ENVIRONMENTAL AND SOCIO-ECONOMIC IMPACT OF OPEN DUMPING OF SOLID WASTE ON DEMOGRAPHIC SITUATION IN LAHORE, PAKISTAN

M. R. Khan[1], S. F. Baig[1], N. Ahmad[2], A. Javed[3], M. Arshad4 and R. Haider[*4]

[1]Department of Environmental Science and Policy, Lahore School of Economics, 19 Km Burki Road Lahore (Pakistan)
[2]Environmental Protection Agency, Govt. of the Punjab, Lahore (Pakistan)
[3]Pak Green Enviro-Engineering Pvt Ltd Lahore, Pakistan.
[4]Environmental Protection Agency, Govt. of the Punjab, Lahore (Pakistan)
Corresponding Author Email: rizwanchemist@gmail.com

ABSTRACT: This study presents a socio-economic analysis of the pervasive impact of open dumping of Municipal Solid Waste (MSW) in Lahore, Pakistan. Focusing specifically on the Mehmood Booti dumpsite, the research evaluates its environmental and health implications on populations residing within a 2-3 km radius, comparing these findings with a control area located 10-15 km away under similar geographical and socio-economic conditions. Data were collected through pretested questionnaires administered to 400 respondents from the study area and 200 from the control area. Statistical analysis, primarily utilizing SPSS software for descriptive statistics and inferential tests (independent sample t-Test, Levene's Test, Chi-square Test, and Cross Tabulation), revealed that while both areas are susceptible to negative environmental impacts, the dumpsite proximity significantly increases vulnerability. This paper details the initial demographic and awareness findings, laying the groundwork for subsequent determination of the Cost of Illness (COI) for prevalent regular and serious diseases, including skin diseases, eye irritation, respiratory ailments, diarrhea, fever, typhoid, and cholera, and the consequent socio-economic losses.

Keywords: Socio-economic Analysis, Environmental Impact, Open Dumping, Solid Waste, Demographic Situation, Lahore, Pakistan.

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INTRODUCTION

The escalating challenges of solid waste management (SWM) represent a critical global concern, particularly in rapidly urbanizing developing nations like Pakistan. Factors such as burgeoning population growth, accelerated urbanization, and economic expansion collectively exert immense pressure on environmental infrastructure and public health (SWM Guidelines, 2016, updated 2021). The ultimate fate of generated solid waste profoundly dictates environmental quality and the well-being of living organisms, especially humans. Improper waste disposal creates significant hazards, defined as any adverse consequence resulting from exposure to pathogenic, chemical, or other associated components of MSW (Centers for Disease and Control, 2009). The likelihood of encountering such adverse effects, or the hazardous conditions themselves, constitutes the concept of risk (Centers for Disease and Control, 2009). Consequently, the unchecked accumulation of solid waste piles poses severe health and environmental threats.

Pakistan is grappling with substantial solid waste management issues, driven by a high population growth rate (2.61%) and GDP growth (6%) (SWM Guidelines, 2016, updated 2021). The relentless rural-to-urban migration further exacerbates the burden on urban services and infrastructure, directly contributing to the increasing volume of solid waste (Mahar et al., 2007). By the end of 2014, Pakistan's daily solid waste generation reached an alarming 71,000 tons (JICA and Pak-EPA, 2015), yet a significant portion of this waste does not reach proper final disposal sites (SWM Guidelines, 2016, updated). Alarmingly, Pakistan currently lacks National Environmental Quality Standards (NEQS) specifically for solid waste, underscoring a critical regulatory gap (Policy and Regulations for Managing Solid Waste, 2010).

Lahore, the capital of Punjab province, exemplifies a metropolitan city experiencing rapid urbanization and population growth. These anthropogenic pressures have disrupted natural ecological balances, leading to alarming levels of water, air, and soil pollution. Since 2011, the Lahore Waste Management Company (LWMC) has assumed responsibility for the city's waste management. In 2012, LWMC partnered with two private Turkish companies, M/s OzPak and M/s Albayrak, to share this responsibility. Despite these efforts, LWMC reports an approximate waste collection efficiency of 68%, increasing to 73% with private sector involvement. This figure remains concerning, especially given that a substantial fraction of the SWM budget is allocated to physical components like collection and transportation, suggesting a compromise on effective waste dumping practices (AVCP, 1996).

