca & Junior 2015; Muia 2018; Collins *et al.* 2022). This low knowledge may be attributed to low exposure to information regarding the management of used diapers. Diaper waste management as a component of infectious waste tends to receive low attention from caregivers, health educators and local authorities. Moreover, almost all the caregivers' effort is directed towards information regarding cheap and affordable diaper brands on the market and almost all diaper information circulating on media in LMICs such as Uganda is filled up with adverts on best diaper brands, with limited information on their management after use (Leaska 2016; Loozap 2020). Compared to primary or no formal education, attainment of tertiary education was significantly associated with high knowledge of the management of used disposable baby diapers. This finding is consistent with Bawankule *et al.* (2017) and Agestika *et al.* (2022) who in their studies in India and Indonesia, respectively, revealed that illiteracy among mothers was associated with unsafe disposal of children's faeces. Low educational attainment may imply less exposure and understanding of media such as the internet and electronic media that may contain information related to used diaper management practices. Further still, we believe that higher education may enhance the awareness and understanding of caregivers on the proper disposal of used diapers and its environmental and health implications, and hence better decision-making (Preeti *et al.* 2016). Stakeholders such as community health workers (CHWs) and nurses are encouraged to extend education regarding used baby diaper management to maternity facilities as has been successfully conducted in Kenya to teach illiterate mothers the importance of proper used diaper management (Mwololo 2013).

The majority of participants knew that responsibility for proper disposal of used diapers lies with them, which is a good prerequisite for proper management. Our findings are similar to those in an earlier study in Wakiso in which almost all caregivers knew that it was their responsibility to see that used diapers were properly disposed of (Kazibwe 2022). Most participants also reported that poor disposal of used diapers could lead to disease outbreaks and soil pollution in line with previously published findings in Zimbabwe (Mathe 2018). It is ideal to properly dispose of diapers so as to avoid their contents from contaminating the environment, which could lead to faecal oral disease outbreaks such as cholera, dysentery, and typhoid (Leaska 2016). This knowledge would be expected to be a catalyst for caregivers to properly manage used diapers in a way that does not harm their lives and that of the environment. The local authorities should continue availing themselves of sufficient information regarding the proper management of used diapers to mothers and child caregivers to

Table 2 | Knowledge and practices of caregivers on used baby diaper management

Variables	Number of participants, $N = 230$	Percentage (%)
Knowledge on used baby diaper management		
Primary stakeholders in proper used diaper management		
Child caregivers	173	75.2
Waste management companies	58	25.2
Government	32	13.9
Diaper manufacturing companies	3	1.3
Health effects of improper diaper disposal[a]		
Disease outbreaks	201	87.4
Unsightly/nuisance	57	24.8
Filthy and smelly odours	56	24.4
Fly and rodent breeding	28	12.2
Contamination of inanimate objects	1	0.4
Environmental effects of poor diaper disposal[a]		
Soil pollution	146	63.5
Communicable diseases	114	49.6
Water pollution	62	27.0
Skin infections	23	10.0
Air pollution	17	7.4
Others (conflicts, clogging of storm water channels)	13	5.7
Knows proper methods of disposal[a]		
No	203	63.4
Yes	27	36.5
Knowledge level		
Low	146	63.4
High	84	36.5
Management practices of used baby diapers		
Type of diaper used		
Disposable diapers	209	90.9
Both	16	7
Cloth diapers	5	2.1
Number of diapers used per day		
≤ 3	188	81.7
> 3	42	18.3
Mean (SD)	3 (0.6)	
Stored diapers before disposal: Yes[b]	173	75.2
Method of diaper storage before final disposal[c]		
Polythene bags	144	83
Dustbins	26	15
Pails	3	2
Appropriate storage container used: Yes[b]	148	64.3
Duration of diaper storage before final disposal in days[c]		
≤ 7	30	17.7

(*Continued.*)

Table 2 | Continued

Variables	Number of participants, $N = 230$	Percentage (%)
> 7	143	82.7
Mean (SD)	11 (15.3)	
Diaper disposal methods		
With household garbage	150	65.2
By burning	40	17.4
In pit latrines	21	9.1
In composite pits	8	3.5
Others (in pails, in open fields)	11	4.8
Appropriate disposal method[b]	44	19.1
Mixed used diapers with other household waste: Yes	138	60.0
Diapers not mixed with other waste in public skips: Yes[b]	178	77.4
Diaper management practice		
Not satisfactory	117	50.9
Satisfactory	113	49.1

[a]Variables for generating additive knowledge score.
[b]Variables for generating additive practice score.
[c]Respondents who stored used baby diapers before final disposal.

ensure this translates into practice. Caregivers with younger children were more likely to have high knowledge regarding diaper management compared to those with older babies. This finding suggests that younger children may require more frequent diaper changes and more attention from caregivers, which may increase their exposure and interest in disposable baby diaper management. It is also possible that this frequent exposure may trigger the caregiver to explore more information regarding environmentally friendly disposal methods for used diapers as a way of protecting the child and community's health. Additionally, newly delivered mothers may happen to visit health facilities more often (Sobowale *et al.* 2021), mostly for child vaccinations, and it is possible that during these visits they receive up-to-date information from health workers regarding the best-used diaper waste management practices.

