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Socio-Environmental Impacts of Solid Waste Management

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Abstract

The burgeoning human population not only exerting pressure on natural resources extraction but also increases waste generation, which causing environmental degradation and health hazards. Population growth and environmental well-being are closely interlinked. Pakistani cities encounter challenges such as irregular waste collection, open dumping, and burning of solid waste, posing significant environmental risks. In Rawalpindi city, solid waste management is poorly practicing by responsible authority due to the lack of funds and other resources. In order to determine the social and environmental impacts of solid waste, survey-based exploration for data collection was done with the help of questionnaires which were administered at household's level and health care level in Satellite Town Rawalpindi, Pakistan. Total 128 questionnaires were administered. Twenty households were randomly selected from each of six blocks and seven diagnostic labs and hospital were selected for data collection. Besides supply side information was gathered from Solid Waste Department (SWD), working under Tehsil Municipal Administration (TMA). Statistical analysis revealed the positive correlation of social and environmental impact with different variables regarding the solid waste. Results underline a direct correlation between solid waste mismanagement and hostile societal and environmental consequences. Open dumping adversely affects health and the local environment due to ineffective waste management practices, slack enforcement of regulations, and inadequate and lack of funding, lapse, and monitoring. Noxious corridor of polluting environment by open dumping of solid waste in residential areas reflects and preludes the restricted healthy environment which is the main factor for vigorous social existence. Addressing these challenges is critical to fostering a healthier and more sustainable living environment.

Keywords: Disposal, Ecological Paradigm, Management, Regulation, Solid Waste

1. Introduction

The intricate relationship between the environment and human activities highlights the critical need for effective environmental management, especially concerning inefficient solid waste management systems. While participatory development methods show promise in addressing this challenge, the lack of community engagement remains a significant hurdle. Local governments could benefit from promoting participatory approaches, as they not only enhance environmental management but also improve service delivery at the grassroots level (Arshad 2023).

Society comprises individuals influenced by various factors such as geography, economy, religion, social interests, and urbanization status, all of which affect their waste generation

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patterns. Socioeconomic factors and attitudes play a significant role in shaping waste generation habits, with awareness campaigns showing potential to positively impact attitudes towards waste. However, a lack of available data and focused studies hampers efforts to establish the link between waste management practices and their impacts on human and environmental health (Debrah et al. 2021; Fadhullah et al. 2022). Public awareness of the risks posed by poor waste management practices is crucial in driving participation and mitigating environmental damage. The social impacts of solid waste include health risks, social opportunities, community attitudes, aesthetic concerns, and employment implications (Abubakar et al. 2022).

In Pakistan, the environmental dimension of solid waste is often overlooked, leading to adverse impacts such as aesthetic nuisances, water and air pollution, and unpleasant odors due to inadequate waste collection and disposal practices. Despite significant waste generation, especially in urban areas, the absence of proper management systems exacerbates environmental and sanitary concerns, negatively affecting public well-being (Akmal et al. 2021). The composition of solid waste in Pakistan includes plastic, metal, rubber, cardboard, paper, textiles, glass, wood, animal and agricultural waste, bones, and food waste, with plastic content posing significant environmental challenges. Waste characteristics vary based on urbanization rates, income levels, industrialization, and commercialization (Chen 2018).

Globally, the 20th century witnessed a significant increase in solid waste generation due to industrialization, economic growth, and resource consumption (Khan et al. 2022). Municipal solid waste predominates, with household waste management emerging as a critical concern, particularly in urban areas like Karachi, where significant waste generation challenges persist despite comparatively low per capita rates. Both formal and informal sectors are involved in waste collection in Pakistan, with municipal authorities and informal scavengers playing key roles. However, challenges remain, including inadequate waste collection rates and unsustainable disposal practices, highlighting the urgent need for comprehensive and sustainable waste management strategies (Hajam 2023).

Understanding the influence of waste generation, its various types, and their socioenvironmental impact on the community of Satellite Town is paramount. Despite its importance, there has been a dearth of research on the socio-environmental effects of solid waste in this area. By delving into these aspects, this study aims to provide valuable insights that can inform decision-making processes regarding solid waste management, not only in Satellite Town but also in Rawalpindi as a whole. Furthermore, the findings of this research can serve as a basis for evidence-based waste management policies in Pakistan. Focused on the vibrant urban landscape of Rawalpindi city, this investigation will shed light on both the social and environmental dimensions of solid waste generation. Ultimately, the study seeks to assess the implications of solid waste generation and its various types within the area, with the aim of generating actionable recommendations for improved waste management practices.

