

Environmental challenges associated with disposal of baby diapers in Hwange town, Zimbabwe

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ABSTRACT: The rapid increase in the use of disposable baby diapers in urban areas is associated with a number of environmental challenges. This study assesses the environmental challenges of disposable baby diapers in Hwange, Zimbabwe. Questionnaires, interviews, and field observations were used for data collection in this study. Data collected from the field was analyzed using Statistical Package for Social Sciences (SPSS) version 25.0 and Microsoft Excel. The study findings show that pollution, diseases, and odours are the major challenges of poor waste management associated with disposable baby diapers in Hwange ZPC residential areas. The study recommends the involvement of responsible authorities in conscientious recycling and education on waste management. The research also recommends the need to conduct longitudinal research to establish the position of local and central government in the bid to promote a safe and healthy environment in mining towns such as Hwange, as they are overlooked.

KEYWORDS: disposable baby diapers; diseases; environmental challenges; waste; Zimbabwe

1. Introduction

Rapid changes in consumption patterns and lifestyle that are attributed to urbanisation and subsequent urban growth are straining environmental sustainability^[1-8]. A key component of this change is the introduction of disposable baby diapers, which are regarded as an improvement on traditional cloth diapers^[9,10]. Prior to the general use of disposable baby diapers as a replacement for cloth diapers, they were used for convenience when travelling^[11,12]. The spoiled diapers used by baby caretakers are either dumped into proper disposal landfill sites or they end up haphazardly littering public spaces, causing an aesthetic nuisance to the environment^[13,14]. Disposable baby diapers are among billions of plastic bags and electronic junk that are scattered around towns and city landscapes^[1,11,13,15]. Developing countries are still using old methods of mixing waste, unlike developed countries where waste separation is done at the source. Waste separation is key to proper waste management, as waste will be treated separately. Spoiled diapers are unfriendly to nature as they contain excreta, which impact negatively on both surface and underground water sources^[11].

Production of disposable baby diaper waste in the EU and Turkey has increased from 18 million in 1997 to more than 22 million^[16]. Diaper waste in the USA and Britain^[17] accounts for four to seven percent of black bin waste. In Dhaka, it was reported that the increased use of baby diapers presented environmental challenges, and it has been worsened by improper disposal methods^[18]. Trends suggest that there is likely to be an increase in the production volume, which will cause pressure on the environment

in the absence of appropriate technical measures for the improvement of the performance of the environment^[17,19]. Kim and Kim^[2] estimated that 240,000 tons of used diapers are generated annually in Korea. This results in the leaching of organic compounds into the groundwater and soil, while at the same time increasing methane production. The population of babies under the age of 2 years is beyond 5 million in Mexico, leading to more than 32 million diapers that are discarded daily. This accounts for six and a half percent of urban waste directed to landfills^[20].

The major problem in most towns in the developing world remains poor solid waste management^[21-23]. In order to ensure sustainability, maintainable practices in the manufacture and use of disposable baby diapers are key. Population increase in developing countries is among other influences that enhanced the rate of diaper uptake^[8,24]. The municipalities in developing countries have a major role in collecting waste generated by households to landfills or disposal sites. In developing countries, solid waste generation usually surpasses collection^[24,25]. Jerie and Mandever^[22] estimated that a hundred thousand people are in danger of death from sickness resulting from poor solid waste management. This is the case in areas where baby diaper uptake is high, especially when the disposal is not properly done.

The statistics in Zimbabwe show that solid waste, which amounts to 60%, is produced in cities and later dumped in open sites^[26,27]. Most households dispose of diapers with household waste, incinerate them, or dispose of them in landfills. Noxious waste like diapers in Harare, the capital of Zimbabwe, is scattered at the river banks, as is the case with the Mukuvisi River in Harare^[12,28]. This poses a threat to the environment, as waste accumulation will exceed the environmental ability to deal with this type of waste. In Zimbabwe, the environmental debate about disposable diapers should mainly focus on urban areas, as they consider them to be fashionable and give status to mothers^[12]. However, there is a need to understand the challenges associated with the disposal of diapers. Studies^[8,12,28] in this research domain focused more on large cities and towns with less consideration of small towns where people have gathered for some years. This motivated this study to focus on the ignored small towns of developing countries. This will contribute towards the attainment of Sustainable Development Goal 3 (SDG) on good health and well-being following the realisation of the environmental impacts of this type of waste.

