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Anthropology

A SYSTEMATIC REVIEW ON SOLID WASTE DISPOSAL AND HUMAN HEALTH RISKS

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ABSTRACT **Background:** Open dumping and substandard waste disposal practices have been cited as key contributors to rising environmental and public health concerns in many developing nations, driven by rapid urbanization and population growth. Such concerns have seen the rise of large volumes of municipal solid waste that is produced due to household and consumer products in the developed world. Poor waste disposal practices have been found to pose risks not only to human health but also to environmental sustainability and general community well-being. Of particular concern are individuals living near these dumping sites who are at risk of environmental contamination. Objective: To systematically evaluate the effects of dumping sites on human health and socio-cultural coping mechanisms within such environments. Methods: Following the PRISMA guidelines, a systematic literature review was conducted. Existing studies include PubMed, ResearchGate, ScienceDirect, Springer Nature Link, and Google Scholar. Mainly, full-text journals are included, while conference papers, abstracts, and non-indexed sources are excluded. After screening and eligibility assessment, studies specifically analyzing the effects of waste management on human health were selected. A total of 26 articles were included in this systematic review. Results: The previous studies noted that the health and environmental effects associated with landfills and dump sites, especially in developing countries like India, were considerable. This is because the research showed pollution by heavy metals such as cadmium, lead, and arsenic, which result in serious illnesses, especially in children, as compared to adults. Conclusion: Poor waste management is still one of the biggest environmental and health problems facing developing countries today. Policy measures and health strategies are needed to solve the problem.

KEYWORDS : Dumping Zone, Human Health, Health Risk Assessment, Heavy Metals, Impact Of Solid Waste

INTRODUCTION

Ecological and public health consequences are adjacent and interlinked through pathways of ecological contamination. Inadequately managed and unsightly landfilling, hazardous contamination in the soil and underwater, discharges polluted gas like greenhouse gases, mainly methane, which is more harmful to residents who stay nearby. Poor waste management foundations have resulted in the continued practices of open dumping in low and middle-income countries worldwide. The exposed dumping of sources of environmental pollution, such as soil, water, and air, creates pathogens and opportunistic organisms, causes pollution of the groundwater, and creates non-point source pollution whereby the pollutants are carried by runoff water and leaching seepage and not by a specific source. Badly managed landfill sites and exposed dumping sites also serve as breeding grounds for vector-borne diseases, such as flies, mosquitoes, rodents, and stray animals, increasing the risk of vector-borne diseases. Low-weight waste products can be dispersed by wind, creating a risk for passerby and traffic. Often, waste pickers work at dumping sites to recover valuable materials from garbage, particularly metals, as a result discharge of poisonous gases, which contribution pollution and are also harmful to animals. Airborne discharge is a main concern, along with the discharges of toxic greenhouse gases like carbon dioxide, methane, and volatile organic compounds(VOCs), which are mainly carbon-based chemicals that readily evaporate at ambient temperatures and degrade air quality while posing serious risks to human health. Plastic combustion outside produces emissions such as dioxins and other cancer-causing substances, leading to constant negative impacts on both humans and ecosystems.

There is considerable environmental degradation as well as health hazards among individuals residing close to places where there is disposal of solid waste. Heavy metals were identified in soils adjacent to the waste disposal area, whereby iron and lead exceeded maximum allowable standards. However, cancer health hazards due to cadmium contamination were reported, while iron posed non-cancer health hazards; some other harmful pollutants include lead (Pb), which suggests carcinogenicity (Saha et al., 2022). Those people residing close to dumping grounds are highly susceptible to health problems like respiratory problems, eye infections, and gastrointestinal ailments compared to socio-economically similar groups staying farther from the dumping site locations. Such information stresses the adverse health effects caused by solid waste disposal in India (Singh et al., 2021). The polychlorinated biphenyls (PCBs), which are the most commonly found pollutants in various environmental compartments such as soil, air, dust, and water, are considered potential carcinogens among nearby residents of Pakistan (Hafeez et al., 2016). Further study indicates that there are high rates of hepatitis, fever, diarrhea, and skin and eye irritation among inhabitants living next to municipal solid waste disposal sites, and contamination with heavy metal constituents leached from solid waste, exceeding WHO drinking-water limits (Murtaza et al., 2020).In Nigeria, a heightened amount of heavy metals in soil near landfill sites revealed that cadmium led to 98-99%of the total ecological risk, showing that children are more vulnerable than adults, despite the overall non-carcinogenic hazard index remaining below unity (Ihedioha et al., 2017). Similarly, an elevated proportion of harmful metals found in urban soils in India has been identified to result in significant non-cancer health hazards to children, mainly owing to anthropogenic and industrial sources (Chabukdhara & Neema, 2013). Evidence from studies in India shows that landfill sites pose measurable health risks due to soil contamination at e-waste and landfill sites. Significant quantitative risk associates that heavy metal contamination at e-waste areas raises cancer risk, specifically for particularly for unprotected workers, while children face higher non-carcinogenic health risks than adults. Even though adult carcinogenic risk from chromium remains below acceptable limits, children are more highly exposed due to greater exposure and sensitivity (Dutta et al., 2022). Health risk from environmental exposure to landfill leachate and contaminated soil also implies that, regardless of low overall pollution potential, long-term exposure may give rise to non-carcinogenic health hazards like kidney damage and gastrointestinal problems, with children again identified as the most at-risk group (Dixit et al., 2024).