Upon reviewing existing literature, it becomes apparent that studies focusing solely on estimating solid waste components and management practices have been conducted, limited to selected cities and areas in Pakistan. Notably, data concerning the socio-environmental impact of solid waste remains conspicuously absent for any city or area in the country, revealing a significant knowledge gap. This gap hampers the formulation of effective waste management policies in Pakistani cities. Hence, this study is proposed to investigate the impact of solid waste on social and environmental health parameters, with the objective of establishing a robust foundation for environmental health protection measures.

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To achieve the objectives of the current study, the commercial area of Rawalpindi was chosen as the focal point. While Pakistan boasts several populous cities, Rawalpindi stands out due to its unique geographical position and historical background. Originally a small village known as "Pind" for many decades prior to the country's inception, Rawalpindi underwent significant transformation after the Pakistani government launched a project on the Korang river and lake, subsequently renaming the village Rawalpindi in 1960. Additionally, following the designation of Islamabad as the capital, Rawalpindi experienced rapid and uncontrolled population growth.

Rawalpindi's governance is divided between two administrative entities: the City District Government Rawalpindi (CDGR) oversees one half of the city, while the other half falls under the jurisdiction of the Cantonment Board, further subdivided into Chaklala Cantonment Board (CCB) and Rawalpindi Cantonment Board (RCB). The proposed study area encompasses Satellite Town (located at 33° 38' 0" North, 73° 4' 0" East), a diverse blend of commercial, residential, and corporate sectors situated within Rawal Town. Satellite Town spans across 46 Union Councils, with the study focusing on a subset ranging from 13 to 26 Union Councils.



Figure 1: Study Area Map (Rawalpindi Cantonment Board is Bounded by the Dotted Line).



Figure 2: Map Showing Satellite Town, Rawalpindi.

Satellite Town, a bustling hub in Rawalpindi city, attracts a significant amount of activity.

Primarily home to middle to upper-class residents, the area's residential layout has evolved over time, with smaller subdivisions added ad hoc to accommodate population growth and migration pressures. Approximately 5000 legally registered houses were reported in Satellite Town by the Tehsil Municipal Administration in 2012 (Urooj 2014).

The presence of several slaughterhouses and shopping plazas adds to the area's commercial vibrancy, resulting in the generation of substantial quantities of waste comprising natural debris, packaging materials, organic matter, and human waste. Limited availability of land in Satellite Town has led to collaboration among opportunistic landowners and developers, resulting in the conversion of vast tracts of land into substandard living place. This situation leads to the accumulation of waste along streets, causing public nuisance, foul odors, and environmental hazards. Understanding waste generation, its types, and socio-environmental implications in Satellite Town is crucial.

The main objective of this research was to comprehensively investigate the social, economic, and environmental impacts of waste generation and management within the current technological context. Additionally, the study aimed to establish correlations between the social, economic, and environmental dimensions of solid waste generation and management, addressing a notable gap in previous research and secondary data availability.

2. Materials and Methods

The study conducted in order to develop understanding about the solid waste impact on environment and public health as well as all those social aspects which suffered from inadequate management of solid waste in an urban area. In order to achieve the objectives, research study designed on the bases of New Ecological Paradigm (NEP).

Qualitative data, acquired through observations and interviews with workers and scavengers, complemented the quantitative data collected. The research utilized a combination of structured questionnaires, interviews, and observations. Random sampling was employed, with questionnaires administered randomly at the household level. A sample size of 128 households was selected, with twenty households chosen randomly from each block. Information regarding social and environmental characteristics, as well as health impacts, was gathered from these households. Additionally, six private diagnostic labs and one hospital within the study area were selected, and questionnaires were administered to assess their waste generation practices.

Both qualitative and quantitative data collected through structured and semi-structured questionnaires were analyzed to describe and evaluate the social and environmental impacts of solid waste in Satellite Town. Qualitative data analysis involved interpreting information gathered through semi-structured questionnaires, while quantitative data included responses to closed-ended questions from various respondents, including the Tehsil Municipal Administration (TMA) Solid Waste Department Authority, households, and laboratory staff.

