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Impact of Solid Waste Dumping Site on Environment and Public Health in Sargodha City

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Abstract

The waste generated from houses, industries and different commercial activities are considered as municipal solid waste. In most of the developing countries especially Pakistan municipal solid waste are not handled properly and are thrown on open places without using proper treatment. This research is conducted to identify the municipal solid waste disposal sites and to compare the health problems between the people residing near dumping sites and the people living 8km away from these sites. A sample size of 60 household was taken out of which 30 household were selected from the surrounding of waste place and 30 household far away from waste site at the distance of (8) km. Data for health problem were collected through questionnaire, interview and also testing the concentration of pH, EC, TDS, Ni, Cu, Cr, Cd in the ground water sample collected from the waste disposal place. The result showed that diseases like skin and eye irritation, continuous fever (malaria, Typhoid),/cough, diarrhea, Infant less weight, stomach problem, heart problem and hepatitis are common in those people who are residing close to waste site as compared to far away residents. The quality of water near waste disposal site is also not good for drinking because the level of heavy metal selected for study like Cadmium, Chromium, Lead, Copper are high than WHO permissible value except copper and as a result source of many water borne diseases. The study concluded that these sites should be established away from the residing areas and should be managed properly.

Keywords: Solid Waste, Dumping Sites, Public Health, GIS

Introduction

Dumping of waste especially open dumping is very dangerous for human health and environment because in this method proper techniques are not used for the collection and handling of leach ate and toxic gases (Roongtanakiat et al, 2003). A leachate is formed, when wastes start decomposed and water from rainfall enter into it (Christensen & Kjeldsen, 1989). If they are not handled properly, they may enter into the underlying soil and contaminate aquifer of drinking water and also surface water by the accumulation of heavy metal like Zinc (Zn), Iron (Fe), Lead(Pb) and copper (Cu) (Chifamba,2007). If the amount of these metals are higher than normal limit it may cause many severe diseases in human such as Cadmium causes kidney problem, cancer, diarrhea and vomiting, while the increase in the amount of Lead effect nervous system, bones, liver, pancrease, teeth and some kind of blood diseases in human body (Abbas et al, 2010).

While the emission of volatile organic compound (VOCs) and carcinogen when municipal solid wastes get burned becomes the cause of bad smell. These are the combination of Organic sulphide, amines and aromatic hydrocarbons which are not only dangerous for environment (Komilis et al, 2004) but also effect individual by causing sleepiness, tiredness, vomiting and some respiratory defect (Steinheider, 1999).Especially the toxic gases ($C0_2$, N2, Ozone and particulate matter (PM <

10µ) release from waste effect the babies of those mothers who are residing near waste site during their pregnancy period. The women who completed their second, third and fourth month in such environment where the amount of C0 was high had more chance of cardiac ventricular septal disease in their babies. While the increased contact to ozone in second month causes aortic artery, pulmonary artery, valve anomalies and conotruncal defects in their babies (Ritz et al 2002).

The waste throwing on open places not only pollute the environment by the emission of various harmful gases but also a breeding spot for many diseases transferring vermin. Many harmful micro-organism e.g Pseudomonas, Micrococcus, Actinomyces, Neisseria, Bacillus and Klebsiella are increasing during the decay of solid waste and causes infection of wound and sepsis in human (Adremi and Falade 2012)

In most of the developing countries like Pakistan solid waste dumping sites are chosen on the base of its proximity to the collecting spot rather than its environmental appropriateness (Kurian, 2002). Distance is also considered as an important factor while choosing a place for throwing of solid waste and the distance of solid waste dumping site from roads should be at least 1km (Chang et al, 2008). According to Sener et al (2011) the solid waste discarding place must be situated at the distance 1km from residential area and 30km away from the centre of main city. It should be well designed and handled in such a way that it causes less or no danger to human health and environment (Marc, 2006). Despite of its danger the waste in most of the developing countries especially Pakistan are not handled properly and are thrown on open places without using proper treatment. This is happened because developing countries have very low amount of budget to solve the problem of discarding waste material as so many techniques are required for this purpose. When the land start contaminated with the waste materials of dumping sites, it affect not only the productivity of land but also the health of animals and human beings (Smith et al, 1996). Elliot et al (2001) studied the birth defect in community existing within 2km area of different hazardous and non hazardous waste spots in U.K. The population existing within 2km zone around each wastes spot was victim of different kinds of health problem such as congenital irregularity, neural tube disorder, abdominal defect, hypospadias and epispadias, surgical correction of gastroschisis and examphalos were common. Moreover the problem of decrease in the weight of newly born babies was examined. So the purpose of this research is to evaluate the health problems that are common in the population residing close to dump sites and compare it with the community living far away from dump site.

