International Journal of Geography, Geology and Environment

P-ISSN: 2706-7483
E-ISSN: 2706-7491
IJGGE 2022; 4(1): 54-58
Received: 28-11-2021
Accepted: 30-12-2021

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Environmental and community health impacts of municipal solid waste dumpsites in Bhanpur and Adampur Chhawani, Bhopal, Madhya Pradesh, India

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Abstract
This research study was intended to scrutinize the environmental and community health impacts of municipal solid waste dumpsites in Bhanpur and Adampur Chhawani, Bhopal, Madhya Pradesh, India. Primary data were collected through a semi- structured questionnaire that was used to gather information on environmental characteristics and population health of Bhanpur and Adampur Chhawani communities' residents. A total of 100 respondents, 50 from Bhanpur and 50 Adampur Chhawani were randomly selected for this study. In our survey, self-reported health problems of residents surrounding Adampur Chhawani dumpsite were typhoid (58%), chest related illness (24%), cholera and diarrhea (34%), malaria (22%) and skin infections (16%). But when compared to the residents residing around Bhanpur dumpsite the number of respondents who had, typhoid, chest related illness, cholera and diarrhea, malaria and skin infections, stood at (52%), (8%), (22%), (12%) & (4%) respectively. It was found that residents living nearby Adampur Chhawani dumpsite are most affected by the dumpsite. This is due to the fact that Adampur Chhawani dumpsite is operational dumpsite and receives waste on daily basis while as Bhanpur dumpsite is closed for waste dump. The study therefore concludes that the dumpsite should be properly managed and cared to minimize its effects on the environment.

Keywords: Solid waste dumpsites, environment, human health, community participation

1. Introduction
With the growing world population and rising demand for food and other necessities, there has been an increase in the amount of waste produced daily in each household. This waste eventually ends up being dumped in municipal dumps and due to poor management and inefficiency, dumping sites turn into sources of environmental and health risks for people living near such dumps (Adam, *et al.,* 2016). Landfill operation is usually associated with contamination of surface and groundwater by leachate from the landfill (mostly if the landfill lacks adequate liners), pungent odour, loud disturbing noise from landfill bulldozers, litter, dust, excess rodents, unexpected landfill fires, bio aerosol emissions; volatile organic compounds (Garrod and Willis, 1998; Palmiotto, *et al*., 2014) [9, 15]. Solid waste dumpsites are a major contributor to the world's anthropogenic greenhouse gas (GHG) emissions because an enormous amount of CH_4 and CO_2 are generated from the decomposition of organic wastes in the dumpsite (Kumar, *et al*., 2004) [11]. The continuous inhalation of CH4 by humans can cause loss of coordination, nausea, vomiting and high concentration can cause death (Okeke and Armour, 2000) [13]. The illegal dumping of MSW is proven to cause many diseases. Occurrences of malaria, diarrhea, and respiratory infections is common among residents living in in poorly waste managed area (Kafando, *et al.*, 2013) [10]. Previous research shows that people living closer to landfill sites suffer from medical conditions such as asthma, cuts, diarrhoea, stomach pain, reoccurring flu, cholera, malaria, cough, skin irritation, cholera, diarrhoea and tuberculosis more than the people living far away from landfill sites (Adeola, 2000; Bridges, *et al.*, 2000; Sankoh, *et al.*, 2013) [4, 6, 16]. The causes of the health problems are as a result of continuous exposure to chemicals; inhalation of toxic fumes and dust from the landfill sites. Using water polluted by MSW for bathing, food irrigation and drinking water can also expose people to diseases and other contaminants. In addition, respiratory symptoms, skin irritation, nose and eyes, intestinal problems, fatigue, headaches, psychological problems and allergies have been found common in people living near landfills (Abul, 2010; Alam and Ahmade, 2013) [1, 5].

Hence the present study has been attempted to evaluate the environmental and human health impacts of solid waste dumpsites.