Currently, Lahore has three operational open dumps: Mehmood Booti, Dagian, and Tiba. Mehmood Booti, operational since 1997, is the largest, receiving approximately 40% of the city's total waste. Numerous studies by researchers have highlighted the disease burden associated with such unmanaged waste piles. It is widely recognized that waste becomes problematic when it harms humans or the environment, yet the consequential economic cost of environmental and health issues emanating from waste dumps has often been overlooked (Jerie, 2016).

Therefore, this study aims to comprehensively analyze the socio-economic losses incurred due to the negative health impacts arising from open solid waste dumping. This paper specifically focuses on the demographic situation and initial awareness aspects, laying the groundwork for a detailed Cost of Illness (COI) assessment in subsequent phases of the research.

LITERATURE REVIEW

The history of socio-economic research concerning solid waste dates back to Freeman (1993), who posited that improper waste disposal activities adversely affect social and economic conditions. He notably discussed the negative human health impacts of solid waste and defined the "Cost of Illness (COI)" as the loss of productivity due to sickness, encompassing associated medical costs. This cost was then framed as the benefit derived from actions preventing damage.

Rushbrook and Pugh (1999) emphasized landfilling as the most appropriate waste disposal method, stipulating that management sites must adhere to standard procedures, including daily soil cover. Their research underscored the importance of sanitary landfills equipped with proper leachate and gas control systems.

The turn of the century witnessed intensive research on various facets of solid waste management. Sarkar (2003) provided an overview of SWM in Delhi, India, highlighting the role and risks faced by waste workers. Gilbreath et al. (2006) investigated birth defects in Alaska, considering that 95% of surrounding villages relied solely on open dumping for waste management. In Beijing, China, Xiao et al. (2007) explored factors compelling waste production, while Yongsi et al. (2008) linked emerging SWM issues to rapid urbanization.

The "Cost of Illness" (COI) approach has been extensively employed to assess the economic costs of illness stemming from solid waste exposure. Folefack (2008) applied this methodology in Yaoundé, Cameroon, where a significant portion of waste was disposed of at the Nkolfoulou dumping site, known to facilitate the proliferation of diseases like diarrhea, malaria, cholera, and typhoid. Giusti et al. (2009) further verified a strong correlation between rising GDP and increasing waste generation.

More recent studies underscore the escalating challenge of SWM. Alam & Ahmade (2013) elucidated general sources, characteristics, and components of waste, emphasizing health impacts by explaining how solid waste provides a breeding ground for pathogens, leading to infectious diseases, neurological diseases, congenital malformations, and cancers. A qualitative study by Sankoh & Tran (2013) investigated the impact of the "Granville Brook" open dumpsite in Sierra Leone, revealing that mixed waste types caused various health problems, including gastrointestinal, genetic, respiratory, and dermatological issues, with cholera, chest pains, and diarrheas being common, and malaria being the most prevalent. The study concluded that residents in close proximity to dumpsites suffered the most. Singh (2013) arrived at similar conclusions, linking increasing waste production to exploding populations and heightened demands. Mugo et al. (2015) in Kenya reported that waste workers at dumpsites faced elevated occupational health risks, such as hearing loss and skin diseases.

Several studies in Pakistan corroborate that solid waste mismanagement significantly impacts environmental well-being and human health, yet the considerable economic cost remains largely unacknowledged. Rafiq et al. (2015) conducted a study in Peshawar, Pakistan, to evaluate the social and economic losses due to open dumping using the COI method. Their research identified prevalent diseases (skin infections, respiratory disorders, gastrointestinal problems, dengue, malaria, psychological disorders) among 200 respondents. Using Tobit and Poisson Models, they estimated mitigation costs and work days lost, confirming an inverse relationship between mitigation cost and work days, and between diseases and productivity loss. Mohsin & Chinyama (2016) assessed solid waste sources and impacts in Bahawalpur, Pakistan, identifying socio-economic factors like income and household size as determinants of waste generation.

Siddiqua et al. (2022) recently provided an overview of landfills, noting that while "controlled and engineered establishments" are ideal, "illegal and uncontrolled landfills known as open dumpsites are prevalent in many developing countries." Their review determined that landfilling is associated with various environmental pollution problems, including underground water contamination from leachate, air pollution from suspended particles and odor, and even marine pollution from potential run-offs.

