ISSN NO 0975 7287

HOUSING, WATER AND SANITATION (HWS) SURVEY OF SLUMS IN MUMBAI 2015

REPORT

अन्तर्राष्ट्रीय जनसंख्या विज्ञान संस्थान देवनार, मुम्बई
INTERNATIONAL INSTITUTE FOR POPULATION SCIENCES, DEONAR, MUMBAI
DEEMED UNIVERSITY
(विश्वविद्यालय समतुल्य)

IIPS
(स्थापना/ Established in 1956)
बेहतर भविष्य के लिए क्षमता निर्माण
Capacity Building for a Better Future

प्रकृतिः रक्षति रक्षिता
Nature Protects if She is Protected

Environmental Information System
Collect Collate Disseminate
INDIA

Envis centre on Population, Environment and Settlement (Pop-Envis)

International Institute For Population Sciences

Deonar, Mumbai -88

ABOUT POP-ENVIS

Background

The Government of India, realising the importance of environmental information, in December, 1982, established an Environmental Information System (ENVIS) as a plan programme. The focus of ENVIS since inception has been on providing environmental information to decision makers, policy planners, scientists and engineers, research workers, etc all over the country. Since environment is a broad-ranging, multi-disciplinary subject, a comprehensive information system on environment would necessarily involve effective participation of concerned institutions / organisations in the country that are actively engaged in work relating to different subject areas of environment. ENVIS has, therefore, developed itself with a network of such participating institutions/organisations for the programme to be meaningful. A large number of nodes, known as ENVIS Centres, have been established in the network to cover the broad subject areas of environment with a focal point in the Ministry of Environment, Forest and Climate Change (MoEF&CC). Both the focal point as well as the ENVIS Centres has been assigned various responsibilities to achieve the long-term & short-term objectives. For this purpose, various services have been introduced by the focal point. ENVIS due to its comprehensive network has been designed as the National Focal Point (NFP) for INFOTERRA, a global environmental information network of the United Nations Environment Programme (UNEP). In order to strengthen the information activities of the NFP, ENVIS was designated as the Regional Service Centre (RSC) of INFOTERRA of UNEP in 1985 for the South Asia sub-region countries.

Population – Environment and Settlement (Pop-Envis) Project is an envis centre of the International Institute for Population Sciences. It specializes on environmental issues with respect to population parameters. Basic objectives of Pop-Envis are:

- Compilation of research article, abstract of published paper, environment related news, short notes, photos, essays, book reviews related to environment and population.
- Three to four newsletters to be published in a year compiling varying information related to Population and Environment, Pop-Envis research and activities.
- Organizing workshop for capacity building for researchers where experts can be invited to deliver lectures.
- To create community level awareness
- Generating data on environmental health through surveys.
- Usual updating of the web site with relevant data and information. Also creating web site in regional languages.
- Answering to the queries through e mail.

IIPS MISSION AND VISION

The International Institute for Population Sciences (IIPS) is an autonomous institution under the administrative control of the Ministry of Health and Family Welfare, Government of India. It offers academic courses on population science and bio statistics act as nodal agency for research and training programmes and provides consultancy to government and non-governmental organizations and other academic institutions.

The IIPS has helped in building a nucleus of professionals in the field of population and health in various countries in the ESCAP region. Students from different countries of Asia and the Pacific region, Africa, and North America have been trained at the Institute. Many, who are trained at the Institute, now occupy key positions in the field of population and health in governments of various countries, universities and research institutes as well as in reputed national and international organizations.

Mission Statement

"The Institute will strive to be a centre of excellence on all population and relevant issues through high quality education, teaching and research. This will be achieved by (a) creating competent professionals, (b) generating and disseminating scientific knowledge and evidence, (c) collaboration and exchange of knowledge, and (d) advocacy and awareness."

Vision Statement

"To position IIPS as a premier teaching and research institution in population sciences responsive to emerging national and global needs based on values of inclusion, sensitivity and rights protection."

POP-ENVIS TEAM

Faujdar Ram	Director IIPS
Aparajita Chattopadhyay	Coordinator
Dhananjay W.Bansod	Coordinator
Chandrakala Ramnayan	Programme Officer
Sudha G.	Information Officer

CONTENTS

TABLES, FIGURES, MAPS AND PHOTOS

LIST OF TABLES

LIST OF FIGURES

LIST OF MAPS

LIST OF PHOTOS

डा० आनन्दी सुब्रमनियन
Dr. Anandi Subramanian

सत्यमेव जयते

वरिष्ठ आर्थिक सलाहकार
भारत सरकार
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय
Senior Economic Advisor
Government of India
Ministry of Environment, Forest & Climate Change

2nd March 2016

FOREWORD

The 2030 Agenda for Sustainable Development that has been unanimously adopted by the 193 Member States of the United Nations in September 2015, calls on countries to begin efforts to achieve 17 Sustainable Development Goals (SDGs) over the next 15 years. The SDGs, while emphasising on 'inclusiveness', addresses the three dimensions of sustainable development: social, economic and environmental. While increasing urbanization leads to the issue of expanding slums and its concomitant problems, available data are city-centric focusing on description of household amenities with people dwelling in slums being reduced to a mere statistic.

Mumbai, the capital of Maharashtra, which is also the financial capital of India, is often under lens for its growing slum population. In this context, the initiative of International Institute for Population Sciences (IIPS) ENVIS, under the ENVIS Scheme of the Ministry of Environment, Forest and Climate Change, to undertake a study on the living conditions of dwellers in slums in Greater Mumbai (Mumbai city and suburbs) is commendable. What is significant is that the study has also garnered scientific information from the dwellers' perspective, such as cost, availability and quality of drinking water including time spent in collecting the same; quality of toilets and time spent for sanitation purposes; their habits related to personal hygiene and cleanliness, all of which reflect on their morbidity.

One of the SDGs is to 'Make cities and human settlements inclusive, safe, resilient and sustainable'. It is laudable that IIPS ENVIS has taken the initiative in generating people-centric primary data, which will facilitate in designing appropriate policies 'with a human face'. I hope this becomes the first in a series of studies on the living conditions of people living in slums and the IIPS ENVIS Centre takes forward this effort and expands its scope to study and compare the lives of dwellers in slums in other parts of India.

Anandi

(Anandi Subramanian)

इंदिरा पर्यावरण भवन, जोर बाग रोड़, नई दिल्ली-110 003, टेली : (011) 24695367, फैक्स : (011) 24695430
INDIRA PARYAVARAN BHAWAN, JOR BAGH ROAD, NEW DELHI-110 003, Tel. : (011) 24695367, Fax : 011-24695430

CHAPTER 1

INTRODUCTION

Large number of urban population live in low quality shelters or areas plagued by overcrowding and inadequate provision of drinking water, sanitation services and waste disposal. Housing, drinking water and sanitation are considered as important basic needs for a healthy life and well being. The availability of safe water and adequate sanitation is critical not merely for health reasons, but also for economic development (WHO and UNICEF, 2006). Urban poverty is generally associated with poor quality housing, overcrowded and unsanitary slum settlements, ill-health, threat of exposure to environmental hazards and fear of eviction from illegal squatter settlements in insecure locations. Around 17% of urban households in India live in slums (Census 2011). Census (2011) defines slum as residential areas where dwellings are unfit for human habitation by reasons of dilapidation, overcrowding, faulty arrangements and design of such buildings, narrowness or faulty arrangement of street, lack of ventilation or sanitation facilities or any combination of these factors which are detrimental for safety and health. Slums are categorized in the following three types:

- **Notified Slums:** All notified areas in a town or city notified as 'Slum' by State, UT Administration or Local Government under any Act including a 'Slum Act'.
- **Recognized Slums :** All areas recognized as 'Slum' by State, UT administration or Local Government, Housing and Slum Boards, which may have not been formally notified as slum under any act.
- **Identified Slums:** A compact area of at least 300 populations or about 60-70 households of poorly built congested tenements, in unhygienic environment usually with inadequate infrastructure and lacking in proper sanitary and drinking water facilities.

Originally, slums in Mumbai were developed due to rapid industrialization, which attracted people and unskilled labourers. The high rate of migration from rural to urban areas forced the poor to retain in small tenements which are characterized by typical one room tenements along with kitchen, sharing a common sanitation. Slums proliferated due to lack of space and high land value.

