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The Danger of Mismanaging Disposable Baby Diapers in Residential Environments: A Case Study of Dukuduku Area

Mbokazi Msawenkosi Sandile[1], Lazarus Donald Mokula Lebeloane[2]
College of Education, Department of Science & Technology[1,2]
University of South Africa[1,2] , Preller Street, Muckleuk Ridge, Pretoria, 0001
Correspondence email: msmbokazi@gmail.com

Abstract: This study discusses the danger of mismanaging disposable baby diapers (hereinafter referred to as diapers) in residential environments. The random disposal of soiled baby diapers harbours communicable diseases such as diarrhoea and typhoid which may cause the death of many young children. Disposable baby diapers are often found carelessly thrown away in many residential areas. Some components of diapers include toxic chemicals which are dangerous because they may kill micro-organisms, plants and animals which consume them. Some also clog the soil causing water loss through run-off, floods and destruction in gardens and fields. The purpose of this study is to raise awareness about the hazards associated with the careless disposal of used diapers. It also seeks to understand how individuals dispose of used diapers in rural villages. A qualitative research design was embraced. Data was gathered through observation and interviews with nappy users (mothers and nannies). The results show that rural villages lack designated disposal areas where people may dispose of their used diapers, so they discard them away whenever it is most convenient for them. The report recommends that the national government develop policies that encourage the manufacture of recyclable, non-toxic and/ or biodegradable diapers. It further recommends that local municipalities could use by-laws to enforce and monitor manufacturing compliance.

Keywords: Disposable baby diaper, health risk, environmental hazard, water contamination

JEL Codes: H51, H52, H53, H75

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1. Introduction

The use and management of disposable baby diapers (hereinafter referred to as diapers) is time immemorial globally. It has taken different forms depending on the people and their cultures [1], [2]. Most caregivers and parents globally use diapers for babies because of their convenience. According to Unsustainable Magazine [2], about four million babies are born annually in the United States of America (USA). Each uses about 2500 diapers in their first year. That means Americans dispose of around a trillion diapers annually from babies under one year-old. There were over four million tons of used diapers with about 80% thereof disposed of in the USA landfills in 2017 [2]. According to Felter's study [3] they reported

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that almost 21 billion diapers were consumed annually in the European Union. According to the Green Building Council South Africa [4] the impact of disposing of diapers on the environment is devastating. About 3.5 billion were registered in landfills in 2018.

There are different types of diapers, namely, biodegradable, and non-biodegradable diapers. The former is made from plant material and is more expensive. The latter is made of synthetic materials and is cheaper. Chemicals like dioxin, a carcinogenic chemical and hazardous by-product of the bleaching process for paper, toxic chemicals related to cancer in leak-proof polymers, highly absorbent polymers, and certain scented chemicals are among them [2]. That means it poses several potential dangers including environmental pollution. They spread bacteria to the environment. However, most caregivers and parents use and dispose of them without considering the danger to the environment. Research on the environmental impact of disposable diapers in urban areas is plentiful, yet minimal attention has been given to rural areas. It is important to note that mothers in rural regions also frequently rely on disposable diapers for their children. The convenience and accessibility of disposable diapers have led to their widespread use across diverse settings including rural communities.

This article explored the risks associated with improper nappy management in South African rural household communities. A qualitative research method was used. Data was collected, analysed, and interpreted. Findings and recommendations were made.

2. Literature Review

Mismanaging diapers leads to environmental pollution. The latter is introducing harmful pollutants which may be either in the air (gaseous), water (liquid), or on land (solid) - into the environment and directly pose a threat to people's health and other living organisms [5], [6]. They contribute significantly to worldwide environmental pollution [7], [8].

South Africa has been characterised by forever increased waste generation and mismanagement. It's exacerbated by uncontrolled population increase ([9]. Reference [10] asserts that people dump solid waste on open land and in landfill sites. Villagers don't have landfill sites as a result dump waste anywhere they find space. Most urban residents have well-organised landfill sites for dumping waste. However, the inconsistent collection of waste by municipality officials, the high human population and filled landfills lead to dumping waste including diapers illegally on open sites (own observation).

Although diapers keep babies dry and comfortable, they're also convenient for employed parents and those villagers where water is scarce, they (disposable baby diapers) pose a threat to the environment where they are disposed of. This is despite environmental impacting factors e.g., getting raw materials like electricity, water, pulp, cotton, plastics, production steps, harmful chemicals releasing sodium polyacrylate, chlorine, PCDDs, and TBT into the air, finishing and disposal procedure [11].

