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Waste Disposal And Population Health In Kisoro District: A Case Study Of Kisoro Municipality`

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Abstract

The study investigates the impact of solid waste disposal on public health in Kisoro Municipality. A total number of three hundred and eighty-four respondents (150) comprising of 60 males and one 90 females were used as a sample of the study respectively for ensuring good coverage. This is in line with Slovenes formula for determining sample size. An instrument developed by the researcher titled the impact of poor solid waste management on public health questionnaire was used for data collection the instrument was validated and reliability index of 0.84 was obtained. The data collected were analyzed using descriptive statistics for research questions Likert scale. The result of the study revealed among others that; poor solid waste disposal lead to outbreak of diseases as the result shows that majority of the respondent were of the view that poor solid waste disposal leads to outbreak of diseases as proof by 50% of the respondents. The study concluded that Proper solid waste disposal should be used to ensure public health safety. The study recommended among others that the community leaders of each ward should be encouraged to enlighten people on the dangers associated with poor solid waste disposal through the public enlightenment to stop dumping of solid waste indiscriminately as this may help to reduce the outbreak of diseases.

Keywords: Assessment, impact, poor solid, waste management, public health

Background of the study

The World Bank estimates that the world generates 2.24 billion tonnes of municipal solid waste annually, a figure projected to rise by 73% to 3.88 billion tonnes by 2050. In high-income countries, sophisticated systems for collection, recycling, and disposal mitigate health risks, yet low and middle-income countries collectively manage only about 48% of waste in controlled facilities, leaving the rest to be dumped in open landfills, burned, or littered in the environment (Christopher et al., 2022). This inadequate management creates a nexus of health hazards, serving as a breeding ground for disease vectors like mosquitoes, rodents, and flies, which transmit illnesses such as malaria, dengue fever, and cholera. Furthermore, open burning releases harmful pollutants including dioxins and particulate matter, contributing to respiratory ailments and environmental degradation (Regan et al., 2024). The global community, through the United Nations Sustainable Development Goals (SDG), specifically Target 11.6, aims to reduce the adverse per capita environmental impact of cities, including by paying special attention to municipal solid waste management. This underscores the universal recognition that effective waste disposal is not merely a municipal service but a fundamental determinant of urban health and sustainability (Sarah et al., 2024).

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Across the African continent, rapid urbanization is outpacing the development of essential municipal services, leading to a crisis in solid waste management (Frank et al., 2023). With an urban population growth rate of approximately 3.5% per year, African cities are struggling under the weight of increasing waste generation. It is estimated that over 70% of municipal solid waste in Sub-Saharan Africa is either dumped indiscriminately or burned in the open. This crisis is exacerbated by a combination of factors, including weak governance, inadequate funding, poor infrastructure, and public apathy (Rashid et al., 2023). The health consequences are severe and disproportionately affect the urban poor who often live in informal settlements adjacent to dumping sites. These populations face elevated risks of diarrheal diseases, acute respiratory infections, and vector-borne diseases. The economic costs are also significant, stemming from increased healthcare burdens and lost productivity (Isaac et al., 2023). While some initiatives promoting recycling and waste-to-energy projects are emerging, they are often fragmented and unable to operate at the scale required to address the monumental challenge, leaving the majority of urban residents exposed to the health risks of poorly managed waste (Kesharwani & Bisht, 2012).