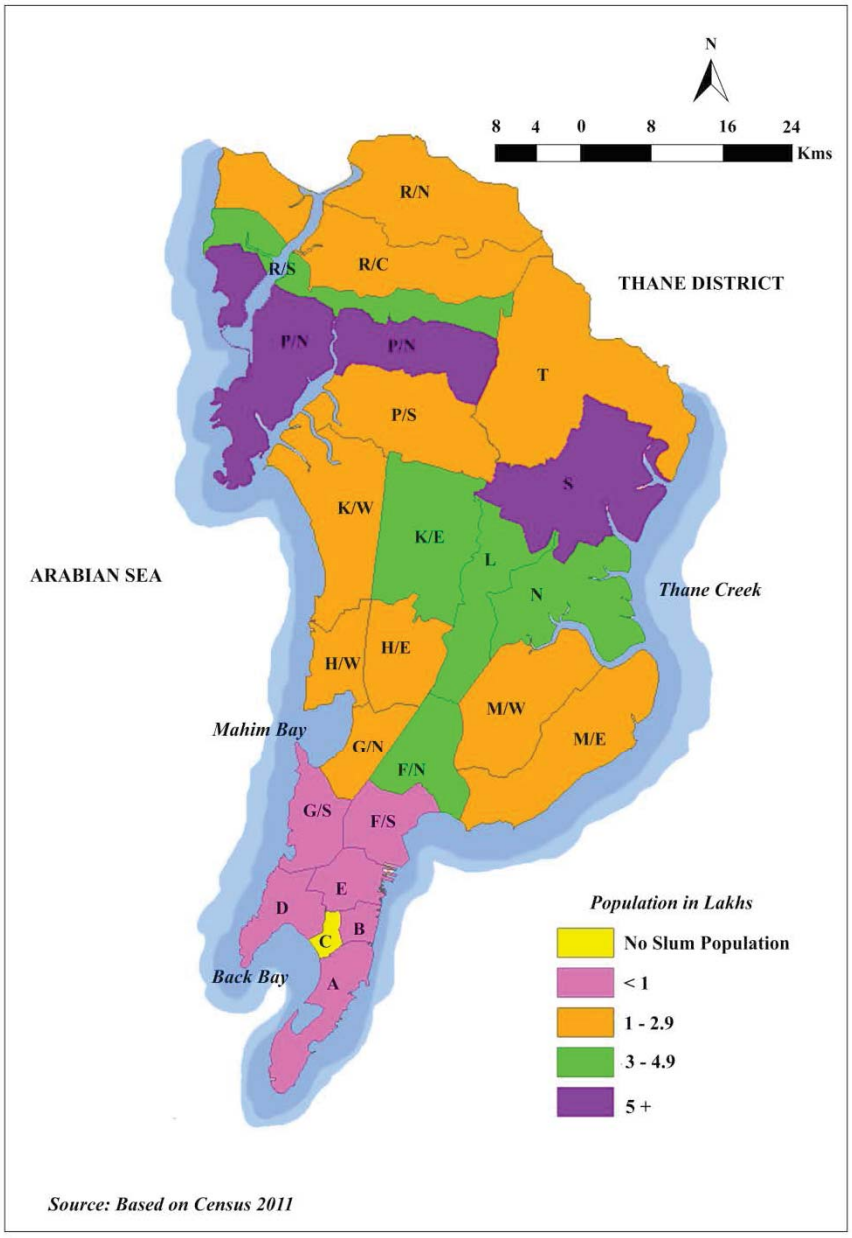
With 24 wards, Mumbai District has a total slum population of 52, 07,700 (Table 1). However, slum population is observed to be more in ward S and P and there is no slum population in ward C (Census 2011). Map 1 represents the ward wise slum population in Mumbai. P/N and S ward has more than 5 lakhs slum population. Population with less than 1 lakh can be observed in wards located in the southern part of the study area (wards such as A, B, D, E, F/S and G/S).

Table 1: Ward Wise Slum Population in Mumbai District 2011

S No.	Ward	Slum Population (2011)	% of Slum Population to total slum population (2011)	% of Slum Population (2011) in the ward
1	A	63,400	1.217	34.3
2	B	14,400	0.276	11.3
3	D	33,000	0.633	9.5
4	E	77,800	1.493	19.8
5	F/N	3,08,400	5.922	58.3
6	F/S	95,200	1.828	26.4
7	G/N	1,89,600	3.64	31.7
8	G/S	78,300	1.503	20.7
9	H/E	2,34,800	4.508	42.1
10	H/W	1,18,500	2.275	38.5
11	K/E	4,03,800	7.753	49
12	K/W	1,08,800	2.089	14.5
13	L	4,90,400	9.416	54.4
14	M/E	2,45,300	4.71	30.4
15	M/W	2,17,200	4.17	52.7
16	N	3,85,600	7.404	61.9
17	P/N	5,04,500	9.687	53.6
18	P/S	2,64,000	5.069	57
19	R/C	1,04,300	2.002	18.6
20	R/N	2,21,500	4.253	51.4
21	R/S	3,99,200	7.665	57.8
22	S	5,37,900	10.32	72.3
23	T	1,11,800	2.146	32.7
	Total	**52,07,700**	**100.00**	

Source: Census of India, 2011

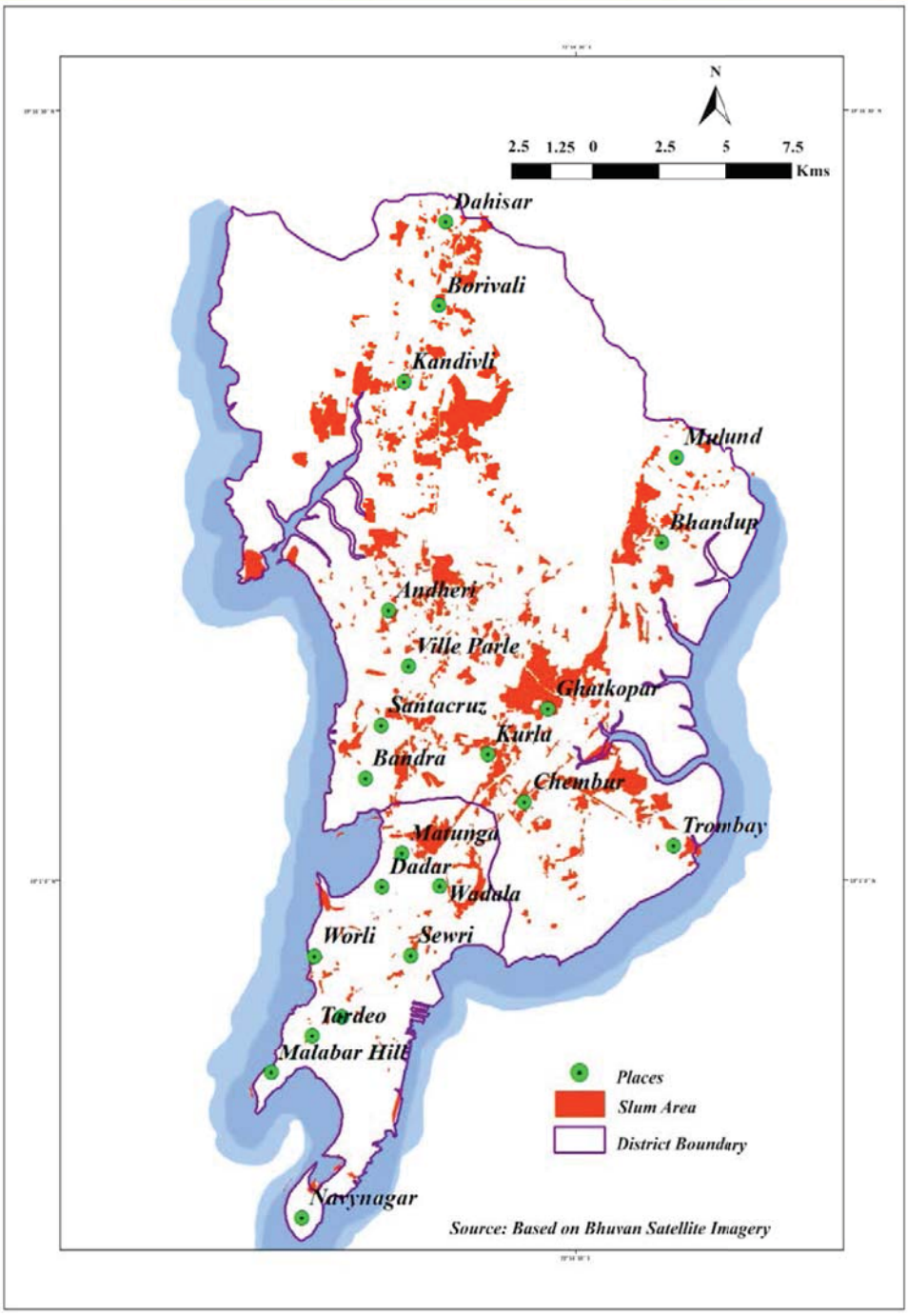
Map 1: Ward Wise Slum Population in Mumbai District 2011



Map 2 depicts the slum pockets identified using visual interpretation of bhuvan satellite imagery (Bhuvan, ISRO). The analysis shows that out of the total land area of 603 sq km, slum area constitutes of about 44 sq.km

.

Map 2: Map of Slums in Mumbai District



1.1 Survey Objectives

The present study highlights the key challenges faced by the slum dwellers on housing, water and sanitation in Mumbai District with the following specific objectives:

a) To study the housing conditions of slums.
b) To investigate the drinking water and sanitation facility available for slum dwellers.
c) To analyse the quality of drinking water at source.
d) To understand the cleanliness habits and associated issues of hygiene.