Today, waste management is a major issue worldwide. With rapid urbanization and an overpopulated population, urban waste has become a critical environmental and public health concern in India. Overburdened landfills release toxic gases and polluted water sources, posing a threat to the everyday risks to nearby cities, including metropolitan cities like Delhi, Mumbai, and Kolkata. Serious environmental and health risks are found in solid waste dumping and landfill exposure in the present research. High levels of toxic heavy metals (Cd, Pb, Cr, Zn, Ni) contamination in soil, water, and crops lead to both carcinogenic and non-carcinogenic health impacts, thereby posing a critical environmental and public health concern, with children being the most vulnerable population. Also, Urban waste leads to leachate contamination of water, creating persistent health risks for vulnerable children. High bio-aerosol loads increase exposure to pathogenic microorganism's exposure increase respiratory and

occupational health problems among waste workers and nearby residents. Inadequate solid waste management contributes to environmental degradation, climate impacts, and Impaired quality of life, while populations living near landfills face higher rates of gastrointestinal, respiratory, and chronic diseases due to exposure to heavy metals and volatile organic compounds. Persistent organic pollutants such as PCBs and PBDEs further increase long-term carcinogenic risks. Remediation studies highlight the urgent need for improved waste treatment technologies and stronger policy interventions to reduce these hazards.

METHODOLOGY

The main scope of this review was concentrated on the analysis of the existing scientific literature concerning the interconnection between proximity to dumpsites and their influence on the development of different diseases as well as psychological problems. Besides, it was important to take into consideration such socio-economic effects that can occur due to the contact with wastes and involve a hazardous work environment, unstable financial situation, and even social isolation. The current systematic review is based on PRISMA criteria (Figure 1).

Search strategy: This systematic review was prepared in accordance with the **Preferred Reporting Items for Systematic Reviews (PRISMA) guidelines,** and the **PICO (Population, Intervention, Comparison, Outcome)** framework was used to formulate the research question. Using the key terms *"impact solid waste on human"*, *"impact of landfilling and dumping zone on human health assessment"*, *"health impact on human in dumping sites"*, and *"health risk assessment heavy metals on human"*, a literature search was conducted across five major databases: **PubMed, ResearchGate, ScienceDirect, Springer Nature Link, and Google Scholar.**

After conducting the screen and eligibility assessment, the articles that experimentally evaluated the effects of dumping activities and dumping sites on the human body were selected and reviewed. The majority of the studies used observation and comparison methodology in the study design to compare exposed versus unexposed/less exposed groups, cross-sectional health assessments, and health risk assessments for both non-carcinogenic and carcinogenic risks due to heavy metal exposure. This review included literature related to both residential exposures from individuals residing near dumping sites and occupational exposures involving individuals working as waste collectors, pickers, and scavengers in these areas. Health risks of exposure through various pathways, such as physical exposure, inhaling, and contaminating environmental media such as air, soil, water, and food, were analyzed by the studies. This study adhered to the PRISMA flowchart for the study selection procedure.

