COMPARATIVE CHEMICAL STUDY OF SOIL NEAR THE PIRANA GARBAGE DUMPYARD AND ITS EFFECT ON THE HEALTH OF COMMUNITY PEOPLE

Ansari Naeemuddin, Ansari Asif, Ansari Hasan, Pathan Firoz, Siddique Farhan, Sheikh Shahnawaz, Ansari Ahmed Raza, Ansari Rafiq, Khan Shahnawaz

Brighton English School, Ahmedabad
Teach For India
PDPU, Gandhinagar

[Pick the Date]

Comparative chemical study of soil near the Pirana garbage dumpyard and its effect on the health of community people

ABSTRACT

In order to identify the correlation between the health hazards and the presence of a garbage mountain which is almost 0.03% of the entire Ahmedabad area, mapping was conducted using health surveys and patterns were analyzed. The Pirana dumpyard has been in the area from past 35 years but it has now touched heights up to 75 feet which is a condition of near collapse. The physical collapse is not as dangerous as the long term damage done by the chemicals which are getting accumulated in the soil due to leaching. It is directly diffusing with the ground water and affecting the health of various people living the vicinity. It was also seen how the distance from the mountain to the place of residence showed an increased medical visits and presence of long term diseases. Therefore it was important to compare the chemicals of the soil and its effect on the health of community members using surveys.

INTRODUCTION

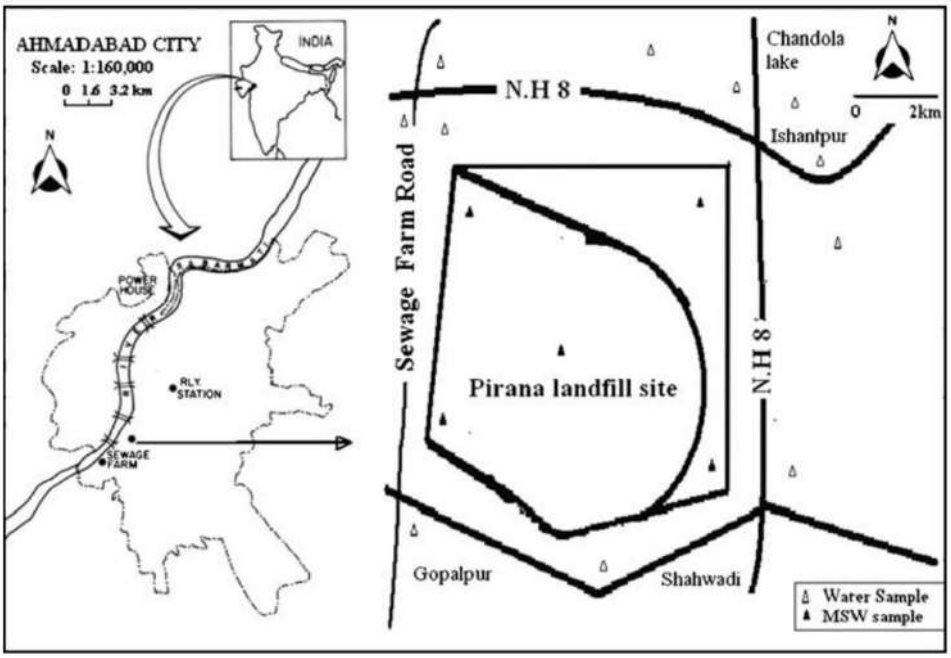
The Pirana dumpyard is 75 feet high and has nearly 70 lakh metric tonnes of garbage. Fires are frequent at Pirana and it takes thousands of litres of water to put down a fire as water penetrates slowly through the thick garbage mountains and operations cannot be stopped unless the fire dies down completely. Materials mostly found in the Pirana landfill are rubber, plastics, synthetics and discarded parts of mobile phones, electronics and other non-biodegradable items. Further, trapped methane gas below the garbage dump adds fuel to the fire, increasing its intensity.