1.2 Survey Design and Methodology

The survey is carried out scientifically in selected wards of Mumbai District. Mumbai District consists of 24 wards. The methodology adopted for the present study is as follows (*Figure1*):

1.2.1 Sampling

Ward wise total slum population of Mumbai District was collected from the Census 2011 records and then the entire wards were divided into two zones, zone I with higher slum population concentration and zone II with lower slum population concentration. From each zone 3 wards had been selected systematically and then from each ward, slum pockets were selected randomly. A total of 1452 households were interviewed for the present study. Adult women who were aware of the household chores are the respondent of this survey.

1.2.2 Questionnaire Design

A simple questionnaire that includes questions on housing, water, sanitation, fuel use, pollution, diseases and economic condition of the slum dwellers was developed and pretested.

1.2.3 Water sample collection

Drinking water samples were collected in a 1 litre white High Density Polyethylene (H.D.P) bottle and 130 ml water in an amber tinted sterilized glass bottles intact without any leakages and were tested in a scientific laboratory, in Mumbai District. Based on the observed values in the drinking water after testing, water quality parameters such as total alkalinity, total dissolved solids, and total hardness were interpolated in GIS environ to figure out the overall quality of drinking water in slums of Mumbai District.

1.2.4 Training and Field Work

We recruited field investigators for a period of one month and they were given intensive training on data collection in the month of January 2015 with the help of subject experts and project staffs.

The survey was administered using paper questionnaire. Every selected household were informed by the field investigators about the survey, its purpose, confidentiality of the information collected and respondent's right to refuse the interview as well as the right to withdraw from the survey at any point during the interview. The interview was started only after seeking an informed consent from the respondent.

The field investigators were continuously supervised and monitored by Pop-Envis project staffs, IIPS, Mumbai.

1.2.5 Qualitative Data Collection

Qualitative data were collected by research scholar volunteers of IIPS. Information on the following items were gathered through field visits, observation and key informant interviews. Information gathered on the following themes.

a) Drinking water: source, modality, timing, storage of water in households.

b) Sanitation: Quality of toilet, average person use of community toilet, toilet use of females and kids, money to be paid for toilet use, water supply in toilet, safety mainly at night in community toilet area, quarrel and accident related to water and sanitation, any community strategy to solve problems.

c) Overall Cleanliness: garbage disposal practices, general cleanliness, drainage, passageways, unhealthy environment, if any.

d) Slum history: genesis, provision of slum rehabilitation, influence of political party.

e) Fuel use: type, awareness and problems related to availability and use.

1.2.6 Mapping

The observed values on quantitative data collection were interpolated in the ArcGIS environ to figure out the overall condition of the slum dwellers on housing, water and sanitation aspects. Interpolation predicts values for cells in a raster from a limited number

of sample data points. It can be used to predict unknown values for any geographic point data.

1.3 Data Entry and Analysis

The quantitative data collected from the field through questionnaire was entered and ana lysed in SPSS. The qualitative data collected through observation, field visit, focus group dis cussion and key informant interview was exported to the NVivo environ to analyse the qua litative data.

1.4 Publications

Key inferences were published as Factsheet (Vol.12 No.3, 2015 (Special Issue)) and were submitted to the Ministry of Environment, Forest and Climate Change (MoEF&CC) in June 2015. The present report describes the quantitative and qualitative insights of the survey and key findings.

Photo1: Training to Trainers, IIPS, Mumbai

Field investigators and student volunteers with Pop-Envis team

Figure1: Methods of Data Collection and Analysis

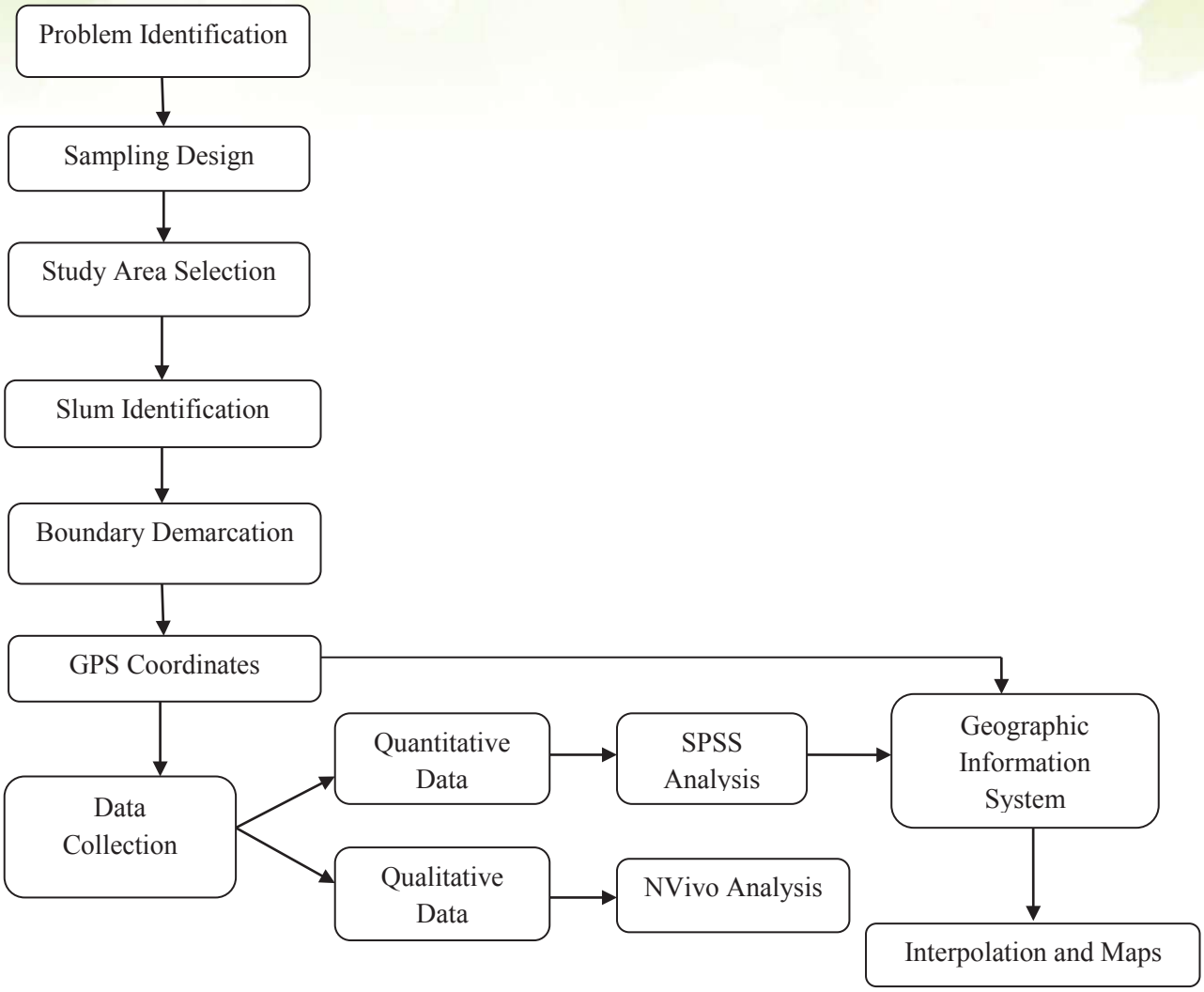


Photo2: Survey Team

CHAPTER 2

LIVING CONDITION: QUANTITATIVE INSIGHTS

Slums have been regarded as a major issue of concern in the developing countries and India is no exception. The present chapter indicates the basic conditions of living of slum dwellers in Mumbai District.

Key Findings

- Around 70% of the households are residing in the same community for more than 15 years.
- About 81% of the slum dwellers live in *pucca* house.
- Thirty eight percent households reported that they do not have any window at home.
- Only 9 % slum households have access to private latrine facility at home.
- Overall, 13% adult female are practising open defecation due to poor quality of public toilets.
- Eighty five percent slum households reported perceived unsafety of public toilet at night.
- Eighty five percent households said that there is no water supply in public toilet.
- Two-third households in slums have access to piped drinking water.
- On an average, around 96 minutes are spent daily for collecting water and the average amount spent for drinking water is Rs. 262/- per month.
- Around 90 % slum households suffer from respiratory diseases such as fever, cough, cold, breathing problem etc.
- Almost 76% percent of the households use LPG as the main fuel for cooking.
- Around 73% of the households reported problem of foul smell.
- Almost all the households (98%) reported that they face problem due to mosquitoes.

2.1 Basic Information

Table 2 shows the basic information of the slum dwellers on religion, caste, native place, mother tongue, literacy and duration of stay in the same community.