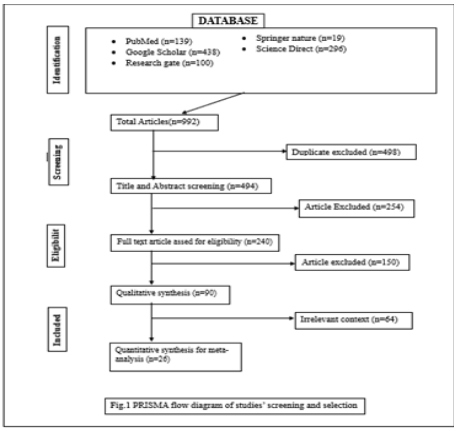

Fig.1 PRISMA flow diagram of studies' screening and selection

Study Selection:

Two co-authors independently screened the titles and abstracts of all retrieved studies. Full-text articles were reviewed for those meeting the predefined inclusion criteria. Studies were included if they were original, human-based research assessing environmental exposures and reporting either measurable health outcomes or quantified pollutant levels exceeding accepted safety limits. Review articles, animal studies, conference abstracts, incomplete reports, and studies not relevant to the research objectives were excluded. Discrepancies between reviewers were resolved through discussion and consensus.

Outcome Variables:

The outcome variables included documented health effects such as respiratory, gastrointestinal, dermatological, reproductive, and other morbidity-related conditions. Additionally, environmental exposure indicators—specifically toxic chemical concentrations in air, water, or soil exceeding nationally or internationally recognized safety thresholds—were considered as secondary outcomes.

Data Abstraction:

Two co-authors independently extracted data from the eligible full-text articles using a standardized extraction approach. Extracted information included study design, authorship, year of publication, country or region of study, type of environmental exposure, outcome variables assessed, and key findings. Any inconsistencies in data extraction were resolved through mutual agreement.

Data summary and synthesis: Data were compiled in a single spreadsheet. Owing to many differences in the kind of data, studied populations, study designs, and outcomes, a narrative synthesis perspective is being used. Key findings of each study are summarized.

Table 1: Studies That Highlight the Impact of Dumping Zone on Human Health

Sl. No.	Authors	Study Population	Study area	Study Objective	Major findings	Study type
1	Saha et al., 2022	Bangladesh	Environmental health risk assessment using pollution indices and health risk modelling	To assess the levels of heavy metal contamination in the soil at the dumping and non-dumping sites and evaluate associated health risks to local populations	Iron and lead surpass safe limits and pose health risks—iron is non-carcinogenic, cadmium is carcinogenic, and lead is not a substantial cancer risk.	Cross-sectional study
2	Singh et al., 2021	India	Exposed group (near dumping site) and non-exposed group (distant from site) with similar socio-economic conditions	To assess the health effects of the dumping site among nearby community members and identify potential risk factors	The study found significantly higher health issues—especially respiratory illness, eye irritation, and stomach problems—among residents living near the Deonar dumping site, highlighting the adverse health impact of solid waste exposure.	Cross-sectional study
3	Hafeez et al., 2016	Pakistan	Health risk assessment of PCBs and PBDEs from soil and dust indicated low to moderate risk to the local population via different exposure pathways.	To assess baseline levels of PBDEs, DP, and PCBs in environmental matrices (soil, dust, water, air) and evaluate associated health risks	The study found that PCBs were the most prevalent pollutants across all environmental matrices at the Lahore dumping site, posing a potential carcinogenic risk to nearby populations, while PBDEs and DPs were present at lower, less harmful levels.	Cross-sectional study
4	Murtaza et al., 2020	Pakistan	Effects of Solid Waste Dumping Sites on Public Health and the Environment	To identify municipal solid waste disposal sites and compare the health problems of people living near vs. far (8 km) from waste sites	According to the study, people who lived close to municipal solid waste disposal sites had much higher rates of illnesses like hepatitis, fever, diarrhea, and skin and eye	Comparative cross-sectional study

