ORIGINAL ARTICLE

Path Analysis : Child Feces and Diaper Disposal Management Comparation Study (Urban and Rural) in Surabaya and Sekadau Regency Indonesia

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ABSTRACT

Introduction: A study in 2021 showed that 91.5% of disposed diapers in urban areas (Surabaya) were picked up by waste collectors (with or without separation). In rural areas (Sekadau Regency), 61% were buried, burned, or composted (others did not use diapers). **Materials and methods:** This was a cross-sectional observational study utilizing a validated 44-questionnaire on knowledge, perceived seriousness, susceptibility, benefits, barriers, and cues to action. A total of 508 caregivers of children aged 0–3 years were sampled from Sekadau Regency (rural) and Surabaya (urban). Statistical analysis was performed using IBM SPSS 26 and SPSS AMOES 26 for path analysis. Demographic and behavioral factors were analyzed using descriptive statistics, bivariate analysis, and multivariate path modeling. **Results:** Findings showed significant differences between urban and rural respondents regarding feces and diaper disposal ($p < 0.05$). Rural caregivers had fewer proper latrines and lower knowledge levels compared to their urban counterparts. Perceived seriousness, susceptibility, benefits, and barriers influenced disposal behavior, with barriers having the strongest impact (standardized path analysis = 0.389). Demographic factors like gender and occupation were closely linked to perception variables, while age and urban-rural status had weaker associations. Path analysis indicated that demographic variables affected disposal behavior both directly and indirectly through HBM constructs. **Conclusion:** Perception will encourage certain child feces disposal behavior. Due to this, appropriate education and policies that focus on child feces disposal are necessary to improve health status.
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INTRODUCTION

Sewerage practices are a challenge for most countries in the world. Disposable diaper usage in children is a common practice in both developed and developing countries. Most of the time, child feces are contained using disposable diapers which are thrown out into open places such as rivers and sewers after a single use (1). In developing countries, disposable diaper usage is categorized as open defecation (2). In urban areas, disposable diapers are a shortcut for mothers to contain their children's feces (3). Diaper waste makes up 1.7% of solid urban waste, which has no special treatment other than being discarded in landfills (4) . Mothers in urban areas prefer to use disposable diapers instead of traditional diapers. Inconvenience in washing diapers is one of the reasons they use disposable diapers (5) . Another reason is that mothers are not aware of disposable diapers' environmental impact in rural areas, 70% (6).

Safe child feces disposal is an important component of children's health as it can keep children away from potential pathogens and parasites that cause diarrhea (7). Unsafe child feces practices can also pollute the household and other environments, thus causing adverse health impacts (8). The Challenges for safe

disposal includes the lack of latrines availability, time, the perception that child feces are not dangerous, and ignorance of where to dispose of child feces (9). Meanwhile, Safe disposal can be done by throwing feces into the a latrine or burying it in the ground (10) .

Indonesia is still facing problems related to the disposal of feces and diapers. In 2012, only half (52%) of households indicated that the feces of their youngest kid under the age of three were safely disposed. Even among households with greater cleanliness, 38% reported dangerous kid feces disposal practices (11). According to the 2012 Indonesian Demographic and Health Survey (IDHS), one-third of children (35%) reported hazardous feces disposal (12). Furthermore, according to the 2018 Basic Health Research data, 33 percent of toddlers' feces are still handled irresponsibly (13). Unsafe disposals make up 42.63% of all under-five feces disposals in Indonesia (95% SK: 41.87-43.38) (14). Furthermore, a study conducted in Indonesia's slum areas found that 45% of mothers carried out the practice of unsafe disposals (3). Java was the main subject of study in this topic, especially West Java and East Java. This is due to the high level of disposable diaper usage in Java compared to other areas in Indonesia (15). Safe disposal behavior in the community is still very low (14).

Based on data from Baseline Health Research 2018, the proportion of unsafe child feces disposals in Indonesian households had a prevalence of 33% in rural communities and 34% in urban communities (16). A preliminary study by Wahana Visi Indonesia (WVI) in 2021 showed that 91.5% of the feces disposals in Surabaya were picked up by waste collectors (with or without segregation). Meanwhile, in the Sekadau Regency, 61% of feces were buried, burned, or composted (others did not use diapers). This shows that the community tended to practice unsafe child feces disposals.