Materials and Methods

Study Area

The dump site selected for this study was along jhal chakkian road in Sargodha city. The waste disposed here are openly on land without using any technique or management. The land around this site is continuously been used for a residential purpose. So the residential areas within 1km radius of dumping waste site were considered as affected zone (jhalchakkian). While the residential areas selected for unaffected zone (cheema colony) were at the distance of 8km from waste site.

Data collection

Quantitative descriptive research design was used for this study to make the result effective and appropriate. In quantitative research numeric data collected from different sources such as experiments, surveys and interviews based on structured and unstructured questionnaire are interpreted and analyzed (Leedy, 1993). For the comparison of health problem a stratified random sampling technique (in which population is divided into non-overlapping strata and from each stratum sample is chosen by using simple random sampling method) was adopted to select 30 household within 1km

radius around waste site and 30 household away from the waste site at the distance of 8 km. In order to check the variation of ground water quality near and away from solid waste dumping site 50 water samples (25 near the waste site and 25 away from the waste site) were taken from the taps of the selected houses, whose water was used for drinking, bathing and washing purpose.

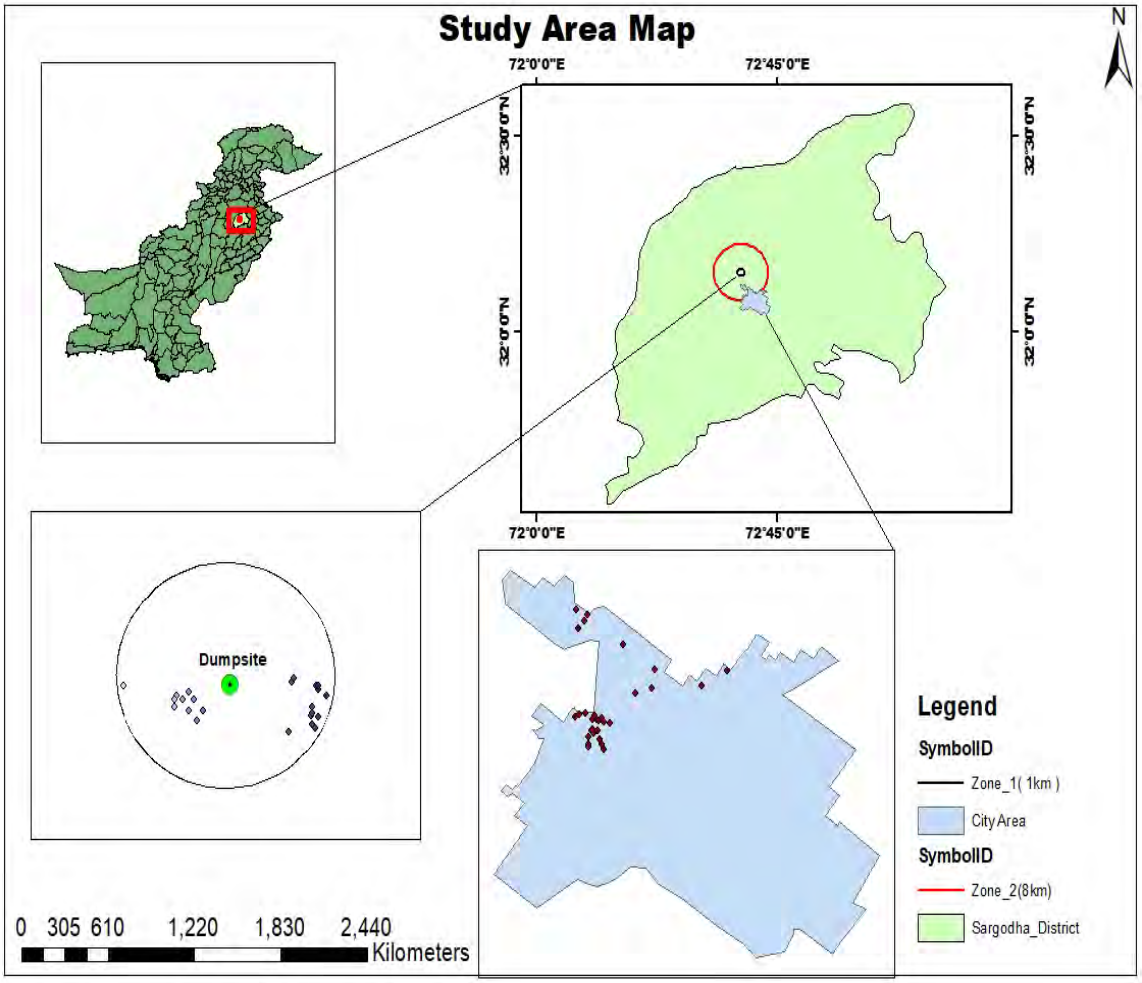

Figure 1. Study Area Map

Data Analysis

The raw data gathered from Interview and Questionnaire were examined and interpreted by using statistical method of SPSS (Statistical Package for Social Science) and Microsoft Excel. It displayed in percentage, frequency, graphs and tables.