Several studies reported that diapers are trash and harmful if they're not properly managed [12], [13]. They contaminate land, water and food production chains. Most diapers that are made of plastic, super-

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absorbance gel and other components are found at landfills and biodegrade years after exposure to air and sunlight. The same happens to those labelled "eco-friendly" and "biodegradable" [12].

Throwing used diapers in landfills without firstly clearing waste into toilets is another environmental problem. According to Ali's [14] study a baby may use between 5000 to 7500 diapers during the baby's nappy-wearing period. They observed that none of the used diapers had decomposed in landfills after some time. They estimated a diaper could take up to 500 years to decompose. That makes it important for parents to throw their baby's faeces down the toilet before they dispose of disposable baby diapers. Reference [14] asserts that faeces diapers contain harmful viruses and microbes which can pollute water by diffusing into rivers, dams and even groundwater. As carriers of pathogens and parasites, excrement is a breeding ground for different viruses, including Hepatitis B and polio. Unattended and exposed diapers attract flies, rats, and other animals that spread diseases and cause intestinal illnesses like gastroenteritis, Escherichia coli, and worms [16], [17]. Added to that could be the spread of communicable diseases e.g., campylobacteriosis, typhoid fever, hepatitis E, cryptosporidiosis, and schistosomiasis when disposed of in landfills [15], [16], [17]. That is why diaper packages have printed instructions for caregivers and parents to rinse diapers and flush the faecal material down the toilet before they put it into the trash. Those instructions seem to be rarely followed (my observation).

Almost one million babies are born annually in South Africa [18]. Each uses approximately 1000 kg of diapers annually. Therefore, in 2 years, each baby would have used more than 2000 kg. This leads to considering the quantity, space, and weight of used diapers produced by one million babies annually, in a decade and more [2]. Most urban residents dispose of diapers in designated areas and villagers use open fields which may be dry swampy or even wet. Some diapers are dumped at the dams, riverbanks, etc. and pollute communal water source(s). That causes major health risks to communities which do not have municipality-provided piped water and rely on dams, groundwater, rivers, and streams, for supply [2].

Chlorofluorocarbons that destroy the ozone layer are generated when diapers are disposed of in landfills. By absorbing solar radiation and keeping it from reaching the surface, ozone acts as the earth's shield. It absorbs ultraviolet (UV) radiation, which has been connected to skin cancer, and cataracts, and can be harmful to various crops and marine life [19]. Another problem with disposing of diapers in landfills is that they decompose slowly and release methane into the air. The latter is a greenhouse gas that replaces oxygen and which, from billions of disposed diapers, add to global warming. The disposal of diapers in landfills slowly threatens the ozone layer [19], [20]. Having reviewed the literature on diapers and their impact on the environment if mismanaged, hereunder is a description of the research materials and methods employed in this article.

3. Materials and Methods

3.1. Time and research site

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The study was conducted from 25 November 2023 to 26 January 2024 at Dukuduku Village in the St Lucia area, under Inkosi Mtubatuba Municipality in KwaZulu-Natal. The St Lucia region is a worldwide-known region rich in agriculture and industrial forestry on KwaZulu-Natal's east coast. It is also one of the primary access points to the iSimangaliso Wetland Park, South Africa's first World Heritage Site [21]. The word "iSimangaliso" means a 'place of Miracle and Wonder'. Isimangaliso Wetland Park is a huge, protected area with Lake St. Lucia as its centrepiece and an homage to hippos, crocodiles, pelicans, and flamingos. There are also antelopes, baboons, elephants, giraffes, and leopards in the park's grasslands and forests. To the north is Sodwana Bay which has colourful coral reefs [22]. Dukuduku Village is characterised by socio-economic factors such as high unemployment rate, poverty and lowest levels of literacy [23].

3.2. Time and research site

A sample of ten mothers, ten nannies and six female teachers from six different daycare centres was randomly and purposefully selected from a section of the population of Dukuduku Village. Although the population of Dukuduku is high, a sample of twenty-six participants was regarded as reasonable for the qualitative study. Participants were selected based on their being mothers of between thirty-five and forty-five years old. All mothers, nannies and day-care teachers confirmed they had more than one baby. They had knowledge and experience of using disposable baby diapers until their children stopped using them. Ten Nannies had practised in that space for more than five years. Day-care teachers did not have a formal qualification in Early Childhood Education but had practised as teachers for more than five years. All participants were assembled with the expectation that they would provide thorough and varied information about their knowledge and experiences [24].