The behavior of Child feces and diaper disposals in the household is influenced by the perceived susceptibility, perceived seriousness, perceived benefits, and perceived barriers in an individual (17). An existing study has also revealed that mothers' behavior is strongly influenced by their belief in their ability to do something (18). Demographic factors, psychological characteristics, and individuals' beliefs are the determinants in the Health Belief Model (HBM) theory. The HBM is still widely used throughout the world to analyze behavioral changes in individuals (19). There are only a few studies that use the HBM to analyze behavioral factors in child feces and diaper disposal. Several previous studies only discussed child feces and diaper disposal in association with certain diseases (9). thus, this study proposed to analyze the behavioral factors for child feces and diaper disposal based on regional differences (urban and rural).

MATERIALS AND METHODS

Research Design

This study was an observational analytical study with a cross-sectional approach. The objective of this study iwas to explore respondents' perceptions of child feces and diaper processing. The research design and procedures were carried out by following the eight principles of Social Marketing, which are orientation, customer, insight, segmentation, behavioral objectives, exchange, competition, marketing mix, and theory-based applied to the CBE stage: Cco-Creation – B-build – E-engage (CBE) stage (20, 21).

Data Collection

The information was gathered for this study using a questionnaire and random sampling technique employed with the under-five population in 2020 participating in Pos Pelayanan Terpadu (Posyandu) or Integrated Service Center in the study area. The sample size in this study was determined using the formula for the two-proportion difference hypothesis test. As many as 250 respondents per region were included to meet the minimum sample size of 500 respondents. Finally, 508 respondents were successfully obtained from both Surabaya and the Sekadau Regency. The data obtained were used to analyze the characteristics and general description of people's behavior in child feces and diaper disposal based on regional differences (urban-rural).

Participants

This study was conducted from February to March 2022. Respondents were infant and under-five caregivers living in several districts in the Sekadau Regency and Surabaya. They were selected through purposive sampling with the following inclusion criteria: carers for under-five aged 0-3 years and people who encouraged changes in under-five nurturing behavior such as mothers, husbands, families, maids, health workers, and so on.
A questionnaire regarding child feces and diaper disposal behavior was developed based on a study by Amanullah and Kamal (22, 18). The questionnaire consisted of 44 questions with five questions about knowledge, seven about perceived seriousness, seven about perceived susceptibility, seven about perceived benefits, seven about perceived barriers, and 11 about cues to action. Scoring was done using a 4-point Likert scale. Positive questions used 1 to represent 'strongly agree' and 4 to represent 'strongly disagree'. Meanwhile, negative questions used 1 to represent 'strongly disagree' and 4 to represent 'strongly agree'. The researchers analyzed child feces and diaper disposal behavior based on the HBM concept. A number of previous studies have used the HBM in analyzing certain health behaviors (23, 24). To test the questionnaire's feasibility and quality,

the validity and reliability test was carried out on 30 respondents outside the sample. The questionnaire's test results for knowledge, perceived susceptibility, perceived seriousness, perceived benefits, and perceived barriers had a total item correlation of > 0.08 and a Cronbach's alpha of > 0.6, which means that the questionnaire was valid.

Data Analysis

A statistical analysis was performed with IBM SPSS 26, while a path analysis was performed using SPSS AMOES 26. Demographic variables were presented using descriptive statistics. Significance values were calculated for each demographic variable related to perceived seriousness, perceived susceptibility, perceived benefits, perceived barriers, and cues to action. A bivariate analysis was performed using Spearman's rank. The researchers used path analysis to analyze the independent variable's effect on the dependent variable through intervening variables and direct influence based on regional differences (urban-rural).

Ethical Clearance

The research has been given the green light by the Health Research Ethics Committee, Faculty of Public Health, Universitas Airlangga, with the ethics number 30/EA/KEPK/2021. It has been deemed ethically sound following the Seven World Health Organization (WHO) 2011 Standards: (1) Social Values (2) Scientific Values (3) Equitable Distribution of Burdens and Benefits (4) Risks (5) Persuasion/Exploitation (6) Confidentiality and Privacy (7) Approval After Explanation, in line with the 2016 Council for International Organizations of Medical Sciences (CIOMS) Guidelines.

RESULTS

Data collection in this study was carried out by distributing questionnaires, so the response rate was 101.6%, which was obtained and calculated from the percentage of the number of returned questionnaires (500) divided by the number of questionnaires distributed (508 questionnaires). The questionnaire return rate (response rate) is 101.6% and includes excellent criteria, meaning that the questionnaire return rate (response rate) is acceptable and the results of the questionnaire answers can be processed, because the response rate is greater than the acceptable criteria.

