

THE ASSOCIATION BETWEEN WASTE MANAGEMENT, WATER, SANITATION, HYGIENE PRACTICE AND CHILD HEALTH IN KHULNA, BANGLADESH: A CASE STUDY ON WARD NO- 26

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ABSTRACT

This study examines the relationships between waste management, sanitation, hygiene practices and child health in ward 26 of Khulna City Corporation, Bangladesh. Rapid urbanization has strained local sanitation and waste management systems, resulting in significant public health challenges. Surveys, interviews and field observations found that 42% of children suffered from waterborne illnesses, primarily diarrhea and dysentery, in the last two weeks. Factors such as inadequate sanitation infrastructure, lack of hygiene education and unsafe drinking water contributed to the spread of preventable diseases. A strong association has been found between poor hygiene practices, open waste disposal and disease outbreaks. The study recommends strengthening waste management systems, improving sanitation and implementing community-wide hygiene education programs. These interventions are critical to reducing disease incidence and improving health outcomes for children in rapidly urbanizing areas such as Khulna.

INTRODUCTION

Globally, poor sanitation and hygiene practices contribute significantly to child morbidity. Every year, around 829,000 people die from unsafe drinking water, poor sanitation and inadequate hand hygiene (WHO, 2019). Over 32% of the world's population lacks access to adequate sanitation and 9% lacks access to safe drinking water, exacerbating the spread of infectious diseases among children (WHO and UNICEF, 2017). Poor hygiene practices, such as defecating in the open, have been linked to outbreaks of cholera, diarrhea, and typhoid fever (Abanyie et al., 2022). In urban areas, rapid population growth is putting strain on existing infrastructure, particularly in developing countries. In sub-Saharan Africa, 56% of waste is disposed of indiscriminately, leading to environmental pollution and increased disease prevalence (Hassan et al., 2024). In South Asia, inadequate sanitation and hygiene practices also contribute significantly to malnutrition and morbidity among children (UNICEF, 2018). Studies in Bangladesh have highlighted the connection between open defecation, proximity to landfills, and the prevalence of diseases such as diarrhea and dysentery (Parvin & Tareq, 2021).

In addition to the impact on physical health, poor WASH (water, sanitation and hygiene) practices affect children's cognitive development and educational outcomes. Chronic exposure to waterborne pathogens leads to malnutrition, stunted growth, and recurrent illness (Shrestha et al., 2020). Hygiene practices such as handwashing with soap have been shown to reduce diarrheal illnesses by up to 40%, but awareness and resources for appropriate hygiene remain inadequate in many regions (WHO, 2014). The UNICEF framework identifies hygiene education, access to clean water and proper sanitation as critical to improving children's health outcomes (UNICEF, 2013). However, many urban areas in developing countries, including Bangladesh, continue to face waste management challenges. In Khulna, a rapidly urbanizing city, over 57% of waste is dumped in open areas, contributing to water pollution and vector-borne diseases such as malaria and dengue (Shammi et al., 2023).

Research also highlights socioeconomic disparities in access to sanitation infrastructure. Lower-income households are more likely to lack access to functioning toilets and clean drinking water, increasing their vulnerability to disease (Nadeem et al., 2024). For example, in Ghana, only 44% of waste is collected while the rest is disposed of indiscriminately, posing a significant risk to public health (Abanyie et al., 2022). The Khulna City Corporation (KCC) area represents a microcosm of these global challenges. This study focuses on Ward 26 of the KCC and aims to assess the impact of waste

management, sanitation and sanitation practices on children's health. It emphasizes the need for integrated policy approaches to reduce environmental health risks in urban areas. This research is critical for policymakers, health organizations and local authorities to understand the interplay between sanitation, hygiene and child health in rapidly urbanizing areas. Addressing these challenges can achieve significant improvements in public health outcomes.