The literature review robustly confirms the direct link between solid waste and its negative health impacts, both globally and specifically in Pakistan. However, a noticeable gap persists in the socio-economic analysis of these disease burdens, particularly in the Pakistani context, which presents a unique environmental and socio-economic landscape. Lahore, as one of Pakistan's most populated cities with high waste generation rates, is an ideal location for this critical research. This study aims to fill this gap by conducting a socio-economic impact analysis of diseases and demographic issues caused by open dumping of municipal solid waste, alongside an assessment of socio-economic losses arising from these environmental impacts.

The overall goal of this study is to conduct a socio-economic analysis of the impact of diseases caused by the open dumping of solid waste. The specific objectives are:

Identification of Common Diseases: To identify and categorize the prevalent diseases emerging from open dumping of solid waste in the study area.

Evaluation of Economic Cost: To quantify the economic cost of these diseases by estimating relevant parameters (e.g., medical expenses, productivity losses).

Estimation of Socio-Economic Benefit: To estimate the socio-economic benefits that could accrue from proper solid waste management, contrasting them with the current scenario of open dumping.

RESEARCH METHODOLOGY

The research employed a structured methodology to analyze the socio-economic impacts of open solid waste dumping in Lahore. This involved meticulous site selection, a robust sampling strategy, comprehensive data collection, and rigorous statistical analysis.

Selection of Site The initial and most crucial step involved the selection of a representative dumpsite, its surrounding residential areas, commercial markets, and educational/recreational areas where the population was likely exposed to the waste. Mehmood Booti dumpsite in Lahore was selected as the primary study site due to its significant operational history (since 1997) and its role as the largest dumpsite in Lahore, accommodating approximately 40% of the city's total waste. This scale makes it an ideal case study for assessing widespread impacts.

- **Location:** As depicted in Figure 1, Mehmood Booti dumpsite is situated at the outskirts of Lahore. However, rapid urbanization has led to population expansion towards the city's edges, significantly reducing the distance between the dumpsite and numerous residential areas. This proximity creates an alarming situation, increasing the risk of disease development and productivity loss among the exposed population.
- **Proximity of Residential Areas:** Table 1 lists residential areas in close proximity to the Mehmood Booti dumpsite, including Mehmood Booti Society (1.7 km), Shadi Pura (2 km), Aliya Town (2.5 km), Shalimar View Housing Scheme (1.5 km), and Crawl Village (2 km).
- **Nearby Healthcare Facilities:** Table 2 provides a list of nearby hospitals and clinics (Mian Munshi Hospital, Mayo Hospital, Shalimar Hospital, Private clinics), which is relevant for assessing healthcare accessibility and the burden of disease.

Table 1: List of residential areas close to the selected dumpsite and distance.

Name of residential area	Distance from dumpsite
Mehmood booti society	1.7 km
Shadi pura	2 km
Aliya town	2.5 km
Shalimar view housing scheme	1.5 km
Crawl village	2 km