The information obtained was evaluated using graphical representations to illustrate the social characteristics of households, environmental variables affected by waste, infectious waste generated by labs, and methods of treatment, disposal, and management. Data analysis was conducted using the IBM Statistical Package for Social Sciences (SPSS) version 19, a widely used computer program for statistical analysis in social sciences, health research, education, market research, survey companies, and government agencies.



3. Results

3.1. Supply Side Information

Information regarding the supply side was obtained from the Solid Waste Department of the Tehsil Municipal Administration (TMA). The Rawalpindi TMA, operating under the City District Government Rawalpindi (CDGR), is responsible for waste collection from point sources, transportation, and disposal of solid waste. Rawal Town TMA oversees a total of 46 Union Councils (UC) with a population of one million. Rawalpindi City is divided into four sectors for solid waste management, each headed by a District Officer (Solid Waste Management) assisted by four Chief Inspectors (CI), each in charge of a sector. Satellite Town comprises Union Councils 13-15, 17-25, and 27, which fall under sector A (Table 1). According to official records, the allocated budget for solid waste management was 643 million, with a total of 283 sweepers allocated specifically for Satellite Town.

S/N	Name of Sector	UC included
1	Sector A	13, 14, 15, 17, 18, 19, 20, 21, 22, 23, 24, 25,27 & 30
2	Sector B	26, 27, 28, 29, 30, 31, 32, 42, 43, 44 & 45
3	Sector C	16, 33, 34, 35, 36, 37, 38, 39, 40,41 & 46
4	Sector D	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 & 12

Table 1: Sectors for waste managing in Rawalpindi.



Figure 4: Sectors for waste managing in Rawalpindi.

The department staff only collects waste from secondary collection points, while sanitary staff sweep roads, streets, and the dumping station on a daily basis. The department also conducts yearly training sessions, although these are limited to supervisory staff. Several campaigns and projects for special solid waste management are conducted throughout the year, focusing on activities such as cleaning the Nullah, managing waste during Eid-ul-Azha, and addressing other major occasions.

There were no storage bins in Satellite Town, Rawalpindi, provided by the Solid Waste Department (SWD) of the Tehsil Municipal Administration (TMA). However, a policy for standardizing storage bins is currently in the development phase. The responsibility for waste management in the area has now been taken up by the Rawalpindi Waste Management Company (RWMC), which aims to streamline operations and adhere to standards. Losar serves as the dumping site for waste collected from all areas of Rawalpindi city. The waste is transported by the responsible authority to a transfer station near the Soan River, from where it is transferred to the main landfill site at Losar (figure 6). The Losar landfill site spans 75 acres and was purchased by the City District Government Rawalpindi (CDGR) in 1994 when it was known as the Rawalpindi Municipal Corporation. It has been used as a landfill for Rawalpindi City since November 2006.

The Solid Waste Department (SWD) in Rawalpindi faces numerous challenges arising from lack of awareness, insufficiently educated staff, citizen behavior, and the presence of unqualified individuals within the organization.



Figure 5: Existing Solid Waste Management in Satellite Town Rawalpindi.



Figure 6: Map of Landfill Site.

Kurdish Studies

3.2. Social and Environmental Impact Analysis

Satellite Town is home to residents from diverse socioeconomic backgrounds, with a mix of commercial and residential properties. Figure 7 shows the distribution of residents living in conditions characterized by filth, unpleasant odors, and favorable environmental conditions within Satellite Town. These circumstances significantly correlate with the proximity of their residences to solid waste dumping sites.

A Block: Figure 7 indicates that among respondents surveyed, 35% respondents live near solid waste dumping sites, while 65% respondents live farther away. Despite this spatial difference, all respondents report experiencing various health impacts attributed to waste, shown in figure 8. Notably, 70% of households express satisfaction with the pleasant environmental conditions around their residences.

