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Environmental And Health Impacts Of Municipal Solid Waste Landfills

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Abstract
Background: Municipal solid waste landfills are said to be the most accepted method of solid waste disposal in the world, this is because its cheaper to manage as compared to other waste disposals. Countries worldwide face an ongoing challenge with solid waste with over two billion tons of Municipal Solid Waste produced every year. This has become a burden to the management of waste at the landfill. Objective: To examine the impacts of municipal solid waste management landfills where it looked at the environmental and health impacts of landfills. Methods: The study design was a cross-sectional study employing quantitative methods using literature review data. Random sampling of 30 articles was used. Data collection technique was done by reviewing the available information and data was analysed using STATA to get frequencies and percentages, chi-square test and regression analysis to test for significance of the findings.
Results: The study revealed a prevalence of 83.33% of environmnetal pollution with water pollution being significantly associated with the impact of landfill at a multivariate analysis of (AOR: 1.51; CI: 0.15 – 0.67; P-Value 0.004), and a prevalence of 73.33% of health impact of landfill having disease impact and nuisance as signifancantly associated with landfills at a multivariate analysis with (AOR: 1.73; CI: 0.31-0 .79; P-Value <0.001) and (AOR: 1.57; CI: 0.19-0.70; P-Value 0.001) respectively.
Conclusion and recommendation : The study findings indicate a high prevalence of environmental pollution with water pollution being significantly associated with the impact of landfills. Additionally, a significant prevalence of health impacts related to landfills was observed with both disease impact and nuisance being significantly associated with landfills. The resultts underscoe the urgent need for effective measures to address and mitigate the environmental and health consequences associated with landfills through for proper waste management to reduce on the impacts experienced from the landfills.
Keywords: *Landfill, Municipal Solid Waste, Solid Waste Management, Uganda*

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I. Introduction And Background

Urban authorities are grappling with the challenge of managing solid waste as the volume of generated solid waste surpasses their ability in both finances and technical ability (WaterAid;WSUP;CIDI, 2011). Countries worldwide face an ongoing challenge in managing solid waste (Madinah, 2016). The management of municipal solid waste involves a multidisciplinary approach that includes waste minimisation, proper storage, waste collection, transportantion and disposal of waste (Nyampundu et al, 2020).

Municipal solid waste landfills are said to be the most accepted method of solid waste disposal in the world (Aziz, et al; 2014) this is because its cheaper to manage as compared to other waste disposals (Nabukeera, Noriza, & Boerhannoeddin, 2015). However, these landfills are a constraint to the environment, peoples health and the countrys economy (Nabukeera et al., 2015). With the poor solid waste management at the source like reducing on the amount of waste generated, re-using and recycling of the solid waste has lead to the incerase in the amount of solid waste dumped at the landfill. The most affected people are those who leave near the landfill like bad smell, birds who end up being a nuisance in the area, leachet that contaminates their water and many others. In addition, the government of experience increase in the finace and technical demand in managing the increasing volume of sold waste disposed interms of paying workers, purchasing machines like vehicles to manage the waste.

Globally, the world produces over two billion tons of Municipal Solid Waste every year this has become a burden to the management of waste at the landfill (Bolen, 2021). Landfills in United States rank as the third most significant human generated methane accounting for more than 15% of all methane emissions in 2019 contributing to climate change a world global problem (United States Environmental Protection Agency). The reliance on landfill sites as the dominant linear approach for waste disposal in china is associated with diverse problems (Lee et al; 2020) like landfill emissions, depreciation of land value and other related concerns.

In South Africa (Makgae, 2010) reported that the predominant method of waste disposal in South Afric is landfilling and its approximated that 10.2 million tons of both general and harzadous end up in landfills which comes with adverse impact on the environment and the health of the people. In Uganda, around 70-80% of the waste produced in the city consists of organic materials with the remaining portion being inorganic (Nabukeera, Boerhannoeddin, & Noriza, 2014), it was indicated that efficiency in solid waste has improved from 45-55% of the generated waste in the city (Madinah, Boerhannoeddin, & Ariffin, 2016). A study carried out by (Isoto et al; 2011) found that poorly managed landfills have various problems associated with them and the study established problems from the respondents where 99.5% reported bad smell as they said that the smell is unbearable.