					irritation. They were also exposed togroundwater that was unsafe to drink due to heavy metal contamination that exceeded WHO limits.	
5	Ihedioha et al., 2016	Nigeria	Evaluation of the risk to human health posed by heavy metal contamination in municipal solid waste disposal soil	To evaluate the concentrations of heavy metals (Pb, Cd, Zn, Mn, Cr, Ni, and Fe), as well as the ecological and human health risks, in the soils surrounding a municipal landfill	High levels of heavy metals, especially cadmium, soil that is highly polluted at the dumpsite and nearby areas; cadmium contributed 98–99% to ecological risk; Children are more vulnerable than adults; the overall hazard index is <1, so no probable health risk	Cross-sectional study
6	Chabukdhara & Nema, 2012	India	Environmental exposure assessment; Risk analysis study	Assessing the amounts of metal pollution (Cu, Cr, Pb, Cd, Zn, Mn, Fe, and Ni) in urban soil, determining its origins, analyzing its spatial distribution, and weighing the health concerns (cancer and non-cancer risks)	high concentrations of Cu, Cr, Pb, Zn, and Ni in Ghaziabad's urban soils, posing non-cancer risks to children, with industrial and anthropogenic sources being the main sources.	Cross-sectional study
7	Dutta et al., 2022	India	Quantitative risk assessment using epidemiological data and US EPA methodology	Using epidemiological data and the US EPA's risk assessment methodology, the study intends to examine the risks to human health and measure the effects of heavy metal pollution on soil at an e-waste disposal site.	The relative risk of cancer is raised by heavy metal poisoning in soil, and unprotected workers are more at risk. While adults' carcinogenic risk from Cr is below the allowable level, children's non-carcinogenic risk is greater.	Cross-sectional study
8	Dixit et al., 2023	India	Environmental health risk assessment and pollution analysis study	The study aims to analyze the physicochemical properties of leachate, assess its pollution potential using the Leachate Pollution Index, and evaluate non-carcinogenic health risks associated with contaminated soil exposure.	Leachate Pollution Index values show low pollution potential, with children facing non-carcinogenic health risks and adults experiencing no immediate health risks. Prolonged exposure may cause kidney damage and constipation.	Comparative cross-sectional study
9	Nors a'adah et al., 2020	Malaysia	Examine the prevalence of illnesses and health problems	The study compares residents exposed to a solid waste	The study found a significant association between dumpsite	Cross-sectional study
					among locals who live near the open solid waste dumpsite.	open dumpsite with those not exposed to determine the prevalence of health symptoms and confirmed diseases.	exposure and sore throat, diabetes mellitus, and hypertension, with a mean residence duration of 22.6	
10	De & Debnath, 2016	India	The study examines the prevalence of health hazards linked to solid waste disposal.	To explore the adverse health effects associated with solid waste disposal in a specific locality of Kolkata	Despite residents' lack of awareness, contributing issues include open-dump sites, excessive waste creation, limited collecting space, failure of waste management facilities, and health hazards such as gastrointestinal disorders, allergies, and asthma.	Community-based descriptive cross-sectional study
11	Kar & Basunia, 2020	India	The research looks at how common infections are among people who live close to a landfill in Kolkata.	Survey the frequency of illnesses among inhabitants living near the Noapara dump.	According to the study, residents living close to Kolkata's Noapara landfill had a high prevalence of both acute and chronic illnesses, such as diabetes, heart disease, hypertension, stomach and gastric problems, asthma, respiratory problems, and eye-related issues. This underscores the substantial health burden that those living nearby face.	Community - based descriptive cross-sectional study
12	Maiti et al., 2016	India	Effects of a closed landfill on the quality of groundwater and surface water.	To characterize leachate and assess its impact on surrounding water resources near a closed dumping site	According to the study, leachate from a closed landfill in Dhapa had significant concentrations of heavy metals, including lead and mercury, as well as TDS, COD, NH_4^+- N, and chloride. Significant environmental pollution and the requirement for efficient leachate treatment and post- closure site management are indicated by these pollutants' exceeding allowable levels.	Descriptive field-based environmental study
13	Maheshwari et al., 2015	India	health effects of landfill waste	An overview of the literature discussing environmental contamination	By producing toxic chemicals like volatile organic compounds	Descriptive study