MATERIALS AND METHODS

Study Area

Khulna City, the third largest urban area in Bangladesh, faces challenges in the areas of water supply, sanitation and waste management. Ward 26 includes densely populated areas that rely on informal waste disposal methods, resulting in environmental and health risks. With a population of over 884,000 residents, the district faces serious deficiencies in waste disposal and sanitation infrastructure (Population and Housing Census, 2022).

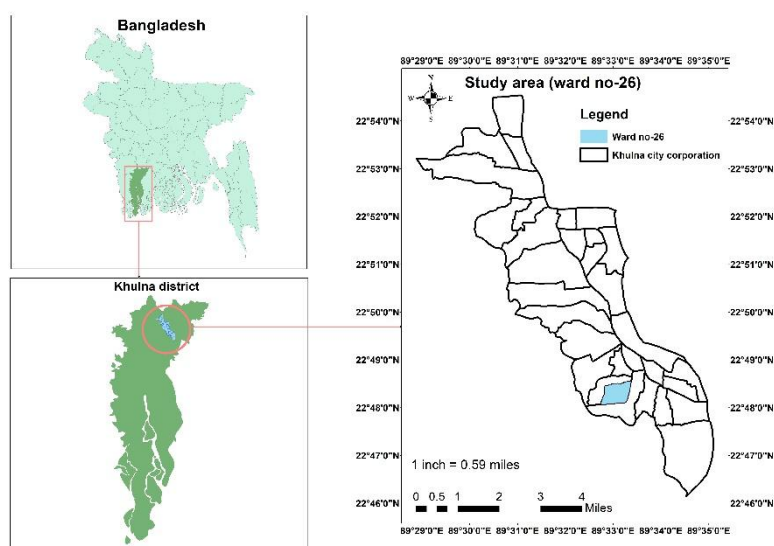


Figure 1 Map of study area

Methodology

The study adopted a mixed methods approach to examine hygiene, hygiene and health in children. It involved surveys with 184 children to collect quantitative data on their hygiene practices and health status. To gain deeper insights, five focus group discussions (FGDs) were conducted with school participants and parents, providing qualitative data on community perceptions and behavior. In addition, key informant interviews (KIIs) with two health experts provided expert opinions on the respective topics. Data analysis was conducted using SPSS and Excel, using both descriptive and inferential statistics to interpret the results. This combination of methods enabled a comprehensive analysis combining numerical data with qualitative insights to understand the factors affecting children's health. Neither groundwater contamination nor distance to landfills were examined, as these are important environmental factors that could affect children's health.