In Uganda, waste management receives less than 10% of urban council budget (Okot-Okumu & Nyenje, 2011). Around 75% of used plastic botlles end up in landfills, lakes, and rivers which is seriously damaging to the environment (Olukya, 2022) in which laws have been put in place to minimise on the amount of waste dumped in the landfill where in 2011, the Government of Nepal has enacted the solid waste management Act and is working actively in partnership with local bodies, private sectors, community Based Organisations (CBOs) and Non-Government Organisation (NGOs) and INGOs in waste management (Baral 2019) and this includes protecting landfills. However, the operated landfills continue to neglect environmental precautions and release leachate and gases that are a challenge (Lars and Boyer, 1999) cited in (Isoto et al; 2011).

Problem statement

There are many problems that are caused by landfill and this is not different in Uganda hence threatening the livelihoods and wellbeing of the nearby communities. These problems include health concerns like diarrhea, monkey pox and the others, the waste produce leachets which destroys the environment (Kamaruddin et al., 2017) in which the soil and water gets polluted which affects people's lives when they consume the contaminated water and food, the waste is also a nuisance to the people around the landfill, increases government expenditure in waste management. Although there have been measurers put in place to minimize waste dumped at the landfill through waste minimization, reuse, recycling and others (Nabukeera et al., 2014), the amount of waste generated and dumped at the landfill keeps on increasing. Therefore, this research will examine the ways solid waste could be minimized at the landfill to inform and support the design of interventions towards minimizing the dumping of solid waste at the landfill. The resultant improvement in the minimization of generating and dumping waste at the landfill may aid in reducing the aforementioned problems.

II. Literature Review

Environmental impact of landfills

Land filling affects the environment through gas emissions, waste littering and leachate movement making it a global issue that requires intervention (Vaverková, 2019). Leachate from landfills releases hazardous liquid substances (Tenodi et al., 2020), the common pollutants found in landfill leachate are toxic and persistent inorganic and organic substances (Parvin & Tareq, 2021). In dry areas, landfills generate less leachate often

seasonally enabling a relaxed landfill design standards due to low precipitation although site specific geological and ground water conditions need to be considered (Blair & Mataraarachchi, 2021).

Water pollution

The landfill has an impact on the decreasing quality of surface and ground water (Al-Arifi, Al-Agha, & El-Nahhal, 2013; Khoiron et al., 2020). In the absence of a proper liner damage, leachate can link through soil contaminating groundwater and nearby rivers making it a threat to aquifer restoration (Mishra, Tiwary, Ohri, & Agnihotri, 2019). In addition, proximity to landfills often lead to compromised groundwater quality due to leachate infiltration posing a threat to human and animal health when used for drinking water (Blair & Mataraarachchi, 2021, Kumari, Gupta, & Kaur, 2017; Danthurebandara, Van Passel, Nelen, Tielemans, & Van Acker, 2012; Parvin & Tareq, 2021) and when groundwater is shallow, it's advisable to implement a leachate control system regardless of climate (Blair & Mataraarachchi, 2021)**.**

Air Pollution

The global environmental impact of landfill emissions primarily includes contributing to the greenhouse effect, ecosystem damage, explosion risks and odor issues caused by trace gases (Danthurebandara et al., 2012; Wang, Levis, & Barlaz, 2019). Landfill operations affect air quality in and around the site through activities like transportation, stockpiling, compaction, waste combustion and natural waste degradation (Khoiron et al., 2020). As gas production increases, the landfill's internal pressure exceeds atmospheric pressure making gas to migrate to areas of lower resistance (Aljaradin & M Persson, 2012).

Landfills emit dust and gases produced from decay of organic wastes including methane and carbon-dioxide, and fire smoke causing air pollution (Danthurebandara et al., 2012; Lou & Nair, 2009; Tenodi et al., 2020; Iravanian & Ravari, 2020; Yang et al., 2014; Yang et al., 2014) and due to the presence of various harmful pollutants, landfill gas emissions are considered a hazardous source of pollution under the urban air toxic strategy posing risks to human health and the environment (Blair & Mataraarachchi, 2021).