2. Materials and Methods

2.1 Study Area

The study was conducted in Bhopal Division which is capital city of Madhya Pradesh, India. Two solid waste dumpsites were selected for the present study viz., Bhanpur dumpsite and Adampur Chhawani dumpsite. The Bhanpur dumpsite is ex-landfill site with the total area of 57.80 acres and it is located at latitude 230 17'47.59''N, longitude 770 25'11.54 E. The Adampur Chhawani dumpsite is scientific and operational dumpsite. The total area of Adampur Chhawani dumpsite is 60 acres and it is located between 230 15'18.66" N and 770 32'25.06'' E.

2.2 Data collection and sample size

A comparative cross- sectional design was employed which involved the use of semi- structured interviewer-questionnaire to randomly selected household respondents. The questionnaire was divided into three sections: Section A: Socio- demographic Information, Section B: Environmental Characteristics and Section C: Health Problems of residents Each questionnaire was carefully reviewed to determine the completeness and validity of the responses. The household heads or adult members (preferably females) of the community who resided around the dumpsite participated in the survey. A total of 100 respondents, 50 from Bhanpur and 50 Adampur Chhawani were selected for the present study.

3. Results and Discussion

3.1 Socio-Demographic Characteristics of Respondents

The social and demographic characteristics of the respondents are presented in Table-1. The results from our field survey states that most of the respondents participated in this survey were aged between 31-50 years. The high participation of women in our study was probably due to availability, better knowledge and awareness of women on the health issues affecting their children and household members (Shomoye and Kabir, 2016) [17]. Most of the respondents have resided around both the study areas for over 5 years and were mainly self-employed (businessman). The distribution for level of education shows that majority of the respondents had no schooling education, few respondents had tertiary education. The dumpsite is home to uneducated populace who have taken refuge in the dumpsites and its vicinity as a means of their survival (Olusosun, 2014) [14].

Table 1: Social and Demographic Characteristics of Respondents

Social and Demographic characteristics of respondents	Adampur Chhawani N=50 (100%)	Bhanpur N=50 (100%)
Gender		
Male	23 (46)	20 (48)
Female	27 (54)	30(52)
Age		
21-30 years	9	11
31-40 years	22	15
41-50 years	16	20
51 and above	3	4
Educational Level		
No Schooling	34	20
Primary	7	5
High School	5	16
Tertiary education	3	9
Employment Status		
Daily wage	21	11
Businessman	23	27
Govt. employ	4	9
Private employ	2	3
Size of family members		
2-3 members	10	14
4-6 members	22	26
6-8 members	14	8
Above 9 members	4	2
Duration of stay in the area		
1-5 years	9	2
5- 10 years	15	8
11 years and above	26	40
Source of Drinking water		
Tube Wells/Bore well	36	7
Govt. Water tank/ pipeline	14	43

3.2 Perceptions of the Respondents on Environmental problems in the community

The results of the study showed that residents living near waste dumps are detrimental to good health. With regards to the infestation of rats and fleas from dumpsites, the majority of respondents (96%) from Adampur Chhawani complained that influence of rats and flies are dominant in the community, although residents of Bhanpur dumpsite also claimed, but the influence is more less compared to Adampur Chhawani. A large majority of the respondents