RESULTS AND DISCUSSION

Results

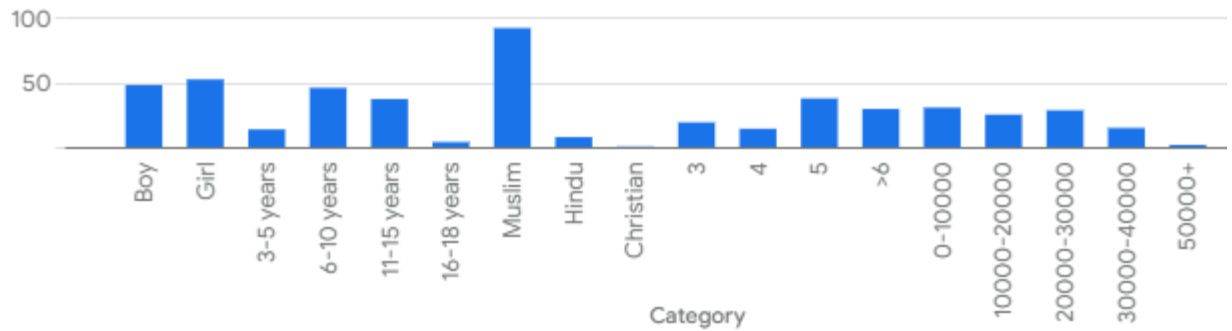


Figure 2 Distribution of respondents

Figure 2 shows a statistical overview of a population and details the distribution of key characteristics such as gender, age, religion, family size and monthly income. The population is almost evenly split between boys (47.8%) and girls (52.2%). Most people are between 6 and 10 years old (45.7%) and 11 and 15 years old (37.0%). A smaller proportion belong to the age groups 3-5 years (13.6%) and 16-18 years (3.8%). The predominant religion is Islam (91.8%). Hindus (7.6%) and Christians (0.5%) represent a minority within the population. The most common family sizes are 5 members (37.5%) and more than 6 members (29.4%). Families with 3 members (19.0%) and 4 members (14.1%) make up a smaller proportion. The most common monthly income ranges are 0-10,000 (30.4%), 10,000-20,000 (25.0%), and 20,000-30,000 (28.3%). A smaller proportion of individuals earn between 30,000 and 40,000 (14.7%) and 50,000+ (1.6%).

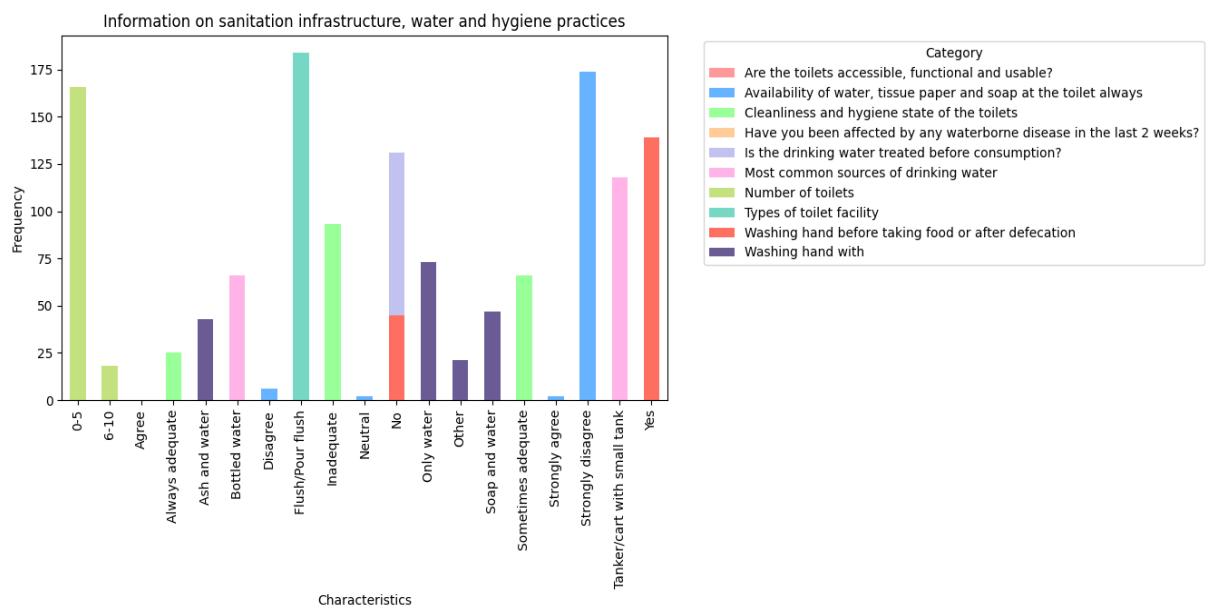


Figure 3 Information on sanitation infrastructure, water, hygiene practices and health