Disposable baby diapers are posing a higher risk in Hwange town, specifically in areas where Zimbabwe Power Company (ZPC) workers reside, as compared to reusable cloth diapers. The diapers disposed of at dumpsites and open dumps are taking a lot of time to decompose, as many haven't decomposed yet. This is posing a greater risk in Hwange as they are potentially contaminating water sources and, in some instances, reported to be blocking sewer systems and storm drains, thereby leading to sewage bursts and flash floods or stagnant water in storm drains. The local board does not reach some areas for waste collection, and where they collect, the board lacks consistency in meeting the stipulated collection schedule. This makes solid waste, including these diapers, a problem in residential areas, as many baby caretakers end up disposing of these diapers in a way that is unfriendly to the environment, as evidenced by visible illegal dumps. The use of disposable baby diapers has been embraced by Hwange ZPC residential area mothers without considering the challenges to the environment. Against this background, this study seeks to assess the environmental challenges of disposable baby diapers in Hwange Urban, Zimbabwe.

2. Study area

The study was carried out in Hwange town, which is situated in the north-western side of Zimbabwe, about 336 km from the city of Bulawayo. Hwange is the provincial capital for Matabeleland North and is situated at approximately 18°22'0" South, 26°29'0" East (**Figure 1**). The usual yearly rainfall for

Hwange is 650 mm, with the summer rainy season spreading from November to March^[29]. Hwange town experiences a hot climate, with the hottest months being September to March, while May to August is considered the coolest. The daytime temperatures during summer are over 32 °C and in October, the hottest month, the temperature frequently peaks over 40 °C. In winter, daytime temperatures are around 26 °C but get colder at night with an average temperature of around 7 °C. The weather in Hwange has a negative impact on diapers disposed of in the environment, as diaper waste, when exposed to heat, reacts to produce methane gas, which contributes to earth's climate change. This gas has deleterious effects on human health and the environment, a factor that motivates the study to assess the impacts of diapers on the environment.

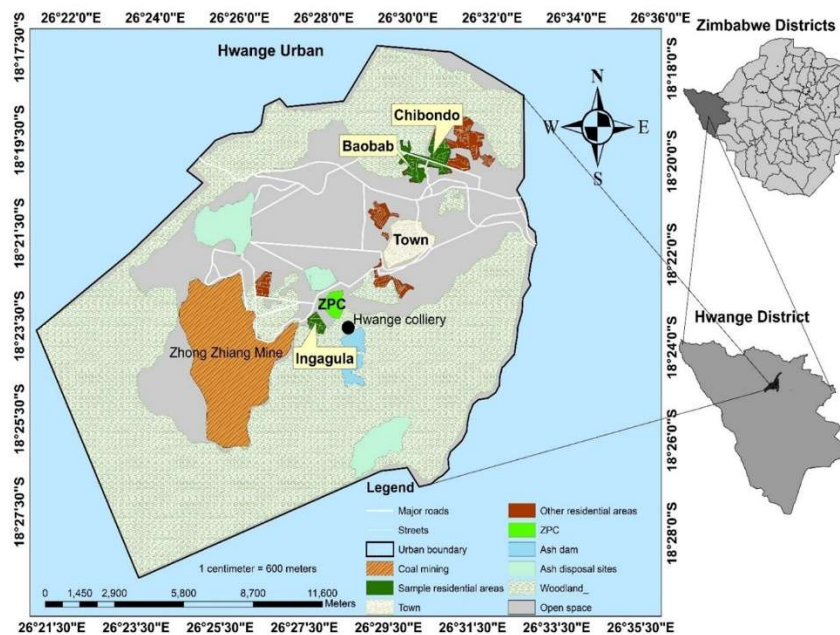


Figure 1. Location of studied areas in Hwange Town.

In terms of vegetation, Hwange is open savannah and mixed woodland; the main vegetation type is *Baikiaea plurijuga* and *Cholosperrum mopane*, with a mixture of both woodland and shrub land^[30]. There is scattered vegetation in the Baobab, Chibondo, and Ingangula areas, which has the potential to affect the sinking of gases that are produced by diapers once disposed into the environment, hence an increase of air contaminants in the atmosphere.

According to the World Population Review^[31], Hwange town had a population of 42,581. Just like any other urban area, Hwange's residential areas are clustered into high, medium, and low density. The high-density residential areas include Ingagula, Number 3, Number 4, and Cindrella, whereas the medium-density areas comprise Chibondo, Empumalanga, Bagdad, and Number 2 and Number 5, and the low-density areas are Baobab and Number 1. These residential areas accommodate employees classified according to their respective positions/levels of employment at work, hence ultimately also classified resultantly according to their income levels. This situation has an impact on the use and disposal of baby diapers, which presents several environmental challenges that are the focus of this research. The Zimbabwe Power Company has divided its workers into clusters of residential areas based on income level. Employees that reside in the Baobab area are managers, engineers, and forepersons who earn high income levels. Chibondo suburb accommodates middle-level income earners such as charge hands, artisans, and technicians. The Ingagula area is occupied by low-level income earners that include

assistants, operators, and security guards.