Soil pollution

Gas pollution from landfills can infiltrate surrounding soil, depleting available oxygen and harming soil-dwelling organisms and plant roots, in addition, gases released from landfills contribute to acid rain impacting soil acidification, ecosystems and plant functions like stomata control, photosynthesis, enzyme activity and synthetic pathways, and precipitation passing through waste undergoes chemical reactions and carries dissolved constituents that can enter and contaminate the soil diminishing fertility and agricultural yield (Aryampa, Maheshwari, Sabiiti, Namuddu, et al., 2023; Kumari et al., 2017; Iravanian & Ravari, 2020; Khoiron et al., 2020).

Biodiversity damage

Gaseous pollutants impact plants, animals and ecosystem where gas migration beyond landfill boundaries displaces soil oxygen, reducing faunal populations and damaging vegetation, in addition, acidic gases contribute to acid rain further affecting soil acidification and ecosystems (Danthurebandara et al., 2012).

Landfill construction disrupts soil quality affecting porosity, density, water holding capacity and aggregate strength and the heavy machinery can cause excessive compaction with recovery taking longer in deeper soil layers (Danthurebandara et al., 2012) and the movement of heavy vehicles during landfill construction and operation leads to excessive soil compaction, vegetation destruction and direct impacts on animal life (Iravanian & Ravari, 2020).

Therefore, the study determined the environmental impacts of landfills.

Health impacts of landfills

Disease impact

In addition to environmental consequences, landfills have various socio-economic impacts including public health concerns (Aryampa et al., 2021; Parvin & Tareq, 2021; Aryampa, Maheshwari, Sabiiti, Bukenya, & Namuddu, 2023). Despite the implementation of advanced designs to minimize emissions, concerns persist regarding the health effects of residing or working near both new and old landfill sites where exposure to contaminants and emissions can occur through direct contact, inhalation or ingestion of contaminated food and water (Awino, 2020; Danthurebandara et al., 2012). Several studies have indicated an increased risk of developing cancer for individuals living near landfill sites and the most observed are cancers affecting the stomach, liver, intrahepatic bile ducts, trachea, bronchus, lung, cervix and prostate (Danthurebandara et al., 2012). Improper landfills harm air quality, endanger residents' health and increase disease risks (Kumari et al., 2017).

Pollution and environmental exposures are linked to preterm birth and low birth weight (Keeler et al., 2023). Close proximity to waste sites impacts children's growth and health (Kumari et al., 2017). Landfill odors cause short-term and long term issues including cancer (David, Thangavel, & Sankriti, 2019; Kumari et al., 2017).

Landfill proximity and groundwater use lead to frequent parasitic infections (Zhang et al., 2021; Kumari et al., 2017). Uncontrolled landfill gases pose fire and explosion risks if not managed (Blair & Mataraarachchi, 2021). Contaminated water can lead to harmful crops and health issues (Mukherjee, Mukhopadhyay, Hashim, & Sen Gupta, 2015; Parvin & Tareq, 2021).

Metals in soil are absorbed by plants thus entering food chain impacting crops and animals (Danthurebandara et al., 2012). Mercury is highly toxic in food chain emitted by landfills via batteries and paint (Danthurebandara et al., 2012). Neglected landfill waste forms hazardous collapsing garbage mounds endangering lives (Blair & Mataraarachchi, 2021).

Land value and availability

The presence of flies, odor, smoke and noise near landfills poses a threat to water supplies and discourages people from living in close proximity (Khoiron et al., 2020). Landfills have a negative impact on property values with a decrease of 5.5_7.3% depending on the distance from the landfill while residential property values increase by an average of 6% as the distance from landfills increases (Danthurebandara et al., 2012). High-volume landfills depress values by 2.5% and the occupation and large space requirements of landfills contribute to land scarcity for human society and ecosystems (Danthurebandara et al., 2012).

Therefore, the study determined the health and social impacts of landfills.