Figure 8 showed that 90% of inhabitants in A-Block suffer from malaria, likely due to the proliferation of malarial mosquitoes near waste disposal sites. Similarly, 55% of residents experienced diarrhea, largely due to flies attracted to waste dumping areas. Statistics also highlights the prevalence of cholera among 45% of A-Block residents, primarily linked to fly propagation resulting from inadequate waste disposal practices. Furthermore, Figure 8 demonstrates that 35% and 25% of inhabitants endure irritation of the eyes and skin, respectively, due to the burning of waste near their residences. These results provided insights into the environmental and health impacts experienced by residents in A-Block, emphasizing the need for improved waste management strategies.



Figure 7: Inhabitant's Response about Living Environment.

B Block: Despite 60% of households reporting a pleasant environment, 80% of residents in B-Block suffer from various health impacts associated with waste disposal practices (figure 7 and figure 8). Comparatively to statistics of Block A, figure 8 showed that 95% of inhabitants in B-Block had malaria, likely due to mosquitoes breeding near waste disposal sites. Similarly, 35% of residents experienced diarrhea due to flies attracted to waste dumping areas. Additionally, 15% of inhabitants in B-Block suffered from cholera, also linked to fly propagation from poor waste disposal practices as well as 20% and 35% of residents, respectively, experienced irritation of the eyes and skin due to burning waste nearby.

Despite the perceived environmental quality, the actual health impacts in B-Block underscore the need for improved waste management strategies.



Figure 8: Health Impact of Solid Waste in Vicinity upon Residents.

C Block: In C-Block, 65% of households report a pleasant environment, yet a significant proportion of residents suffer from health impacts associated with waste disposal practices.

Statistics of C Block in figure 8 showed that 95% of inhabitants in C-Block have malaria, likely due to mosquitoes breeding near waste disposal sites. Similarly, 10% of residents experienced diarrhea due to flies attracted to waste dumping areas. Furthermore, statistics revealed that 10% of inhabitants in C-Block suffer from cholera, also linked to fly propagation from poor waste disposal practices. Additionally, 30% and 45% of residents, respectively, experience irritation of the eyes and skin due to burning waste nearby.

D Block: Many households (70%) in D-Block report a pleasant environment, yet a significant proportion of residents suffer from health impacts associated with waste disposal practices.

Figure 8 showed that 90% of inhabitants in D-Block have malaria, likely due to mosquitoes breeding near waste disposal sites. Similarly, statistics indicated that 60% of residents experience diarrhea due to flies attracted to waste dumping areas. Furthermore, 35% of inhabitants in D-Block suffer from cholera, also linked to fly propagation from poor waste disposal practices. Additionally, 25% of residents experience irritation of the eyes and skin due to burning waste nearby.

E Block: In E-Block, 65% of households report a pleasant environment, yet a significant proportion of residents suffer from health impacts associated with waste disposal practices. 90% of inhabitants in E-Block had malaria, likely due to mosquitoes breeding near waste disposal sites and 30% of residents experienced diarrhea due to flies attracted to waste dumping areas. Whereas 20% of inhabitants in E-Block suffered from cholera, also linked to fly propagation from poor waste disposal practices. Additionally, 20% and 35% of residents, respectively, experienced irritation of the eyes and skin due to burning waste nearby.

F Block: In F-Block, 70% of households report a pleasant environment living away from dumping site, yet a significant proportion of residents suffer from health impacts associated with waste disposal practices.

Statistics revealed that 95% of inhabitants in F-Block had malaria, 55% of residents suffered from diarrhea due to flies attracted to waste dumping areas, and 50% of inhabitants in F-Block

suffered from cholera, linked to fly propagation from poor waste disposal practices. Additionally, Figure 8 demonstrates that 50% and 40% of residents, respectively, experience irritation of the eyes and skin due to burning waste nearby.

The presence of medical waste from clinics and hospitals in the dumping station located in F-Block exacerbates the health risks faced by residents in the vicinity.

Overall, these findings emphasize the urgent need for comprehensive interventions to mitigate the adverse health impacts experienced by residents in Satellite Town.

4. Discussions

This study was survey based using questionnaire for data collection like Sabon Gari research study in 2012. Three differently structured questionnaires in order to get more information from higher level of administration and management directive body of government, residential area, and commercial area. Total 128 questionnaires were administered randomly, out of which 120 were responded by households and 7 were responded by diagnostic labs and hospitals and one from District Officer (DO) of SWM department.