The dataset (Figure 3) provides an overview of sanitation, hygiene, water sources and health. All 184 respondents (100%) use toilets that flush or flush. Most households (166, 90.2%) have 0–5 toilets, while 18 (9.8%) have 6–10. Accessibility is sufficient for 110 respondents (40.2%), but inadequate for 74 (59.8%). Cleanliness is always sufficient for 25 respondents (13.6%), insufficient for 93 (50.5%) and partially sufficient for 66 (35.9%). Water, tissues and soap are rarely available (174 respondents, 94.6%). For hygiene reasons, 139 respondents (75.5%) wash their hands before eating or after defecation. Of these, 73 (39.7%) use only water, 47 (25.5%) use soap, 43 (23.4%) use ash and 21 (11.4%) use other materials. Sources of drinking water include tankers/trucks (118 respondents, 64.1%) and bottled water (66, 35.9%), but only 53 (28.8%) treat it. Health data shows that 77 respondents

(41.8%) recently reported children with waterborne illnesses. These findings highlight critical areas requiring improvements in sanitation, hygiene and water security.

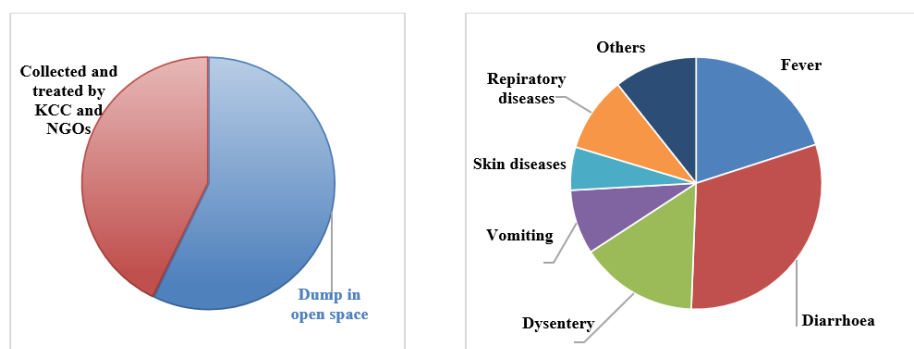


Figure 4 Waste management practices and affected diseases

The data shows that 57.2% of waste is still dumped in open areas, causing significant health and environmental risks, while 42.8% is properly managed by KCC and NGOs (Figure 4). Diarrhea is the most common health problem, affecting 30.75% of the population, followed by fever (20.14%), dysentery (15.28%) and vomiting (8.33%), all due to poor sanitation and waterborne diseases are attributed. Respiratory diseases affect 9.72% of the population, while 5.56% are affected by skin diseases, often due to poor hygiene. In addition, 10.75% reported various other medical conditions, including chronic and acute diseases (Figure 4).

Table 1 Relationship between waste dumping in open space and disease prevalence

Variable	Waste Dumping in Open Spaces	Prevalence of Diseases
Waste Dumping in Open Spaces	1	0.856
Prevalence of Diseases	0.856	1

Table 1 shows a strong positive correlation ($r = 0.856$) between open dumping and disease prevalence, highlighting the health risks of improper waste disposal.

Discussion

Functional toilets promote better hygiene and reduce the risk of illness (Dancer et al., 2021). Children in households with access to improved sanitation are less likely to suffer from frequent episodes of diarrhea, which is critical for healthy growth and development (Dahir Turyare, 2024). Poor plumbing maintenance contributes to water pollution and increases exposure to pathogens. Improvements in handwashing, particularly with soap, can significantly reduce illnesses such as diarrhea and respiratory infections (WHO, 2014). Many residents still use open latrines, resulting in fecal water contamination, which poses a significant health risk, especially to children (Ernawati et al., 2024). Studies have shown that communities with poor hygiene practices tend to have higher rates of diseases such as diarrhea, cholera, typhoid, and respiratory infections that are preventable through better hygiene (Zadock et al., 2024).

