Buletin Kedokteran & Kesehatan Prima
Vol.4 No.2 (2025)
DOI: 10.34012/bkkp.v4i2.7234

ORIGINAL ARTICLE

Factors affecting community waste disposal in the Deli River, Medan Petisah

Artosi Sumana Lumban Batu[1], Rapael Ginting[2]*, Hartono[2]

ABSTRACT

Humanity and other living organisms coexist within the environment. Rivers, as essential components of the environment, provide critical benefits for human survival, including supplying water for daily use, supporting fisheries, and facilitating water transportation. However, human activities frequently exert negative impacts on river ecosystems, such as the disposal of solid and industrial waste. This study aimed to identify the factors influencing community waste disposal practices in the Deli River, Petisah Village, in 2023. Employing a quantitative, descriptive-analytical cross-sectional survey design, the study population comprised 250 residents residing along the Deli River, from which a sample of 154 participants was selected through simple random sampling. Bivariate analyses were conducted using the Chi-square test. The findings demonstrate significant associations between waste disposal behavior and knowledge (p=0.004), attitude (p=0.004), practices (p<0.001), and infrastructure (p=0.008). Furthermore, logistic regression analysis identified infrastructure as the strongest predictor of waste disposal behavior, indicating that inadequate infrastructure increases the likelihood of respondents disposing of waste into the river.

Keywords: waste, river, knowledge, attitude, practice

Introduction

The environment encompasses the space occupied by humans and other living organisms. Among environmental components, rivers serve a particularly vital role by providing numerous benefits essential to human survival, including water for daily activities such as bathing, washing, and consumption, as well as for fishing and water transportation.[1] However, anthropogenic activities frequently exert detrimental effects on these aquatic ecosystems. Such negative impacts include the use of rivers as dumping sites for solid waste and industrial effluents, and destructive fishing practices such as poisoning with chemicals like potassium cyanide.[2]

According to the World Bank's 2023 “Atlas of Sustainable Development Goals,” Indonesia ranked as the world's fifth-largest waste producer in 2020, generating approximately 65.2 million tons of waste. While high waste production is commonly associated with larger populations, the volume of waste generated by a nation is also significantly influenced by the lifestyle habits of its citizens.[3] National-level data from the Ministry of Environment and Forestry’s (KLHK) National Waste Management Information System (SIPSN) indicates that Indonesia generated 35.83 million tons of waste in 2022, representing a 21.7% increase from 2021, the highest level recorded in the past four years. Of the total waste generated in 2022, only 22.44

Affiliation
[1]Undergraduate Program in Public Health, Universitas Prima Indonesia, Medan, Indonesia
[2]Department of Public Health, Universitas Prima Indonesia, Medan, Indonesia

***Corespondence:**
rafaelginting@unprimdn.ac.id

million tons (62.63%) were managed, leaving 13.39 million tons (37.37%) unmanaged. At the regional level, Central Java was the largest contributor, accounting for 5.51 million tons (15.39%) of the national total.[4] Data from the Institute for Wetland Ecology and Conservation (Ecoton) further highlight that Indonesia produces 8 million tons of plastic waste annually, of which only 3 million tons are processed, leaving 5 million tons unmanaged. A significant proportion of this unmanaged plastic waste is disposed of improperly, including being buried or burned, with 2.6 million tons ultimately entering river systems.[5] The inherent interdependence between humans and their environment is irrefutable, as human life depends on environmental resources such as water, soil, plants, animals, and air. This dependency underscores the critical need for sustainable management and conservation of natural resources.[6]

Rivers are natural watercourses that originate from upstream mountainous or highland regions and flow towards estuaries at the sea. They are a crucial source of clean water and also contribute to oxygen production via phytoplankton photosynthesis. However, water pollution significantly diminishes this oxygen generation, as phytoplankton (key contributors at the base of the aquatic food web) are highly sensitive to environmental degradation.[7] Populations residing in river basin areas are particularly vulnerable to waterborne infectious diseases due to insufficient access to clean water, both in quality and quantity, and inadequate sanitation practices such as open defecation in rivers and improper disposal of solid waste and wastewater. Additionally, substandard housing conditions further exacerbate the risk of environment-related infectious diseases.[8]