Regarding management practices, most respondents exhibited poor management practices. This could potentially be due to the low investment in diaper waste management and neglect of used baby diapers as infectious waste. According to local authorities in Nansana, there is not any diaper waste management plan in the municipality. This appears to be a common trend in almost all public health departments in urban authorities in Uganda. As a result, diaper waste receives less priority, yet it sometimes turns out to be infectious. The study also revealed that most caregivers used disposable diapers, with convenience being the primary justification. This is in agreement with several studies on why people choose to use diapers (Kimani *et al.* 2015; Nyamayedenga & Tsvere 2020; Agestika *et al.* 2022; Kordecki *et al.* 2022). After use, disposable diapers were stored for an average of 11 days before final disposal. Storing used diapers for such a long time is a potential threat to human health. Stored diapers could be sources of bad odour, can attract harmful pests and insects as well as act as breeding habitats for disease-transmitting vectors such as flies and mosquitoes (Ntekpe *et al.* 2020; White *et al.* 2023). This practice could be a result of the absence of laws and regulations regarding the household disposal of infant waste in Uganda (Reese *et al.* 2015; Mathe 2018). In the long run, caregivers end up disposing of diapers in a way they think is right such as along the streets or in trenches where they can block runoff water, contaminate water sources, and cause floods (Bain & Luyendijk 2015). Mothers and child caregivers should therefore be guided through policies, laws, and education in order to improve their used diaper management practices and behaviours.

Participants with younger children were less likely to properly manage used diapers compared to their counterparts with older children. This is in corroboration with a study in Cambodia where mothers with younger children were less likely to manage baby faeces hygienically (Miller-Petrie *et al.* 2016). This finding may be explained by the fact that caregivers with younger children tend to use more diapers compared to older children. It also indicates that younger children, below the potty-training stage may pose more challenges and difficulties for the caregivers in disposing of used diapers in a safe and

Table 3 | Factors associated with high knowledge and proper management of used baby diapers

	Knowledge, *n* (%)			
Variable	**Poor, *n* (%)**	**Good, *n* (%)**	**Adjusted PR (95% CI)**	***p*-value**
Marital status				
Married	83 (66.9)	41 (33.1)	Ref	
Separated	22 (64.7)	12 (35.3)	1.29 (0.74–2.56)	0.362
Single	41 (56.9)	31 (43.1)	0.85 (0.53–1.36)	0.493
Parental age (years)				
17–24	60 (58.8)	42 (41.2)	1.19 (0.57–2.48)	0.646
25–34	77 (68.1)	36 (31.9)	0.69 (0.35–1.34)	0.272
≥35	9 (60.0)	6 (40.0)	Ref	Ref
Parental education level				
None or primary	24 (72.8)	9 (27.3)	Ref	
Secondary	70 (72.2)	27 (27.8)	1.13 (0.59–2.15)	0.710
Tertiary	52 (52.0)	48 (48.0)	2.09 (1.12–3.92)	0.021
Child age				
≤12	55 (50.5)	54 (49.5)	1.78 (1.04–3.01)	0.034
13–24	57 (76.0)	18 (24.0)	0.88 (0.49–1.59)	0.673
≥25	34 (73.9)	12 (26.1)	Ref	
Occupation of caretaker				
Employed	63 (56.8)	48 (43.2)	Ref	
Housewife	56 (71.8)	22 (28.2)	0.85 (0.44–1.66)	0.640
Not employed	27 (65.9)	14 (34.2)	1.13(0.59–2.15)	0.709
Income of caretaker (USD)[a]				
<27.8	100 (68.5)	46 (31.5)	0.79 (0.44–1.44)	0.445
27.8–138.9	34 (57.6)	25 (42.4)	Ref	
>138.9	12 (48.0)	13 (52.0)	1.13 (0.71–1.78)	0.615
	Practices, *n* (%)			
Variable	**Unsatisfactory**	**Satisfactory**	**Adjusted PR (95% CI)**	***p*-value**
Marital status				
Married	56 (45.2)	68 (54.8)	Ref	
Separated	16 (47.1)	18 (52.9)	0.89 (0.60–1.32)	0.559
Single	45 (62.5)	27 (37.5)	0.76 (0.51–1.15)	0.201
Parental age (years)				
17–24	57 (55.9)	45 (44.1)	1.14 (0.83–1.55)	0.421
25–34	51 (45.1)	62 (54.9)	0.81 (0.39–1.66)	0.557
≥35	9 (60.0)	6 (40.0)	Ref	
Parental education level				
None or primary	17 (51.2)	16 (48.5)	Ref	
Secondary	43 (44.3)	54 (55.7)	1.13 (0.77–1.66)	0.521
Tertiary	57 (57.0)	43 (43.0)	0.87 (0.57–1.32)	0.502
Child age				
≤12	66 (60.6)	43 (39.5)	0.68 (0.48–0.95)	0.024
13–24	33 (44.0)	42 (56.0)	0.96 (0.71–1.30)	0.811
≥25	18 (39.1)	28 (60.9)	Ref	
Occupation of caretaker				
Employed	60 (54.1)	51 (46.0)	Ref	
Housewife	35 (44.9)	43 (55.1)	1.11 (0.62–2.02)	0.722
Not employed	22 (53.7)	19 (46.3)	0.98 (0.54–1.80)	0.953
Income of caretaker (USD)[a]				
<27.8	27 (45.8)	32 (54.2)	Ref	
27.8 to 138.9	16 (64.0)	9 (36.0)	0.65 (0.38–1.14)	0.135
>138.9	74 (50.7)	72 (49.3)	0.78 (0.44–1.38)	0.393