3. Materials and methods

A mixed-methods research design was used in this study since it allows a combination of quantitative and qualitative techniques of data collection so as to complement and expand research findings^[32]. In this research, quantitative research was used in quantifying the number of disposable diapers generated by households with children under five years in the three residential areas of Zimbabwe Power Company. The quantitative design focused on hypothesis testing through statistical testing and data analysis to establish the relationship between variables of disposable baby diaper quantities generated and income levels (low, medium, and high). Qualitative research is mainly investigative in nature and is used to acquire an appreciation of underlying causes, aims, and ideas^[33]. In this study, qualitative research was used in analysing the knowledge levels on waste disposal and management of disposable baby diapers of women with children under five years. Qualitative approaches used in this research include questionnaires, interviews, and field observations.

According to ZPC clinical records, there are 434 households with children under the age of five years in the three residential areas. Baobab, Chibondo, and Ingangula residential areas had 102, 137, and 195 households with children under 5 years. Cresswell^[34] suggests that at least 10%–30% of the target population can be sufficient to study and generalise the findings to the target population. To improve the representativeness of the sample, the researchers considered 49% of the target population, which is above the recommended minimum. This 49% was reached after a series of sample percentage increments to see a reasonable number of questionnaires that could provide significant responses. This translated to 50, 67, and 96 households in Baobab, Chibondo, and Ingagula residential areas, respectively, who constituted the sample (Table 1).

Sample size calculation formula:

$$49/100 \times \text{Number of households with children under 5 years}$$

Table 1. Sample size determination criteria.

Residential area	Number of households	Sample at 49%
Baobab Hill	102	50
Chibondo	137	67
Ingagula	195	96
Total	434	213

Since the information on households with children under the age of 5 was obtained from local clinics that serve these residential areas, the house numbers were also provided. These house numbers were put in a hat followed by random picking until the number of samples required in each residential area was adequate.

In order to quantify disposable baby diapers waste generated by households with children under five years, the researchers conducted a longitudinal survey. The survey was conducted on the sampled population from December 2020 to January 2021 for a period of 4 weeks. The researchers provided collecting plastic bags to each household with a child under the age of five to discard baby diapers they would have used. The subjects were oriented on the requirements of the process so as to avoid distorted results. The subjects were instructed to dispose all the diapers they used per day in smaller plastic bags into the collection bags. Each plastic collection bag had a sticker and label denoting the house number

and strata of income level. The researchers collected the diapers disposed in the plastic bags once per week in order to count the total number of diapers used per household and then ultimately transported the waste to the local board waste disposal facility.

In this research, a questionnaire which comprised of both open and closed-ended questions to obtain qualitative and quantitative data was used to gather data to address the objectives of the study. To address the first objective of the study, the questionnaire had a section with questions on the quantity of waste generated from disposable baby diapers waste. These included questions like, Do you dispose baby diapers? If yes, how many are used and disposed weekly? The questionnaire also had closed-ended questions, which enabled the households to provide quantitative data on household income generated. It also had a section to gather data on the knowledge levels on disposable baby diapers waste disposal and management of mothers of children under five years in Baobab, Chibondo, and Ingagula residential areas. The section had a set of questions such as What are the methods used to dispose diapers? In what ways are diapers proving to be a key solution to the problems faced by the community? The last section, which addressed objective number 3 of the study, had a set of questions on challenges associated with diaper waste disposal. This included questions such as What are the threats presented by diapers to the social and economic environment?

Key informant interviewees purposively selected included local councils, the Environmental Management Agency (EMA), and the Ministry of Health and Child Care Representative. These groups were targeted because they had qualitative information about the quantity and environmental challenges of diaper disposal, which was essential to address the study objectives. EMA officers provided information on the type of waste disposed at dumpsites and on the threats presented thereof. The local council representative provided essential information on refuse collection in the residential areas. The Ministry of Health and Child Care Representatives were interviewed since they had background knowledge on the potential health threats presented by disposal of baby diapers. This information was essential to address objective number 3. Interviews were guided by a check list that had been drafted prior to the baseline survey. Observations were also conducted so as to identify the type of waste disposed at dumping sites, thereby providing essential information to address the research objectives. Field visits in the Zimbabwe Power Company's three residential areas were done to assess how these residents dispose of such types of waste. The results gathered in this research were presented in pie charts, bar graphs, and tables using Microsoft Excel to draw conclusions which answer the problem under research. Prior to this research, ethical clearance was sought and granted by the Department of Geography and Environmental Studies at Midlands State University. Informed consent enabled the participants to choose whether or not to participate since the results were purely for academic purposes.