Social impacts of solid waste on Satellite town community were assessed by observation and response from randomly selected nearby and far away households from dumping site of waste. Majority of respondents who were living near the dumping place of solid waste generated from houses, markets, hospitals, parlors, hotels, school, and college have impact on their health, surrounding environment and social life. These problems can solve by integrating social dimension regarding management of solid waste in Satellite town analogy to research done in 2012 by Gurberlet.

Collection of waste is main problem in Satellite town. No proper collection system from houses and other built-up area was recorded through questionnaire data given by respondents. 35% respondents were those who were dumping their household waste by their self whereas 1.7% respondents were those whose waste was collected by governmental sweeper and 63.3% were had hired sweeper. Similarly, one study done on developing countries by Boadi revealed that 80% populations did not have waste collection facility at their home. Only 13.5% of respondents were served with the facility of door waste collection while rests were disposed off their waste: either at communal collection points, in open space or dump directly in the waterways (Boadi 2005).

Another picture which brought in light that those hired sweepers were actually the SWD appointed sanitary staff who charge money from houses to clean their street and dumping waste from houses to dumping places. But the charges were varying from house to house like 7.5% houses were giving 100 rupees, 1.7%, 18.3%, 5.8%,20%, 11.7% were paying 120, 200, 250, 300 and 500 Rs/- respectively.

Another study conducted in Pakistan by Pak-EPA with the collaboration of Japan international Cooperation Agency, Pakistan Ministry of Environment and UNDP in 2005. These institutions developed the guidelines on Solid Waste Management (Mahar 2007). In which Pak-EPA calculated that waste generation rate varies from 1.896 - 4.29 kg/house/day. It stated by EPA that in Pakistan proper collection and disposal has not been carried. That's why the people are suffering from poor living condition and environmental conditions have become worst. The scope of problems regarding solid waste is its management either directly or indirectly. The leading factor that is upsetting the solid waste and its disposal management is rapid and

continuous growing rate of population and households. But there are many aspects comprise development, temperature, precipitation, waste pickers, carrying capacity, inadequacy, and limitations of municipalities, which are essential to manage the solid waste.

From results it has also been observed that majority inhabitants in F and A block were suffering from the odor of waste emitting from dumping places as both blocks were commercially established, as large number of educational institutes, parlor, hotels and motor workshops exited and colleges, many diagnostic labs and hospital were in F-block which responsible for generating diverse type of solid waste and ultimately causing environmental and health issues among inhabitants. Analogy to the case study done in 2013 on non-segregated disposal of solid waste in dumpsites, results of which has evidenced to be a problematic situation near urban areas in developing cities of the world. Open dumping of waste can cause major environmental and public health threats in urban cities (Sankoh 2013).

Similar to the results of case study of Freetown, Sierra Leone which showed that both nearby living and far away inhabitants suffered from the malaria, chest pains, diarrhea and cholera diseases (Sankoh 2013), and study on health risks by Gouveia (2009) in which it has been emphasized that, number of health diseases including respiratory psychological disorder, skin, eyes and nose irritation, gastrointestinal problems, and allergies were due to dumpsites near the residential areas. Results of this present conducted study emphasized that solid waste dumping places in Satellite town Rawalpindi are breeding places for many disease transmitting vectors like flies, mosquitoes, and rats. Most prevalent diseases like malaria, diarrhea, cholera, and eye and skin irritation were reported by randomly selected household's respondent. However, frequency of occurrences of these diseases were varying according to blocks in satellite due to distance of houses from dumping places. Ratio of respondents living near and far away from dumping places was 50:70. In block A 35% houses were living near solid waste dumping place and 65% were existed far away and 90% had malaria fever, 55% had diarrhea 45% had cholera,35% had eye irritation and 25% had skin irritation due to odor, disease vectors and burning of waste on dumping place in vicinity of A block.