The garbage shaped mountains make the occurrence of fires more frequent and difficult to put out. Due to lack of space in the landfill, the garbage is not spread out evenly and is dumped near the existing garbage mountains. The fumes emerging out of the fire are severely toxic in nature. Methane and carbon dioxide are the main gases in these toxic fumes. Daily visitors at Pirana, as well as the residents who have made the landfill site their home for several years are the worst sufferers as toxic fumes as lung and cardiac disease are common among Pirana residents.

We are students from 7th grade from Brighton English School and we are doing a project called **City as Lab** project. In CAL we have to make our city as a lab and have to find a problem which is affecting thousands of people and start researching on it. We are researching about Comparative chemical study of soil near the Pirana garbage dumpyard and its effect on the health of community people we initially started with a Research Question “What are the levels of chemical compounds present in the soil due to the garbage mountain”, we collaborated with Pandit Deendayal Petroleum University for our technical support. To take it further we analyzed data through our surveys and mapped the pattern to the proximity with the garbage mountain.

One resolution paper was signed by 2000 people for removing the garbage mountain. Our purpose of doing is that we want to know what the levels of chemical are accumulated in the soil of the place around by the garbage mountain. We also want to solve the problem of our community which all occurs because garbage mountain.

Fig. 2 A layout of Pirana landfill site with its location in Ahmadabad city and India, including sampling locations



Source: Environmental monitoring and assessment, 141(1-3), 309-321

Currently Pirana is at the second largest landfill of the state and it is spreading. It is covering lots of area now it is coming towards the community. There are walls have been established around the garbage mountain to safe guard it but people break it.

Fig 3: Picture of the garbage mountain

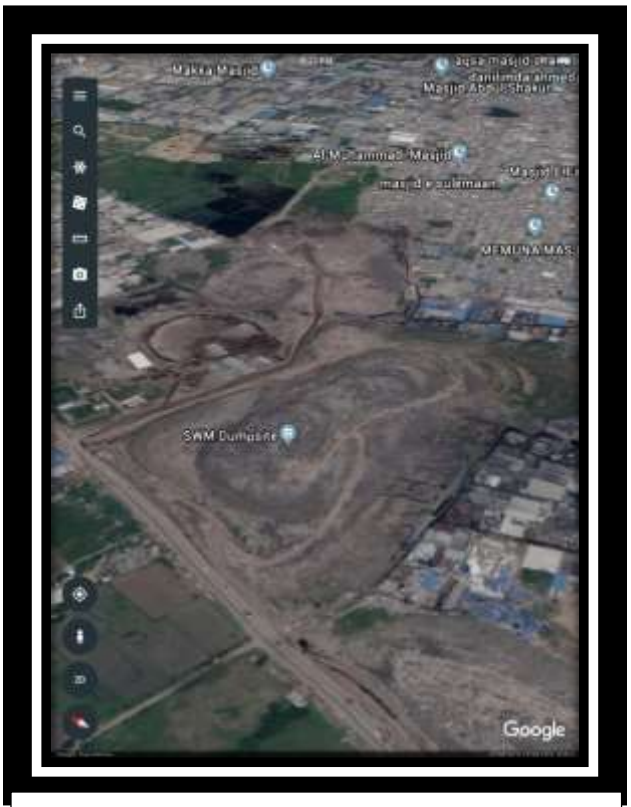


Fig 4: Google map image of the garbage mountain

Comparative chemical study of soil near the Pirana garbage dumpyard and its effect on the health of community people

HYPOTHESIS

We think there are chemical compounds present in the soil due to the garbage mountain which are affecting the health of our community by means of ground water. The community which is not educated and lives very near to the mountain is severely effected in terms of physical health. It will affect the quality of water underground, decrease the fertility of soil because it generates a lot of toxic gases like carbon dioxide which will form acid rain, which will further percolates in the soil along with the chemical compounds which pollutes the water and makes it toxic.

METHODOLOGY

Our RQ is the level of chemical compound accumulated in the soil in the recent year from the Pirana dumpyard. First of all when we started we share our problems and most of the problems came around the GM means Garbage Mountains. Then we think about how it is becoming problems for us. From the data we get to know that chemical, burning of garbage, unwanted gasses were such a big problem but it was hard to decide so we start giving marks on a scale to each problem.