Qualitative data obtained through open-ended questions in questionnaires and semi-structured interviews was summarised in a descriptive and explanatory manner under defined sub-headings^[35]. Thematic analysis, which is a qualitative analytic method for identifying, analysing and reporting patterns (themes) within data^[36], guided the researchers in interpreting interviewees' accounts. The emerging themes from questionnaires' open-ended questions were grouped, quantified, and presented as descriptive statistics or in tables. Quantitative data were first coded and input to a Microsoft Excel spreadsheet before being fed into the Statistical Package for Social Sciences (SPSS) 23.0 version for statistical analysis. Quantitative data obtained from questionnaires was subjected to further statistical analysis. A parametric test called Pearson correlation was used to ascertain the strength of relationships between income earned and diapers disposed.

4. Results and discussion

4.1. Income levels of households

The researchers grouped households under the questionnaires according to their income levels, which are highest income, medium income, and low income. The results show that most of the households (45.71%) had high income, which was \$ZWL 33,000 and above, medium income ranging from \$ZWL 26,000–\$ZWL 32,000 (34.2%), and low income ranging from \$ZWL 18,000 to \$ZWL 25,000, as indicated by 20% (**Figure 2**). The researchers grouped the income using the Pay as You Earn tables.

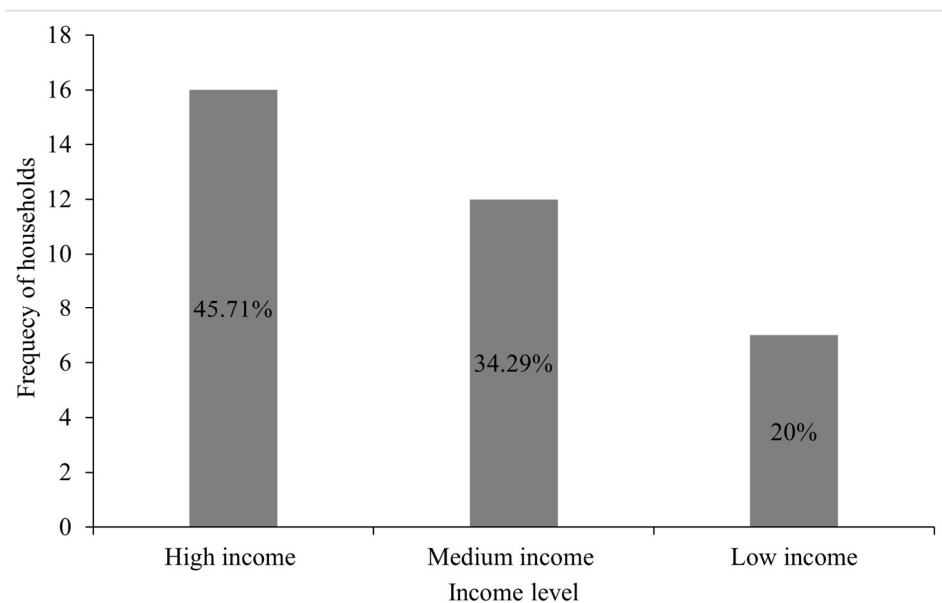


Figure 2. Income level of households.

From the results in **Figure 2**, the researchers noted that those who reside in Baobab, a low-density suburb, have the highest income levels compared to those in Chibondo and Ingagula. Ingagula, a high-density suburb, recorded the lowest income levels as the suburb is dominated by low-grade workers, including assistants. These findings concur with those of Jerie and Mandevere^[22], who observed that in urban areas income varies with residential type due to differences in employment and lifestyles. Since the scope of the study extended beyond descriptive statistics, it was imperative to infer the nature of the relationship between income and diapers disposed.

Results in **Table 2** show that most of the diapers (896) were disposed by households in the low-density suburb who earned ZWL\$ 33,000+, with the least being disposed by low-income earners falling in the bracket of ZWL\$ 18,000–25,000. The possible explanation to this could be the fact that households in low-density areas can afford to buy diapers for their children compared to their counterparts in high- and medium-density areas due to limited capacity.

Table 2. Income range and quantity of diapers disposed.

Income range	Quantity of diapers
ZWL\$ 18,000–25,000	239
ZWL\$ 26,000–32,000	542
ZWL\$ 33,000+	896

Source: Field Survey (2021).

However, it was imperative to determine the strength of the relationship between income earned and the number of diapers disposed by households. The goodness of a parametric test called Pearson was used to test the strength. In this case, a P -value of 0.725 implies that there is a strong positive correlation. This has been interpreted to mean that the number of diapers disposed varies with income earned in the three residential areas of Hwange. This finding concurs with that of Wambui et al.^[37], who in a separate study observed that the number of diapers disposed tends to increase in relation to the amount earned by a household head. The major reason why people earning a high income use more diapers is that they are comfortable with children, and they are good in situations where water is scarce.