perceived unpleasant odour and various health problems as being the most urgent issues associated with living close to the dumpsite. With regards to the effects on the quality of environment around the dumpsite, majority of the household respondents of Adampur Chhawani (88%) complained of the odour emanating from the dumpsite while 8% perceived from Bhanpur dumpsite. This means decomposition of organic solids wastes due to spend long time at places of storage and became source of health hazards on community and environmental pollution. Ohwo (2011) [12] stated that waste left unattended to for a long time constitute serious hazard and produces offensive odour which can cause serious health challenges to those living around the site. Furthermore, uncontrolled burning of waste in open dumpsite could result in air pollution and increase greenhouse gas emission which has been known to contribute to climate change. Burning waste is usually an environmentally poor waste management option that releases a hazardous mixture of cancer-causing compounds and other toxic substances into the environment (UNEPA, SWM, 2015) [18]. Inappropriate disposal of solid waste can be risky which often manifest by contamination of surface and ground water through leachate. Majority of the respondents (90%) from Bhanpur and (40%) from Adampur Chhawani reported groundwater contamination due to dumpsite leachate. Studies have shown that it is inevitable for landfills not to contaminate groundwater, as leachate percolates into groundwater through cracks of membranes (for sanitary landfills) and contaminates it, because of high bacteria content. The preceding section of the present study carried out laboratory analysis of groundwater in the both areas and found groundwater contamination from both the study areas, however, the source of drinking water in the vicinity was provided by the Municipality. In context to the noise pollution, 16% respondents from Adampur Chhawani perceived noise pollution due to regular movement of vehicle carrying solid waste from city to dumpsite while respondents from Bhanpur dumpsite reported less nose 4%, this may be due closer of dumpsite. Fig. 1 Showing the Perceptions of the Respondents on Environmental problems in the community.

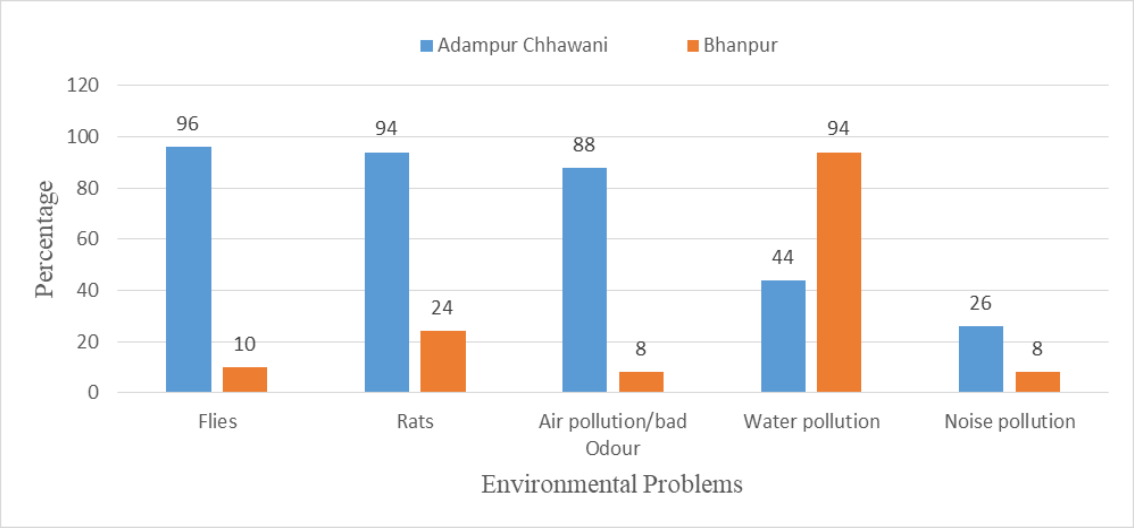

Fig 1: Showing the Perceptions of the Respondents on Environmental problems in the community.

3.3 Perception of respondents on illness/ disease in the community

The study had find out health impacts that were affecting local communities residing around the dumpsites. In our survey, self-reported health problems of residents surrounding Adampur Chhawani dumpsite were typhoid (58%), chest related illness (24%), cholera and diarrhea (34%), malaria (22%) and skin infections (16%). But when compared to the residents residing around Bhanpur dumpsite the number of respondents who had, typhoid, chest related illness, cholera and diarrhea, malaria and skin infections, stood at (52%), (8%), (22%), (12%) & (4%) respectively. Similar results were reported by other studies, who showed that diarrhea, typhoid fever, skin infection and respiratory infections were frequent among the residents surrounding the waste dumpsites (Addo *et al.*, 2015; Dea and Debnathb, 2016) [3, 7]. Further, the WHO (2000) [19] states that residents who live reside around the waste dumps are subjected to more attacks of cholera, acute intestinal infections, skin diseases, blood and eyes cancer and respiratory infections (WHO, 2000) [19]. These studies together with our study illuminated the potential health consequences of poor SWM. The results in the present study revealed that self-reported health problems were high at Adampur Chhawani dumpsite compared to Bhanpur dumpsite. This is due to the fact that Adampur Chhawani dumpsite is operational dumpsite and receives waste on daily basis while as Bhanpur dumpsite is closed for waste dump. Fig. 2 Showing Perception of respondents on illness/ disease in the community.