In block B ratio of near and far living was 35:65 out of which 95% suffered from malaria, 35% had diarrhea, 15% had cholera, 20% had eyes irritation and 35% had skin irritation. In block C ratio of near and far living was like A and B whereas 95% had malaria, 10% had diarrhea, 10% had cholera, 30% had eyes irritation and 45% had skin irritation. In block D 30% were living near and 70% were living in far distance from dumping place of solid waste. Out of total respondents of D block 90% had suffering from malaria due to the malarial mosquitoes, 60% had diarrhea and 35% had cholera caused by flies' propagation, 25% had eyes and 25% had skin irritation due to open burning of waste in vicinity of D block. In block E ratio of living in near and far was 35:65. 90% had reported malarial disease, 30% had diarrhea, 20% were suffering from cholera, 20% had eyes and 35% had skin irritation due to waste heaps and open burning. Similar ratio of near and far houses was in block F however 95% respondents were suffering from malaria, 55%, 50%, 50%, 40% were had diarrhea, cholera, eyes and skin irritation respectively. The percentage of disease suffering was higher in F block due to the placement of large dumping station as well as many diagnostic labs and hospital existed in F block that dump their infectious waste at main dumping station situated in F-block. Similar study was carried out by Abul, S. in 2010 on the solid waste disposal and its impact on environment and health in Manzini. Researcher stated that solid waste disposal sites located in the peripheries of the urban areas were breeding places for insects and rodents. By these organisms several diseases could be transmitted to the human that affect population's health.

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Another aspect which was observed and revealed from results was surrounding environment in different blocks and around houses. Results revealed that those houses which were having smelly or filthy houses, inhabitant of those houses had health impact and inhabitants of those houses which were having pleasant environment in their surroundings were also suffering from diseases. Results in table 4.15, 4.16 and 4.17 shown that most highlighting parameter is distance of houses from dumping station of solid waste no matter whether household's experiencing smelly environment or pleasant environment, those inhabitants which were living closed to dumping stations had great health impact and percentage of suffering from diseases was high as compare to those who were living in far distance houses from the dumping station. Similarly, distance of houses and disease rate was reviewed in research paper of Nigeria by Ogunrinola (2012) who reported that distance between the houses and dumpsite fluctuates inversely with rate of recurrence and reported type of illness.

In Satellite town mostly (88.3%) households were generating mixed type (both organic and inorganic) waste whereas 7.3% houses were generating inorganic waste more than organic and 4.2% households were generating more organic content in their waste. Type of waste varied according to the living standard of inhabitant. Every household generate significant quantity of plastic content in their waste. However useable material like bread (roti), tin or metal containers old clothes and newspapers given at no price or sold to scavengers or scrap dealers. In one study conducted by Ashraf in 2016, physical composition of solid waste in Pakistani cities were based upon the food waste which was 8.4-21 in percentage, 10.2-15.6 in percentage of leaves grass fodder and straws and 13.9- 23.55 percentage of waste segregated as recyclable elements from solid waste.

Dumping station in Satellite town not only holds waste generated by households but also encompass Health Care Waste generated by diagnostic labs and hospital. Infectious and toxic waste like cultures, expire medicine, injection syringes and tissue samples are practiced dumping at municipal waste dumps. In one study it has been reported that in Pakistan around 250,000 tons of medical waste is annually produced from all sorts of health care facilities (Kumar, 2010). Risk of HIV and Hepatitis B infection and other diseases has been increased due to the dumping of Health Care Waste (HCW) in the dumpsites of domestic waste near the residential area (Delvoie 2005). Another study accompanied by Yongsi (2008) showed that hazardous waste in dumpsites can affect human health via on direct and indirect exposure and children are being the most susceptible to these toxins. Whereas release of chemical from waste into the environment leads to chemical poisoning and through direct chemical exposure, it can lead to infectious and allergic illness.

From results it has revealed that there was no major concern of segregating waste among laboratory management staff. Some labs were found to separating their waste into two bins as instructed by National Cleaner Production Center. In past first incinerator in Rawalpindi was installed at Holy Family Hospital (HFH) in 15 September, 2007 but get closed in March 2011 due to some technical problems.

Public more and often do not consider and realize the potential of risks by the poor practicing of bad waste management. Even there are no available data and disseminated information and focus studies to establish the connection between the waste impact to human and environmental health and management (Allesch 2014).

Public awareness about risks posed by the human activities determines an interest towards the approaches for participation in anticipation and mitigation of the activities which lead to environmental damages and, further on, to human health (Cudjoe 2021).