4.2. Quantity of diapers used by households in respective residential areas

The people in the low-density suburb of Baobab (896) have proved to generate the highest quantities of disposable baby diapers compared to those in the medium- and high-density residential areas with 542 and 239, respectively (**Figure 3**). These people in Baobab have high income levels, hence use large quantities of diapers; some even ignore potty training their children up to the age of five years.

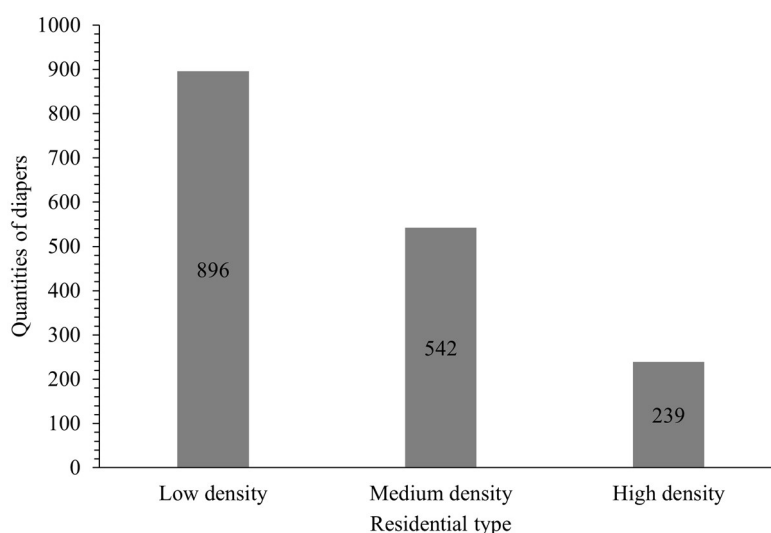


Figure 3. Diapers produced by location.

The researchers observed that the use of disposable diapers may be influenced by where an individual resides. From the data collected, most people who stayed in low-density (Baobab) areas were the ones who used the highest numbers of disposable diapers. During an interview, the Ministry of Health and Child Care representative remarked that more diapers are disposed in the low-density area, as households in high-density areas describe the use of disposable diapers as a luxury. The people in the Chibondo area are the ones under medium density since they are the ones also having a medium income level. They are still trying to move from washable nappies to the use of disposable diapers, while those in Ingagula are still using traditional cloth diapers. The Huggies brand, which is rated as the most expensive diapers, was mostly found in Baobab, while in Chibondo and Ingagula, most diapers that were seen were the Panda and Master diapers, which are cheaper and of poor quality.

Results show that households with high income levels in the low density use more diapers. Thus, there is a positive relationship between income level and quantities of diapers produced. The major reason why people earning a high income use more diapers is that they are comfortable with children, and they are good in situations where water is scarce^[37]. In Hwange, these three residential areas are subject to water rationing where water supply is not continuous, as some days water does not run from the taps.

The result is in sync with those made by Jerie and Mandevere^[22], in which they found that the amount of waste disposal goes with location, that is, areas where high-income earners stay have a high rate of waste disposal. Their line of argument was that disposable diapers are more accessible to high-income earners.

4.3. Knowledge levels of households on diaper waste disposal and management

Results in **Figure 4** show that the majority of households (38%) in Hwange dispose diapers in open dumps. Disposable diapers are predisposed after being used. They explained that most diapers are dumped at open pits as the local authority is reluctant to collect refuse. When local authorities fail to collect refuse, households are left with no option except to dispose diapers at illegal dumpsites. About 24% of the households resorted to burning the used diapers, although it presents environmental challenges that they are not aware of. Composting, biogas production with garbage, and others had 15%, 7%, 10%, and 6%, respectively (**Figure 4**). Chikwana^[11] opined that in Zimbabwe, diapers are disposed at illegal dumpsites. The inconsistency and unavailability of resources give problems to nursing mothers on how and where to dispose spoiled diapers. Studies by Mathe^[38] in Gwanda Urban and Schenck et al.^[39] in Samora Machel Township, South Africa, revealed that the commonly used method for spoiled diaper disposal is open dumping, a situation also observed in this study. This was evidenced by an increase in littering in the nearby bushes as spoiled diapers were seen everywhere around the bush. During an interview, the local council representative highlighted that the Hwange local board's infrastructure has limited capacity for handling spoiled diapers. Usually, people in areas where the collection of waste is poor tend to use plastic bags for waste storage, which later are dumped at night. These wastes usually include spoiled diapers.