Uganda exemplifies the waste management challenges prevalent in East Africa. The country experiences one of the highest urbanization rates in the world, and its municipal authorities are consistently unable to provide adequate solid waste management services (Regan et al., 2024). The National Environment Management Authority (NEMA) reports that urban areas in Uganda generate about 1,500 tonnes of solid waste per day, but only 40-50% is collected. The remainder is often burned, buried haphazardly, or discarded in drainage channels and open spaces. This situation is driven by a chronic under-investment in waste management infrastructure, a lack of enforcement of environmental laws, and low public awareness (Ntirandekura et al., 2022). The health impacts are starkly visible, with improper waste disposal contributing significantly to the high incidence of sanitation-related diseases. For instance, diarrheal diseases remain a leading cause of mortality among children under five, and poor drainage of leachate from waste contaminates water sources, leading to outbreaks of cholera and other waterborne diseases, particularly in densely populated urban centers (Abiodun et al., 2019). The Ugandan government's strategy has increasingly emphasized decentralization, placing the responsibility on district administrations and municipalities, but these local governments often lack the technical capacity and financial resources to execute their mandates effectively (Racheal et al., 2023).

Kisoro District, nestled in the scenic but densely populated southwestern highlands of Uganda, faces unique waste management challenges that are acutely concentrated in its main urban center, Kisoro Municipality (Ariyo, 2023). As the district's commercial and administrative hub, the municipality experiences significant inward migration and a burgeoning population, which in turn leads to a rapid increase in solid waste generation from households, markets, and business establishments (Derrick et al., 2023). The municipality's location, characterized by hilly terrain and its

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proximity to sensitive ecosystems like the Bwindi Impenetrable National Park and Mgahinga Gorilla National Park, adds an extra layer of environmental urgency to the waste issue. The existing solid waste management system is critically overstretched, characterized by inadequate collection vehicles, limited waste receptacles, and irregular collection schedules (Christopher et al., 2022). Consequently, illegal dumping in valleys, roadsides, and watercourses is a common sight. This creates a direct and persistent threat to population health; the decomposing organic waste and stagnant water in blocked drains provide ideal breeding grounds for mosquitoes and other pests, while the contamination of soil and water sources poses risks of gastrointestinal diseases (Ivan et al., 2023). The situation is compounded by low public awareness on proper waste segregation and disposal practices. Therefore, this study is imperative to investigate the specific nexus between the current waste disposal mechanisms and the health outcomes of the population in Kisoro Municipality. The findings will provide crucial, localized evidence to inform policy and practical interventions aimed at safeguarding public health and ensuring environmental sustainability in this unique and rapidly developing Ugandan municipality (Alex et al., 2024).

Statement of the problem

Kisoro Municipality, the primary urban center of Kisoro District, faces a growing public health crisis driven by inadequate solid waste management (Deus, 2023). The municipality's rapid population growth and commercial activity have led to a significant increase in waste generation, which has critically overwhelmed the existing disposal infrastructure. This is evidenced by irregular waste collection services, a scarcity of designated receptacles, and prevalent illegal dumping of refuse in open spaces, drainage channels, and roadside areas (Christopher et al., 2022). This poor waste management creates a direct and severe threat to population health. The accumulating waste serves as a breeding ground for disease vectors, including mosquitoes, rodents, and flies, increasing the risk of malaria, dengue fever, and diarrheal diseases. Furthermore, the contamination of soil and water sources by leachate from decomposing waste poses a continuous hazard, potentially leading to outbreaks of cholera and other gastrointestinal illnesses (Abiodun et al., 2019). While the link between waste and disease is globally recognized, there is a lack of specific, empirical data on the nature and severity of this relationship within the unique context of Kisoro Municipality (Abiodun et al., 2019). Therefore, this study is necessary to definitively investigate the impact of current waste disposal practices on the health of the population, to provide evidence for targeted interventions.

Specific Objectives

i. To find out the level of waste disposal in Kisoro Municipality.
ii. To find out the level of population health in Kisoro Municipality.
iii. To find out the relationship between waste disposal and population health in Kisoro municipality.