Water quality parameters such as pH, Electrical conductivity (EC), Total dissolved solid (TDS), Nickel, Lead, Copper, Cadmium and Chromium collected from both affected and unaffected zone into distilled bottle and jars made of poly venial chloride (PVC). The locations of samples were recorded through GARMIN GPS receiver. In order to maintain the natural chemistry of sample different preservation method were applied such as PH control, protection from sunlight and kept in cool place. The water samples were tested from University of Sargodha Lab (Hi-Tech Instrumental Lab) and Pakistan Council of Research in Water Resources (PCRWR) Lab in Sargodha. Different technique and formulas were used to check the concentration of different pollutant in water. The

concentration of Cd, Cr, Pb, and Cu were tested through Atomic Absorption Spectroscopy (AAS). While the EC and pH were analyzed by using conductivity and pH meter respectively. The results were compared with standards set by the World Health Organization (WHO, 2008). Then acquired values were imported into ArcGIS software for further analysis and spatial distribution maps were generated to evaluate the results

Results and Discussion

The results obtained from the parameter selected to test the quality of drinking water near and away from waste site are shown in table 1. It showed that quality of water near waste dumping site is not fit for drinking because the measured values of heavy metal are higher than WHO permissible value in ground water sample. The excess level of these metals is responsible for many diseases in human such as cadmium causes respiratory and reproductive problem, Lead causes kidney problem while Chromium and nickel are responsible for skin, eye irritation.

Table 1. Results of Drinking water quality near and away from solid waste dumping site