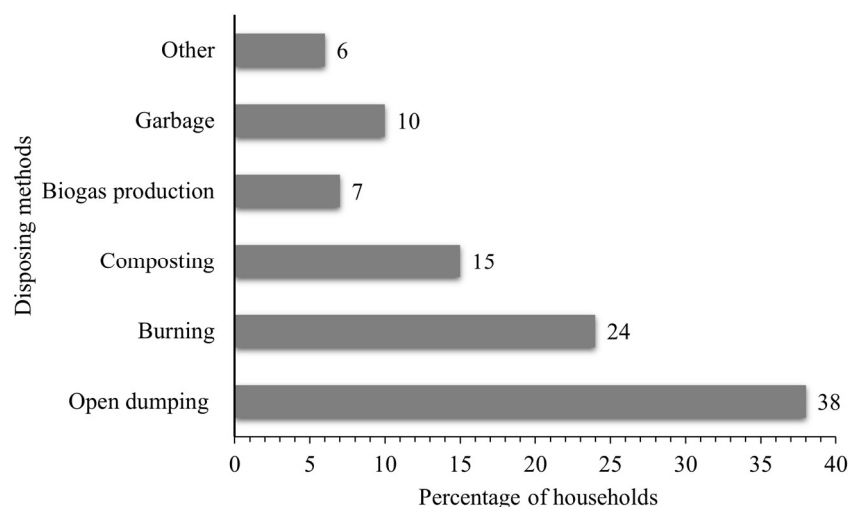


Figure 4. Methods used for disposing diapers.

4.4. Reasons for using disposable diapers

People have different reasons why they have moved from the traditional cloth nappies to disposable diapers. Long ago, nursing mothers used to make use of cloth nappies as diapers were scarce, and some mothers were not aware of their existence. The coming up of disposable diapers has made people shift from the old nappies.

The benefits of using disposable diapers have driven away the traditional cloth diapers from the market. The disposable diapers come with greater advantages according to households, including being less labour intensive (there is no time needed in washing), easy to dispose like when travelling one can just throw it into pit bins, easy to use, and environmentally friendly (**Figure 5**). Results in **Figure 5** show

that the majority of the households (30%) use diapers because they are easy to dispose, followed by 25% who highlighted that it is environmentally friendly. Other proportions are: 20%, 19%, and 6% that are easy to use, affordability, and others, respectively. During interviews, the EMA Officer remarked that some of the households use diapers because they are cheap since they are sold for \$1 a pack of ten, and also because they can be sold according to quality, like Huggies, Master Diapers, Panda, and so on, thus making many people able to buy them. This was complimented by the shortage of water in the area to wash traditional cloth diapers, hence the reason to substitute with diapers that don't need to be washed. The study findings revealed that the use of disposable baby diapers is becoming popular as most baby care givers now use disposable baby diapers. A study carried out by Remigios^[12], in Senga suburb in Gweru City showed that most women and housewives use disposable diapers as they are convenient to them because they are easy to dispose and save them on time of washing. If a diaper is spoiled, one simply removes it from the baby and dispose it off without washing.

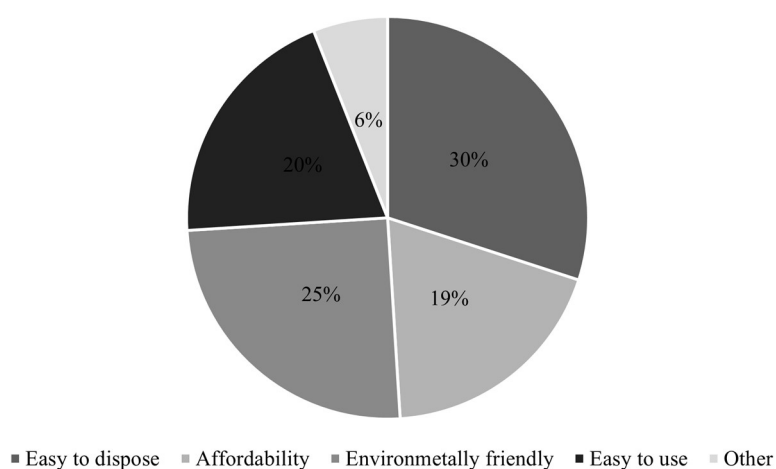


Figure 5. Reasons for using disposable diapers.

4.5. Environmental challenges posed by poor disposal of diaper waste

Households pointed out several challenges associated with the disposal of baby diapers. Most of the households (80%) highlighted that pollution is a serious environmental challenge, with 30% also pointing out that diaper disposal results in disease outbreaks as dogs carry them from illegal dumpsites to homes (**Figure 6**). Households explained that diapers pose a major environmental eye sore as they are spread everywhere, which distorts the aesthetic value of the environment. During an interview, the EMA Officer highlighted that during the rainy season, diapers are a threat as they are sometimes washed away into riverine ecosystems, a situation that puts the communities at risk. This finding tally with that of Remigios^[12], who observed the same situation in Senga and Nehosho residential suburbs in Gweru Urban.