Methodology

This design, utilizing a cross-sectional approach, was deemed appropriate for obtaining a comprehensive picture of

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the situation as it stood at the time of the study, and was valued for being comparatively economical and straightforward to analyze. The study was geographically focused on Kisoro Municipality in Kisoro District, a region in the Kigezi area bordered by Kabale District, the Democratic Republic of Congo, Kanungu District, and Rwanda. The target population for the inquiry consisted of 240 individuals, comprising resident members of the municipality as the primary respondents, supplemented by the three Local Council III Chairpersons and the Environmental Officer of Kisoro Municipality as key informants (Abiodun et al., 2022). The resident members were targeted because their areas, being at the grassroots level, were considered the most directly affected by waste disposal and its impacts on population health.

From this target population, a sample size of 154 respondents was derived using the Slovene's formula with an error tolerance of 0.05. This sample was composed of 150 resident members, the three Local Council III Chairpersons, and the one Environmental Officer (George Stanley & Nafiu, 2020). A mixed-method sampling technique was employed to select participants. Simple random sampling was used for the resident members to ensure each individual had an equal and independent chance of being selected, with specific attention paid to including both male and female members (Nafiu et al., 2017). For the key informants, purposive sampling was utilized, whereby the researcher used expert judgment to select the Local Council III Chairpersons and the Environmental Officer specifically for their unique knowledge and positions relevant to the research problem (Jallow et al., 2022).

Data collection was carried out using a combination of methods to ensure comprehensive data triangulation. The primary instrument was a questionnaire, with separate versions prepared for the resident members and the key informants (Nafiu et al., 2012). The questionnaires, written in English, contained sections on personal information, waste disposal practices, and population health, and were structured with closed-ended questions aligned with the study's objectives. To supplement the questionnaires, interviewing was employed, utilizing brief interview guides. This method was chosen to ensure a higher response rate, allow for deeper probing of responses, and provide flexibility in adapting the language for clarity, thereby minimizing misinterpretations (Nafiu et al., 2017). To ensure the quality and accuracy of the collected data, rigorous control methods were implemented. Validity was established by seeking expert opinions from a research supervisor to refine the instruments, while reliability was confirmed through a pre-test survey in a similar setting to check for consistency in the results before the main study.

Following data collection, the management and processing phase involved editing, coding, and tabulating the responses. Data analysis was performed using the Statistical Package for Social Sciences (SPSS) software (Nelson et al., 2022). Descriptive statistics, including frequency distributions and percentages, were used to analyze the

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quantitative data, while qualitative data from interviews was subjected to content analysis, with responses categorized into thematic areas. Throughout the research process, strict ethical considerations were upheld. This involved seeking informed consent from all respondents, assuring them of voluntary participation and confidentiality, and obtaining official permission from the university and local authorities.

Results

Table 1: The level of waste disposal in Kisoro Municipality

Statements about the level of waste disposal in Kmc	strongly agree(5)		agree (4)		un decided (3)		disagree (2)		strongly disagree(1)		Total
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq (%)
What is the level of waste disposed in Kmc	30	15	15	25	3	5	7	11.7	5	8.3	60 (100%)
Identifying the relationship between waste disposal and population health.	15	25	30	50	2	3.3	8	13.3	8.3	8.3	60 (100%)
Responsibility for the clearing of waste disposal in Kmc	5	8.3	2	3.3	15	25	8	13.3	30	50	60 (100%)
Is there possible areas for disposing off waste in Kmc	30	50	8	13.3	15	25	2	3.3	5	8.3	60 (100%)

Source: Field Survey (**2024)**

According to the Likert table 1 above, the level of Waste Disposal in Kisoro Municipality in as urbanization and population are high with the highest percentage of respondents of about 60%. Therefore, Urbanization and population growth are solely responsible for high increasing rate of solid waste and its proper management is a major problem of Municipal Corporation. In this study, the sources and components of solid waste were identified; type and the quantity of solid waste disposed, methods of solid waste disposal and impact of improper waste management on health were highlighted. The result shows that excreta and other liquid and solid waste from households and the community, are a serious health hazard and lead to the spread of infectious diseases. In my findings 25% of the local members agreed that the level of waste disposal in Kisoro municipality is high. They just dispose garbage anywhere in the town (Nelson et al., 2023). There are potential risks to environment and health from improper handling of solid wastes. Direct health risks concern mainly the workers in this field, who need to be protected, as far as possible, from contact with wastes. There are also specific risks in handling wastes from hospitals and clinics. For the general public, the main risks to health are indirect and arise from the breeding of disease vectors, primarily flies and rats.