Table 2 Basic Information of Slum Households

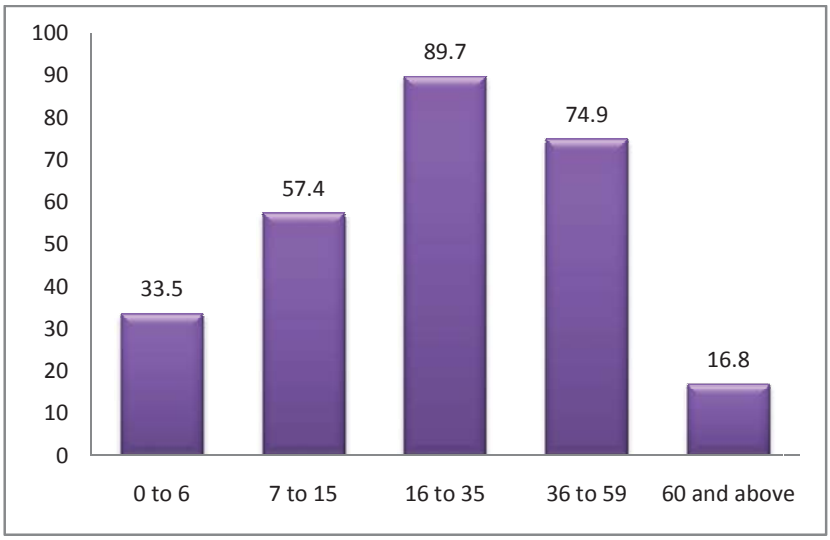
Number of Households	**1452**
Households in Authorized Slum[1] (%)	76.6
Religion (%)	
Hindu	82.0
Muslim	12.2
Caste (%)	
Scheduled Caste	13.4
Scheduled Tribes	6.4
Other Backward Class	43.1
Others	28.2
Native Place (%)	
Maharashtra	50.8
Uttar Pradesh	25.6
Gujarat	7.4
Tamilnadu / Karnataka / Andhra Pradesh	8.5
Mother Tongue (%)	
Marathi	46.8
Hindi	34.4
Gujarati	7.0
Tamil / Telugu / Kanada	5.8
Can Read and Write any Language (%)	65.9
Duration of Stay of the Household Head (%)	
0 - 5 Years	6.8
5 - 9 Years	12.5
10 - 14 Years	10.5
15 Years and Above	70.1

[1] *Household that have legal document related to housing and electricity*

The survey was conducted in 1452 slum households of Mumbai District. Of the 1452 households, 77% of the slum households are authorized. The survey defines authorized households based on the availability of legal documents on housing and electricity. About, 82% of the surveyed households belong to the Hindu religious community followed by Muslims (12%). About 43% of the households belong to Other Backward Class (OBC). Thirteen percent and six percent households belong to Scheduled Caste (SC) and Scheduled Tribes (ST) respectively. The study reveals that half of the slum households came from different parts of Maharashtra (51%) followed by Uttar Pradesh (26%), Tamilnadu / Karnataka / Andhra Pradesh (8%) and Gujarat (7%). Approximately,

47% of the households reported that their mother tongue is Marathi followed by Hindi (34%). Two - third of the slum dwellers reported that they can read and write in their own mother tongue. Around 70% of the households reported that they reside in the same community for more than 15 years and 13% of the households reported that they reside in the same community for 5 to 9 years. Only 7% slum dwellers reported that they have resettled here since last 5 years. The age group in figure 2 shows that in 1452 households around 90% people belong to the age group 16 to 35 followed by age between 35 to 59 years (75%). Around 57%, 34 % and 17% people are between the age group of 7 to 15, 0 to 6 and 60 and above respectively.

Figure 2 Percent Household Population by Age Groups



2.2 Economic Condition

Economic status includes main occupation, whether engaged in organized or unorganized sector, household assets and income etc.

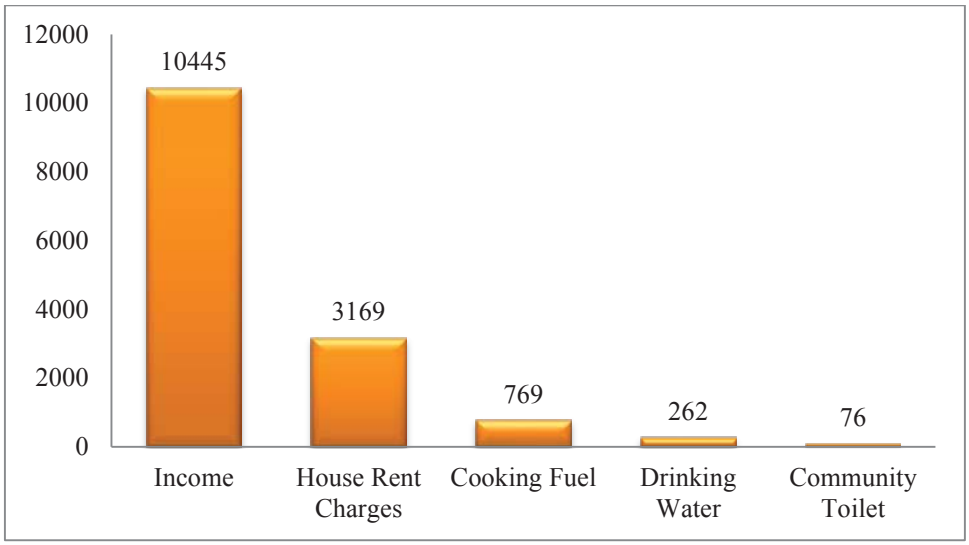
Table 3 Economic Status of the Slum Households

Mean Monthly Income of Household (Rupees)	**10445.0**
Earning mainly from Unorganized Sector (%)	71.1
Main Occupation (%)	
Service	59.0
Own Business	18.5
Industry Labour	11.7
Housekeeping	4.3

Household Assets (%)	
Mobile	95.7
TV	86.1
Mixer	79.7
Bed	36.0
Refrigerator	29.9
Bike / Scooty	7.0
Sewing Machine	6.9
Computer / Laptop	3.3

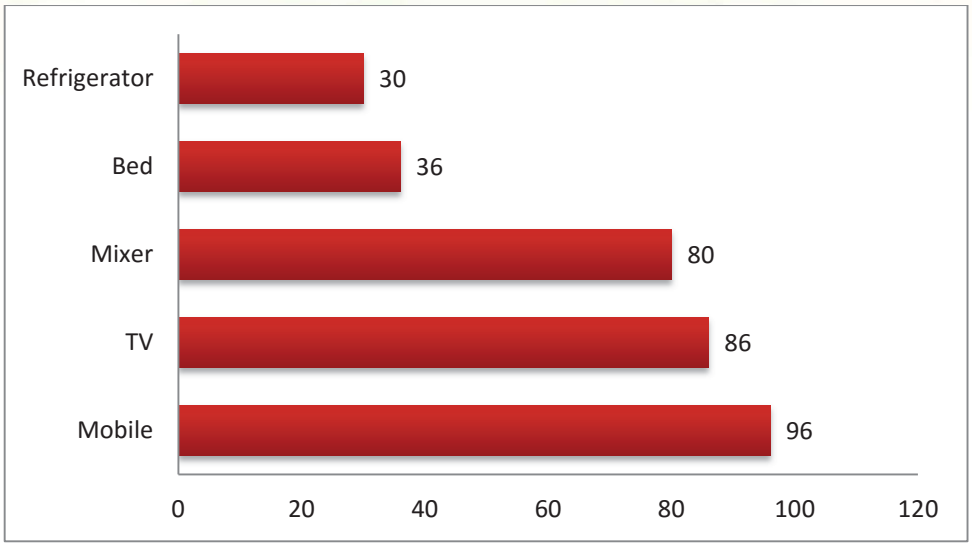
Table 3 reveals that the average monthly income of the surveyed households is Rs. 10445/-. Around 71% reported that they work in the unorganized sector. About 59% of the households reported that the main occupation is service followed by own business (18.5%) or working as industry labour (12%). A small number (4%) of households mainly work as housekeepers in apartments and private companies. Figure 3 represents the monthly income and expenditure for drinking water, cooking fuel, housing rent and community toilet. The monthly rental charges paid for housing is 3169/- rupees. The total expenditure for drinking water is Rs. 262/- per month. The amount spent for cooking fuel is Rs. 769/- and the average amount spent for community toilet is reported to be Rs. 76/-.

Figure 3: Average Monthly Income and Expenditure (Rupees)



The inference on household assets (Figure 4) reveals that almost all the households have mobile phones followed by television (87%) and mixer (80%). Households having bed (36%), refrigerator (30%), bike / scooty and sewing machine (7%) are lesser in number. Only three percentage of the household own either a computer or a laptop.

Figure 4: Household Assets (%)



2.3 Housing Characteristics

Housing in the survey includes type of houses, ownership of the house, house with or without window and house with adequate ventilation.