Improved hygiene, including handwashing with soap and access to clean water, significantly reduced the incidence of diarrheal disease in developing countries (Wolf et al., 2022). Improved access to purified water significantly reduces the incidence of diarrhea and other illnesses in children, leading to improved overall health outcomes (Solomon et al., 2020). Open dumping promotes the spread of water- and vector-borne diseases, including cholera and malaria. Effective waste management systems, such as proper waste separation and disposal are essential to minimize health risks, especially for children (Abanyie et al., 2022). According to the World Health Organization (WHO), improving sanitation could reduce the global burden of diarrheal diseases by 36%, thereby significantly reducing the incidence of diseases associated with poor sanitation (WHO, 2014). Public awareness campaigns can also play an important role in promoting proper waste disposal practices (Debrah et al., 2021). Integrated interventions in sanitation, hygiene education and waste management are crucial. Investments in WASH infrastructure and community awareness campaigns are critical to reducing child morbidity. Policymakers should also prioritize monitoring and maintenance of existing facilities, for example through regular inspections and allocating resources for maintenance (Waddington et al., 2023).

CONCLUSION

Research on waste management, water, sanitation and hygiene practices in Ward No. 26 of Khulna, Bangladesh, highlights the strong link between inadequate sanitation, poor water quality and child health in the region. The study shows that ineffective waste management, reliance on unsafe water sources and poor hygiene practices contribute significantly to the spread of water-borne diseases, malnutrition and poor health outcomes among children. The findings highlight the urgent need for improved sanitation, improved waste management systems and widespread education on proper hygiene practices. Addressing these issues would not only reduce disease prevalence but also promote the overall well-being of children in the community. Local authorities and health organizations must prioritize these measures to improve public health and prevent preventable illnesses and deaths among children. To ensure better health outcomes for children in Khulna, efforts should focus on improving access to adequate sanitation, providing clean and safe water, and conducting public health awareness campaigns. Additionally, integrating improved waste management strategies into these initiatives will promote a cleaner and healthier environment and address the root causes of many childhood diseases related to water and sanitation issues.

REFERENCES

- Abanyie, S. K., Amuah, E. E. Y., Douth, N. B., Antwi, M. N., Fei-Baffoe, B., & Amadu, C. C. (2022). Sanitation and waste management practices and possible implications on groundwater quality in peri-urban areas, Doba and Nayagenia, northeastern Ghana. *Environmental Challenges*, 8.
<https://doi.org/10.1016/j.envc.2022.100546>
- Dahir Turyare, M. (2024). *PREVALENCE AND PREDICTORS OF DIARRHEA AMONG CHILDREN UNDER FIVE YEARS IN BONDHERE DISTRICT, SOMALIA* [Jomo Kenyatta University of Agriculture and Technology].
<http://localhost/xmluihandle/123456789/6519>
- Dancer, S. J., Li, Y., Hart, A., Tang, J. W., & Jones, D. L. (2021). What is the risk of acquiring SARS-CoV-2 from the use of public toilets?. *Science of the Total Environment*, 792, 148341.
- Debrah, J. K., Vidal, D. G., & Dinis, M. A. P. (2021). Raising awareness on solid waste management through formal education for sustainability: A developing countries evidence review. *Recycling*, 6(1), 6.
- Ernawati, R., Nurjanah, M., & Wahyuni, T. (2024). The Correlation of Environmental Sanitation with Stunting Incidents in School-Age Children. In *Indonesian Journal of Global Health Research* (Vol. 6, Issue 2).
- Hassan, A. W., Zhang, D., & Ibrahim, M. (2024). Accessibility to WASH and waste management services in African urban informal settlements: A comparative analysis. *Journal of Water Sanitation and Hygiene for Development*, 14(2), 91–112. <https://doi.org/10.2166/washdev.2024.201>