As Indonesia's third-largest city, Medan faces significant waste management challenges. With a population of 2,435,252 and a density of 9,522.22 people per square kilometer in 2020, the city's high population density coupled with rapid economic growth has led to pressing infrastructure and environmental concerns. These include the proliferation of illegal and permanent structures on drainage systems, road shoulders, and sidewalks, which violate municipal regulations and obstruct water flow.[7] According to SIPSN data from 2022, household waste accounts for 44.99% of Medan’s total waste. Although the city generates approximately 2,000 tons of waste each day, only about 800 tons are deposited in official landfills, with 1,000-1,200 tons remaining unmanaged. Notably, only 13% of the total daily waste is segregated and processed, thereby preventing it from reaching landfills.[9]

The Deli River, a principal waterway with a basin area of 402 km², flows through Deli Serdang Regency and Medan City before discharging into the Malacca Strait. The river is prone to flooding, causing substantial disruption and damage to local communities. Consequently, hydrological analyses are essential for the development of effective flood control and river management strategies. Recent studies have indicated that flooding in the Deli River is exacerbated by several factors, including high-intensity rainfall leading to riverbank erosion, and the encroachment of residential, office, and commercial buildings, which reduce the river's cross-sectional area and therefore its discharge capacity.[10–12] Furthermore, inadequate maintenance of river infrastructure and low public awareness regarding waste management contribute to the continued practice of dumping waste into the river channel. Therefore, the present study aims to investigate the factors influencing residents of the Petisah sub-district to dispose of waste into the Deli River.

Method

This quantitative, descriptive-analytical, cross-sectional survey aimed to identify factors influencing residents’ behavior regarding waste disposal into the Deli River. The study was conducted in November 2023 in the Petisah sub-district of Medan, Indonesia, focusing on a community residing along the riverbanks. The study population comprised 250 residents living along the Deli River in the Petisah sub-district. A sample of 154 participants was selected through simple random sampling using the Slovin formula.

Primary data were collected via structured interviews utilizing a questionnaire administered to the selected participants. The questionnaire consisted of ten items measuring the independent variables: knowledge, attitude, practice, and the availability of infrastructure and facilities. Secondary data on the number of residents living near the river were obtained from the Petisah sub-district office. The dependent variable, community waste disposal behavior, was categorized as either “Good” (not disposing waste into the river) or “Not Good” (disposing waste into the river). The independent variables were categorized as follows: Knowledge was classified as “Good” (scores 6–10) or “Poor” (scores 0–4). Attitude was classified as “Positive” (more than 50% positive responses) or “Negative” (50% or fewer positive responses). Practice was categorized as “Good” (more than 50% positive responses) or “Poor” (50% or fewer positive responses). Infrastructure and facilities were classified as “Good” or “Poor.”

Data processing involved editing, coding, data entry, cleaning, and tabulation. Data analysis included univariate analysis to describe the frequency distribution of each variable, followed by bivariate analysis using the Chi-square test to assess the relationships between independent variables and the dependent variable.

Results

Based on the data presented in Table 1, the majority of respondents were female, accounting for 89 individuals (57.8%), while male respondents numbered 65 (42.2%). Regarding age, most respondents were adults aged 26 to 45 years, totaling 113 individuals (73.4%), whereas adolescents aged 12 to 25 years represented a minority, with only 6 individuals (3.9%). In terms of educational attainment, most respondents had attained a high level of education (including senior high school, diploma, bachelor's, master's, or doctoral degrees) comprising 102 individuals (66.2%). A smaller proportion had a lower level of education, defined as elementary or junior high school, totaling 52 individuals (33.8%). Regarding occupation, homemakers comprised the largest group with 67 individuals (43.5%), while private sector employees formed the smallest group, with 25 individuals (16.2%).