III. Methodology

Study design

The study was a cross sectional, quantitative study that used literature review.

Sources of secondary data

Academic journals and publications which are scholarly journals, articles and conference papers were used.

Data collection methods/ instruments and procedures

The researcher relied on the existing sources and not directly collecting data. This was done by reviewing literature through searching, reviewing and analyzing previously published research articles, books, reports and other relevant documents related to the study.

Eligibility criteria

Inclusion

Secondary data in line with the studies specific objectives was reviewed.

Exclusion

Secondary data not in line with the studies specific objectives was not be reviewed.

Study variables and their measurements

Dependent variables

The dependent variable was the impact of landfills and was answered with a "Yes or No".

Independent variables

The independent variables were; water pollution, air pollution, soil pollution, noise pollution, biodiversity damage, disease impact, nuisance, visual impact, community welbeing and fire explosion, and these were measured with a "Yes or No".

Quality control measures

To ensure the reliability, validity and accuracy of the study, the following are the quality measures which were employed;

- ✓ Data quality checks by regular monitoring and reviewing of the collected data for accuracy.
- ✓ Data entry and cleaning by implementing double data entry to minimize data entry errors.
- ✓ Content validity was done by ensuring that the measurement tool covers all relevant aspects of the association between knowledge, awareness and MSWM.

Data collection methods and tools

Systematic review of secondary data was employed by the researcher in relation to the study objectives.

Data collection and procedure was done as follows;

- ✓ 30 articles from 2012 -2023 were retrieved and reviewed

✓Data quality was evaluated by looking at its accuracy, reliability and relevance.
✓Data was managed by entering it in excel, securely stored and backed up to maintain its integrity.
✓Data was cleaned and organized to ensure it is in a suitable format for analysis by removing irrelevant variables to ensure accuracy of data.
✓After data collection, data was analyzed using STATA.
✓And finally, a report was written and the findings were disseminated through academic publications.

Data management and analysis

Collected data was organized in a systematic and structured way by creating and naming the files and documentation of data sources.

Data cleaning and preprocessing were done to address any inconsistency and missing values in the secondary data by standardizing variables.

Relevant variables were selected from secondary data to align with the research objectives by including both the dependent and independent variables and excluded variables which were not related directly to the study.

Data integration were done by integrating and merging the datasets appropriately by ensuring that the variables are compatible and have common identifiers to combine the data effectively.

Data analysis

Data was analyzed in three (3) stages;

i) Univariate level. Data was described by summarizing the variables of the study. Frequencies and percentages were obtained.
ii) Bivariate analysis. This was done to determine the relationship between the dependent variable and the independent variables. Since the outcome was binary categorical, Odds ratio and confidence intervals were obtained to identify the significance level between the independent variable and the outcome.
iii) Multivariate analysis. In order to predict for association and to control for the confounding variables. Variables associated at bivariate with a P-Value less than 0.20 were taken at the multivariate level where conclusions were drawn for association after controlling for all the other variables. Because the outcome was binary, Logistic regression was applied and variables with P value ≤ 0.05 at 95% CI were considered as the impact of landfills.

Ethical considerations

The study respected copyright laws by correctly citing and attributing the sources of the data. Privacy and confidentiality of individuals associated with the data were maintained.

Limitations of the study

The study used a literature review study design which had a challenge of data relevance and accuracy because they don't directly address the research questions or objectives of the study. This was minimized by clearly defining the study objectives to ensure that the secondary data aligns with the specific needs of the study.

The study used secondary data which affected the quality of data. Data may be incomplete or contain errors thus the researcher evaluated the reliability, validity and accuracy of the data before using it for analysis.

Plan for dissemination of findings

Research report was written and handed over at the university (IUIU), and any other interested stakeholders for implementation of the study findings.

IV. Results

Characteristics of the respondents on the impact of landfills

A total of 30 articles were included in the study. The percentage of participants who reported that landfills have an impact to the environment causing water pollution were 70%, air pollution 56.67%, soil pollution 56.67%, noise pollution 16.67%, while biodiversity damage was 26.67%. in addition, participants who reported that landfills have an impact on people's health, those that reported disease impact were 60%, nuisance 40%, visual impact 16.67%, community wellbeing 16.67%, and fire explosion 16.67%.