3.3. Data collection procedure

A qualitative research methodology was used for gathering data. An interview schedule was used. Ten mothers who used diapers for their babies volunteered to be interviewed to gather data. Ten nannies and six daycare centre teachers who respectively use diapers for the babies they take care of also agreed to be interviewed. The open-ended interviews focused on eliciting narrative data that allowed researchers to explore respondents' views [25]. Participants were probed to elaborate wherever necessary. All interviews were conducted in the local language, IsiZulu, where, and at whatever time suited respondents. Interviews were audio-recorded, transcribed verbatim and translated into English by someone other than the interviewers. The authors sought permission to audio record the proceedings of the interviews and it was granted. An unobtrusive observation in the form of physical trace analysis was conducted. Observations enabled researchers to describe respondents and sites using four senses namely, feeling, sight, smell, and touch. Diapers that had been used were gathered along the rivers and in open areas, as shown in Figure 2. The municipality was then contacted to assist with picking up and transporting these collected diapers to landfill sites used in urban areas. Field notes were taken from participants' setting, purpose, social

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behaviour, the frequency and duration of phenomena as well as taking pictures of the site for data analysis, interpretation, and discussion.

3.4. Data analysis, interpretation, and discussion

Because the study is qualitative, data were analysed, interpreted, and discussed through Colaizzi's [26] seven-step descriptive phenomenological method of data analysis and interpretation [26]. They include reading and familiarising oneself with the content. Significant statements are then extracted from the data. Meaning is given to those statements. Themes are created from that meaning. Created themes are categorised to facilitate logical information. It is then integrated into a comprehensive description of the phenomenon. Lastly, the researcher verifies the provided data with respondents to ensure that the interpretation aligns with their lived experiences. In contextualising these steps, the researchers first, read all respondents' gathered data to familiarise themselves with it. They remained objective as they identified and gave meaning to all relevant phenomena that arose. All themes regarded as important and relevant were identified and clustered and then meaning was given to them. All themes were used to analyse and interpret data [26], [27]. Some respondents were quoted verbatim to avoid influencing them. Researchers then briefly recorded every statement to capture its essence. Relevant sources were referred to wherever there was a need. Lastly, researchers reviewed all data to ensure and justify reliability and validity [26].

4. Results and Discussion

When participants were asked which baby napkin, they preferred the most, the disposable one or the cloth napkin? Most participants were in favour of disposable diapers the reason being that they are convenient and only need to be used once before being thrown away. It is time and energy-saving and cheaper, compared to reusable cloth napkins which are time-consuming and expensive. They claimed that washing involves the use of water, washing powder and electricity and one has to spend a lot of time washing and waiting for it to dry. It was revealed that the number of disposable diapers used for each baby a day depends on the age and feeding. Young babies use an average of eight to ten disposable diapers each day, since, they are fed mostly liquids. Whereas older babies use an average of four to six diapers per day as they are fed much of solid foods [28]' Based on Colaizzi's [26] method of data analysis and interpretation, it emerged that used diapers were disposed of in different ways. Some participants discarded diapers in open fields and created enormous trash (Parker, 2021). Improper disposition of used diapers ends up littering public spaces like parks, beaches and streets. The sight of these discarded diapers, Figures 1 and 2, not only creates an eyesore but also poses health risks to humans and wildlife [17]. Figure 1 depicts soiled diapers indiscriminately thrown away or dumped openly on various points such as bushes, roadsides and river banks [5]. Some seemed to have been recently thrown (figure 1) while others looked as having been lying there for years, figure 2.

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Following is a picture of recently disposed diapers.

Fig. 1: Picture of freshly disposed diapers taken by authors

Following is a picture of diapers disposed of over a long period, collected and waiting for collection.