Table 4: Housing Characteristics

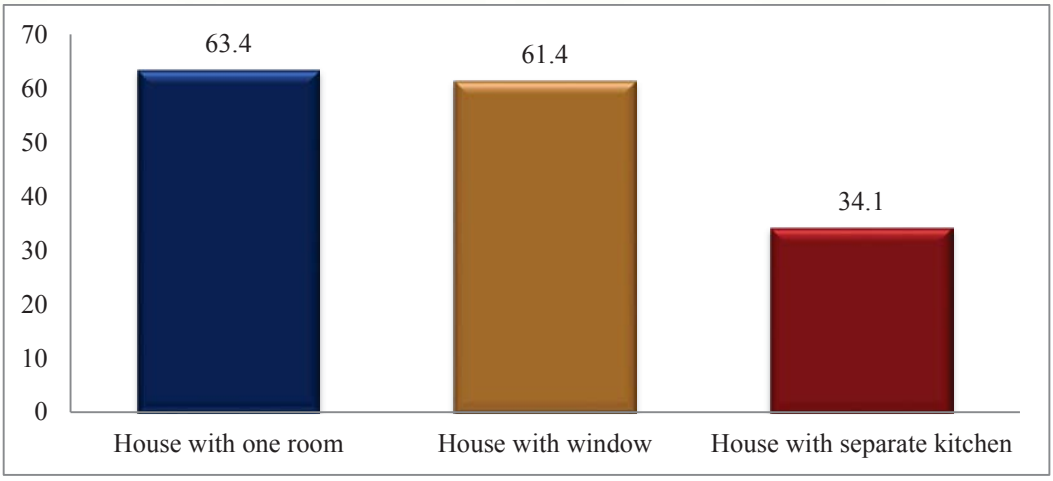
Particulars of Housing	Percent
Staying in *kuccha* house* (%)	11.3
Staying in own house (%)	71.2
House without window* (%)	38.6
House with proper light and air* (%)	70.5
House with one room* (%)	63.4
Keeping domestic animals in/very close to house* (%)	19.7
Area of House (Sq.feet)	138.5

**Observed by interviewer*

About 81% of the slum dwellers have *Pucca* house, i.e. made of sturdy material and concrete roofing. Seventy one percent of the households have ownership to the house (Table 4). Map 3 depicts the percent distribution of *pucca* houses in different slums of Mumbai District. More than 90% of the slum households located in the southern and south eastern part of the study area have *pucca* houses. While, in the northern, eastern, western and central part of the study area, less than 70% slum households have *pucca*

houses. Approximately, 71% of the slum dwellers reside in their own house. Figure 5 depicts the key indicators of housing.

Figure 5: Indicators of Housing (%)

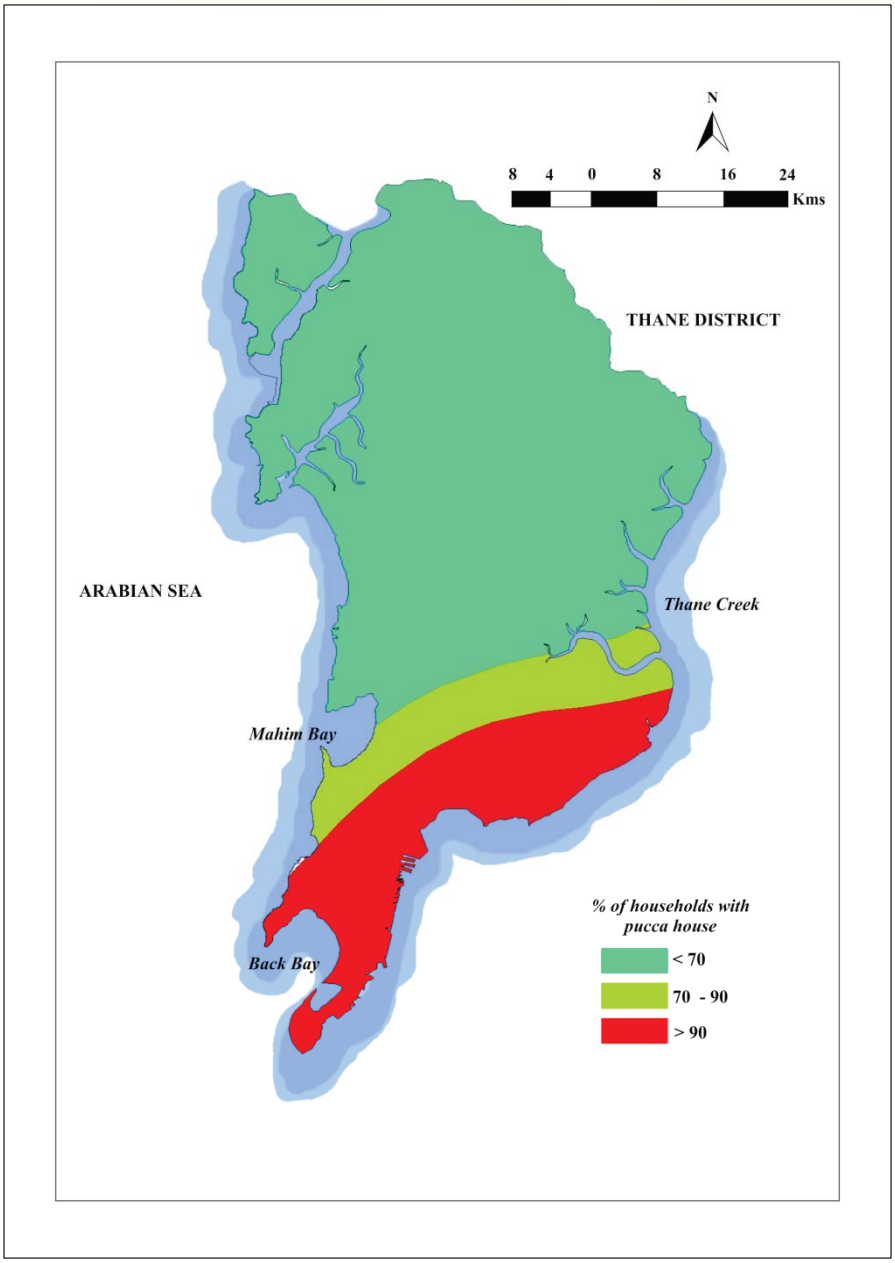


Thirty eight percent households do not have any window at home. However, 70% households observed to have light and air inside the house. Approximately, 20% households keep domestic animal indoor or very close to the house. About 63% of the households live in one room dwelling with an area of 138 square feet and only 34% households have separate kitchen.

Photo3: A Kuccha House

This picture is taken in a slum located in the hilly areas of Northern part of Mumbai District. This house is made of kuccha / temporary materials

Map 3: Households with Pucca House



2.4 Toilet Facility and Waste Disposal:

Public toilet is an important amenity for the urban poor. Generally, people living in slums do not have access to private sanitation (Table 5).

Table 5: Access to and Quality of Toilet Facilities

No Latrine facility at household (%)	91.0
Public Toilets with no water supply (%)	84.6
Need to carry water to the Public toilet (%)	82.7
Perceived poor cleanliness in public toilet (%)	83.5
Mean distance of public toilet (meters)	58.0
Public toilet perceived to be unsafe at night (%)	84.6
Average waiting time in morning hours in public toilet (minutes)	20.0
Mean monthly expenses for using public toilet (Rupees)	76.0
Disposing child's stool in drain/passage way (%)	57.9
Female members practising open defecation at night (%)	12.5

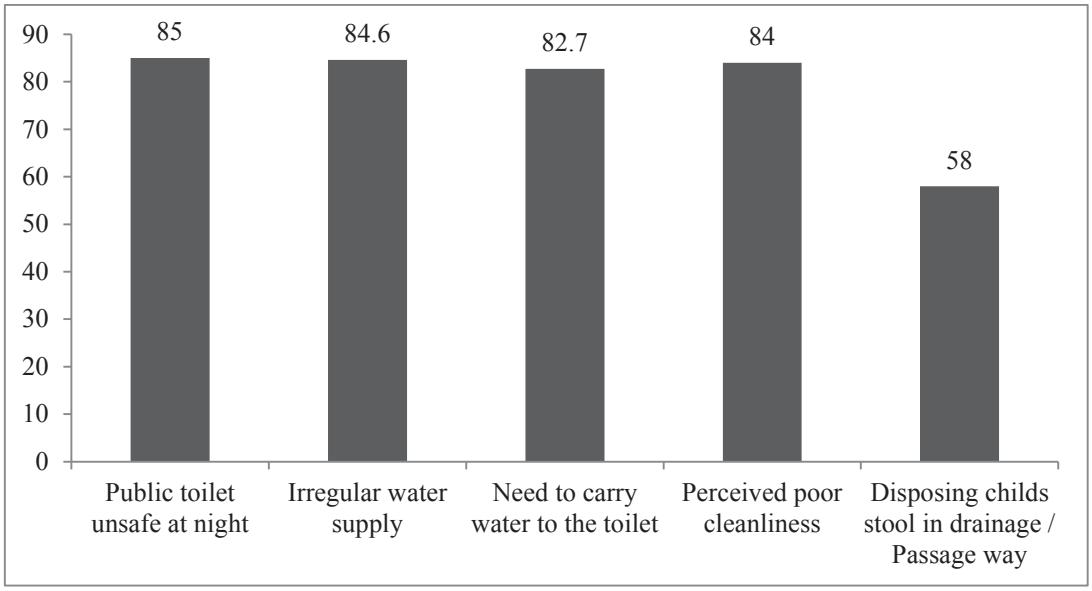
Only 9% slum households have access to private latrine facility at home. About 91% of the slum dwellers in Mumbai District are using public toilet. Eighty five percent of the slum households reported that there is no water supply in the public toilet and also the public toilet is reported to be unsafe at night. Around 83% slum households reported that they have to carry their own water bucket for using the public toilet. Overall, 13 percent adult female opined that they practise open defecation due to poor quality of public toilets. Fifty eight percent respondents reported that they dispose of child's stool in the drain or passage way. The average distance of the public toilet from the house is observed to be 58 meters.