Table 1 characteristics of the impact of landfill

variables	Frequency (n=30)	Percentage (%)
Water Pollution		
Yes	21	70.00%
No	9	30.00%
Air Pollution		
Yes	17	56.67%

No	13	43.33%
Soil Pollution		
Yes	17	56.67%
No	13	43.33%
Noise Pollution		
Yes	5	16.67%
No	25	83.33%
Biodiversity damage		
Yes	8	26.67%
No	22	73.33%
Health		
Disease Impact		
Yes	18	60.00%
No	12	40.00%
Nuisance		
Yes	12	40.00%
No	18	60.00%
Visual impact		
Yes	5	16.67%
No	25	83.33%
Community wellbeing		
Yes	5	16.67%
No	25	83.33%
Fire explosion		
Yes	5	16.67%
No	25	83.33%

Environmental and health impacts of landfills

The study revealed 83.33% environmental impact of landfills in which water pollution, air pollution and soil pollution were statistically significant. The study also revealed that 73.33% of respondents reported health impact of landfills whereby disease impact and nuisance were found to be statistically significant.

Environmental and health impacts of landfills

At bivariate logistic regression analysis, landfill impacts that were significantly associated with the environmental impacts included water pollution (COR: 0.80; CI: 0.21 - 2.97; *P*-Value 0.0002), air pollution (COR: 1.60; CI: 0.52 - 4.89; *P*-Value 0.0059), and soil pollution (COR: 1.60; CI: 0.52 - 4.89; *P*-Value 0.0059).other impacts like noise pollution were not statistically associated with the environmental impact of landfills (Table 2). The health impacts statistically associated included disease impact (COR: 17.00; CI: 2.26 - 127.74; *P*-Value 0.0016), nuisance (COR: 1.25; CI: 0.49 - 3.16; *P*-Value 0.0080), visual impact (COR: 2.12; CI: 0.91- 4.92; *P*-Value 0.1464), community wellbeing (COR: 2.12; CI: 0.91- 4.92; *P*-Value 0.1464) and fire explosion (COR: 2.12; CI: 0.91- 4.92; *P*-Value 0.1464), (Table 3).

After running a multivariate analysis, variables that were significantly associated with the environmental impact of landfills included water pollution (AOR: 1.51; CI: 0.15 – 0.67; *P*-Value 0.004), with a *p*-value ≤0.05 (Table 4). Variables that were significantly associated with the health impact of landfills included disease impact (AOR: 1.73; CI: 0.31-0 .79; *P*-Value <0.001), and nuisance (AOR: 1.57; CI: 0.19-0.70; *P*-Value 0.001), with a *p*-value ≤0.05, (Table 5).

After adjusting for Air pollution, Soil pollution, Noise pollution and Biodiversity damage, there were higher odds of polluting water as a result of landfills than not having polluted water (AOR: 1.51; CI: 0.15 – 0.67; *P*-Value 0.004). After adjusting for Visual impact, community wellbeing, fire explosion and nuisance, the odds of causing diseases to the surrounding people was (AOR: 1.73; CI: 0.31-0 .79; *P*-Value <0.001) as compared to people with no diseases. After adjusting for Visual impact, community wellbeing, fire explosion and disease Impact, the odds of causing nuisance to the surrounding was (AOR: 1.57; CI: 0.19-0.70; *P*-Value 0.001) as compared to those staying far from the landfill.