Before it, we made a mind map of all the problems. Then the chemical was the most relevant problem to our community which we decided. So we started mind mapping of the problem. Then we wrote our hypothesis. Then we read newspaper to get data of Pirana dump yard. And we went on GM so many times. Finally we did an exercise under our design thinking model i.e., *Glad, Mad and Sad* by making a map of our community.

We used Google maps to divide our community into certain strata and divided the area into zones (zoning) to understand the effects on people. We made health surveys so that we can know that in 1 month how many times in this area people have diseases. We asked question like how many time they fall sick .How long they are living here and how many feet the boring level is to see the chemical level. You can find a sample here.

Comparative chemical study of soil near the Pirana garbage dumpyard and its effect on the health of community people

DATA COLLECTION

We collaborated with FD Juhapura School to conduct pH of the soil because PDPU is very far in Gandhinagar. He used a pH meter tells the acidity of the soil. The soil samples were collected from the dumping sites using a shovel and collected in polythene bags and labelled. We added one part of soil to 5 parts of water

Distance of Soil Sample from the Garbage Mountain	
1. 0.5 meters	8.86
2. 1 meters	8.87
3. 5 meters	8.4
4. 10 meters	8.51
5. 100 meter	8.4

We also referred to the earlier study conducted by PDPU in the area in 2007 to our data:

Table 1 Statistical comparison of the concentrations of chemical constituents between groundwater, leachate and municipal solid waste (MSW)

Constituents	Groundwater		Leachate	MSW	
	Range	Mean±SD	Mean	Range	Mean±SD
pH	7–7.2	7.06±0.1	8.35	8.55–9.1	8.76±0.19
TDS (mg/l)	769–949	858±66.3	1758	NA	NA
EC(μS/cm)	1160–1485	1305±112.6	26500	0.12–1.9	1.06±0.87
Na^+ (mg/l)	20.4–27	23.75±2.2	470	NA	NA
K^+ (mg/l)	1.53–43	11.17±15.3	135	NA	NA
Ca^{2+} (mg/l)	328–383	360±19.0	89	NA	NA
Mg^{2+}(mg/l)	68–98	84.6±8.3	306	NA	NA
HCO_3^-(mg/l)	370–400	391.8±10.8	110	NA	NA
Cl^- (mg/l)	110–192	143.9±31.7	837	NA	NA
SO_4^{2-} (mg/l)	76.8–170.5	125.2±32.7	287	NA	NA
PO_4^{3-} (mg/l)	0.18–0.65	0.29±0.1	13.6	NA	NA
NO_3^- (mg/l)	32–73.5	49.90±14.2	178	NA	NA
Fe (mg/l)	2–195	52±16.4	365	9800–16800	14320±2987
Cr (μg/l)	2–30	3±0.001	21.5	9.5–26.2	20.6±9.6
Zn(μg/l)	8–90	3.68±0.023	201	126.8–157	145.2±12.8
Mn(μg/l)	2–17	8.7±0.004	423	300–500	400±70.7
Cd(μg/l)	1–5	3±0.001	100	0.06–8.6	2.5±0.79
Pb(μg/l)	3–42	19.5±0.01	120	9.1–14.7	12.6±2.7
Ni(μg/l)	2.5–7	4±0.001	60	3.2–29.8	16.94±9.7
Cu(μg/l)	6–32	13±2.7	55.6	15.9–32.6	25.05±8