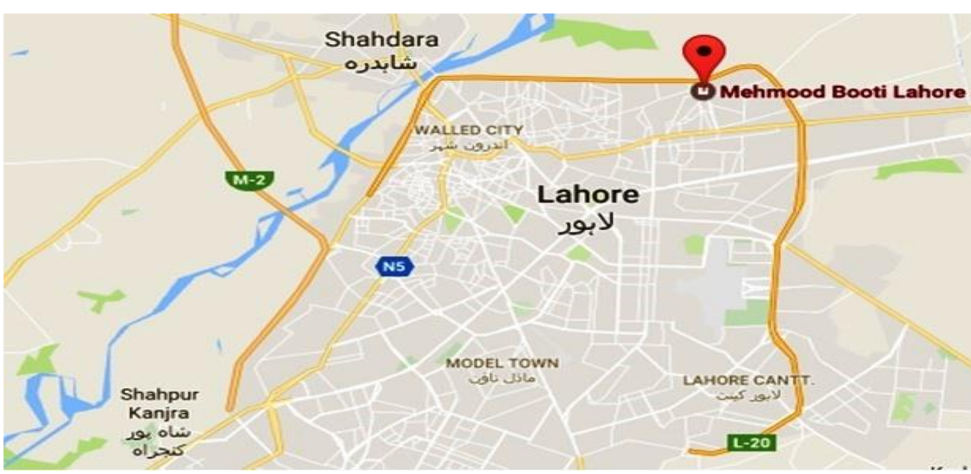

Figure 1: Study Area

Setting Up Boundaries To define the study's scope, the dumpsite was Designated as the central point, a circular boundary, extending 2-3 km from the dumpsite, was established as the "study area," encompassing the exposed population (Figure 2). For comparative analysis, a "control area" with similar geographical and socio-economic conditions was selected, located 10-15 km away from the dumpsite. This controlled comparison allows for a more accurate attribution of impacts to the dumpsite's proximity.

Sample Selection/Sampling Method Following the boundary definition, the total population residing within the 15 km radius of the dumpsite was estimated at 250,000, through initial interviews and consultation with Union Council-132. The sample size was determined using the Krejcie and Morgan Table (1970), yielding a sample size of 384 at a 95% confidence interval and a 0.05 margin of error. This validated sample size was rounded up, with 400 respondents selected from the dumpsite/study area and 200 from the control area, ensuring a balanced comparison.

A systematic random sampling method was employed to ensure an evenly sampled population and provide each individual an equal chance of selection. This involved selecting every kth household after a random start point within the defined study and control areas. The preferred choice of respondents for interviews was based on individuals aged 18 or above, and ideally, the head of the family, to ensure comprehensive household-level insights.

The level of methane gas was monitored near the Aeroqual 500 ambient air analyzer. The concentration of methane was monitored w.r.t. distance from the dumping site.

Data Collection Both secondary and primary data were meticulously collected in a two-step process:

- **Secondary Data Collection:** This primarily involved a desktop study, entailing a thorough review of relevant scholarly journal articles, reports from the Tehsil Municipal Administration (TMA) Lahore, Lahore Waste Management Company (LWMC), and reports from the Punjab Urban Unit. This provided essential background information and contextual data on SWM practices and demographics.
- **Primary Data Collection:** Primary data were gathered through self-administered, pretested questionnaires and direct interviews with selected respondents. The pretesting of questionnaires was conducted on a small pilot group to ensure clarity, relevance, and cultural appropriateness of the questions, and to identify any ambiguities before full-scale deployment. Interviewees included residents living near the dumpsite, hospital managers, waste workers, and personnel representatives of Lahore Municipal Corporation (LMC). The surveys specifically aimed to capture the economic consequences on residents near the dumpsite and the impact on individual productivity, by collecting data on total work days and school days lost due to illness.
  - **Field Surveys:** In addition to questionnaires, field surveys were conducted near the dumpsite to allow for personal observations and direct assessment of hazards associated with unmanaged waste disposal. These observations complemented the quantitative data with qualitative insights into the ground reality.
  - **Medical Data Collection:** Surveys were also conducted in nearby hospitals to collect necessary medical data, which would later inform the Cost of Illness (COI) calculations by providing insights into disease incidence and healthcare utilization patterns.

Data Analysis The collected data were computed and analyzed using SPSS software (Version 22), a widely recognized statistical package for social and behavioral sciences. The analysis involved both descriptive and inferential statistical techniques:

- **Descriptive Statistics:** Measures such as mean, median, mode, frequency distributions, and percentages were applied to summarize and describe the demographic characteristics of the surveyed populations in both the dump and control areas (e.g., number of years living in the area, house ownership, rent, household size, education levels, occupations, and income).
- **Inferential Statistics:** To compare the two groups (dump area vs. control area) and assess the significance of observed differences, the following statistical tests were employed:
  - **Independent Sample t-Test:** This test was applied to compare the means of two continuous variables (e.g., average number of years living in the area, total household income) between the dump and control groups. The underlying assumption of homogeneity of variances was assessed using Levene's Test.
    - **Hypothesis for t-Test:**
    - H0: There is no significant difference in the mean of the variable between the dump area and the control area.
    - H1: There is a significant difference in the mean of the variable between the dump area and the control area.
    - **Interpretation:** If the 2-tailed significance value (p-value) for the t-test was less than 0.05, the null hypothesis was rejected, indicating a significant difference between the two groups. A p-value greater

than 0.05 indicated no statistically significant difference.