Table 1. Respondent characteristics

Characteristics	n	%
Gender		
Male	65	42.2
Female	89	57.8
Age		
Adolescents (12-25 years)	6	3.9
Adults (26-45 years)	113	73.4
Elderly (46-65 years)	35	22.7
Education		
Low (Elementary, Junior High)	52	33.8
High (Senior High, Diploma, Bachelor, Master, Doctorate)	102	66.2
Occupation		
Self-employed	62	40.3
Private employee	25	16.2
Homemaker	67	43.5
Knowledge		
Good	43	27.9
Poor	111	72.1
Attitude		
Negative	81	52.6
Positive	73	47.4
Practice		
Good	41	26.6
Poor	113	73.4
Infrastructure		
Good	45	29.2
Poor	109	70.8

Concerning knowledge levels, the majority of respondents were assessed as having poor knowledge, accounting for 111 individuals (72.1%), compared to 43 individuals (27.9%) with good knowledge. Attitudinally, most respondents demonstrated a negative attitude (81 individuals, 52.6%), whereas 73 individuals (47.4%) exhibited a positive attitude. Similarly, poor practice was observed in the majority of respondents, totaling 113 individuals (73.4%), with only 41 individuals (26.6%) demonstrating good practices. Finally, most respondents perceived the facilities and infrastructure in their environment as inadequate, comprising 109 individuals (70.8%), while only 45 individuals (29.2%) considered them adequate.

Based on the data presented in Table 2, a total of 111 respondents demonstrated poor knowledge; among them, the majority (71.2%, n=79) engaged in improper waste disposal into the river, while a smaller proportion (28.8%, n=32) practiced proper disposal. Of the 43 respondents with good knowledge, most (65.1%, n=28) still disposed of waste improperly, whereas a minority (34.9%, n=15) disposed of waste appropriately.

Regarding attitudes, among 81 respondents who exhibited a negative attitude, the majority (67.9%, n=55) disposed of waste improperly, while 32.1% (n=26) demonstrated proper waste disposal behavior. Conversely, of the 73 respondents with a positive attitude, most (71.2%, n=52) continued to dispose of waste improperly, with only 28.8% (n=21) engaging in proper disposal. Concerning practices, 113 respondents reported poor waste management behaviors; within this group, the majority (67.3%, n=76) disposed of waste improperly, and a smaller segment (32.7%, n=37) exhibited correct disposal practices. Among the 41 respondents with good practices, most (75.6%, n=31) still disposed of waste improperly, while 24.4% (n=10) disposed of waste appropriately.

Table 2. Relationship between knowledge, attitudes, practices, and facilities and infrastructure and the public disposing of waste

Variable	Public behavior of disposing of waste into the river				Total		*p-value*
	Good		Poor				
	n	%	n	%	n	%	
Knowledge							
Good	15	34.9	28	65.1	43	100.0	0.004
Poor	32	28.8	79	71.2	111	100.0	
Attitude							
Negative	26	32.1	55	67.9	81	100.0	0.004
Positive	21	28.8	52	71.2	73	100.0	
Practice							
Good	10	24.4	31	75.6	41	100.0	0.000
Poor	37	32.7	76	67.3	113	100.0	
Infrastructure							
Good	13	28.9	32	71.1	45	100.0	0.008
Poor	34	31.2	75	68.8	109	100.0	

Finally, in terms of infrastructure, 109 respondents reported poor access or infrastructure, with the majority (68.8%, n=75) exhibiting poor waste disposal behavior, and 31.2% (n=34) demonstrating proper disposal. Among 45 respondents with good infrastructure, most (71.1%, n=32) disposed of waste improperly, while 28.9% (n=13) disposed of waste properly. Chi-square analysis revealed statistically significant associations between waste disposal behavior and knowledge (p=0.004), attitude (p=0.004), practices (p<0.001), and infrastructure (p=0.008) within the community disposing waste into the Deli River.

Table 3. Results of logistic regression analysis

Variable	p	PR	95% CI
Knowledge	0.529	1.277	0.031 – 0.692
Attitude	0.670	1.164	0.089 – 0.298
Practice	0.313	.666	0.098 – 0.467
Infrastructure	0.008	1.234	0.056 – 0.341

The results of the logistic regression analysis indicate that infrastructure is the most significant predictor of waste disposal behavior among residents of Petisah Sub-district into the Deli River in 2023 (p = 0.008; PR = 1.234). This finding suggests that respondents with inadequate infrastructure are 1.234 times more likely to dispose of waste into the river, highlighting the critical role of infrastructure in shaping environmental sanitation behaviors.