Photo 4: Public Toilet

This public toilet has no water and light facility

Figure 6 depicts the key indicators of the public toilet. Around 84% of the slum dwellers reported that they perceive poor cleanliness of public toilet and 85% reported such toilets as unsafe at night. It has been observed that on an average one has to wait for 20 minutes daily in the morning to use the public toilet. The average amount spent monthly for using the public toilet is Rs. 76.0/-.

Figure 6 Indicators of Public Toilet (%)

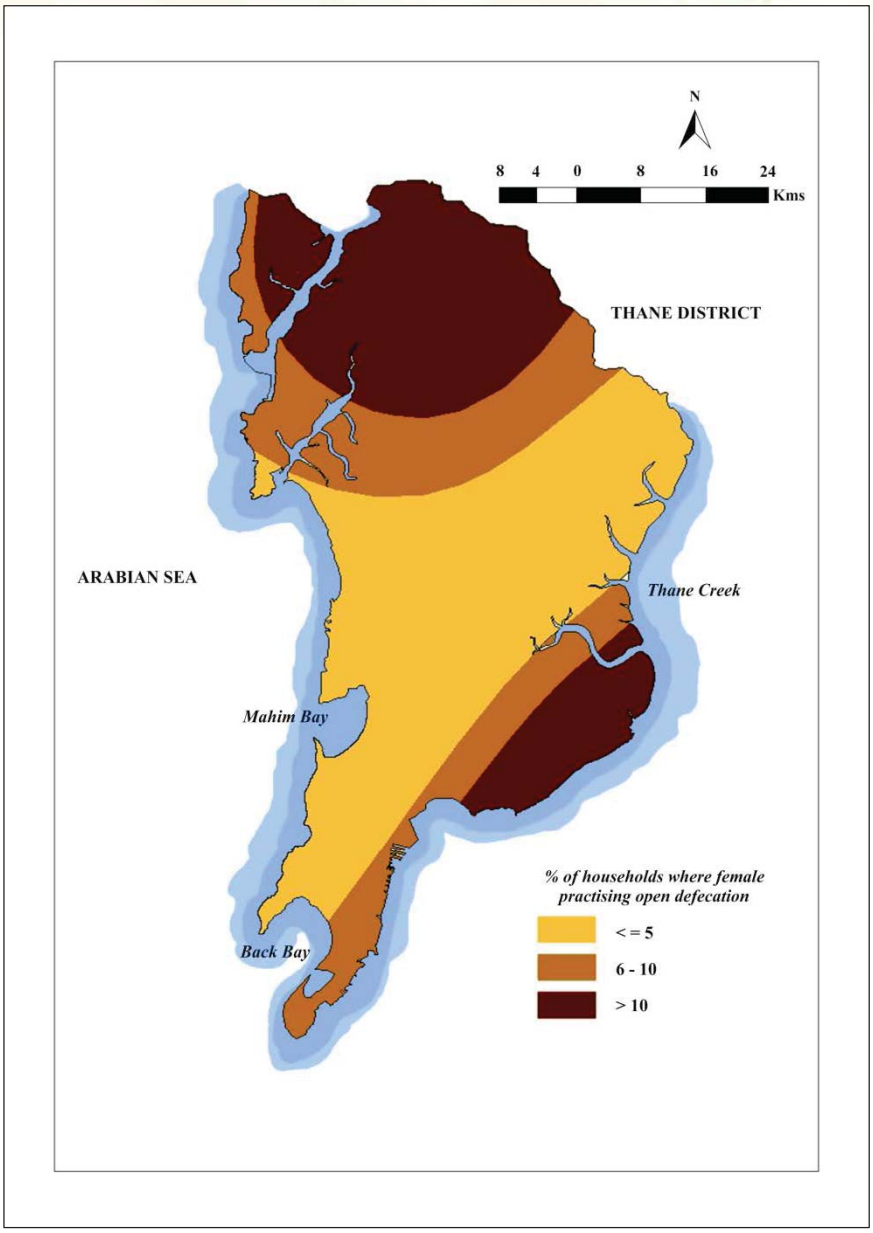


Map 4 shows the percent females practicing open defecation at night. Percent households located in the northern and south eastern part of the study area where females practise open defecation is observed to be more than ten percent.

Photo 5: Carrying Water to the Public Toilet

A child carrying water to the public toilet

Map 4: Females practising open defecation at night



2.5 Drinking Water:

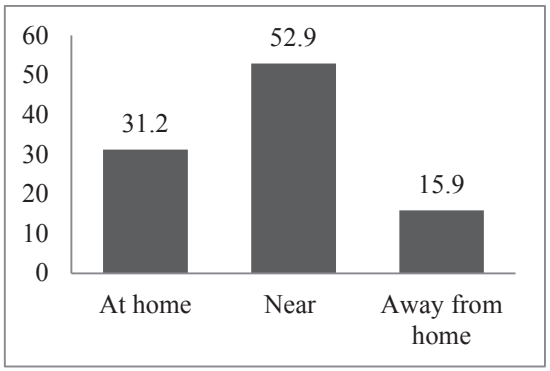
Drinking water parameters includes source of drinking water, availability of water per day, water collection point and quality of drinking water (Table 6).

Table 6: Access to Safe Drinking Water

Drinking Water	
Main source of drinking water (%)	
Access to piped water	65.6
Access to Public Tap / Stand Pipe	31.2
Well / hand pump / borewell	1.3
Tanker / Truck	1.0
Others	0.9
Location of water collection point (%)	
At home	31.2
Near	52.9
Away from home	15.9
Household treating drinking water (%)	33.8
Mean hours of water availability (hours)	6.0
Average time spent for water collection per day (Minutes)	96.5
Mean Monthly expenses for drinking water (Rupees)	262.3

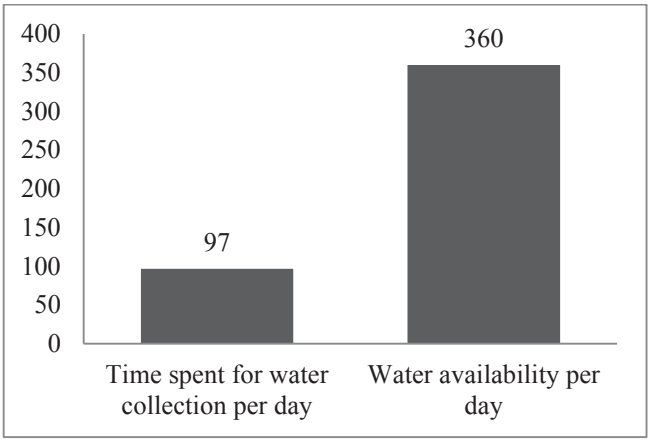
Drinking water is collected from nearby tap and is stored in drums and cans for drinking as well as for other purposes. Around 65% of the households have access to piped water, followed by tap water (31%). Approximately, 1.3% and 1.0% of the households have access to well / hand pump / bore well and tanker / truck respectively.

Figure 7: Location of Water Collection Point (%)



Around 31% said that they have access to drinking water facility at home. More than half of the households reported that the water collection point is near their home (Figure 7). Majority of them get water once a day for 3-4 hours. The mean hours of water availability is observed to be 6 hours (Figure 8). The slum dwellers reported that on an average around 96 minutes are spent daily for collecting water and the average amount spent for drinking water is Rs. 262/- per month.