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The level of waste disposal in Kisoro municipality is medium because some of the people usually burn garbage from their homes within the municipality and even from their homes. Uncontrolled hazardous wastes from industries mixing up with municipal wastes create potential risks to human health. Traffic accidents can result from toxic spilled wastes. There is specific danger of concentration of heavy metals in the food chain, a problem that illustrates the relationship between municipal solid wastes and liquid industrial effluents containing heavy metals discharged to a drainage/sewerage system and /or open dumping sites of municipal solid wastes and the wastes discharged thereby maintains a vicious cycle including these some other 25 types of problem for instance Chemical poisoning through chemical inhalation. (Participant 6 stated). One of the participants revealed that the level of waste disposal within the municipality is very high because some of the traders just expose wastes within town. Improper waste disposal and management causes all types of pollution: air, soil, and water. Indiscriminate dumping of wastes contaminates surface and ground water supplies. In urban areas, waste clogs drains, creating stagnant water for insect breeding and floods during rainy seasons. Uncontrolled burning of waste and improper incineration contributes significantly to urban air pollution. Greenhouse gases are generated from the decomposition of organic wastes in landfills, and untreated leachate pollutes surrounding soil and water bodies. Health and safety issues also arise from improper WASTEM. Insect and rodent vectors are attracted to the waste and can spread diseases such as cholera and dengue fever. Using water polluted by waste for bathing, food irrigation and drinking water can also expose individuals to disease organisms and other contaminants. (Participant 12 revealed) In addition, another respondent revealed that Exhaust fumes from waste collection vehicles, dust stemming from disposal practices and the open burning of waste also contribute to overall health problems. People know that poor sanitation affects their health, especially in developing and low-income countries, where the people are the most willing to pay for environmental improvements. Furthermore, Current treatment strategies are directed towards reducing the amount of solid waste that needs to be land-filled, as well as recovering and utilizing the materials present in the discarded wastes as a resource to the largest possible extent. Different methods are used for treatment of solid waste and the choice of proper method depends upon refuse characteristics, land area available and disposal cost they are as follows. (Participant 7 revealed). The level of waste disposal to population health is considered high. It is a controlled combustion process for burning solid wastes in presence of excess air (oxygen) at high temperature of about 1000oc and above to produce gases and residue containing non-combustible material. One of the most attractive features of the incineration process is that it can be used to reduce the original volume of combustible MSW by 80– 90%. (Participant 7 added). Another respondent revealed that the level of waste disposal is still low because too much wastes exist in large towns and cities and Kisoro town is still developing. Rapid urbanization in developing countries leads to a dramatic increase in solid waste production, with serious socio-economic and ecological impacts. In order to avoid the associated hazards, particularly those related to human health and the environment, solid waste management is indispensable. Disposal of

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municipal waste that predominantly comprises household and commercial refuse has become a daunting task for local governments and municipalities of Uganda. Issues related to both inadequacy of service delivery and inappropriate disposal signify that waste management should be high on the local environment policy agenda. In particular, the external cost of waste management is high, and cost recovery of refuse collection may cause the exclusion of many households and additional costs on the households that avail themselves of the service. In this study, we carried out an evaluation of the health damage caused by improper waste disposal in a sample of heterogeneous households. In most developed countries, a door-to-door collection system is commonly used, but municipalities in developing countries can provide this service to only a limited proportion of the population due to financial and administrative incapacity [participant 9 revealed]. As a result, waste is thrown into open landfill sites and dumpsites, which evolve into sources of health and environmental threats for people living in the neighborhood. Because of poorly designed municipal waste management systems, many urban areas in developing countries experience significant environmental deterioration and health threats.