Table 2 Bivariate analysis of the environmental impact of landfills

variables	Environment Impacts of solid waste landfills		Unadjusted OR (95%CI)	P-value
	Yes (%)	No (%)		
N=30	25 (83)	5 (17)		
Water Pollution	21 (70)	9 (30)	0.80 (0.21-2.97)	0.0002
Air Pollution	17 (57)	13 (43)	1.60 (0.52- 4.89)	0.0059

Soil Pollution	17 (57)	13 (43)	1.60 (0.52- 4.89)	0.0059
Noise Pollution	5 (17)	25 (83)	4.00 (1.50-10.65)	0.2815
Biodiversity damage	8 (27)	22 (73)	3.40 (1.25- 9.21)	0.1464

Bivariate logistic regression analysis, 95% Confidence Interval, *P* value <0.20 are statistically significant

Table 3 Bivariate analysis of the health impacts of landfills

variables	Health impacts of solid waste landfills		Unadjusted OR (95%CI)	P-value
	Yes (%)	No (%)		
N=30	22 (73)	8 (27)		
Disease Impact	18 (60)	12 (40)	17.00 (2.26-127.74)	0.0016
Nuisance	12 (40)	18 (60)	1.25 (0.49- 3.16)	0.0080
Visual impact	5 (16.67)	25 (83.33)	2.12 (0.91- 4.92)	0.1464
Community wellbeing	5 (16.67)	25 (83.33)	2.12 (0.91- 4.92)	0.1464
Fire explosion	5 (16.67)	25 (83.33)	2.12 (0.91- 4.92)	0.1464

Bivariate logistic regression analysis, 95% Confidence Interval, *P* value <0.20 are statistically significant

Table 4 Multivariate analysis of the environmental impact of landfills

variables	Environmental impacts of solid waste landfills		Unadjusted OR (95%CI)	P-value	Adjusted OR (95%CI)	P-value
	Yes (%)	No (%)				
Water Pollution	21 (70)	9 (30)	0.80 (0.21-2.97)	0.0002	1.51 (0.15-0.67)	0.004
Air Pollution	17 (57)	13 (43)	1.60 (0.52-4.89)	0.0059	1.14 (-0.16-0 .38)	0.414
Soil Pollution	17 (57)	13 (43)	1.60 (0.52-4.89)	0.0059	1.15 (-0.13-0.41)	0.296
Biodiversity damage	8 (27)	22 (73)	3.40 (1.25-9.21)	0.1464	1.46 (-0.15-0.33)	0.455

Multivariate analysis, 95% Confidence interval, *P* value<0.05 are statistically significant

Table 5 Multivariate analysis of the health impacts of landfills

variables	Health impacts of solid waste landfills		Unadjusted OR (95%CI)	P-value	Adjusted OR (95%CI)	P-value
	Yes (%)	No (%)				
Disease Impact	18 (60)	12 (40)	17.00 (2.26-127.74)	0.0016	1.73 (0.31-0 .79)	<0.001
Nuisance	12 (40)	18 (60)	1.25 (0.49-3.16)	0.0080	1.57 (0.19-0 .70)	0.001
Visual impact	5 (17)	25 (83)	2.12 (0.91-4.92)	0.1464	1.26 (-0.09-0.56)	0.156
Community wellbeing	5 (17)	25 (83)	2.12 (0.91-4.92)	0.1464	1.02 (-0.31-0.34)	0.910
Fire explosion	5 (17)	25 (83)	2.12 (0.91-4.92)	0.1464	0.90 (-0.44-0.25)	0.574

Multivariate analysis, 95% Confidence interval, *P* value<0.05 are statistically significant

V. Discussions

This literature review study examined the environmental, health and social impacts of municipal solid waste landfills. The impact of landfill on the environment was on water pollution, air pollution, soil pollution, noise pollution and damage on the ecosystem; the health of landfills was on causing diseases to people exposed to the waste, impact on plants, fire outbreak, waste nuisance, land value, land availability. The findings reveal that majority of the respondents recognize the negative impact of landfills on the environment.

The major environmental impact of landfill was reported to be on water pollution where a much concern was seen on the leachet that percolates into the soil to the underground water and also through erosion that contaminates the surface water. Contaminated water affects both human and animal life when they get into contact with the water for example drinking, bathing, washing clothes and others. In addition, contaminated water bodies like lakes and rivers can kill the aquatic life such as fish and make them poisonous for human consumption. This was also reported in a similar study by (Ismail & Latifah, 2013; Ozbay, Jones, Gadde, Isah, & Attarwala, 2021),

however, this contradicts with a study carried out by (Nabukeera et al., 2015) who reported that there is no pollution on the surface spring of the Landfill as well as the ground water.