Analyzed Sample near Waste Site (Zone I) and away from Waste site (Zone II)														
Sr No	**pH**		**TDS**		**Cadmium**		**Chromium**		**Copper**		**Lead**		**EC**	
WHO Value	6.5-8.5		600-1000mg		0.003mg/L		0.050mg/L		2.000mg/L		0.010mg/L		1000us/cm	
	Zone I	Zone II	Zone I	Zone II	Zone I	Zone II	Zone I	Zone II	Zone I	Zone II	Zone I	Zone II	Zone I	Zone II
S1	7.9	7.1	2137	990	0.008	0.001	0.050	0.050	1.000	1.000	1.089	0.009	1943	999
S2	6.4	6.9	1459	879	0.009	0.002	0.045	0.045	3.967	2.000	1.001	0.001	946	1005
S3	3.7	7.7	833	799	0.003	0.003	0.074	0.074	2.245	2.000	0.978	0.008	1226	899
S4	11.3	7.3	997	997	0.002	0.025	0.055	0.055	1.967	1.967	0.008	0.007	1467	789
S5	8.3	7.3	2404	546	0.010	0.001	0.567	0.049	2.989	1.989	1.868	0.009	936	898
S6	4.8	6.8	2027	667	0.009	0.002	1.000	1.000	1.978	0.978	2.888	0.006	2981	921
S7	7.8	7.8	1789	891	0.002	0.001	1.060	0.040	3.000	1.897	0.009	0.009	2632	675
S8	9.6	7.6	1931	193	0.004	0.001	0.674	0.034	0.777	0.777	1.789	0.009	2841	743
S9	6.3	7.3	1681	645	0.005	0.002	0.030	0.087	2.876	0.876	3.456	0.006	773	872
S10	8.1	7.1	1153	878	0.003	0.003	0.356	0.050	3.001	2.001	0.005	0.005	1696	921
S11	7.8	7.8	654	544	0.001	0.001	0.456	0.038	1.999	1.999	0.006	0.006	963	963
S12	7.9	7.5	1745	777	0.095	0.002	1.050	0.047	2.945	1.945	1.008	0.008	2567	778
S13	9.3	7.3	1105	762	0.002	0.001	0.030	0.032	3.567	3.567	1.567	0.007	825	843
S14	12.1	7.1	784	784	0.001	0.001	0.222	0.044	1.789	1.875	0.006	0.006	1153	862
S15	7.4	7.4	1232	899	0.039	0.002	0.078	0.053	1.899	1.899	0.098	0.008	1812	812
S16	4.1	7.5	1296	982	0.002	0.002	0.045	0.043	2.121	1.121	1.934	0.004	907	907
S17	8.6	7.6	539	843	0.025	0.003	0.326	0.050	0.878	0.878	0.006	0.006	794	794
S18	7.6	7.6	1094	698	0.004	0.002	0.087	0.032	2.894	1.894	0.007	0.007	610	610
S19	9.0	7.0	1855	788	0.001	0.001	0.040	0.045	3.521	1.521	0.007	0.007	2729	729
S20	7.6	7.8	1079	987	0.009	0.001	0.123	0.048	1.878	1.878	1.078	0.008	887	587
S21	3.3	7.3	618	643	0.002	0.003	0.030	0.051	2.786	1.786	1.098	0.008	909	909
S22	6.2	7.2	1996	721	0.010	0.004	0.088	0.039	3.001	2.001	0.009	0.001	936	936
S23	8.3	7.3	890	890	0.002	0.004	0.040	0.050	1.900	0.900	0.006	0.006	1310	710
S24	3.4	7.4	909	909	0.088	0.003	0.007	0.046	2.002	2.002	1.023	0.003	838	738
S25	6.5	7.5	1133	840	0.001	0.003	0.045	0.032	1.986	1.986	1.005	0.005	1267	767

Source: Laboratory analysis

The result indicates that 20% ground water sample collected near dumping site has low and high pH value from prescribed limits. The variations in pH value lead to many degenerative diseases like cardiovascular diseases, heart disease, high blood pressure, high cholesterol level and arthritis. The EC value is also higher in 52% waste site groundwater samples while 68% waste site ground water samples have higher TDS value. These higher values also lead to health problem in water user. While the value of pH, TDS and EC are in permissible limit in ground water samples taken from the controlled area away from waste site. The concentrations of heavy metal like Cd, Cr, Pb, and Cu are higher in 48%, 60%, 56% and 60% respectively in ground water samples collected from solid waste dumping site. While the value are under permissible limit in groundwater samples taken from area away from waste dumping site.