Figure 8: Time Use for Drinking Water (Minutes)

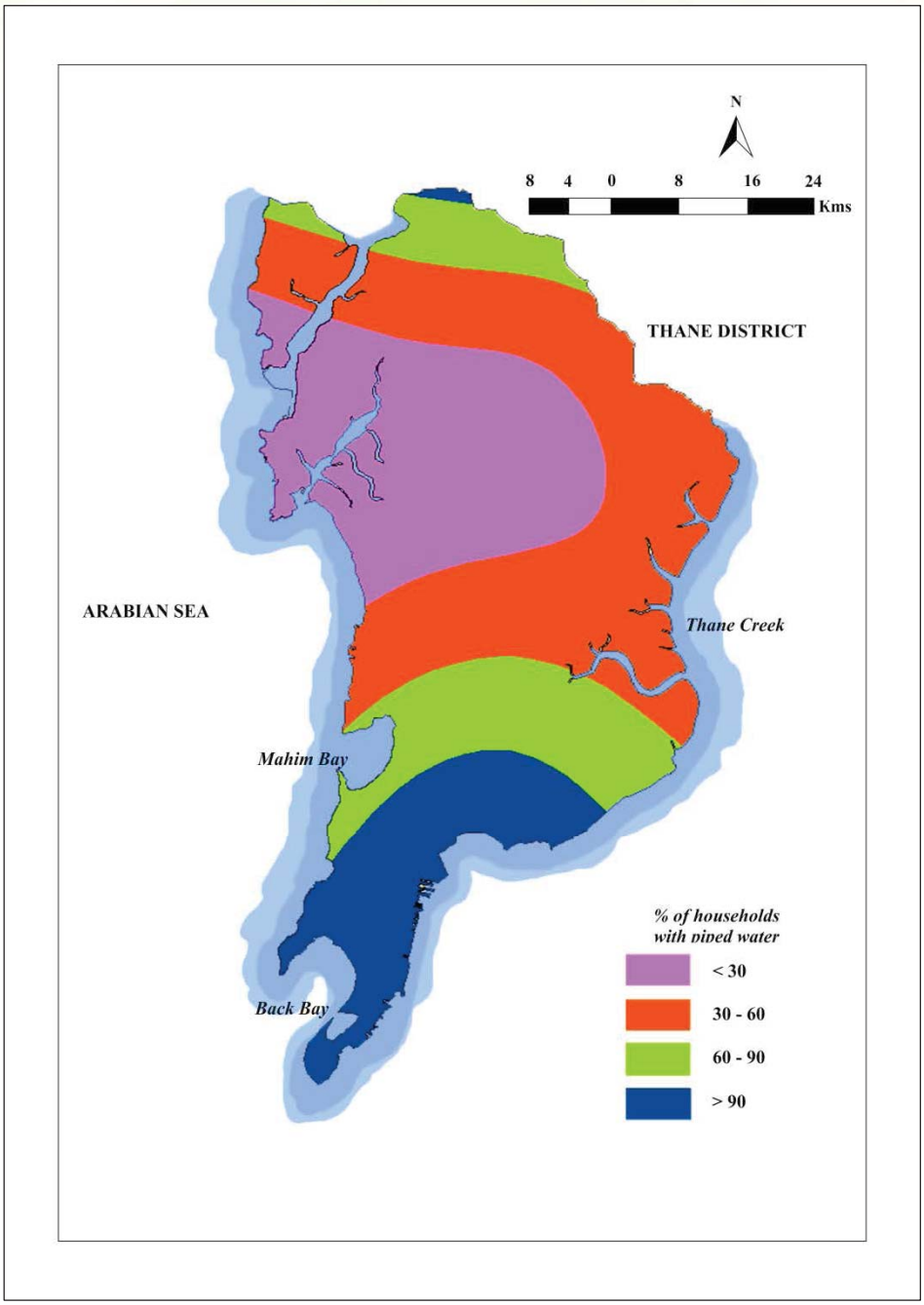


Map 5 represents the percentage of households having piped water connection. More than 90% of the households located in the southern part of the study area have access to piped water facility. However, only less than 30 percent of the households located in the slums of western part of the study area have access to piped water.

Photo 6: Water Storage

Water for drinking and other purposes is generally stored in big drums and small tins.

Map5: Household with Piped Water



The quality of drinking water available in slums of Mumbai is observed to be in the permissible limit. Table 7 reveals the observed value for various drinking water parameters that are tested in the laboratory.

Table 7: Drinking Water Quality Parameters

Parameters	Acceptable Range*	Observed Mean Value
pH Value	6.5-8.5	7.2
Electrical Conductivity	Not Specified	130.6
Total Dissolved Solids	Max 500	85.0
Total Alkalinity	Max 200	23.8
P-Alkalinity	Not Specified	< 1
Total Hardness	Max 200	44.1
Chlorides	Max 250	9.9
Calcium	Max 75	9.7
Magnesium	Max 30	4.8
Sulphates	Max 200	1.5
Reactive Silica	Not Specified	20.0
Total Bacterial Count	Not Specified	10.8
Coliforms	Absent	Absent
Escherichia coli	Absent	Absent

As per Bureau of Indian Standard

Turbidity: Turbidity is a measure of water clarity. Turbidity is caused due to the amount of suspended particle in water, which includes soil particles (clay, silt, and sand), algae, plankton, microbes, and other substances. Water with a maximum turbidity of 1 Nephelometric turbidity unit (NTU) is considered potable which is observed to be <1 within the desirable limit.

Color: Color is measured in Hazen Units. Water with color of less than 5 Hazen units is considered potable. Color of the drinking water changes due to the concentration of suspended materials such as particles of clay. Color of drinking water in the study area is observed to be in the desirable limit which is < 1 Hazen units.

pH Value **:** pH is a measure of how acidic/basic the drinking water is. The range goes from 0 - 14, with 7 being neutral. pH of less than 7 indicates acidity, whereas a pH of greater than 7 indicates a base. However, pH above 6.5 and below 8.5 is considered potable. The value of pH observed in the drinking water ranges from 7.25 to 7.31 with an average of 7.28.

Odour and Taste: Odour and taste in water is directly related to the amount of dissolved solid particles in the same. Both the parameters are observed to be agreeable.

Electrical Conductivity: This is the measurement of the ability of water to conduct an electric current - the greater the content of ions in the water, the more current the water can carry. It is highly dependent on the amount of dissolved solids (such as salt) in the

water. Limit for electrical conductivity is not specified by the Indian Standards. The average value of the electrical conductivity of drinking water observed is 130.6 µS / cm.

Total Dissolved Solids (TDS): A total dissolved solid (TDS) is a measure of the amount of dissolved material in the water. Consuming drinking water, which has the highest concentration of TDS leads to aesthetic problems (such as undesirable taste, salty and bitter taste and health hazards. TDS in drinking water ranges from 84 to 90 mg/l with an average of 85.0 mg/l in the study area.

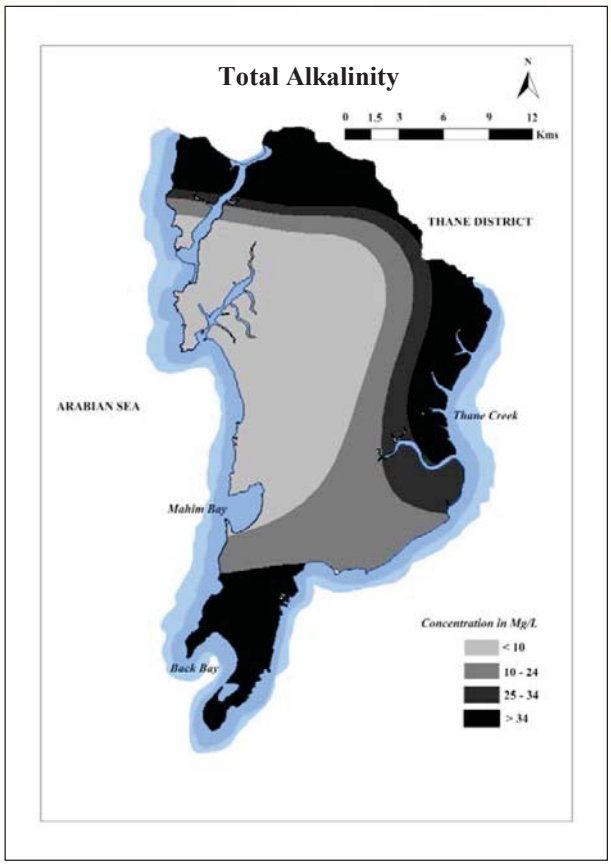
Total Alkalinity and P-Alkalinity: Alkalinity is a measure of the capacity of water to neutralize or "buffer" acids. Highly alkaline waters, above pH 9.0 can cause drying of skin. Total alkalinity of water below 200 mg/l is considered potable. Total alkalinity in the study area ranges from 28 to 143 mg/l with an average of 23.8 mg/l. Phenolphthalein alkalinity (p-alkalinity) is present only when free carbon dioxide (CO2) is absent and therefore exists only when the pH exceeds 8.3. Desirable limit for Phenolphthalein alkalinity is not specified by the Indian Standards. The P-alkalinity of drinking is observed as <1 in the slums.