Indiscriminate dumping of disposable diapers may cause so many environmental challenges, such as odours and breeding of flies, as highlighted by 16% and 11% of the households, respectively (**Figure 6**). Households pointed out that disposal of diapers results in the creation of bad odours which also have health implications for the surrounding environment. Flies have also resulted in diseases in the form of cholera, diarrhea, and dysentery, which puts the community at risk. Solid waste management in developing countries includes open dumping and burning of waste, which cause air, water, and land pollution^[28,40]. Soiled diapers, if thrown together with untreated feces and urine, leach, causing contamination of underground water. In the study carried out by Jerie and Mandever^[22] odours were

reported as one of the major impacts of improper waste disposal. Research has proved that decaying diapers are a major source of methane, a gas that is highly explosive and dangerous to the environment.

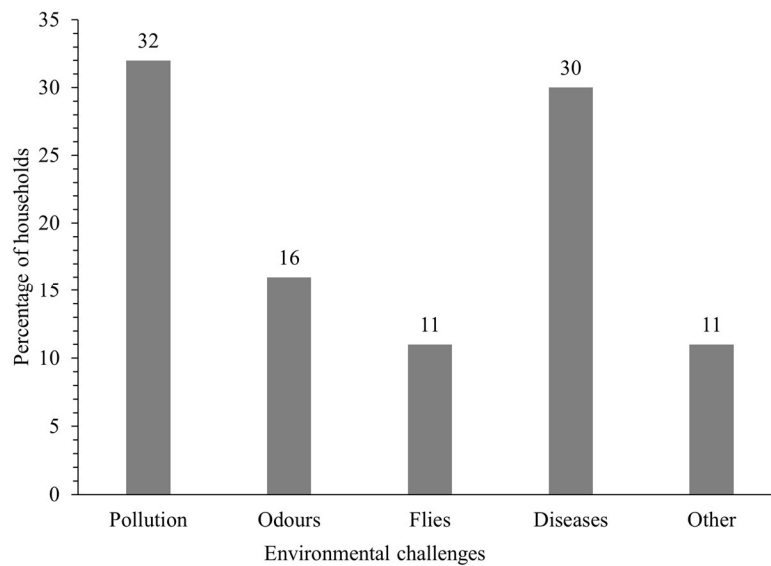


Figure 6. Environmental challenges of poor diaper disposal.

5. Conclusion and recommendations

The study assessed the environmental challenges of disposable baby diapers in Hwange ZPC residential areas. Results show that poor diaper waste management is mainly responsible for pollution, diseases, and odours. The various forms of pollution that result from these diapers are water, land, and air pollution. However, the increased use of these diapers in the area results in the open dumping of diapers along the roadsides and in backyards, which results in diseases and unpleasant odours that threaten the attainment of SDG 3 on good health and well-being. If no meaningful measures are explored, the level of environmental pollution attributed to diaper disposal is likely to remain high. Therefore, to ensure sustainable environmental management, there should be the planned implementation of appropriate measures to manage diaper disposal. In this study, the researchers found out that the majority of households use open dumping as their waste disposal method. This implies that, generally, waste management in Zimbabwe's urban areas is poor due to a lack of knowledge. Most residents are ignorant of the proper methods of diaper disposal; hence, they end up polluting the environment with these diapers.

The findings further show that most people use disposable diapers because they are easy to dispose of. This explains why people in Zimbabwe prefer disposable diapers because they do not pose a hustle when it comes to disposing of them, unlike washable nappies that cannot be thrown away. This is against the background that some alternatives require hand or machine washing, and this may be expensive and time-consuming. The study emphasizes that the government, through relevant authorities, should introduce Pay-as-you-throw Policies that require consumers to pay for the volume of garbage that they produce and a zero or minimal fee for reprocessing. The aim is to offer financial motivation for reprocessing while decreasing waste. The manufacturing sector should also practice extended producer responsibility, which ensures that manufacturers are responsible for the safe disposal and recycling of their products post-consumption. This will therefore contribute towards the attainment of the United Nations Sustainable Development Goals. The government must develop and implement suitable actions so that competent authorities can receive all necessary information to guarantee that waste dumping or

recovery is realised in the most cost-effective and sensible manner with regard to environmental protection. Such actions must also apply to accepted disposal companies, as they concern waste for which they take disposal accountability on behalf of third parties.

Author contributions

Conceptualization, KM (Kudakwashe Muringaniza) and KM (Karren Madhara); methodology, OM; software, OM; validation, TM, KM (Kudakwashe Muringaniza) and OM; formal analysis, KM (Kudakwashe Muringaniza), KM (Karren Madhara), OM and TM; investigation, KM (Kudakwashe Muringaniza); resources, KM (Kudakwashe Muringaniza); data curation, TM and OM; writing—original draft preparation, KM, OM and TM; writing—review and editing, KM and OM; visualization, KM (Kudakwashe Muringaniza) and KM (Karren Madhara); supervision, KM (Kudakwashe Muringaniza); project administration, KM (Kudakwashe Muringaniza). All authors have read and agreed to the published version of the manuscript.