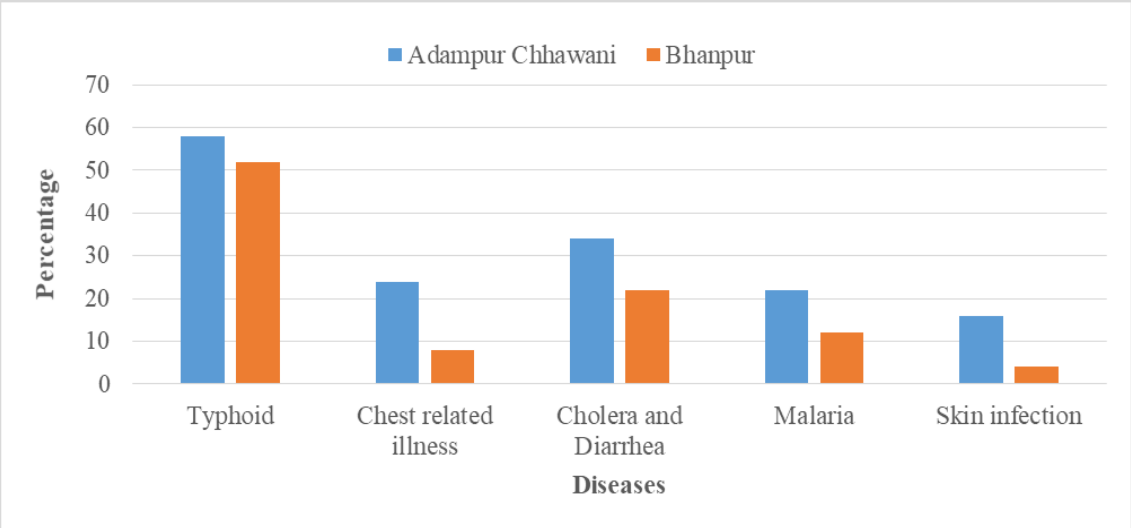

Fig 2: Showing Perception of respondents on illness/ disease in the community.

4. Conclusion

This study examined the environmental and health impacts of households living around (nearby) the Bhanpur dumpsite and Adampur Chhawani dumpsite in Bhopal, Madhya Pradesh. Results from the analysis of data revealed that both Bhanpur residents and Adampur Chhawani residents suffered from related diseases due to the location of the dumpsite closer to their settlements. It was discovered during the survey that residents living nearby Adampur Chhawani dumpsite are most affected by the dumpsite. Hence they were victims of typhoid, Chest related illness, Cholera and Diarrhea, Malaria and skin infections. The reason for this is the Adampur Chhawani dumpsite is operational and has many environmental related health implications on local populace. This state of health of respondents in this study can be linked to pollution from the dumpsite. It was also noted that the extent of air and water pollution is worse in the raining season as a result of offensive and disease-carrying odor, as well as ground water pollution. The study therefore concludes that the dumpsite should be properly managed and cared to minimize its effects on the environment. For improved health status of the people living less than fifty metres away from the dumpsite, it is a matter of concern for the Bhopal Municipal Corporation to resettle such residents in a safe and clean environment. The local population needs to be educated by health departments about the effects of dumpsites on their health and preventive measures should be provided to the local population.

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