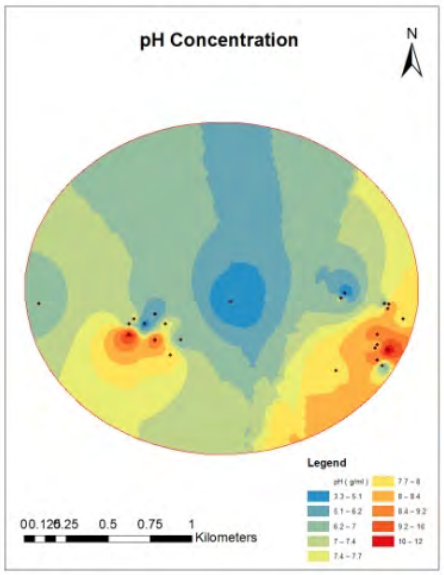

Figure 2. Concentration of pH

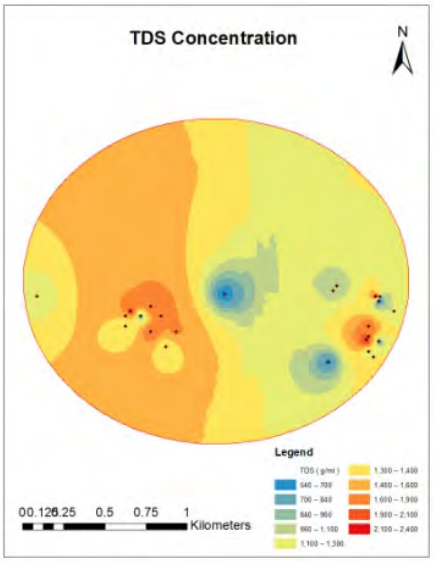

Figure 3. Concentration of TDS

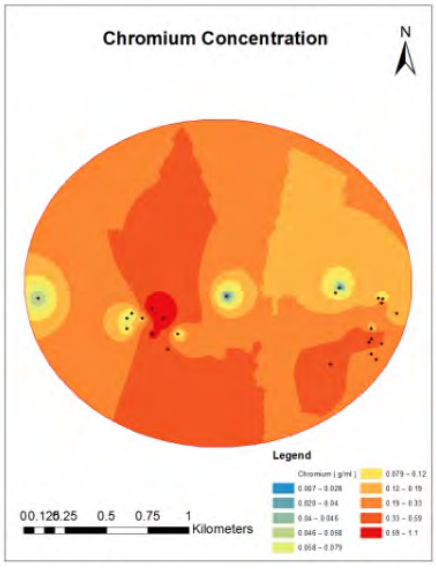

Figure 4. Concentration of Chromium

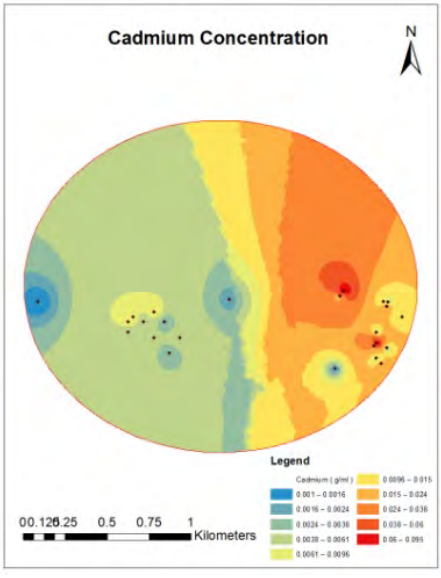

Figure 5. Concentration of Cadmium

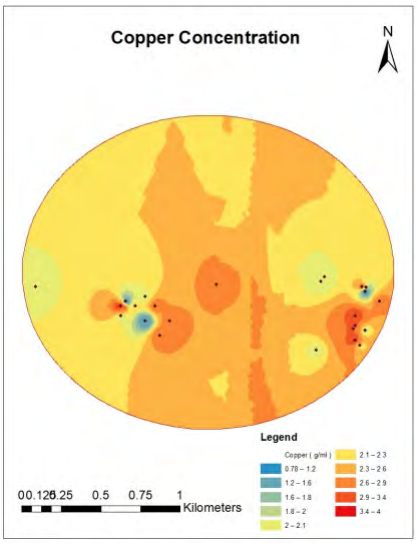

Figure 6. Concentration of Copper

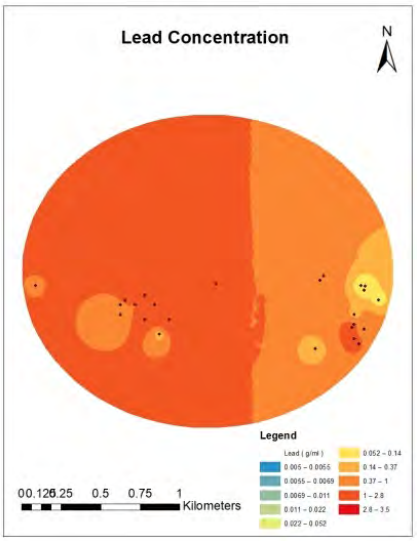

Figure 7. Concentration of Lead

Table 2. Location views of resident about their surroundings.