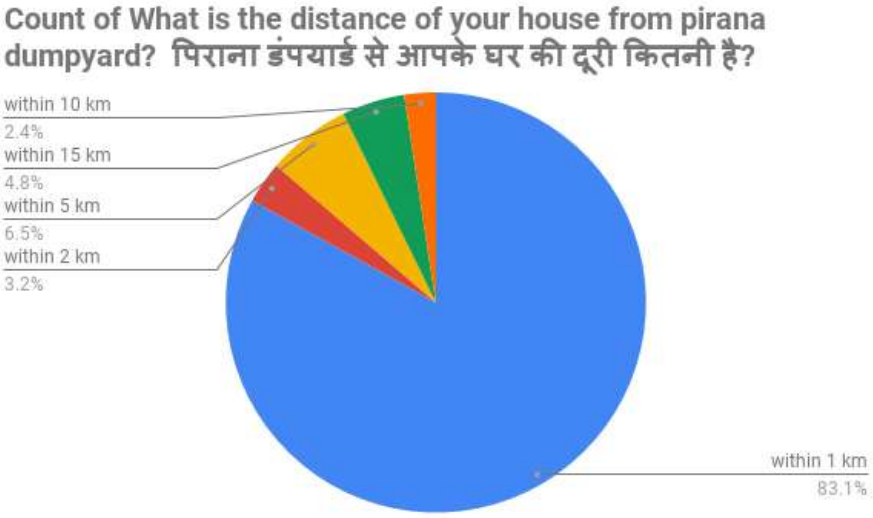
All units of MSW are in mg/kg except pH.

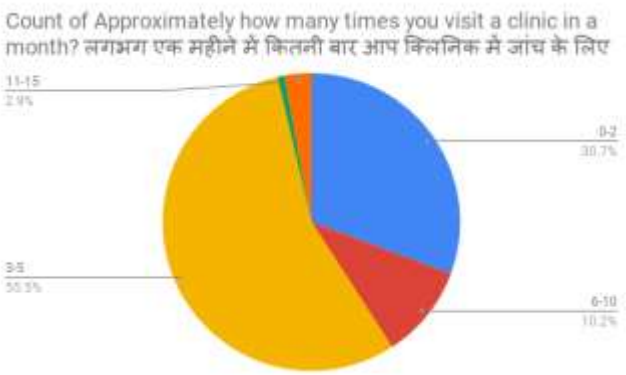
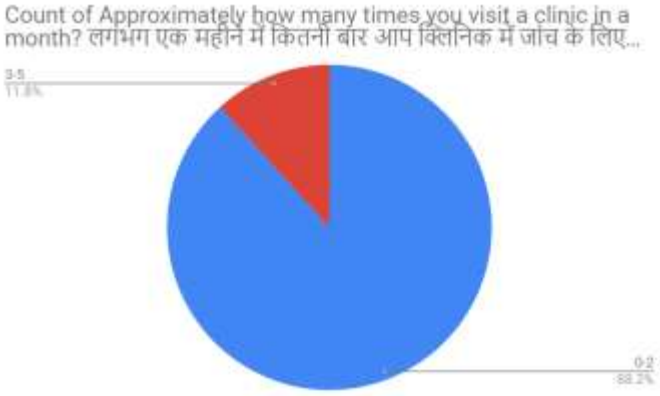
NA Not analyzed

Comparative chemical study of soil near the Pirana garbage dumpyard and its effect on the health of community people