Table I shows the respondents' characteristics based on rural (Sekadau Regency) and urban (Surabaya) areas in Indonesia. It was found that most of the respondents, both rural and urban, were housewives. This is because the respondents in this study were mostly mothers who had children, with a greater number of them coming from urban areas. Meanwhile, the male respondents were mostly from rural areas. Respondents in rural areas mostly lived in their own homes, while respondents in urban areas mostly lived with their parents. Most respondents graduated from high school, in both rural and urban areas. The majority of them had a good level of knowledge, especially those from urban areas. Moreover, most respondents from urban areas already had proper latrines. However, there were still a few respondents from rural areas who owned proper latrines.

Table I: The Characteristics of Respondents' Demographic

Characteristic Variables	Rural		Urban		Total	
	n	%	n	%	N	%
Gender						
Male	14	66.7	7	33.3	21	4.2
Female	236	49.3	243	50.7	479	95.8
Residency Status						
House	146	69.9	63	30.1	209	41.8
Live with parents	88	41.9	122	58.1	210	42.0
Boarding house	2	3.0	64	97.0	66	13.2
Others	14	93.3	1	6.7	15	3.0
Education						
Did not attend school	8	66.7	4	33.3	12	2.4
Elementary school	77	53.1	68	46.9	145	29.0
Junior high school	73	55.3	59	44.7	132	26.4
Senior high school	79	42.9	105	57.1	184	36.8
Diploma (D1-D4)	2	50.0	2	50.0	4	0.8
S1 & S2	11	47.8	12	52.2	23	4.6
Occupation						
Housewife	210	50.8	203	49.2	413	82.6

CONTINUE

Table I: The Characteristics of Respondents' Demographic (CONT.)

Characteristic Variables	Rural		Urban		Total	
	n	%	n	%	N	%
Occupation						
Laborer	2	66.7	1	33.3	3	0.6
Temporary employee	5	100.0	0	0.0	5	1.0
Government Employee	2	100.0	0	0.0	2	0.4
Private	3	15.0	17	85.0	20	4.0
Entrepreneur	3	15.0	17	85.0	20	4.0
Others	25	67.6	12	32.4	37	7.4
Knowledge						
Poor	26	70.3	11	29.7	37	7.4
Good	224	48.4	239	51.6	463	92.6
Latrine Ownership						
No	21	87.5	3	12.5	24	4.8
Yes	229	48.1	247	51,9	476	95.2

Table II shows the correlation between determinant factors and perceptions of seriousness, susceptibility, benefits, and barriers with regard to demographic characteristics such as social status, education, occupation, and age. The results indicate significant differences between urban and rural areas concerning the aforementioned perceptions ($p < 0.05$).

Table II: The Relationship Between Demographic Factors and Perceived Seriousness, Perceived Susceptibility, Perceived Benefit, and Perceived Barrier

Variables	Perceived Seriousness		Perceived Susceptibility		Perceived Benefit		Perceived Barrier	
	r	*p-value*	R	*p-value*	r	*p-value*	R	*p-value*
Area	0.761	0.036*	0.212	0.035*	0.1651	0.036*	0.939	0.042*
Gender	0.328	0.290	0.065	0.040*	0.367	0.043*	0.503	0.474
Residency Status	0.000	0.042*	0.001	0.044*	0.003	0.043*	0.015	0.044*
Education	0.441	0.044*	0.304	0.005*	0.263	0.003*	0.300	0.008*
Occupation	0.044	0.042*	0.166	0.046*	0.246	0.046*	0.080	0.042*
Age	0.031	0.043*	0.022	0.042*	0.006	0.044*	0.030	0.042*
Latrine Ownership	0.160	0.041*	0.182	0.043*	0.440	0.049*	0.332	0.339

Perceived seriousness is a perception related to feces and diaper disposal behavior. It has serious impacts on things such as environmental pollution and various diseases. Perceived susceptibility is an individual's perception of potential disease due to feces and diaper disposal. An individual who has this perception believes that unsafe disposals will trigger environmental pollution and the spread of disease. Perceived benefit is an individual's perception of potential benefits due to safe disposals. An individual who has this perception believes that safe disposals will bring environmental and health benefits. The perceived barrier is an individual's perception of things that hinder safe disposal behavior. An individual who has this perception believes that safe disposals will also prevent and inhibit environmental pollution and the spread of disease.