Table 2: The level of population health in Kisoro Municipality

Statements about the level of population health in Kmc	strongly agree(5)		agree (4)		un decided (3)		disagree (2)		strongly disagree(1)		Total
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq (%)
What is the level of population health in Kmc	30	15	15	25	3	5	7	11.7	5	8.3	60 (100%)
Identifying the relationship between population health and waste disposal.	15	25	30	50	2	3.3	8	13.3	8.3	8.3	60 (100%)
Responsibility for the people in handling their health in Kmc	5	8.3	2	3.3	15	25	8	13.3	30	50	60 (100%)
Is there a possible remedy for handling health issues in Kmc?	30	50	8	13.3	15	25	2	3.3	5	8.3	60 (100%)

Source: Field Survey (2024)

According to the Likert table 2 above, the level of population health in Kisoro Municipality is about 60% basing on the Municipal corporations which generally provide bins at a community level, and are evacuated after being filled.

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Waste containers are provided at designated convenient points within a community to enable households to put out their trash. Waste pick-up vehicles are supposed to empty these containers as soon as they are full. However, waste is often overflowing, and land dumping takes place near the bins and on illegal sites. In addition, the paucity of bins increases the time, effort, and cost of waste disposal and households may, in turn, choose inappropriate dumping on unauthorized sites. Illegal dumping on unauthorized land, in canals and streams, and on roadsides all contaminates canal and ground water supplies. Moreover, improperly handled waste blocks sewage, which creates a conducive environment for the breeding of mosquitoes that spread malaria, dengue, and other infections. One of the respondents revealed that the level of population health in Kisoro Municipality is relatively medium at around 13.3%. Some of the people are still conservative about the advantages of population health where they just expose wastes everywhere which results into danger to the population within Kisoro Municipality. (Participant 2 stated). Municipal corporations in Uganda generally provide bins at a community level, which are evacuated after being filled. Waste containers are provided at designated convenient points within a community to enable households to put out their trash. Waste pick-up vehicles are supposed to empty these containers as soon as they are full. However, waste is often overflowing, and land dumping takes place near the bins and on illegal sites. In addition, the paucity of bins increases the time, effort, and cost of waste disposal and households may, in turn, choose inappropriate dumping on unauthorized sites. Illegal dumping on unauthorized land, in canals and streams, and on roadsides all contaminates canal and ground water supplies. Moreover, improperly handled waste blocks sewage, which creates a conducive environment for the breeding of mosquitoes that spread malaria, dengue, and other infections and the findings are in line with that of Bwito, 2019). In addition, another respondent stated that the level of population health is relatively low. Accordingly, Kisoro Municipality is facing serious solid waste management (SWM) problems that have received a lot of attention due to an increase in environmental vulnerability [participant 2 revealed]. Recent assessments in major cities of Kisoro showed that the average waste generation rate from all types of municipal controlled areas varies from 0.283 kg to 0.613 kg per person each day, and waste production is growing annually at a rate of 8.3% to 15% which has affected population health in Kisoro. In addition, Kisoro ranks highest for poorly handled plastic in Kigezi region. In Kisoro 1 million tons of solid waste are produced annually, out of which 13.3% are plastics, contributing approximately 0.2million tons of plastic waste along the Indus river to Chuho. Almost 1.2 million plastic bags are produced in a year and make their way into water streams and landfills, making sewerage systems even harder to manage and this has affected population health in Kisoro municipality.