Conflict of interest

The authors declare no conflict of interest.

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Appendix A

Household questionnaire

Kudakwashe Muringaniza, Karen Madhara, Tatenda Musasa, Oshneck Mupepi are academic researchers from the Department of Geography and Environmental Studies at Midlands State University carrying out a study on “Environmental challenges associated with disposal of baby diapers in Hwange town, Zimbabwe”. The information collected is for academic purposes hence your name will not be published in any way. The researchers are kindly asking for your cooperation in answering the following questions. Please answer the following questions by putting a tick in the box.			
Section A: Demographic data			
1.1 Gender			
Female	☐	Male	☐
1.2 Age			
>20 years	☐	21–30 years	☐
31–40 years	☐	<41 years	☐
1.3 Marital status			
Married	☐	Single	☐
Divorced	☐	Widowed	☐
1.4 Educational qualifications			
Primary	☐	Secondary	☐
Diploma	☐	Degree	☐
1.5 Occupation			
1.6 Income range			
ZWL\$ 180,000–25,000	☐	ZWL\$ 260,000–32,000	☐
ZWL\$ 33,000+	☐		☐
Section B: Knowledge on diaper waste disposal and management			
2.1 Do you have knowledge on how to dispose used diapers?			
Yes	☐	No	☐
2.2 Rank the disposal methods of baby diaper waste in order of priority or best approach?			
i).....			
ii).....			
iii).....			
iv).....			
v).....			
2.3 Which method of disposal do you think is the best for baby diapers?			
Open dumping	☐	Burning	☐
Latrines	☐	With garbage	☐
Composting	☐	Biogas production	☐
Other	☐		
If Other; specify			
2.4 How do you dispose of spoiled baby diapers?			
2.5 Why do you use that method for baby diaper waste disposal?			
2.6 What do you do before dispose baby diapers any treatment or separation in your house?			
2.7 What do you think are the reasons for disposing baby diapers?			
They cannot be recycled	☐	They are environmentally friendly	☐
They are biodegradable	☐	There is lot of space	☐
2.8 Disposable baby diapers eventually disappear if thrown in the street?			
True	☐	False	☐
2.9 The best way to dispose of diapers in to burn them?			

Agree	☐	Disagree	☐
2.10 Do you know any legislation for waste management?			
Yes	☐	No	☐
2.11 How do you rate the effectiveness of legislation on baby diaper waste?			
Very effective	☐	Effective	☐
Ineffective	☐	Not sure	☐
Section C: Quantities of diapers generated			
3.1 Do you have any baby/babies using diapers currently?			
Yes	☐	No	☐
3.2 How old is the baby?			
0–6 months	☐	6–12months	☐
1–2years	☐	3–5 years	☐
3.3 How many diapers on average do you use per day?			
1–5	☐	6–10	☐
11–15	☐		
Section D: Environmental challenges of diapers			
4.1 How often is waste collected in your area?			
Twice per week	☐	Once per week	☐
I'm not sure	☐	Never collected	☐
4.2 Do you have bins to dispose used diapers			
Yes	☐	No	☐
4.3 Does the Hwange local board involve you in meetings or activities to clean the environment?			
Yes	☐	No	☐
4.4 What are the environmental challenges associated with these baby diapers?			
Odours	☐	Flies	☐
Rodents	☐	Diseases	☐
Pollution	☐	Others	☐
If Other; specify			
4.5 Are there rodents, mosquitoes, flies etc. on dumps where disposable diapers are thrown?			
Yes	☐	No	☐
4.6 Are there any illegal solid waste dumps in open areas in the residential area?			
Yes	☐	No	☐
4.7 On average what distance would one travel before coming across a waste dump.			
>500 m	☐	<500 m	☐
<1000 m	☐	<5000 m	☐
4.8 Do the dumps contain pampers?			
Yes	☐	No	☐
4.9 Are the diapers soiled with excreta?			
Yes	☐	No	☐
Thank you for your cooperation			

Appendix B

Observational checklist

House number.....Coordinates:
X.....Y.....

Question	Yes	No	Remarks
Are refuse bins present on houses?			
Is there any illegal dumping of disposable baby diapers ?			
Are they mixed with other types of wastes at disposal?			
Is there separation of disposable diapers from other wastes at sources?			
Are disposable baby diapers waste piled at the backyard of the houses?			
Is there any presence of vectors/rodents?			
Is there any composting of these wastes?			