Gender and occupation are the demographic factors with the strongest relationship to all perception variables, while age and areas (urban-rural) are the factors with the weakest. Table III shows that perceived seriousness, perceived susceptibility, perceived benefits, and perceived barriers have a relationship with child feces and diaper disposal behavior in both rural and urban areas ($p < 0.05$). The strongest relationship was found in the perceived barriers (0.301). Urban and rural communities have a strong perception that safe child feces and diaper disposal will inhibit environmental pollution and the spread of disease.

Table III: The Relationship Between Child Feces Disposal Behavior and Perceived Seriousness, Perceived Susceptibility, Perceived Benefit, and Perceived Barrier

Variables	R	P-value	95% Confidence Interval of the Difference	
			Lower	Upper
Perceived Seriousness	0.241	0.037*	1.99	2.08
Perceived Susceptibility	0.140	0.020*	1.93	2.03
Perceived Benefit	0.198	0.009*	2.04	2.12
Perceived Barrier	0.301	0.037*	2.37	2.50

A path analysis was used to analyze demographic factors' influence on child feces and diaper disposal behavior through perceived seriousness, perceived susceptibility, perceived benefits, and perceived barriers as shown in Figure 1. The path analysis model was made based on the HBM theory. It has been checked for suitability using IBM SPSS and SPSS AMOES 26.

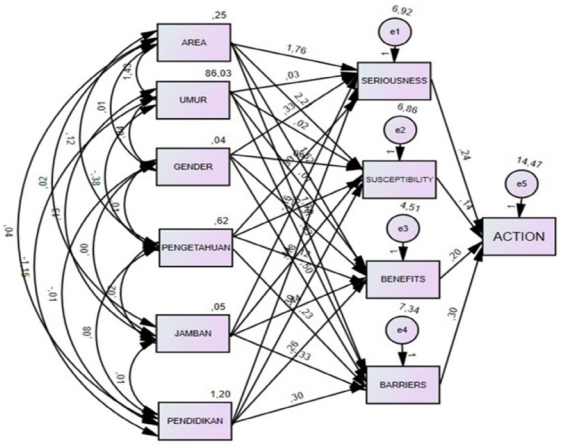

Figure 1: Path Analysis Diagram

Figure 1 shows that demographic factors influence child feces and diaper disposal behavior through perceived seriousness, perceived susceptibility, perceived benefits, and perceived barriers. Perceived seriousness (b = 0.563; SE = 0.06; standardized path analysis = 0.370), perceived susceptibility (b = 0.533; SE= 0.06; standardized path analysis = 0.354), perceived benefits (b = 0.107; SE = 0.112), and perceived barriers (b = 0.579; SE = 0.06; standardized path analysis = 0.389) directly had a significant effect on child feces and diaper disposal behavior. Meanwhile, demographic factors indirectly had a significant effect on child feces and diaper disposal behavior through perceived seriousness, perceived susceptibility, perceived benefits, and perceived barriers. Areas (urban-rural) had an indirect effect on perceived seriousness (b = 2.140; SE = 0.238; standardized path analysis = 0.371), perceived susceptibility (b = 2.346; SE = 0.235; standardized path analysis = 0.419), perceived benefits (b = 1.777; SE = 0.190; standardized path analysis = 0.384), and perceived barriers (b = 2.200; SE = 0.243; standardized path analysis = 0.374). In addition, age, area, knowledge, education, and latrine ownership also indirectly affected child feces and diaper disposal behavior.

DISCUSSION

Several studies have revealed that the behavior of feces and diaper disposals behavior is influenced by the areas' demographic factors of the areas and perceptions of feces and diaper disposals (10). Demographic factors such as age, knowledge, and areas in this study were found to be significantly associated with unsafe disposals. Other studies have also suggested that age is a significant factor (14). The findings showed that the older the mother, the less likely she is to adopt unsafe disposal practices due to more adequate information and experience. Studies in Cambodia and Ethiopia also found similar results which suggest that the older an individual, the more mature they will be (25, 26). In terms of public trust, a more mature individual will be more trusted to perform better disposal practices than a less mature individual. Experience and maturity are the key factors (24).