Location view		Close to waste place (Within 1km Zone)n=30		Away from waste place (Within 08 Km)n=30	
		Frequency	Percentage	Frequency	Percentage
Smelly	Yes	28	93	1	3
	No	2	7	29	97
Filthy	Yes	30	100	2	7
	No	Null	0	28	93
Intensity of Mosquitoes	High	28	93	8	27
	Low	2	7	22	73
Intensity Of Flies	High	27	90	6	20
	Low	3	10	24	80

Source: Field survey conducted by author in 2014

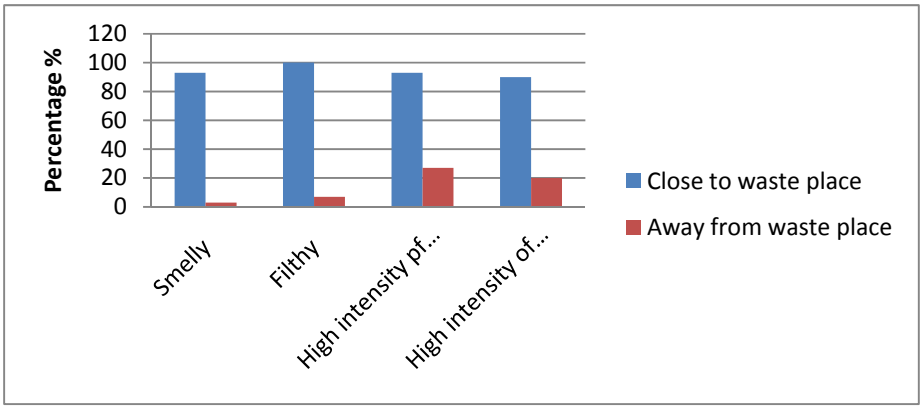

Figure 8. Views of resident about their surroundings environmental conditions

Comparison of health problem in affected area and unaffected area

Data collected from both areas show that population residing close to waste disposal site is not pleased with the location of waste disposal place because waste disposed here are without using proper method/ planning. This cause not only bad smell but also the breeding spot for the mosquitoes and flies. They are all complaining to manage this place.

While the respondent living away from waste place are satisfied with their surrounding only 3% feel smell and 7% indicate dirt/filthy in their surroundings. The 93% respondents near waste place indicate that it is a breeding spot for mosquitoes and 90% indicates about flies. The intensity of mosquitoes and flies in area away from waste is low as compared to waste disposal place because 27% and 20% far away respondent said that intensity of mosquitoes and flies are high**.**

Table 3. The comparison of different diseases among the resident of both areas

Diseases		**Close to waste place (n=30)**		**Away from waste place (n=30)**	
		Frequency	**Percentage**	**Frequency**	**Percentage**
Skin and eye irritation	Yes	26	87	2	7
	No	4	13	28	93
Diarrhea	Yes	13	43	3	10
	No	17	57	27	90
Stomach Problem	Yes	8	27	3	10
	No	22	73	27	90
Heart problem	Yes	6	20	1	3
	No	24	80	29	97
Hepatitis	Yes	10	33	2	7
	No	20	67	28	93