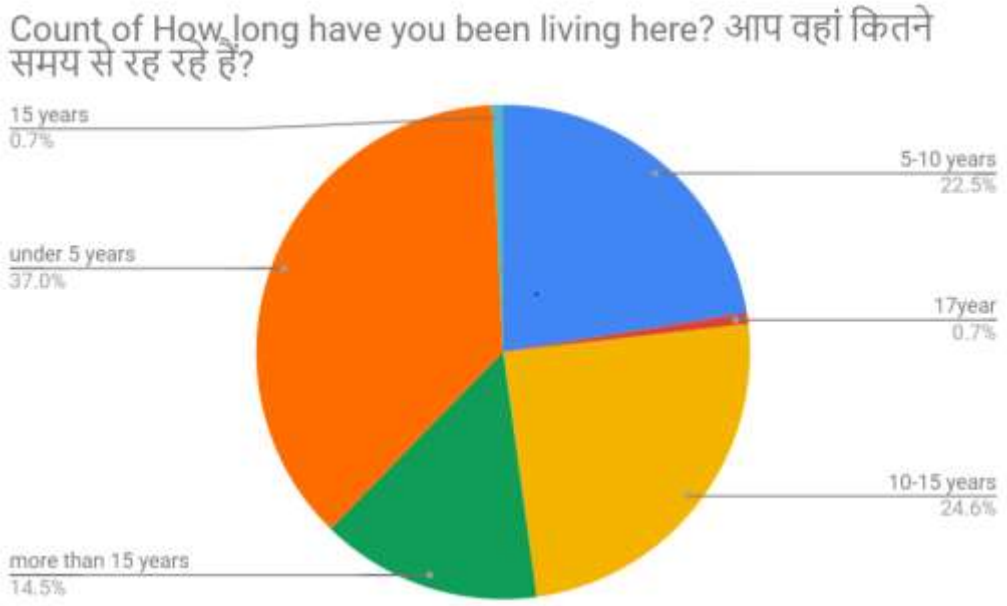
DATA ANALYSIS

Geographical Analysis of people who participated in the survey.

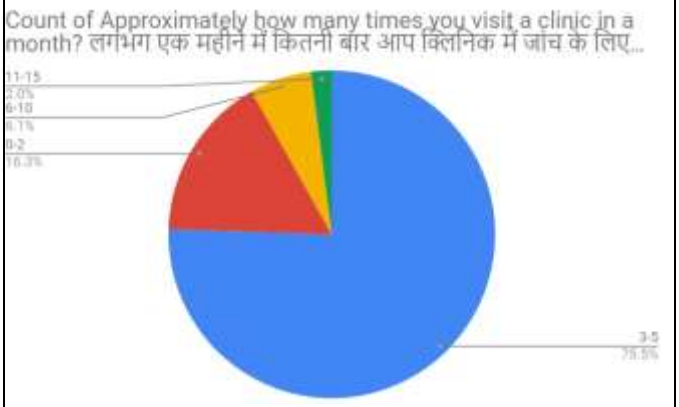


Frequency of going to clinic by people living under 1 km	Frequency of going to clinic by people living more than 5 km away
	

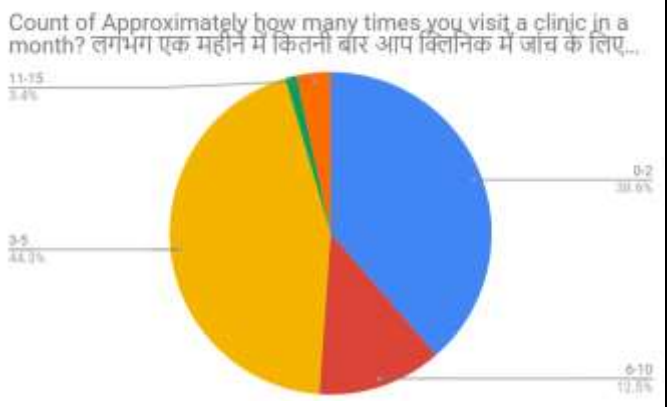
Analysis of the duration of exposure:



Frequency of people going to clinic who are living for less than 5 years

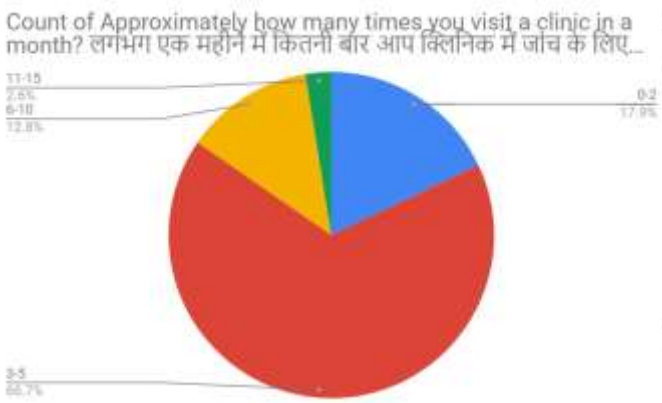
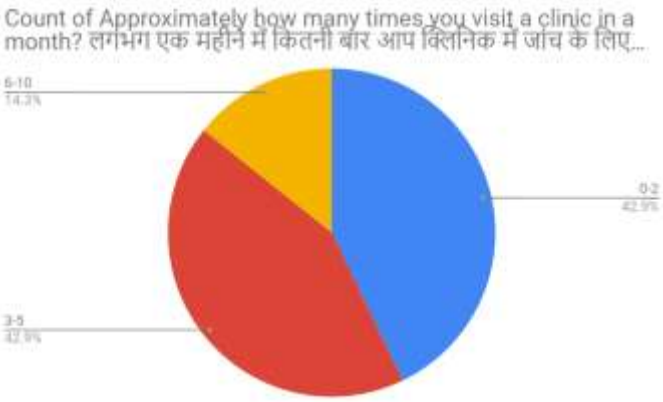
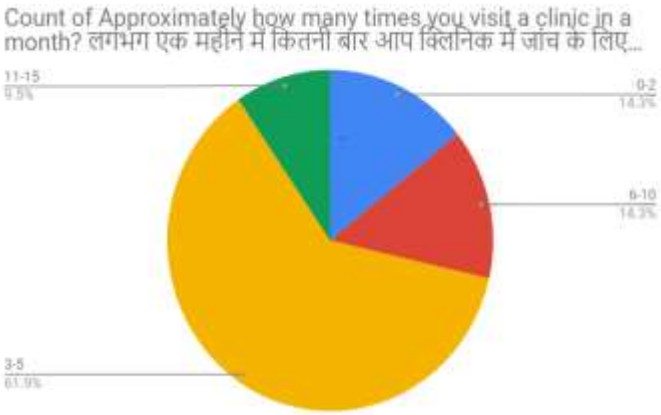
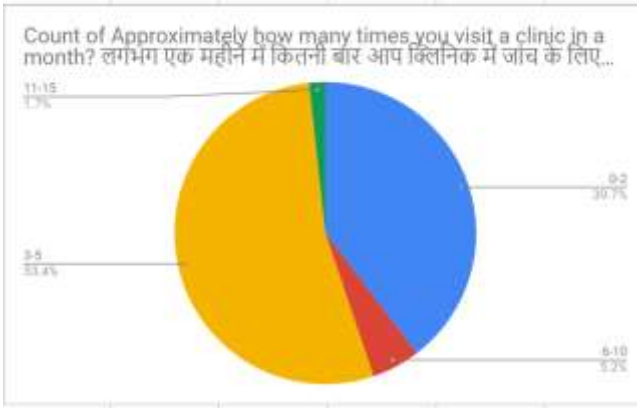