Similarly, the study reveals air pollution as another environmental impact. This is because of the gases emitted at the land fill like methane and carbon-dioxide, fire explosions that produce smoke in the atmosphere and the dad odor produced from the decomposition of the biodegradable waste as also stated in a similar study by (Ozbay et al., 2021). These pollutants have a great impact on the health of people when they inhale the particulates found in the air, the greenhouse gases produced like methane deplete the ozone layer leading to climate change.

The study also reveals that landfills have an impact on soil quality. This is because of the metals that are found in the waste including leachet. Polluted soil has consequences such as reduction in the growth of other plants which affects the fauna of the place and affects agricultural production. In addition, when crops are polluted, the chemicals will enter the food chain and be consumed by people leading to different diseases like cancer, food borne diseases and others which are a challenge to human lives. It was reported that landfills are a danger to the ecosystem. This can be during landfill operations such as construction when the top soil is removed which affects the natural habitats, loss of biodiversity and the disruption of the entire ecological process as also explained by a study conducted by (Vaverková et al., 2023) that stated that the near surface pollution events which are not captured by the existing regulatory monitoring schemes have affected the vegetation in the nearby places of the landfills.

However, it was found out that a smaller percentage of the respondents reported noise pollution. Although the reporting is low, it suggests that noise is a challenge to people living near the landfill. Noise pollution is mostly generated during landfill operations such as compacting waste, disposal of waste and others. Noise can lead to vibrations which affects the stability of the soils that can cause the collapse of some buildings and also affects the hearing of the people thus leading to poor quality of life of the people.

There is a high potential of health risks associated with staying near landfills. This can be due to air pollution which is a result of fire outbreaks from the explosion of gases, bad odor, and dust. A study by (Tansel & Inanloo, 2019) stated that odors are one of the major causes of complains by the residents living around landfills. This can be transmitted to the people through the inhalation of the particles; people get diseases like respiratory diseases, eye inching and others. In addition, water pollution can lead to skin problems when in contact with contaminated water, water and food borne diseases when drinking contaminated water and eating food prepared with polluted water. Soil pollution also affects people's health in a way that contaminated soil contaminates plants by retarding their growth and also making other plants poisonous to the health of the people when they consume it. These plants and fish contain heavy metals like zinc, lead, mercury, copper and others that cause cancer, congenital problems and others to the people exposed with the landfill.

It was also found out that landfill impacts on the value of the land. This is because of the nuisance from the landfill such as flying papers and polythene bags blown by the wind, bad odor and smoke due to explosions of gases and the fire set by the waste pickers at the landfill. This can be seen during land purchasing in which people prefer to buy it at a lower price as compared to places far away from the landfill. in addition, people also do not prefer to settle in places near the land fill which explains why people who settle near the landfill are low income earners.

Landfills were reported to have an impact on the availability of land because landfill occupies a very large piece of land which could be used for other developmental activities like commercial centers. However, this was reported with a small percentage meaning that the respondents didn't prioritize the aspect of land value and availability.

VI. Conclusion

The study revealed that a high percentage of the respondents reported water pollution as the major environmental pollution by landfills followed by soil pollution, air pollution and damage of the ecosystem showing their knowledge and awareness of the hazards associated with the exposure of landfills. In addition, health concerns were raised as one of the impact of landfills which showed that people living near the landfill are at a higher risk of getting diseases due to their exposure to the landfill which is from getting in touch with the polluted water, air and the crops contaminated from the polluted soil.

VII. Recommendations

Health education and awareness is important to the people living around the landfills so as to enable them take precaution measures such as boiling water, not carrying out agriculture on polluted soil and others.

There is need for proper waste management like reducing, reusing, recycling, composting and waste to energy conversion which should be aimed at reducing waste dumped in the landfill. This can be achieved through public education and awareness campaigns to promote proper waste disposal and government should promote

recycling companies through tax subsidies and already market for the products produced for example build Uganda buy Uganda products.

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