Discussion

This study found a significant relationship between knowledge and the behavior of the community regarding waste disposal into the Deli River. This finding is consistent with research by Suryani[13] which also identified a significant correlation between knowledge and waste disposal behavior in the Sago River, Pekanbaru. The majority of individuals who dispose of waste into the Deli River have limited knowledge, as indicated by the questionnaire results. They tend to perceive disposing of trash into the river as more practical, free, and a long-standing habit. This lack of knowledge and poor behavior is also influenced by the limited availability of waste disposal sites (TPS) and insufficient information on proper waste management. The level of knowledge among respondents significantly influences their behavior, as adequate information about proper waste management promotes better practices.[14]

Attitude also has a significant relationship with community behavior regarding waste disposal into the Deli River. These results align with research by Astina[7] which found a significant relationship between attitude and household waste disposal behavior in rivers. A lack of awareness about the dangers of improper waste disposal makes community members indifferent, even though it can lead to natural disasters, river pollution, and habitat destruction. The majority of respondents demonstrated a negative attitude toward waste disposal into the river. This irresponsible behavior can trigger environmental problems and damage. If negative attitudes persist, they can pose a threat to the local environment and community, as accumulated waste in the river can cause flooding during the rainy season. Plastic waste, in particular, will not decompose, and its presence only makes the river dirty and unsanitary. Therefore, it is crucial for the community to take preventive measures.[15]

This study also revealed a significant relationship between practice and waste disposal behavior, consistent with Mahda et al.[16] findings on waste disposal behavior along the Mantung Riverbank. Most respondents exhibit poor practices, as the majority of community members living along the riverbanks do not contribute to maintaining cleanliness. Furthermore, the local government's practices are also considered inadequate due to the absence of clear regulations, strict sanctions, and sufficient waste disposal facilities to prevent such behavior. Human behavior is driven by specific stimuli, and practice is the operational manifestation of an individual's knowledge, attitude, and behavior toward their environment.[17]

The infrastructure variable has a significant relationship with community behavior regarding waste disposal into the river. The majority of residents living along the Deli River feel that the existing infrastructure is insufficient. Waste disposal facilities in Petisah Sub-district are limited, with only two pushcarts and two DIPO bins provided for the community and no bins for pedestrians. Many residents also lack trash cans in their homes and instead use plastic bags. Household waste disposed of in the river can lead to shallowing, narrowing, and foul odors. If this continues, the river's water level will rise due to sedimentation. Support is needed from the sub-district government to enforce sanctions and from the Flood Disaster Control Agency to empower communities in flood prevention and mitigation efforts. Additionally, legislation is essential to regulate community participation in flood disaster management.

Conclusion

The primary findings of this study revealed that the majority of respondents exhibited poor knowledge of waste disposal (72.1%), negative attitudes towards waste management (52.6%), and improper waste disposal practices (73.4%). Moreover, most respondents (70.8%) perceived the existing facilities and infrastructure, such as limited waste disposal sites and the lack of household trash bins, as inadequate. Chi-square analysis demonstrated a statistically significant association between the behavior of disposing waste into the river and respondents' knowledge ($p = 0.004$), attitudes ($p = 0.004$), practices ($p < 0.001$), and infrastructure ($p = 0.008$). Logistic regression analysis identified inadequate infrastructure as the most significant predictor of this behavior, with respondents lacking sufficient infrastructure being 1.234 times more likely to dispose of waste into the river. In conclusion, this study underscores that poor knowledge, negative attitudes, improper practices, and, most importantly, insufficient infrastructure significantly contribute to the improper waste disposal behavior observed among residents of the Petisah sub-district with respect to the Deli River..