- **Levene's Test:** This test was performed prior to the t-test to assess the equality of variances for the continuous variables between the two groups.
  - **Interpretation:** If the significant value of Levene's Test was less than 0.05, the assumption of "equal variances assumed" for the t-test was violated, and the "equal variances not assumed" results of the t-test were considered. If the p-value was greater than 0.05, "equal variances assumed" was accepted.
- **Cross Tabulation:** This technique was used to examine the relationship between two categorical variables (e.g., residential area vs. frequency of illness, perception of dumpsite implications). It presents results in a tabular format, showing observed and expected counts.
- **Chi-square Test:** This test was applied in conjunction with cross-tabulation to determine if there was a statistically significant association (dependence) between two categorical variables.
  - **Hypothesis for Chi-square Test:**
  - H0: The two categorical variables are independent (no association).
  - H1: The two categorical variables are dependent (an association exists).
  - **Interpretation:** If the chi-square p-value was less than 0.05, the null hypothesis was rejected, indicating a significant dependence between the variables.
  - **Effect Size (Phi Coefficient):** To quantify the strength of the association, the Phi coefficient (for 2x2 tables) was considered from the symmetric measures table. According to Pallant (2010), effect sizes are interpreted as: 0.1 (small), 0.3 (medium), and 0.5 (high).

The data from the control group were subjected to the same collection and analytical procedures to ensure direct comparability.

Interpretation of Results Results were systematically interpreted and presented in tabular and graphical formats. Comparisons were drawn between the impacts on populations living near the dumpsite and those residing further away in the control area. These findings were then critically compared with the results of similar studies found in the existing literature to contextualize the study's contributions.

RESULTS

The results section is structured to first present the demographic profiles of the study and control areas, followed by findings related to public awareness regarding the dumpsite's implications.

Table 2. Level of methane around the dumping site

Sr. No.	Distance (Meter)	CH4 (ppm)
1.	0	15
2.	20	12.2
3.	40	9.1
4.	60	6.2
5.	80	5.6
6.	100	4.4
7.	120	3.2
8.	140	2.4

Table 3. Demographic and Key Awareness Data for Dump and Control Areas

Parameter	Type	Dump Area (Study Area)	Control Area	Unit/Description
Demographics				
Avg. Years Living in Area	Mean	14.97 years	12.87 years	Mean number of years respondents resided in the area.
House Ownership	Percentage	85% Owned	79% Owned	Percentage of households owning their residence.
Avg. Monthly Rent (Renters)	Percentage	46.7% (Rs. 8k-13k)	38.1% (Rs. 14k-19k)	Most common rent range for rented houses.
Avg. Household Size	Mean	5.30	5.50	Mean number of individuals per household.
Avg. Adults per Household	Mean	3.00	3.12	Mean number of adults per household.
Avg. Children per Household	Mean	2.30	2.36	Mean number of children per household.
Avg. Educated Members per Family	Mean	4.65	4.74	Mean number of educated individuals per family.
Highest Education Level (Matriculation)	Percentage	38.0%	41.0%	Percentage of respondents with Matriculation as highest education.
Highest Education Level (Bachelors)	Percentage	34.5%	38.5%	Percentage of respondents with Bachelor's as highest education.
Most Recurring Occupation	Percentage	50.0%	49.5% Self-	Most prevalent occupation type.