Source: Field survey conducted by author in 2014 and medical repots

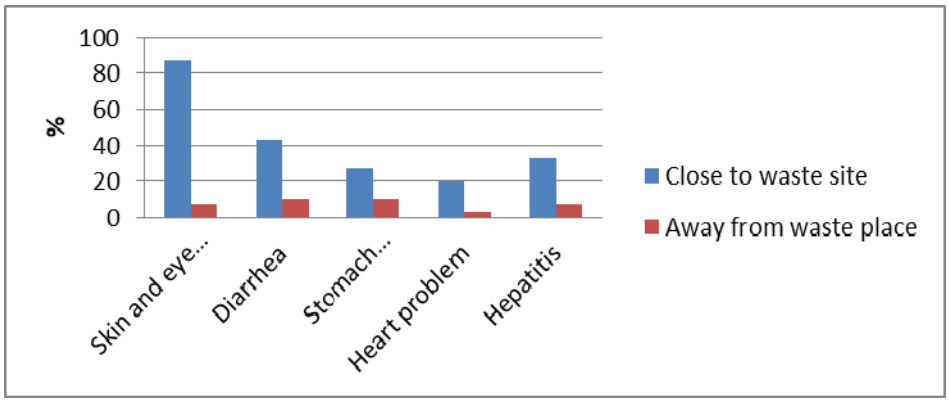

Figure 9. The Comparison of diseases

Table 3 and Figure 9 show the comparison of different diseases in the population residing close or away from waste discarding place. The intensity of skin and eye irritation is 87%; Diarrhea 43%, Heart problem 20%, Hepatitis 33% and stomach problem are 27% in those respondents who are residing close to waste place. While the intensity of all these diseases is low in far away respondents.

Table 4. Time period of cough and fever

Disease	Time Interval	Close to waste place(n=30)		Away from waste place(n=30)	
		Frequency	Percentage	Frequency	Percentage
Fever (Malaria, Typhoid)	After 1 week	9	30	0	0
	After 1month	10	33	1	3
	After 6 month	3	10	5	17
	After several years	8	27	24	80
Cough and flu	After 1week	7	23	1	3
	After1month	10	33	2	7
	After 6month	2	7	4	13
	After several Years	11	37	23	77

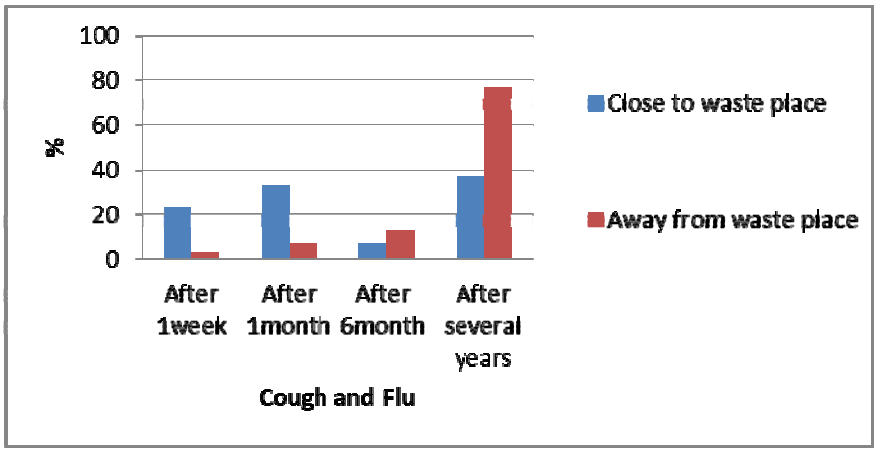

Figure 10. The comparison of Cough and Flu with time period of the population residing close or away from waste discarding site

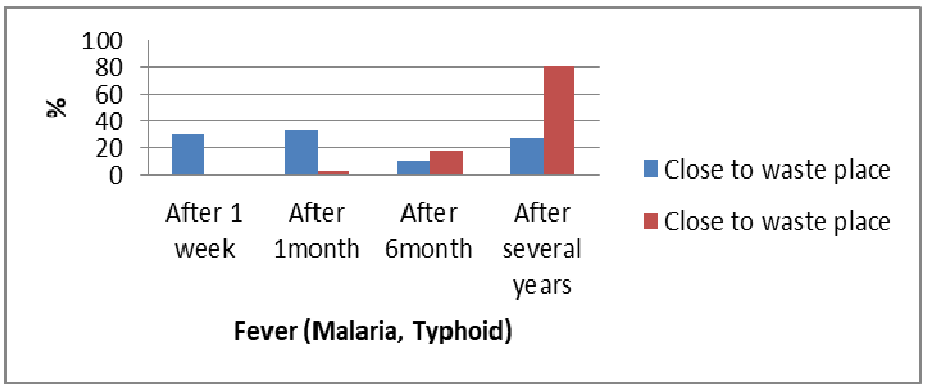

Figure 11. The comparison of fever with time period of the population residing close or away from waste discarding site