				and its health implications for residents near dump sites.	(VOCs), which may lead to birth abnormalities, cancer, and other health problems, including skin irritation, allergies, and mental health disorders, landfills contribute to pollution of the air, land, and water.	
14	Babs-Shomoye et al., 2016	Nigeria	Health risk assessment for those who live near the landfill	The purpose of this study is to assess the health effects that the Olusosun Dumpsite has on the people who live in the human settlements that are located nearby.	A study found that 92.5% of respondents believe the dumpsite affects environmental quality, 16.3% report health impacts, and 83% express major concerns about odor.	Descriptive cross-sectional study
15	Mor et al., 2018	India	Impact of landfills on groundwater pollution.	This study uses both new and published physicochemical data to evaluate the health and environmental effects of the Leachate Pollution Index (LPI) in Indian landfills.	The study reveals that Indian landfills in Chandigarh, SAS Nagar, and Panchkula have LPI values exceeding the allowable limit, posing a significant threat to human health, the environment, and groundwater quality.	Observational Study
16	Torkashvand et al., 2021	Iran	Health risk assessment from leachate exposure.	Determine the effect of recently smoked cigarette butts on the levels of heavy metals and health risks in landfill leachate.	Landfilling cigarette butts is inappropriate for waste management since it raises the risk of health problems and heavy metal pollution. It is advised to recycle or use alternative disposal techniques.	Experimental Laboratory-Based Study
17	Du & Li, 2022	China	Health risk assessment	The study aims to evaluate the level of heavy metal contamination, assess the agricultural feasibility, and assess the potential health risks associated with landfill site reuse.	Arsenic is the most dangerous metal, according to the study, which also shows significant heavy metal pollution in a landfill. The contamination, which affects both adults and children, is primarily caused by leaching and the spread of groundwater. Due to the high carcinogenic risk associated with agriculture, remediation is essential before reuse.	Analytical study
18	Gurusamy & Thangam, 2023	India	Investigation of environmental hazards and statistical associations for items recovered from landfills	The study's objectives are to define SLM, evaluate pollution indicators, estimate the health hazards associated with exposure to heavy metals, and use statistical correlation to find indicator elements.	In landfill mining solid waste, the study finds substantial levels of contamination and health concerns, mostly from lead, chromium, and zinc. Cr (VI) is a useful element for monitoring pollution, and hexavalent chromium is recognized as an indicator element.	Analytical study
19	Wu et al., 2023	China	Assessment of environmental risks and analysis of chemical fractionation in waste management byproducts.	A study examines the biological and environmental risks of heavy metals in SSWTT bottom ash by assessing their concentrations, chemical forms, toxicity upon leaching, and compliance with national soil standards.	Though some samples contained excesses of heavy metals such as Cd, Cr, Cu, Ni, Pb, and Zn exceeding agricultural soil limits, the majority of samples met development land norms, according to the study. Standards for hazardous waste were met by all samples, However, only three passed landfill control.	Analytical study
20	Wang et al., 2022	China	Environmental monitoring and ecological risk assessment	To assess heavy metal contamination in atmospheric dust and evaluate ecological risk using the enrichment factor, geo-accumulation index, and risk index	Cadmium, iron, aluminum, and magnesium accounted for 98.81% of the metals found in dust fall. Cadmium and zinc were substantial pollutants. Cadmium provided the greatest threat to the environment.	Analytical study
21	Dehghani et al., 2021	India	Residents of urban areas are exposed to solid waste and their control practices.	Assessment solid waste disposal category, handling approaches, and their outcomes on humans and the surroundings	Critically insufficient waste materials harm nature, human health, and the standard of living.	Analytical study
22	Maria et al.,2021	Italy	Municipal solid waste in incineration plants in Italy	To find out the impact of the municipal solid waste on the nature and health consequences of human beings using a life cycle assessment method, and contrast it with data from epidemiology.	Through the Life cycle approaches, the effect of municipal solid waste is emphasized with epidemiological and biomonitoring studies,	Analytical study
23	Gujre et al.,2021	India	Health risk assessment through municipal	To find out the impact of heavy metal contamination in human body	Significant health hazard through excessive pollutant	Observational study

			solid waste disposal	through the municipal solid waste disposal.	concentration with Chromium. Simultaneously, manganese and zinc posed low to marginal ecological hazard.	
24	Ababukar et al.,2022	Global south	Health risk assessment from SWM	Assessing the human and environmental health impacts of current solid waste management practices in Global South cities.	Affecting the marginalized community from illegal and unsustainable SWM practices also causes many environmental pollution, climate impact, and public health risks.	Reviewed study based on secondary data.
25	Parvin & Tareq 2021	Bangladesh	Public health risks assessment	Assessing the human health risk from the Leachate which comes to the landfill.	High risks to human health and carcinogenic risks through the water, which is contaminated with toxic metals like Leachate.	Systematic review
26	Akpeimeh et al.,2019	Nigeria	Health risk assessment	To investigate respiratory health among waste workers who work in open dump sites.	Enhanced microbial load in the air causes chronic respiratory health conditions in scavengers and waste workers.	Cross-sectional study

RESULTS:

The search of databases yielded 992 articles; however, only 26 articles met the predetermined inclusion criteria and were hence included in the systematic review. The selected articles could be broadly classified into two main categories: (i) articles that demonstrated the health effects observed among populations living or working in the vicinity of the dumping sites, and (ii) articles that assessed health risks based on environmental pollution and exposure risk assessment models. Several epidemiological and community-based studies have demonstrated a higher prevalence of respiratory diseases, gastrointestinal disturbances, skin and ocular irritation, and diabetes and hypertension, among other health issues, among populations living and waste handlers working in the environment of the dumping site. Occupational exposures to biological aerosols, pathogens, and high microbial load were found to be one of the contributing factors (Singh et al., 2021 De & Debnath, 2016 ,Akpeimeh et al., 2019).

Several other studies analyzed the risks posed by various environmental health hazards through environmental risk assessments, by estimating the level of toxicants and heavy metals found in soil, leachate, groundwater, dust, and ambient air. The risk of carcinogenic and non-carcinogenic health risks was calculated using known exposure models, especially for toxic heavy metals like cadmium, lead, arsenic, and chromium (Saha et al., 2022 , Ihedioha et al., 2016 , Chabukdhara & Nema, 2012 ,Dutta et al., 2022). High levels of heavy metal contamination in the groundwater and landfill leachate proved to be a major source of concern when the contaminated water was used for drinking and irrigation purposes. Zinc is one of the commonly found elements, but its level of toxicity was lower compared to other toxicants. It was assessed only from an aggregated risk assessment perspective without being directly linked with health risks.

On the whole, it can be seen that poor waste management techniques and long-term exposure to dump sites result not only in health effects already observed but also pose significant health hazards. However, the fact is that some of the examined research does not provide enough information on biomonitoring, food chain contamination, and waste characteristics necessary for making clear conclusions. In other words, there is an obvious need for more detailed scientific study of the issue.

Table 2: Categorization of Studies Based on Primary Outcome Measures

Category (by Outcome Measure)	Author(s)	Primary Outcome Measured	Key Findings / Impact
Environmental Contamination & Potential Health Risk (Exposure-Based)	Saha et al., 2022 , Ihedioha et al., 2016 , Chabukdhara & Nema, 2012 ,Dutta et al., 2022 , Dixit et al., 2023 , Wang et al., 2022 ,Hafeez et al., 2016	Concentration of heavy metals or POPs in soil, dust, air, or water; modeled carcinogenic and non-carcinogenic risk indices	Toxic metals (Cd, Pb, Cr, As, Ni) and POPs exceeded regulatory limits in environmental media; health risks were inferred using risk assessment models rather than direct disease outcomes.
Water & Leachate Contamination (Exposure Pathway–Specific)	Maiti et al., 2016 ,Mor et al., 2018 , Parvin & Tareq, 2021, Du & Li, 2022	Heavy metal concentrations and leachate pollution indices in groundwater/surface water	Groundwater and surface water contamination exceeded WHO or national limits; potential human health risks were relevant where contaminated water was used for drinking or irrigation.
Epidemiological & Community Health Outcomes (Disease-Based)	De & Debnath, 2016,Kar & Basunia, 2020 ,Maheshwari et al., 2015 ,Norsa'adah et al., 2020	Prevalence of diseases and self-reported morbidity among residents	Higher prevalence of gastrointestinal, respiratory, dermatological, and chronic conditions (e.g., diabetes, hypertension) among populations residing near dumping sites compared to less-exposed groups.
Occupational & Respiratory Health Outcomes	Akpeimeh et al., 2019 , Singh et al., 2021, Babs-Shomoye et al., 2016	Respiratory symptoms, occupational morbidity, microbial or bioaerosol exposure	Waste workers and individuals with prolonged occupational exposure showed increased respiratory symptoms and health complaints, associated with bioaerosol and microbial exposure.
Solid Waste Management Systems & System-Level Impacts	Dehghani et al., 2021 , Abubakar et al., 2022 , Maria et al., 2021 ,Gujre et al., 2021	Environmental and public health indicators assessed through MSW practices and Life Cycle Assessment (LCA)	Poor municipal solid waste (MSW) management contributes to environmental degradation, public health risks, and climate impacts; LCA studies linked waste handling practices to broader health and ecological burdens.