[a]Exchange rate at the time: USD 1 = UGX 3600; USD, United states dollar; UGX, Uganda shillings.

hygienic manner, such as finding suitable storage and disposal methods, avoiding mixing with household waste, as well as reducing environmental impacts. The majority of participants reported that while they waited for garbage collection service providers to pick garbage for final disposal, they stored used diapers in polythene bags and mixed them with other household garbage during disposal in corroboration with Muia (2018) and Kimani *et al.* (2015)'s studies. Storing used diapers in open polythene bags attracts animals such as dogs that can tear the diapers to release faecal contents into the environment (Mathe 2018; Ntekpe *et al.* 2020). Storing used diapers with other household garbage may also discourage waste segregation at the source, putting garbage collectors at risk of contracting faecal–oral diseases while transporting and sorting garbage at the disposal site. In order to encourage diaper waste segregation from household garbage, mothers and child caregivers should be encouraged to use diaper bins for storage of used diapers. Furthermore, awareness about the dangers of mixing diaper waste with other household garbage should be carried out by the municipal council to change the caregivers' perception of it.

RECOMMENDATIONS ON APPROPRIATE MANAGEMENT PRACTICES FOR USED DIAPERS

In the absence of public health guidelines, we propose several strategies to enhance diaper management in low-resource settings. First, consider using reusable diapers to minimize waste. However, recognizing the rising popularity of disposable diapers, limit their use to an average of three diapers per child daily. After changing a diaper, ensure proper handling: shake faeces into the toilet, seal the diaper tightly, and store it in a sealed plastic bag. Keep used diapers separate from household waste, storing them in a designated area for 2–3 days. For disposal, avoid open burning, which can lead to health risks and environmental pollution. Instead, use a well-managed landfill or controlled incinerator. Lastly, raise awareness among mothers about the importance of responsible diaper management, emphasizing both health and environmental implications.

STRENGTHS AND LIMITATIONS

Diaper management practices are under-researched in Uganda despite the exponential rise in the use of diapers over the last few years. A strength of the study is therefore that it will be one of the few studies providing basic information on the management of used diapers by child caregivers for proper planning and managing of used diaper waste in similar settings in the country. However, the study relied primarily on self-reported data which depended on the participants' honesty and could have been biased. The bias was reduced by thoroughly explaining the consent form to the participants before accepting them for study participation and by answering any queries they had about the study. Additionally, our study primarily focused on caregivers in an urban low-resource setting. Future studies may assess the management practices in affluent settings.

CONCLUSION

A low percentage of caregivers had high knowledge of the management of used diapers, and almost half of them exhibited satisfactory management practices. This leaves caregivers vulnerable to a variety of hazards resulting from improper management of used diapers, many of which could have been easily mitigated. Attainment of a tertiary level of education and having a younger child was associated with high knowledge of used diaper management. In addition, having a younger child was associated with proper used diaper management. Our study recommends an increase in regular household sanitary inspections, and health education as well as providing appropriate facilities and infrastructure such as diaper bins for diaper disposal in order to improve the caregivers' knowledge, attitudes and practices towards the management of used diapers. In addition, active multi-sectorial collaboration among different stakeholders such as municipal and local leaders, diaper manufacturers, NGOs and CHWs in Nansana municipality is key to supporting mothers and child caregivers with adherence to proper management of used diapers.

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AUTHORS' CONTRIBUTIONS

AS, SK, DM, and STW were involved in the conceptualization. AS and STW were involved in data collection, formal analysis, and writing the original draft of the manuscript. SK and STW supervised the work and are guarantors for this work. All

authors were involved in the review & editing of the manuscript and have all read and approved the final version of the manuscript.

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DATA AVAILABILITY STATEMENT

All relevant data are included in the paper or its Supplementary Information.

CONFLICT OF INTEREST

The authors declare there is no conflict.

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