In present study results showed that all respondents were aware with the impacts of solid waste on their health and environment. Regarding management all respondents suggested different suggestions. 70% of respondents living near to dumpsite were emphasized on the proper management of dumpsite so they can live better healthy life until living in Satellite town. 8% were those who were annoying with dumping heaps of waste nearby their houses, they suggested that waste should burn because waste heap near their houses was not managing properly and lifting authority was not picking and transporting that waste for two to three days. Due to this they were experiencing bad odor environment and suffering from unpleasant environment near their houses. Beside they overlook the effects of burning waste which emitting noxious smell and dust that can ultimately affect their health and environment as well. Moreover 22% were those respondents who were living near the dumping site but emphasized on waste segregation and proper treatment. For proper management it is necessary to separate out the different waste content especially in organic and inorganic so waste can be treating properly and environmentally soundly. 50% respondents which were living far away from the dumpsite were thinking that waste problem can solve by proper management and accentuating that "responsible authority is week in managing waste that's why they are facing problems in their vicinity". 41% far living respondents were stressing on proper sorting and treating waste whereas 9% were putting their accent on burning waste in order to eliminate waste problem in their vicinity.

Since 2012 Punjab Environmental Protection Agency legislating Hospital Waste Management Rules, 2005 on all health care facility unit. By this implementation all labs and hospitals started sending their hazardous waste to National Cleaner Production Center (NCPC) at Attock Refinery Limited, Morgah Rawalpindi. NCPC managing hazardous industrial and hospital waste through Incineration on request of Punjab government. For treatment through incineration NCPC charge the lab and hospitals very reasonable amount that is 25/- Rs for 1kg. results revealed that all testing labs were conducting Histopathological, PCR, Micro culturing, Blood and urine test in their labs. After testing a significant amount of waste generating every day which collected by NCPC. But there was no proper segregation method of health care waste at labs. Due to this sometime infectious waste get into municipal waste which ultimately cause health and environmental impact. By this action health care unit become source of sickness for human beings as discussed in study accompanied by Yongsi in 2008, showed that hazardous waste in dumpsites can affect human health via on direct and indirect exposure and children are being the most susceptible to these toxins. Whereas release of chemical from waste into the environment leads to chemical poisoning and through direct chemical exposure, it can lead to infectious and allergic illness. Whereas World Bank reported that risk of HIV and Hepatitis B infection and other diseases has been increased in developing countries due to the dumping of Health Care Waste in the dumpsites of domestic waste near the residential area (Delvoie 2005).

Efforts to address these challenges include initiatives like the SWEEP project, but significant gaps remain. The impact of waste mismanagement extends to public health risks, with diseases like malaria, diarrhea, cholera, and respiratory ailments prevalent among residents. Medical waste from healthcare facilities also poses health hazards if not managed properly.

The study emphasizes the need for comprehensive waste management strategies focusing on public health and environmental sustainability. Recommendations include enhanced public

awareness, improved waste collection and segregation practices, and stricter enforcement of waste disposal regulations. Collaboration between stakeholders is crucial to address the challenges associated with solid waste management in Satellite Town.

5. Conclusions

The present study revealed a lack of proper management of solid waste in the Satellite Town area of Rawalpindi. There was no proper monitoring of dumping municipal or hazardous waste, and the dumping station in F-block was not properly maintained. Additionally, different diagnostic labs were not following biosafety levels correctly. There was no proper segregation system at the healthcare level, nor was there a collection facility at the household level. Until 2012, there was no legal enforcement for waste management from the government on the diagnostic labs. Previously, open dumping was commonly practiced by the labs. After 2004, a few labs and hospitals began treating infectious waste through the incinerator at Holy Family. Unfortunately, it has not been operational for the last two years. Since 2012, the Punjab government has taken the initiative to enforce liability on all labs in Punjab to manage and treat their waste, or else their lab will be shut down. Due to this legal obligation, all labs started sending their special waste to the NCPC (National Cleaner Production Center).

The study's results conclude that government policies and plans for solid waste management in Satellite Town need to integrate social and environmental aspects. This complex challenge is not only for Satellite Town in Rawalpindi but for every area of Pakistan, requiring proper monitoring in waste management through policy formulation to eliminate risks to environmental and public health. Moreover, significant public involvement should be included in making management effective. With public involvement and proper monitoring of the solid waste management system, every area and city in Pakistan can move towards a healthier, environmentally sustainable development, from a socially and economically supportive, acceptable, and sanitary perspective.

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