Experimental & Remediation-Focused Studies	Torkashvand et al., 2021 , Du & Li, 2022	Changes in contaminant levels following intervention or experimental treatment	Experimental and analytical studies demonstrated that remediation strategies and improved waste handling can reduce contaminant levels and modeled health risks; human health outcomes were not directly measured.

Table 3 categorizes the reviewed studies by population group and primary research focus. Existing studies examined residents living near dumping sites and reported an increased burden of respiratory, gastrointestinal, dermatological, and specific chronic conditions. Studies focusing mainly on children assessed heavy metal exposure and estimated carcinogenic and non-carcinogenic risks, identifying children as a particularly vulnerable group. Occupational studies among waste workers reported increased respiratory and health complaints associated with bioaerosol and microbial exposure. Other studies evaluated environmental contamination, leachate characteristics, and food-chain exposure through contaminated soil and crops. Overall, findings indicate both documented health effects and substantial potential exposure risks, though methodological heterogeneity limits direct comparison and generalization.

Table -3: Categorization of Studies Based on Population

Group	Author(s)	Country	Focus / Objective
General Public / Residents near Dumpsites	Singh et al., 2021 , De & Debnath, 2016 , Kar & Basunia, 2020 , Norsa'adah et al., 2020 , Maheshwari et al., 2015 ,	India, Malaysia	To assess the health effects, such as respiratory, gastrointestinal, and chronic disease illnesses, that are found among residents who live near dumping sites and landfills.
Children / Vulnerable Groups	Ihedioha et al., 2016 , Chabukdhara & Nema, 2012 , Dutta et al., 2022	Nigeria, India, Pakistan	Assessment of the heavy metal exposure and non-carcinogenic/carcinogenic risks, mostly found in children.
Waste Workers / Scavengers	Akpeimeh et al., 2019 , Babs-Shomoye et al., 2016	Nigeria	To investigate occupational health hazards owing to bio-aerosols and microbial exposure at ajar dumpsites.
General / Environmental Assessment	Saha et al., 2022 , Maria et al., 2021 , Gujre et al., 2021 , Abubakar et al., 2022	Bangladesh, India, Global South, Italy	environmental contamination, human health hazard, and the impacts of municipal solid waste management practices.
Agricultural / Crop Exposure	Du & Li, 2022 , Parvin & Tareq, 2021	China, Bangladesh	Evaluate heavy metal contamination from landfills and its impacts on soil, crop safety, and human health via the food chain.
Landfill / Leachate Focus	Maiti et al., 2016 , Mor et al., 2018 , Wu et al., 2023 , Torkashvand et al., 2021	India, China, Iran	Mostly, leachate composition, chemical pollution, and potential health hazards from landfill runoff.

CONCLUSION

The current review summarizes existing literature to assess the relationship between exposure to landfills and dumping sites and environmental contamination and health hazards. Of the articles reviewed, 11 were concerned with the health status of populations exposed to dumping areas. Nine of these showed increased morbidity in populations living and working in proximity to dumping sites where respiratory diseases, gastrointestinal complaints, skin ailments, and occupational ailments were the most frequent conditions noted. On the other hand, only two studies found limited relationships between dumping site exposure and health status. Another group of fifteen articles was concerned with the environmental impacts of landfills. The main finding of these studies was the presence of significant amounts of heavy metals and/or toxic chemicals in environmental samples exceeding recommended maximum concentrations. However, in all of these cases, no clinical outcome measure was used. Six articles included information about children in particular and five made comparisons between exposure levels for children and adults, all agreeing that children are especially at risk because of increased exposure indices.

Outcomes related to respiratory health had the strongest connection with exposure to dumping areas, while outcomes for cancers and chronic metabolic diseases were not strongly supported. However, all studies that were discussed in the paper indicate that poorly organized dumping areas create a serious environmental risk that is associated with health outcomes. Nonetheless, there was a great amount of variability in terms of methodologies, little evidence from biomonitoring, and a lack of longitudinal studies that could prove causality.

Finally, one cannot deny the importance of such environmental risks as air pollution and groundwater contamination by toxic elements and heavy metals caused by poorly organized dumping areas. This fact makes the problem even more critical since it requires strict waste management policies and effective health interventions aimed at minimizing negative health outcomes.

Limitation

The current study has certain limitations, just like any other. Instead of quantifying the health outcome, the study provided a descriptive analysis of the maternal and child health outcomes. Additionally, the study's approach was diverse and only included English-language articles.

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