This study observed the practice of feces and diaper disposal practices in two types of areas in Indonesia,: rural (the Sekadau Regency) for rural areas and urban (Surabaya) for the urban area. The results show that regional differences (rural and urban) had a significant influence on the practice of feces and diaper disposal practices. Previous studies have shown that the practice of safe disposal is more prevalent in urban areas (25). On the other hand, the practice of unsafe disposal practices in rural areas has been found to be twice as higher prevalent as in urban areas (27). This difference is caused by the desire to conform to certain social norms/expectations related to safe disposal practices, which are generally different between urban and rural areas (25). In addition, this can also be caused by the low education levels of education, where most rural residents are only elementary and junior high school graduates. The prevalence of safe disposal is directly proportional to the level of education (28). According to Dindaroglu, education, especially formal education, determines the way an individual perceives things (20). An individual who has a higher level of education will tend to have a better perception than an individual who is uneducated or has a low level of education. The higher the education, the more information and knowledge (27). Therefore, an individual with a higher level of education has more advanced and broad thinking about many things, including the dangers of having unsafe child feces and diaper disposals.

Health knowledge is directly related to health behavior. The better an individual's level of knowledge, the better their understanding of implementing healthy behavior (30). This study found that, generally, respondents already had good knowledge regarding child feces disposal, with the majority of them coming from urban communities. A study conducted in Indonesia (East Java and West Java) found that urban communities had

better knowledge as they had better social conditions compared to rural communities (31). Urban area residents also have access to more information and are more receptive to new information. Mothers with greater access to information regarding proper disposal methods are more likely to possess a comprehensive understanding of the appropriate management of infant excreta. This knowledge equips them to cultivate a hygienic and healthful living environment (18).

The way families dispose of child feces and diapers can be influenced by whether or not they have a latrine. A study discovered that most urban communities had latrines, while rural communities had very few. This finding aligns with a previous study by Asnake, which noted that latrine use was more common in urban areas than in rural ones. This is likely due to urban communities having better knowledge about latrine use, sanitation and hygiene practices, as well as receiving more education and support from the government. (32). Based on a study by Routray and Caruso, child feces disposal in latrines in rural areas is constrained by water shortages and dissatisfaction with government-funded latrines (33). Families who have government-provided latrines are statistically more inclined to engage in open defecation compared to those with privately constructed latrines. This can be attributed to the dissatisfaction stemming from the typically smaller pit sizes in government-provided latrines (34). In the absence of supporting facilities, and coupled with a lack of awareness, rural communities are increasingly compelled to engage in open defecation. According to a study conducted by Sahiledengle, the improper disposal of child feces was found to be more widespread in rural areas as opposed to urban areas (35). The research findings indicated that improper waste disposal occurred less frequently in regions with well-educated populations, access to clean water, and adequate sanitation facilities, particularly in urban settings (35).

However, this study also found that gender did not have a significant relationship with unsafe disposal behavior. This could be due to the fact that the respondents in this study were mostly women with good knowledge. In addition, several previous studies rarely involved men as research respondents because women, as mothers, are more associated with child feces and diaper disposal practices (36, 37). Although there are studies involving both men and women as research objects, the studies did not include the aspect of gender in their discussions (25, 28). Previous studies have also shown that safe disposal practices were fully supported by all family members, including both the father and mother (7).

The results showed that perceived seriousness, perceived susceptibility, perceived benefits, and perceived barriers had a significant influence on child feces and diaper disposal behavior ($p < 0.05$). All perceptions in this study were categorized as 'fair' in both urban and rural areas, except for perceived barriers which were categorized as 'good'. The r (strong relationship) in the perceived barrier had the highest value (0.301). This is in line with previous studies' findings that suggested perceived barriers as the strongest factor in not adopting good behavior compared to other types of perceptions (23). Barriers perceived by an individual will be very important and persuasive in adopting healthy behavior, as is the case in safe child feces and diaper disposal practices.

Perceived barriers were mostly categorized as 'good' in urban areas. This shows that rural area residents generally find it more difficult to practice healthy behavior as they have to struggle more than urban communities. This is reasonable since they have lower access to water, sanitation, and hygiene (25). Members of a household with no latrine will feel it is difficult to implement safe disposals as they have to seek out clean water from an external water source (26). Safe disposals only occur in households that have latrines or good-quality toilets (38, 39). In addition, rural communities do not know how to teach their children to practice safe disposal (7).