		Salaried-Private	employed	
Avg. Earning Hands per Household	Mean	1.72	1.72	Mean number of earning members per household.
Avg. Monthly Household Income (Rs.)	Mean	50,200	52,540	Mean monthly income in Pakistani Rupees.
Awareness & Perception				
Most Troubling Implication (Odor)	Percentage	78.0%	7.5%	Percentage identifying odor as most troubling dumpsite implication.
Most Troubling Implication (Aesthetics)	Percentage	14.5%	23.5%	Percentage identifying aesthetics as most troubling.
Most Troubling Implication (Negative Health)	Percentage	7.5%	22.0%	Percentage identifying negative health impacts as most troubling.
Inviting People Problem ("Sometimes")	Percentage	63.5%	8.0%	Percentage reporting "sometimes" a problem for inviting people.
Inviting People Problem ("Not at all")	Percentage	9.0%	72.5%	Percentage reporting "not at all" a problem for inviting people.
Troubled by Odor ("Yes, most of the day")	Percentage	71.5%	3.0%	Percentage troubled by odor "most of the day".
Troubled by Odor ("Live at considerable distance")	Percentage	2.0%	73.0%	Percentage indicating they live too far for odor to be an issue.
Frequency of Illness ("Less often (0)")	Percentage	63.5%	46.5%	Percentage reporting 0 illnesses in the last month.
Frequency of Illness ("Rarely (1-2)")	Percentage	28.5%	47.0%	Percentage reporting 1-2 illnesses in the last month.
Govt. Concern (Yes)	Percentage	46.5%	85.0%	Percentage believing government is concerned.
Waste Disposal (Dustbin)	Percentage	56.5%	44.0%	Percentage using dustbins for household waste disposal.
Waste Disposal (Container)	Percentage	24.5%	45.5%	Percentage using containers for household waste disposal.
Waste Disposal (Dumping Ground)	Percentage	19.0%	10.5%	Percentage using dumping ground for household waste disposal.
Waste Collection Freq. (Once a week)	Percentage	90.5%	79.5%	Percentage reporting waste collected at least once a week.

Demographics

Years Living in the Area Table 3 compares the average number of years respondents had been living in their respective areas. In the dump area, the mean duration of residency was 14.97 years, while in the control area, it was 12.87 years. Both areas show a relatively long-term residency.

House Ownership Table 3 indicates house ownership status. In the study (dump) area, 85% of respondents owned their houses, with only 15% renting. The control area showed a similar trend, with 79% owning and 21% renting, suggesting a common pattern of homeownership across both locations.

House Rent For those who rented (Table 3), in the dump area, 46.7% paid between Rs. 8000-13000, followed by 30% paying Rs. 2000-7000, and 23.3% paying Rs. 14000-19000. In the control area, 38.1% paid Rs. 14000-19000, 28.6% paid Rs. 2000-7000, 23.8% paid Rs. 8000-13000, and 9.5% paid Rs. 20000 and above. This slight variation in rent ranges, with a higher percentage paying higher rents in the control area, suggests a marginal socio-economic difference, potentially indicating that the control area residents might be slightly better off or that the proximity to the dumpsite influences property values and rents in the study area.

Household Composition (Households, Adults, Children) Tables 3 provide details on household composition. The average household size in the study area was 5.30 members (total 1060 households from 200 respondents), comprising 3.00 adults and 2.30 children on average. In the control area, the average household size was 5.50 members (total 1100 households from 200 respondents), with 3.12 adults and 2.36 children on average. These figures indicate largely comparable household structures between the two areas.

Education

Number of People Educated Table 3 shows that in the dump area, an average of 4.65 members per family had acquired education, totaling 930 educated individuals out of 1060. In the control area, an average of 4.74 members per family, totaling 948 educated individuals out of 1100, indicating similar educational attainment levels across both groups.

Highest Level of Education Acquired Table 3 details the highest level of education attained. In both areas, matriculation was the most common highest level of education (38% in dump area, 41% in control area), followed by a bachelor's degree (34.5% in dump area, 38.5% in control area). A relatively low percentage pursued master's degrees (10.5% in dump area, 1.5% in control area), suggesting that the majority of the population in both areas belongs to a lower socio-economic class.

Occupation and Income

Most Recurring Occupation Table 3 presents the most recurring occupations. In the dump area, 50% of respondents were in salaried private enterprise, 35% were self-employed, and 15% were in salaried government enterprise. In the control area, the highest percentage (49.5%) was self-employed, followed by salaried government enterprise (29.5%) and private enterprise (21%). This variation suggests that control area residents might have a greater propensity for establishing their own small businesses, possibly indicating a slightly better financial capability.

Total Number of Households Earning Table 3 indicates that the average number of earning members per household was 1.72 in both the dump and control areas, with a total of 344 employed individuals from 200 families in each area.

Total Income Table 3 shows monthly income. The mean monthly household income in the dump area was Rs. 50,200, totaling Rs. 10,040,000 per month for the sample. In the control area, the mean monthly income was Rs. 52,540, with a total monthly income of Rs. 10,508,000 for the sample. These figures reinforce the similarity in socio-economic status between the two areas, indicating that both populations generally belong to a lower socio-economic class with comparable living standards.