Relationship between waste disposal and population health in Kisoro District

One of the most serious health consequences of dumping waste in inhabited areas is the risk of infectious diseases through water. Endemic zoon tic diseases, which are highly correlated with fecal material at waste disposal sites, are

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usually flushed away by rain into the surface or ground water, thus polluting the water source. Contaminated water contains fecal coli form counts up to

15.25 MPN/100ML of water, as compared to the recommended level of 0 MPN/100 ML, which makes it extremely unhealthy for drinking purposes [participant 7 revealed]; the health effects of heap MPN are metals in waste can also be life threatening and may range across headache, irritability, memory deterioration, diminished intellectual capacity, kidney damage disease, and liver and bioaccumulation leading to cancer. The relationship between waste disposal and population health is statistically significant. The disposal of waste at landfill sites has an effect on people living in the site neighborhoods [respondent 2 revealed]. A study showed that 60% of participants living near a landfill site reported significant air pollution due to bad odors, and 56% of those living near the landfill site expressed concerns for their health in the future. The prevalence of diarrhea in households was found to be 13.3% in a cross-sectional epidemiological analysis [participant 5 added]. One of the most serious health consequences of dumping waste in inhabited areas is the risk of infectious diseases through water. Another respondent revealed that the existing waste disposal systems in developing countries have resulted in the mushrooming of unplanned dumpsites. Environmental governance of SWM is becoming the central component of a sound waste management policy that dominates the development discourse. Studies in the literature have focused primarily on the planning part, and very few studies have investigated the social and health costs of waste production and its disposal activities. The externality aspect of waste management makes it essentially a normative policy issue. The utility provider may recover the financial cost of the service from waste producers; however, it would be difficult to analysis this without calculating the cost of externalities creating the relationship statistically significant. The relationship between the two terms is considered as a main challenging issue. It is alarming that waste is typically discarded in an unauthorized way and that many residents of the metropolis do not dump their waste at the designated sites. Even the planned urban areas lack appropriate waste collection. Private Service providers in the waste management sector operate either on a commercial basis where services are provided to those who demand it or as private 30 operators who serve all residents of a locality and receive a subsidy from local municipal governments. In addition, source-segregation of waste materials among households prior to collection is unusual in the sample compared to in advanced countries, where waste is typically segregated and collected separately. In Sustainability 2021, 13, 2717 4 of 18 the twin cities, waste segregation at the source among households is lacking, and generated waste is jumbled in a single container. Solid waste management is unsustainable in Islamabad–Rawalpindi as the local authorities fail to handle waste properly. The spreading of uncollected heaps of waste is visible almost everywhere, posing a major threat to public health and the quality of the local environment.

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Conclusion

Conclusively, the results of the study indicated that Relationship between waste disposal and population health in Kisoro Municipality was very significant. The decomposition of waste into constituent chemicals is a common source of local environmental pollution. This problem is especially acute in developing nations. Very few existing landfills in the world's poorest countries would meet environmental standards accepted in industrialized nations, and with limited budgets there are likely to be few sites rigorously evaluated prior to use in the future. The problem is again compounded by the issues associated with rapid urbanization. A major environmental concern is gas release by decomposing garbage. Methane is a by-product of the anaerobic respiration of bacteria, and these bacteria thrive in landfills with high amounts of moisture. Methane concentrations can reach up to 50% of the composition of landfill gas at maximum anaerobic decomposition.

Recommendations

To the local members; the members should always consider appropriate ways on how they can keep the Municipality clean so that they can have a better health and protection.

To the Government; First of all, it is urgent that government should come up with an implementation strategy that allows us to maintain the unique characteristics of Municipalities, Cities and Towns as a green industry, thereby eventually achieve green growth by actively developing public functions, such as atmospheric purification and environmental protection through better health and cleaning of towns, innovation and clean technology. It is particularly necessary to establish green governance where all members, relevant organizations and policy makers concerned can work together, where a strong implemented green growth and an effective execution system are required to accomplish green growth. The government should advice the members to always engage in cleaning towns and municipalities in appropriate seasons so as to gain much from sanitation and hygiene for not only family sustainability and consumption but also for the public. In addition to that, there should be a systematic stage-by-stage strategy to develop technology and be devised and implemented on a steady basis so that green technology successfully implemented.

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