The results showed that perceived seriousness was mostly 'sufficient' for rural communities and 'good' for urban communities. This finding supports a previous study that states that what drives safe disposal behavior is the perception that exposure to feces can cause diseases such as typhus and cholera (7). Poor behavior that triggers the emergence of various diseases can influence an individual to behave well. However, this does not apply to rural communities that generally think that child feces are not harmful to health (40); thus, it can be concluded that an increase in perceived seriousness can significantly influence an individual to implement healthy behavior and vice versa (32).

Perceived susceptibility is significantly related to health behavior (32). Perceived susceptibility is defined as the implementation of healthy behavior that depends on the individual's perception of their susceptibility to disease (41). A previous study explained that, in general, child caregivers believed that child feces were unharmful to health, especially among those who were still breastfeeding (9). They considered safe disposals trivial. However, when viewed from the perceived susceptibility lens, rural areas were categorized as 'poor' in terms of child feces disposal. In fact, unsafe disposal prevalence in rural areas was higher than in urban areas where there is an increased risk of diarrhea (42). Given these facts, rural communities should have better-perceived susceptibility regarding child feces and diaper disposal practices.

This study's findings suggest that perceived benefits in urban areas can be categorized as 'good'. Latrine ownership was mostly found in urban areas. This is supported by urban communities generally having

better socio-economic, water, sanitation, and hygiene infrastructure compared to rural communities (3). Latrine use is associated with significant health improvements (1). Previous studies explained that implementing safe disposal can reduce workloads, improve personal hygiene, and make the household environment cleaner (7). However, a study in Kenya suggests the opposite: the costs involved in practicing safe disposal outweigh its long-term benefits (9).

The potential disease in child feces is known to be more contagious than in adult feces. Safe disposal behavior is one of the twelve healthy family indicators, which state that it is useful to avoid the transmission risk of diseases related to feces, such as diarrhea. The environmental health program has never considered safe disposal practices to be a significant factor in creating a clean and healthy life; therefore, it is necessary that all family members, especially parents, implement healthy behavior. In order to create appropriate policies regarding child mortality and morbidity, the Indonesian government must understand more about the characteristics of households that practice unsafe disposals.

This study's demographic bias stems from its primary focus on mothers and housewives, which limited the inclusion of male caregivers and might have excluded viewpoints that could offer a more comprehensive understanding of diaper disposal practices and kid feces. The findings' applicability to other Indonesian regions with distinct socioeconomic and cultural settings is limited by the regional scope, which is restricted to Sekadau Regency (rural) and Surabaya (urban). Additionally, using self-reported data raises the possibility of social desirability bias, which could cause the data to not correctly reflect disposal behaviors in real life. Additionally, the study's cross-sectional methodology limits the capacity to demonstrate causal links between disposal behaviors, perceptions, and demographic characteristics. Furthermore, infrastructure elements like water availability and sanitation quality were not adequately assessed.

Based on these results, it is advised that government organizations and legislators improve public health education by launching focused programs for rural populations that overcome cultural obstacles and highlight the health hazards associated with improper disposal. To get beyond structural constraints, funding for the construction of latrines and clean water access should be given top priority. Community-based monitoring systems should also be put in place to keep tabs on disposal practices. Local leaders can be enlisted to promote behavior change, and community-led support groups can be established for parents to exchange experiences and expertise. While schools should include sanitation and hygiene education in their curricula to inculcate positive habits in children from an early age, healthcare providers can incorporate instruction on safe disposal methods into routine health visits.

In order to fill these deficiencies, future research should include male caregivers to give a thorough picture of family activities, broaden geographical coverage to capture a variety of regional contexts, and conduct longitudinal studies to establish causal linkages. Cost-benefit assessments should be conducted to determine the economic viability of implementing safe disposal procedures, and studies should also examine the direct impact of water, sanitation, and hygiene infrastructure on disposal behaviors. Future initiatives can help improve sanitation and health outcomes throughout Indonesia by addressing these constraints and broadening the scope of investigation.

CONCLUSION

In order to create a clean and healthy environment, child feces and diaper disposal behavior require special attention. Demographic factors such as age, knowledge, and education affect feces disposal behavior perceptions in both urban and rural areas. Perception will encourage certain child feces disposal behaviors; therefore, it is necessary to change child feces and diaper disposal behavior in accordance with demographic factors and community needs. Education through centers for pre- and postnatal healthcare and information can be an alternative way to increase knowledge about safe and healthy child feces disposal.

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