Awareness

Most Troubling Implication of Dumpsite Table 3 reveals perceptions of the dumpsite's impact. For residents near the dumpsite, **odor** was the most troubling implication (78%). In stark contrast, for the control area residents, odor was the least bothering aspect (7.5%). Instead, the control group cited aesthetics (23.5%) and negative health impacts (22%) as concerns, while a significant portion (47%) stated that the dumpsite did not affect them at all. This clearly highlights the direct, localized impact of odor due to proximity.

Frequency of Problems in Inviting People due to Locality Table 3 explores social implications. In the dump area, 63.5% reported that inviting people was "sometimes" problematic due to their house locality. Conversely, 72.5% of respondents in the control area stated it was "not at all" an issue, demonstrating how proximity to the dumpsite affects social interactions and perceived desirability of the residential area.

Trouble Caused by Nuisance Odor of MSW Dump Table 3 further elaborates on the odor nuisance. A significant majority (71.5%) in the study area reported being troubled by the odor "most of the day." In contrast, 73% from the control area responded, "we live at a considerable distance" and that odor was not an issue. This provides strong empirical evidence of the direct impact of the dumpsite's emissions on daily life in the immediate vicinity.

Frequency of Illness in the Last Month Table 3 indicates the self-reported frequency of illness. In the dump area, 63.5% reported getting ill "less often (0)" in the last month, followed by 28.5% reporting "rarely (1-2)" illnesses. In the control area, 47% reported "rarely (1-2)" illnesses, and 46.5% reported "less often (0)." While seemingly similar, further in-depth analysis of specific disease types and duration of illness, which will be part of the COI assessment, is required to draw definitive conclusions on health discrepancies.

Perception of Government Concerns Regarding Health Impacts Table 3 examines public perception of government concern. In the dump area, 51.5% disagreed that the government was concerned about health impacts from open dumps, while 46.5% agreed. In the control area, a vast majority (85%) believed the government was concerned, with only 4% disagreeing. This stark difference in perception reflects a higher level of dissatisfaction and a sense of neglect among residents directly affected by the dumpsite.

Waste Disposal Action and Collection Frequency

Household Waste Disposal Action Table 3 shows household waste disposal practices. In the study area, 56.5% used dustbins, 24.5% used containers, and 19% used dumping grounds (likely unofficial). In the control area, 45.5% used containers, 44% used dustbins, and 10.5% used dumping grounds. The higher percentage of direct "dumping ground" use in the study area could be linked to proximity and perceived lack of formal alternatives.

Frequency of Waste Collection by Local Authorities Table 3 details waste collection frequency. In both study (90.5%) and control (79.5%) areas, a significant majority reported waste collection at least once a week, indicating a general presence of collection services. However, a higher percentage of "rarely" or "never" responses in the dump area hints at potential inconsistencies or dissatisfaction with the regularity of services in that specific vicinity.

DISCUSSION

This study embarked on a comprehensive socio-economic analysis of the impacts of diseases and demographic issues arising from open dumping of MSW in Lahore. A holistic approach, involving a comparative assessment between a dumpsite-proximate study area (Mehmood Booti) and a control area, was adopted to achieve the research objectives.

The initial phase of the study, focused on demographic and socio-economic profiling, aimed to establish comparability between the two selected areas. The results largely demonstrated consistency across most demographic factors, including years of residency, house ownership, average household size, total household members (adults and children), educational attainment, number of earning hands, and total household income. Minor differences were observed, such as in house rent; a higher percentage of respondents in the control area reported paying higher rents (Rs. 14000-19000) compared to the dump area (Rs. 8000-13000). This discrepancy may suggest a slightly better socio-economic standing in the control area or, more pertinently, that the lower rents and property values near the dumpsite contribute to its affordability, attracting residents despite environmental concerns. Similarly, occupational variations—with more individuals in salaried private enterprise in the dump area versus self-employment in the control area—might also reflect subtle differences in economic opportunities or entrepreneurial capacity linked to location. Overall, the demographic analysis strongly indicates that both populations generally belong to a lower socio-economic class, sharing comparable living standards, thus validating the control area for comparative analysis.