Fig. 2: Picture of gathered diapers taken by authors waiting for collection

The aesthetics of natural environments are marred by the presence of these non-biodegradable items, leading to a degraded visual experience for visitors and residents alike. One respondent said: "They look like wildflowers wherever you find them". When participants were asked why they discard soiled diapers on open fields. The reason given was that there were no designated areas (landfills) for dumping soiled diapers. There is no proper plan for solid waste management at Dukuduku Village. Farm animals such as chickens, dogs, pigs, birds, and other vermin delve over discarded soiled diapers on land and open waste

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piles in search of food [29]. Thereby harbouring harmful pathogens which cause diseases. The most puzzling effect of disposable diapers on the environment may be the formation of solid garbage, of which they are said to be the third largest individual component in municipal solid waste, behind only bottles and newspapers, which make up 1.5% and 4% of the total ([30], [31]

Since solid waste is not collected, some have resolved by burying down soiled disposable diapers in their home yards or open grounds. Some participants stated that they requested their husbands to excavate trenches to bury soiled disposable diapers. "My husband helps me by digging a pit for putting diapers". In the day-care centre, we dug some soiled diapers which were buried three to five years ago, they were still not decomposed. Disposable diapers take hundreds of years to break down, which means that the diapers that you wore as a baby are likely still intact, sitting where it was disposed of [2], [5]. This indicates that diapers are not easily decomposed in the soil amid some manufacturers who claim that their diapers are biodegradable. The study discovered that claims about a product's biodegradability or composability are fabricated to entice consumers and provide the impression that it is distinct from competing products; as a result, these claims are blatantly false [32]. Disposable diapers can be buried or dumped carelessly, but this has the unintended consequence of combining with groundwater and contaminating drinking water with bacteria, viruses, protozoa, and helminths ([17] putting the health of the public at risk. This is even though it is less obvious to locals. Human beings acquire infections from contaminated food and water. Many of these infections are enteric, meaning they can contaminate food and water. Some of these infections are transferrable from humans to animals and vice versa. Sequentially, these harmful bacteria, protozoa, helminths, and viruses propagate infectious diseases like cholera, giardiasis, amoebiasis, and typhoid. Buried diapers may block the soil pores, water-logging the soil and causing water loss through run-off, floods and destruction in gardens and fields [33]. Water runoff and floods wipe out organic matter, nutrients, sediments, and pesticides in rivers and lakes where they harm natural aquatic species. Some diapers were also found disposed of on the banks of the river contaminating water posing a threat to aquatic life and potentially impacting human health when drinking such contaminated water [34].

Other informants told us that they burn soiled disposable diapers, although they (soiled disposable diapers) burn with difficulty. "I burn soiled disposable diapers even though they do not burn completely." We also observed incomplete burnt soiled diapers. Disposable diapers are extremely difficult to burn because of their jelly-like material and wet state from being soiled with pee and excrement [35]. Burning soiled disposable diapers also creates enormous air pollution. The remnants of burnt disposable soiled diapers also pose a problem since they cannot be decomposed and create unattractive environments. Instead burning of soiled plastic diapers emits dioxins, and toxic fumes that pose health hazards to humans, animals and the environment as such [32].

5. Conclusion and Recommendations

In conclusion, the problem of discarded used diapers on the environment goes beyond just being an eyesore, it has lasting consequences for the aesthetic quality of our environment, and human and animal health. By taking steps to reduce diaper waste and encouraging sustainable diaper choices, we can help

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preserve the beauty of our environment for future generations. Participants showed a vast knowledge about the benefits of using baby disposable diapers and very little is known about the dangers of disposing baby diapers indiscriminately on the environment. Awareness of the dangers posed by improper disposal of soiled baby diapers is crucial and must be prioritized. Encourage mothers, fathers and nannies to consider environmentally friendly alternatives such as compostable diapers or reusable cloth diapers and educate them on how they differ. It is recommended that the national government develop regulations forcing nappy manufacturers to produce recyclable, non-toxic, or biodegradable materials. Indiscriminate nappy disposal is a global health concern that has to be addressed immediately since it affects the health of people, animals, plants and ecosystems. Therefore, local municipalities need to designate areas to dispose of used diapers in rural areas. Local municipalities could craft by-laws to enforce compliance and monitor the manufacturing and disposal of recyclable diapers. The government could also purchase used disposable diapers as a way of encouraging recycling of disposable diapers.

Clinics should play a vital role in educating mothers about the harmful effects of disposable diapers on both babies and the environment. These educational sessions can cover a wide range of topics such as the chemicals found in disposable diapers, their long-term impact on a baby's health, and the environmental consequences of their disposal. Additionally, clinics can also provide information on more sustainable diaper options, such as cloth diapers or biodegradable alternatives, and offer tips on how to effectively use and clean them. By empowering mothers with this knowledge, clinics can help promote healthier choices for babies and the planet, creating a more sustainable future for all.

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