References

1. Angriani P, Sumarmi, Ruja IN, Bachri S. River management: The importance of the roles of the public sector and community in river preservation in Banjarmasin (A case study of the Kuin River, Banjarmasin, South Kalimantan – Indonesia). Sustain Cities Soc. 2018 Nov;43:11–20.
2. Mukharomah E, Handaiyani S, Wijayanti TF. Analisis Faktor-Faktor yang Mempengaruhi Pola Perilaku Masyarakat Membuang Sampah di Sungai Musi (Studi Kasus Kelurahan 10 Ulu). Unbara Environ Eng J. 2020;1(1).
3. World Bank. Atlas of Sustainable Development Goals 2017: From World Development Indicators [Internet]. Washington, DC: World Bank; 2017. Available from: https://hdl.handle.net/10986/26306
4. Anjani AD, Budiaman B, Hidayaht AN. Environmental Care Behavior through Waste Bank (Study at Teratai Waste Bank Pondok Pucung Sub-district, Pondok Aren District, South Tangerang City). Adv Soc Humanit Res. 2024 May 10;2(5):721–30.
5. Ecoton. Waste Management: Addressing the Negative Impacts of Waste Imports to Indonesia [Internet]. 2024. Available from: https://ecoton.or.id/waste-management-addressing-the-negative-impacts-of-waste-imports-to-indonesia-2/
6. Azizah SYN, Sudarti S. Analisis perilaku masyarakat dalam membuang sampah di Sungai Bedadung Kabupaten Jember. J Ilm Publika. 2023 Jan 27;11(1):65.
7. Astina N, Fauzan A, Rahman E. Faktor-faktor yang berhubungan dengan perilaku masyarakat dalam membuang sampah rumah tangga ke sungai di Desa Pamarangan Kanan Kabupaten Tabalong Tahun 2019. Med Technol Public Heal J [Internet]. 2020 Sep

25;4(2):181–90. Available from: https://journal2.unusa.ac.id/index.php/MTPHJ/article/view/1632
8. Rasyidah A, Herawati H, Rachmawati K. Faktor-Faktor yang Berhubungan Dengan Perilaku membuang sampah ke Sungai Di Kelurahan Sungai Kuin Kota Banjarmasin. Dunia Keperawatan J Keperawatan dan Kesehat [Internet]. 2024 Jul 29;12(2):206–18. Available from: https://jdk.ulm.ac.id/index.php/jdk/article/view/529
9. Pemerintah Daerah Kota Medan. Pengelolaan Sampah Bukan Hanya Tanggung Jawab Pemerintah. 2024; Available from: https://portal.medan.go.id/berita/plt-wali-kota-medan-pengelolaan-sampah-bukan-hanya-tanggung-jawab-pemerintah__read4761.html#:~:text=Dari jumlah tersebut%2C lanjutnya%2C hanya sekitar 800,mencemari lingkungan apabila tidak dikelola dengan baik.
10. Ginting M, Rangkuti RY. Analisis Pengendalian Banjir Sungai Deli dengan Metode Normalisasi. Universitas Sumatera Utara; 2018.
11. Harahap R, Jeumpa K, Mulyana R. Evaluasi Banjir Rancangan DAS Deli Dengan Metode HSS Gama 1 dan HSS SCS. In: Prosiding Seminar Nasional …. Medan; 2023. p. 121–4.
12. Simanjuntak IRU, Sihombing TMP, Yuliyanto A, Sitepu ARH, Zhafira E, P K, et al. Analisis kapasitas Sungai Deli dalam rangka penanggulangan banjir. J Tek Sipil. 2024 May 26;13(1):47–58.
13. Suryani S. Hubungan pengetahuan dengan perilaku masyarakat dalam membuang sampah di Sungai Sago Pekanbaru. Din Lingkung Indones. 2020 Jan 30;7(1):58.
14. Yusuf R, Fajri I. Differences in behavior, engagement and environmental knowledge on waste management for science and social students through the campus program. Heliyon. 2022 Feb;8(2):e08912.
15. Aduana EM, Calamba AMG, Genotiva AMJ, Pueblo AOL, S. Pardillo DJ. Plastic Waste in Waterways: Assessing Pollution Levels and Community Awareness. Int J Sci Manag Stud. 2024 Nov 30;45–57.
16. Mahda R, Posumah JH, Laloma A. Perilaku masyarakat dalam membuang sampah di Bantaran Sungai Mantung Kecamatan Beo Kabupaten Kepulauan Talaud. J Adm Publik. 2019 Jul 17;5(6).
17. Sharma NP, Gupta V. Human Behavior in a Social Environment. Treasure Island (FL): StatPearls Publishing; 2024.