The assessment of public awareness and perception regarding the implications of waste mismanagement revealed significant distinctions directly attributable to geographical proximity. Residents in the dump area overwhelmingly identified odor as the most irritating factor (78%), whereas in the control area, odor was the least bothering aspect (7.5%). This aligns with observations by Salam (2010), who also reported the pervasive nature of obnoxious odors from open waste dumps in Manzini. The psychological and social burden imposed by this nuisance was evident in the study area, where 63.5% found inviting guests problematic due to their locality. In stark contrast, 72.5% of the control group reported no such issue, underscoring the profound social stigma and quality of life degradation experienced by communities living near dumpsites.

Furthermore, the study illuminated a concerning gap in public awareness about the direct health hazards of living near open dumps, despite general education levels being comparable. While most respondents understood the importance of education, a significant portion remained ambiguous or unaware about the specific health risks associated with dumpsite proximity. A mixed response was received when asked about the harmfulness of living near an open dump, with a majority in both areas either confused ("don’t know") or understating the risk ("not likely" or "somewhat likely"). Only 18% in the study area acknowledged the "very likely" harm, compared to a relatively higher 52% in the control area. This suggests that direct exposure, while causing discomfort (odor), does not automatically translate into a comprehensive understanding of long-term health risks, highlighting the need for targeted public health education campaigns.

The preliminary findings regarding self-reported illness frequency show some similarities between the two groups. However, to truly assess the health impact and determine the Cost of Illness (COI), a deeper analysis of specific disease prevalence, duration of illness, healthcare utilization, and productivity loss is indispensable. This current section primarily establishes the demographic homogeneity and highlights the differential environmental nuisance and social impacts experienced by the two groups due to the dumpsite.

Limitations: While this study provides valuable insights, it is important to acknowledge certain limitations. The primary data relies on self-reported information, which may be subject to recall bias or subjective interpretations of illness frequency and perceptions. The health impact assessment in this specific part of the study is descriptive and primarily focuses on perceptions and general illness frequency rather than clinical diagnoses and detailed COI calculations, which are intended for subsequent phases. The selection of a single dumpsite, while representative, limits the generalizability across all open dumping sites in Pakistan, which may vary in size, age, and waste composition.

Conclusion and Future Directions: This initial phase of the study provides a detailed insight into the destructive impact of a mismanaged, open dumpsite, specifically the Mehmood Booti site, on the demographic situation and environmental perceptions of nearby communities in Lahore. The rigorous comparative analysis between the study area and a demographically similar control area has clearly delineated how proximity to an open dump severely compromises the living standards and health conditions of residents. While both populations share similar socio-economic characteristics, residents near the dumpsite experience significantly higher levels of nuisance (particularly odor) and social inconvenience, alongside a concerning lack of comprehensive awareness regarding the inherent health risks.

This study successfully establishes a robust baseline of comparable demographic and socio-economic conditions between the exposed and control populations.

This foundation is crucial for the subsequent, more detailed analysis intended for a doctoral thesis:

1. **Quantification of Environmental Health Impacts:** To determine the precise extent of environmental impact as a direct cause of regular and serious diseases (e.g., skin diseases, eye irritation, respiratory ailments, diarrhea, fever, typhoid, and cholera) by analyzing medical data and respondent health histories.

2. **Calculation of Cost of Illness (COI):** To rigorously calculate the economic burden imposed by these diseases, including direct medical costs and indirect productivity losses (e.g., lost work days, school days), on individuals and households living in the affected areas.

3. **Socio-Economic Loss Assessment:** To comprehensively assess the broader socio-economic losses encountered by the population due to reduced quality of life, diminished property values, and other unquantified impacts.

The findings underscore the urgent need for improved solid waste management practices in Lahore and other urban centers in Pakistan. The continued reliance on open dumping creates significant public health crises and socio-economic disparities. This research serves as a critical step towards providing empirical evidence for policymakers to implement targeted interventions, such as transitioning to sanitary landfills, establishing robust waste collection systems, and launching public awareness campaigns focused on health risks and proper waste segregation. Ultimately, this study aims to contribute to a more sustainable urban environment and improved public health outcomes in Pakistan.

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