Frequency of people going to clinic who are living for more than 5 years

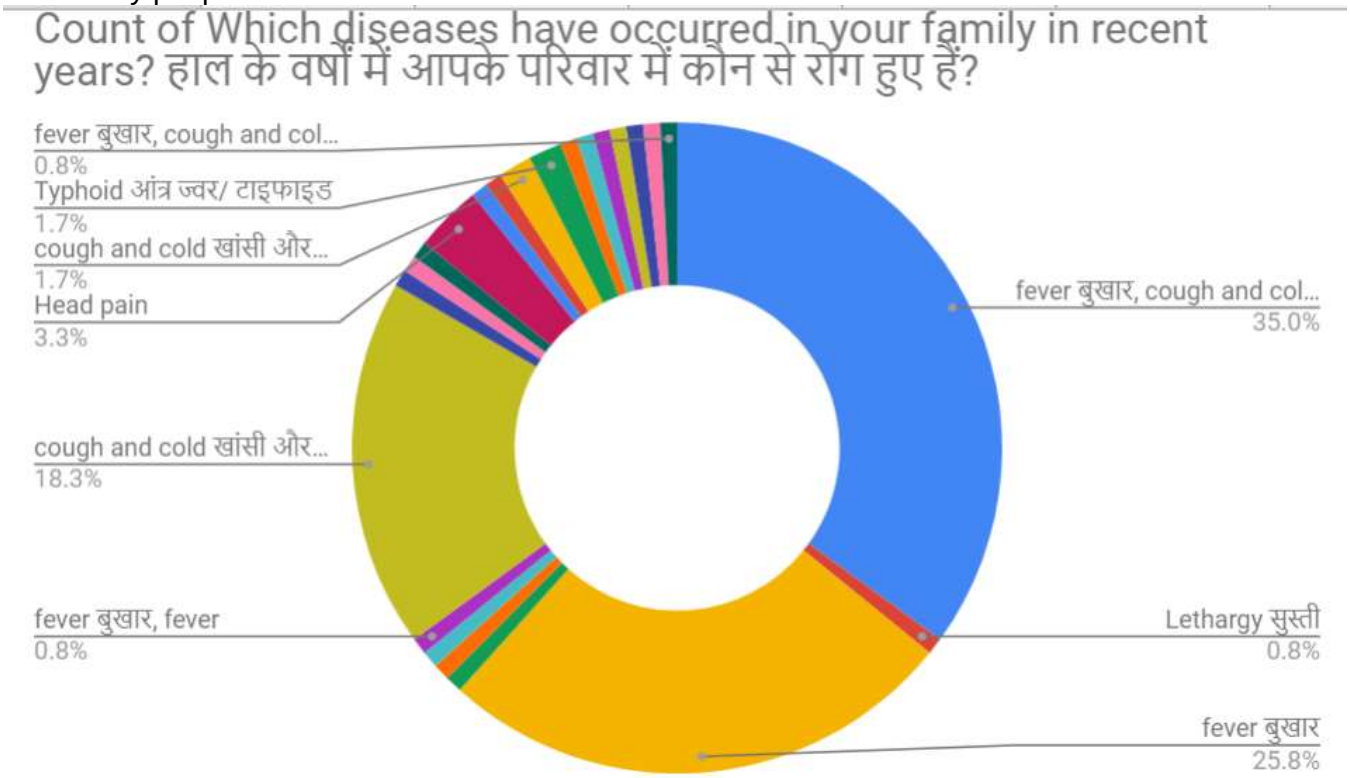


ANALYSIS AS PER WORK ENVIRONMENT (FREQUENCY OF VISITING CLINICS)

Comparative chemical study of soil near the Pirana garbage dumpyard and its effect on the health of community people

DAILY WAGE WORKERS	GOVERNMENT EMPLOYEES
	
BUSINESS	**PRIVATE**
	

ANALYSIS OF MAJOR DISEASES



RESULTS AND MAPPINGS

1. More than **53%** of the people who are living within one kilometer from the garbage dumpyard goes to clinic around 3-5 times in a month compared to those living farther than 5kms, who goes to any medical clinic which is just **11%**. This shows us that people is the direct vicinity are the most affected.

2. The frequency of people visiting clinic is double (**12%)** for people living near the dumpyard for more than 5 years which is just **6%** for people living here less than that. This is specific to visits in category of 6-10 visits in a month. For people the duration of exposure has a strong effect on their heath. More the exposure more is their visit to clinics for medical reasons.

3. Frequency of people who work in government **42.9%** (3-5 times) go to clinic and. Frequency of people who work in Daily wage **66.7%** time go to clinic (3-5 times). This shows that people who are

working as labour's and not aware about themselves are severely affected than the people with better employment.

4. From 2007 to 2019 the pH of soil has changed from an average of 8.3 to 8.9 due to the high amount of garbage being dumoed.

BIBLIOGRAPHY

(1) Singh, U. K., Kumar, M., Chauhan, R., Jha, P. K., Ramanathan, A. L., & Subramanian, V. (2008). Assessment of the impact of landfill on groundwater quality: a case study of the Pirana site in western India. *Environmental monitoring and assessment*, *141*(1-3), 309-321

(2) https://indianexpress.com/article/india/gujarat-2500-mt-tonne-garbage-slides-buries-vehicles-4765807/

(3) https://timesofindia.indiatimes.com/city/ahmedabad/invisible-acid-flames-behind-womans-death/articleshow/65727020.cms

(4) https://swachhindia.ndtv.com/nearing-35-years-ahmedabads-pirana-landfill-is-infamous-for-its-garbage-mountains-and-frequent-fires-11855/

(5) https://www.cleanindiajournal.com/tag/ahmedabad-municipal-corporation/

(6) https://www.cleanindiajournal.com/un-funds-study-for-waste-free-ahmedabad/

(7) We used internet (Google Earth) to measure area of near piranha dump yard.

(8) We take help from near that area people by doing survey.