The people residing close to waste place fall ill continuously especially with fever like malaria due to high intensity of mosquitoes near waste place and there are a child who have been shifting

here for 6month becomes continuously fall ill due to fever. There are 30% respondents that become victim of fever (Malaria and Typhoid) after 1 week, 33% after 1 month, 10%after 6month and 27% after several years. The comparison of fever with time period of the population residing close or away from waste discarding site are shown in table 4 and Figure 11. Moreover the ratio of cough and flu with the time period is higher in population residing close to waste place as compared to those living away from waste site. There are 23% respondents, who become ill due to cough and flu after 1 week, 33% after 1month, 7% after 6month and 37% are those who fall ill after several years. While the population residing away from waste site are only 3% who fall ill due to cough and flu after 1 week, 7% after 1 month, 13% after 6month and 77% after several years. This means the risk of different diseases are high in the population residing close to waste discarding site as compared to the population residing away from it.

Table 5. Comparison of health and birth place of infant close or away from waste place

Place of infant birth	Close to waste place(n=30)		Away from waste place(n=30)		Health of Infant	Close to waste place (n=30)		Away from waste place(n=30)	
	Frequency	%	Frequency	%		Frequency	%	Frequency	%
Home	18	60	7	23	Weak	24	80	5	17
Hospital	12	40	23	77	Healthy	6	20	25	83

Source: Field survey including hospital birth report of children.

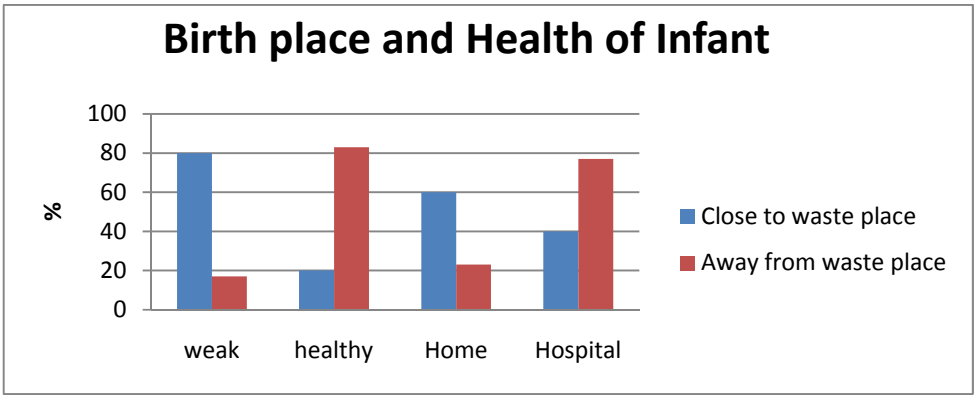

Figure 12. Birth place and health of Infant

Table 5 and figure 12 show that 80% infant of respondents residing close to waste discarding site are weak and only 20% are healthy. While the 43% Infant born healthy and 17% weak infant of those respondents who were residing away from waste place.

The 60% infant of respondents residing close to waste discarding site were born at home and 40% were born at hospital. The birth of mostly babies of respondent residing away from waste site are took place at hospital. The 77% of the babies were born at hospital and 23% were at home.

Conclusion

The main purpose of this study was to identify the impact of solid waste disposal site on the health of people residing close to it. So comparison study was conducted among resident residing close or away from waste disposal site and water sample was also tested. The result depicts that the emission of different pollutant from waste into air, water and land effects the health of people and

the people residing close to waste site are victims of many diseases like Skin/eye irritation, Continuous fever (malaria, Typhoid), cough, diarrhea, Infant less weight and stomach problem. The water near waste disposal site is also not fit for human health and cause of many water born diseases due to presence of heavy metal (Cd, Pb, Ni, Cr). So the waste disposal site are proper managed especially those sites which are located close to residential area.

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