- Nadeem, M., Anwar, M., Adil, S., Syed, W., Al-Rawi, M. B. A., & Iqbal, A. (2024). The Association between Water, Sanitation, Hygiene, and Child Underweight in Punjab, Pakistan: An Application of Population Attributable Fraction. *Journal of Multidisciplinary Healthcare*, 17, 2475–2487.
<https://doi.org/10.2147/JMDH.S461986>
- Parvin, F., & Tareq, S. M. (2021). Impact of landfill leachate contamination on surface and groundwater of Bangladesh: a systematic review and possible public health risks assessment. In *Applied Water Science* (Vol. 11, Issue 6). Springer Science and Business Media Deutschland GmbH.
<https://doi.org/10.1007/s13201-021-01431-3>
- Population and Housing Census 2022 - District Report: Khulna*. (2024). Bangladesh Bureau of Statistics.
<http://nsds.bbs.gov.bd/storage/files/1/Publications/PHCensus/Khulna/District%20Report%20khulna.pdf>
- Shammi, A. T., Hassan, N., Golder, M. R., Molla, H., & Islam, S. S. (2023). Health status assessment of people adjacent to temporary waste disposal sites in Khulna city, Bangladesh. *Heliyon*, 9(9). <https://doi.org/10.1016/j.heliyon.2023.e19810>
- Shrestha, A., Six, J., Dahal, D., Marks, S., & Meierhofer, R. (2020). Association of nutrition, water, sanitation and hygiene practices with children's nutritional status, intestinal parasitic infections and diarrhoea in rural Nepal: A cross-sectional study. *BMC Public Health*, 20(1). <https://doi.org/10.1186/s12889-020-09302-3>
- Solomon, E. T., Robele, S., Kloos, H., & Mengistie, B. (2020). Effect of household water treatment with chlorine on diarrhea among children under the age of five years in rural areas of Dire Dawa, eastern Ethiopia: A cluster randomized controlled trial. *Infectious Diseases of Poverty*, 9(1). <https://doi.org/10.1186/s40249-020-00680-9>
- UNICEF. (2013). *Water, sanitation and hygiene* | UNICEF.
<https://www.unicef.org/bangladesh/en/water-sanitation-and-hygiene>
- UNICEF. (2018). *WHAT ARE THE MALNUTRITION TRENDS IN EGYPT?*
www.unicef.org/egypt/
- Waddington, H. S., Masset, E., Bick, S., & Cairncross, S. (2023). Impact on childhood mortality of interventions to improve drinking water, sanitation, and hygiene (WASH) to households: Systematic review and meta-analysis. *PLoS Medicine*, 20(4). <https://doi.org/10.1371/journal.pmed.1004215>
- WHO. (2014). *Preventing diarrhoea through better water, sanitation and hygiene Exposures and impacts in low- and middle-income countries*.
<https://www.who.int/publications/i/item/9789241564823>
- WHO. (2019). *Water, sanitation, hygiene and health A PRIMER FOR HEALTH PROFESSIONALS*. WHO/CED/PHE/WAS/19.149
- WHO. (2023). *Drinking-water*. <https://www.who.int/news-room/fact-sheets/detail/drinking-water>
- WHO, U. (2017). *Progress on drinking water, sanitation and hygiene : 2017 update and SDG baselines*. World Health Organization and the United Nations Children's Fund.
- Wolf, J., Hubbard, S., Brauer, M., Ambelu, A., Arnold, B. F., Bain, R., Bauza, V., Brown, J., Caruso, B. A., Clasen, T., Colford, J. M., Freeman, M. C., Gordon, B., Johnston, R. B., Mertens, A., Prüss-Ustün, A., Ross, I., Stanaway, J., Zhao, J. T., ... Boisson, S. (2022). Articles Effectiveness of interventions to improve drinking water, sanitation, and handwashing with soap on risk of diarrhoeal disease in children in low-income and middle-income settings: a systematic review and meta-analysis. In *www.thelancet.com* (Vol. 400). www.thelancet.com

Zadock, H. B., Muasya, D., & Gichuhi, D. (2024). Education The Relationship Between Reliability of Improved Water Service And Pupil's Hand Washing Practices In Lurambi Sub County, Kakamega County, Kenya. *African Journal of Emerging Issues (AJOEI)*. Online ISSN, 18(6), 70–82.