(9) We take help from Professor Dr. Anurag kandaya of (PDPU) and his associate Himanshu bhaiya who coordinated our visits.

(10) We take help from divya bhaskar newspaper

(11) We used Microsoft excel, Microsoft word, with help of this we calculate health care survey and we write our research paper.

(12) We take help of Nikita Parekh, Training and Impact Team, Teach For India

(13) We used google forms for conducting surveys.

Shahnawaz KHAN

Ansari Naeemuddin, Ansari Asif, Ansari Hasan, Pathan Firoz, Siddique Farhan, Sheikh Shahnawaz, Ansari Ahmed Raza, Ansari Rafiq, Khan Shahnawaz

APPENDIX : SURVEY FORM

Class of Explorers : Project [CITY AS LAB]- SURVEY FORM

We are students from 7th Grade, Brighton English School. Please help us in our research project, we are mapping the implications of the garbage mountain on our health.(हम 7 वीं कक्षा, ब्राइटन इंग्लिश स्कूल के छात्र हैं। कृपया हमारे अनुसंधान परियोजना में हमारी मदद करें, हम अपने स्वास्थ्य पर कचरा पहाड़ के निहितार्थों का मानचित्रण कर रहे हैं।)

Your Name आपका नाम

Your answer

Where are you living currently in Ahmedabad ? वर्तमान में आप अहमदाबाद में कहाँ रह रहे हैं?

- ◯ Near Bombay Hotel बॉम्बे होटल के पास
- ◯ Danilimda
- ◯ Chipa Soceity छीपा सोसायटी

Comparative chemical study of soil near the Pirana garbage dumpyard and its effect on the health of community people

- ○ Paldi
- ○ Juhapura
- ○ Isanpur
- ○ Vatwa
- ○ Narol
- ○ Others
- ○ Other: _____

What is the distance of your house from pirana dumpyard? पिराना डंपयार्ड से आपके घर की दूरी कितनी है?

Choose

How long have you been living here? आप वहां कितने समय से रह रहे हैं?

Comparative chemical study of soil near the Pirana garbage dumpyard and its effect on the health of community people

- ○ under 5 years
- ○ 5-10 years
- ○ 10-15 years
- ○ more than 15 years

What is your occupation? आपका व्यवसाय क्या है?

- ○ Private
- ○ Government
- ○ Daily wage
- ○ Business

How many members are there in your family? आपके परिवार में कितने सदस्य हैं?

- ○ 1-5

- ○ 6-10
- ○ 11-15
- ○ 16-20

What is your education level ?आपका शिक्षण स्तर क्या है ?

- ○ Not been to school स्कूल नहीं गया
- ○ till 8,कम से कम 8
- ○ till 12th, कम से कम 12
- ○ Graduation कॉलेज

How many kids you have in the family ? आपके परिवार में कितने बच्चे हैं?

- ○ None
- ○ 1-5

- ○ 6-10
- ○ 11-15

Approximately how many times you visit a clinic in a month?
लगभग एक महीने में कितनी बार आप क्लिनिक में जांच के लिए जाते हैं?

- ○ 0-2
- ○ 3-5
- ○ 6-10
- ○ 11-15

Which diseases have occurred in your family in recent years? हाल के वर्षों में आपके परिवार में कौन से रोग हुए हैं?

- [ ] fever बुखार
- [ ] cough and cold खांसी और सर्दी
- [ ] malaria मलेरिया
- [ ] Typhoid आंत्र ज्वर/ टाइफाइड
- [ ] Jaundice पीलिया
- [ ] Cholera हैज़ा
- [ ] Cancer (Any type) कैंसर (कोई भी प्रकार)
- [ ] Unexplained diseases अस्पष्टीकृत रोग
- [ ] Lethargy सुस्ती
- [ ] Other:

Thank you so much for your response. This will help us a lot in our research paper. We will acknowledge your support.
आपकी प्रतिक्रिया के लिए बहुत बहुत धन्यवाद। यह हमारे शोध पत्र में हमारी बहुत मदद करेगा। हम आपके समर्थन को स्वीकार करेंगे।

SUBMIT