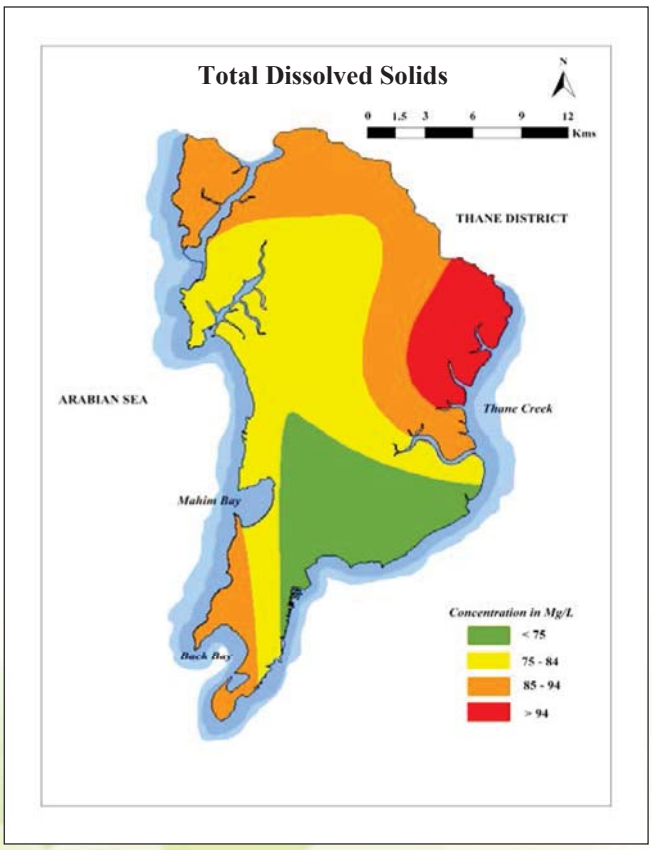
Total Hardness: The hardness of water is generally due to the presence of calcium and magnesium in the water. Total hardness in water less than 200 mg/l is considered potable. Total hardness in the drinking water varies from 42 to 47 mg/l with an average of 44.1 mg/l. Map 6 depicts the water quality parameters such as Total dissolved solids, Total Alkalinity and Total hardness observed in drinking water of the study area.

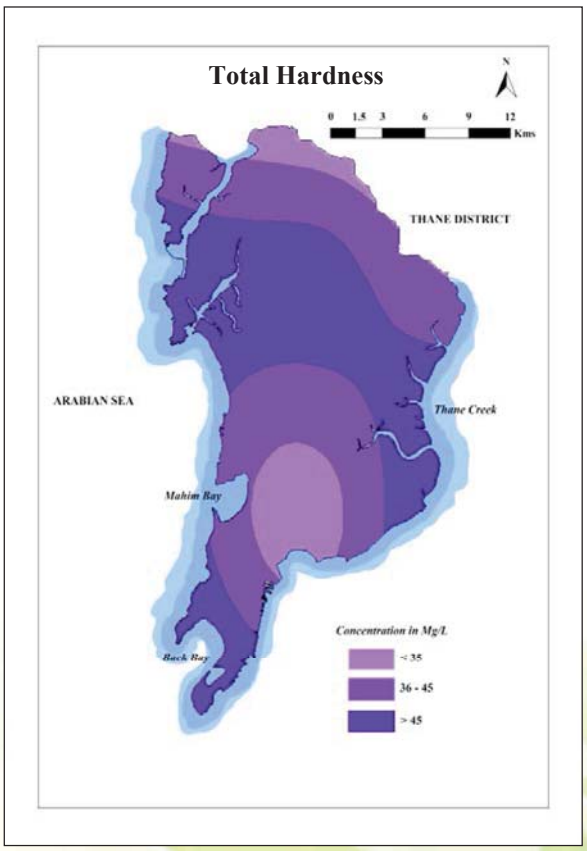
Photo 7: Drinking Water Sample Collection

This picture is taken in a slum located in the Southern part of Mumbai. Sample water is collected for testing in the laboratory.

Map 6: Households by Quality of Drinking Water Parameters (%)







Chlorides: Chloride, in the form of the Cl– ion, is one of the major inorganic anions, or negative ions, in saltwater and freshwater. Chlorides in water less than 250 mg/l are considered potable. The chloride concentration in drinking water tested ranged from 9.0 mg/l to 10.5 mg/l with an average of 9.9 mg/l.

Calcium, Magnesium, Sulphate: Calcium and Magnesium occurs in the water naturally. Calcium in water below 75 mg/l and magnesium below 30 mg/l are considered potable. Calcium concentration in drinking water of the study area observed from a minimum of 9.3 mg/l to a maximum of 11.2 mg/l with an average of 9.7 mg/l. While, magnesium in drinking water ranges from 4.6 mg/l to 4.9 mg/l with an average of 4.8 mg/l. High concentrations of sulphate in the water we drink can have a laxative effect when combined with calcium and magnesium, the two most common constituents of hardness. Sulphate content in water below 200 mg/l is considered potable. The sulphate tested in drinking water of the study area ranges from 1.4 to 2.3 mg/l with an average of 1.5 mg/l.

Reactive Silica: The "Total Silica" content of water is composed of "Reactive Silica" and "Unreactive Silica". Reactive silica (e.g. silicates SiO4) is dissolved silica that is slightly ionized and has not been polymerized into a long chain. The desirable limits for reactive silica in water are not specified in India. Reactive silica in the drinking water varies from 18 mg/l to 22 mg/l. The average concentration of reactive silica in drinking water is 20.0 mg/l.

Total Bacterial Count: Total bacterial count is the enumeration of the microorganisms like bacteria, yeast, mold present in the sample tested, which includes all types of microbes including non-pathogenic and pathogenic (disease causing). The count represents the number of colony forming units (cfu) per g (or per ml) of the sample. The average concentration of Total Bacterial count is 10.8 cfu/ml.

Coliforms: Coliform is a family of bacteria common in soils, plants and animals. The coliform family is made up of several groups, one of which is the fecal coliform group, which is found in the intestinal tracts of warm-blooded animals including humans. Coliform concentration in the drinking water is absent.

Escherichia coli: Among hundreds of strains of bacterium Escherichia coli, E. coli O157:H7 is an emerging cause of waterborne illness. Although most strains of E. coli are harmless and live in the intestines of healthy humans and animals, this strain produces a powerful toxin and can cause severe illness. E. coli concentration in the drinking water tested is observed absent.

2.6 Fuel Use

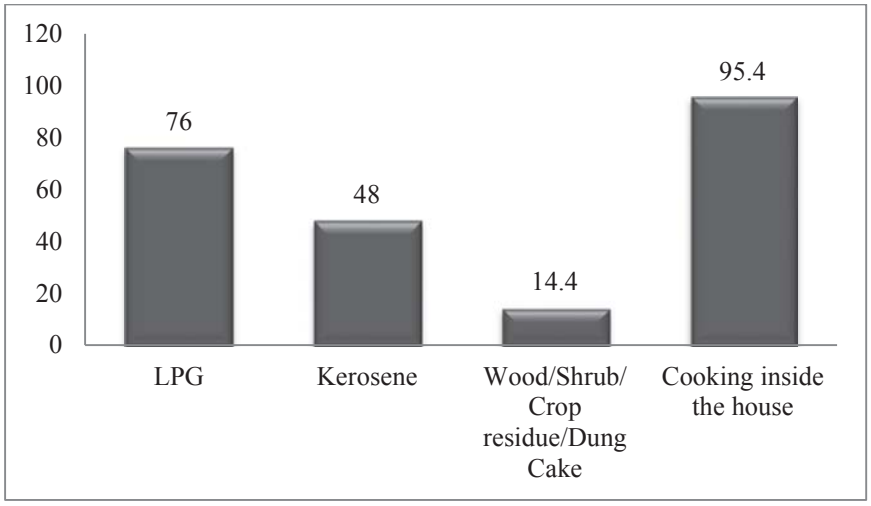
This section provides an overview of the type of fuel used for cooking and mode of cooking (Indoor / Outdoor). The questionnaire classified cooking fuel as LPG, charcoal/ coal/lignite, bio gas, kerosene, and wood/shrub/dung cake/crop residue. Table 8 shares the main source of cooking fuel and its monthly expenses.

Table 8: Main Source of Cooking Fuel and Monthly Expenses for Fuel

Type of Fuel Use	
Liquefied Petroleum Gas (%)	75.5
Kerosene (%)	47.5
Wood/Shrub/Crop residue/dung cake (%)	14.4
Monthly expenditure for cooking fuel (Rupees)	769.0

Liquefied petroleum gas (LPG) is the main source of cooking fuel in most of the households, followed by kerosene and wood/shrub/dung cake/crop residue. Figure 9 represents the main source of cooking fuel. Almost 76% households use LPG as the main fuel for cooking. Around 48% households use kerosene for cooking and 14% of the households reported that they use wood/shrub/dung cake/crop residue for cooking. The survey reveals that around 5% of the slum households is observed to be cooking outside the house. The mean monthly expenditure for cooking fuel is 769.0 rupees. Around 71% slum households reported that they use gas stoves for cooking and 23% use kerosene stove.

Figure 9: Main Source of Cooking Fuel and Place of Cooking (%)



2.7 Cleanliness

Cleanliness is one of the major problems of slum dwellers. Table 9 shows that only 20% of the households perceive clean surroundings.

Table 9: Cleanliness and Hygiene Practices (%)

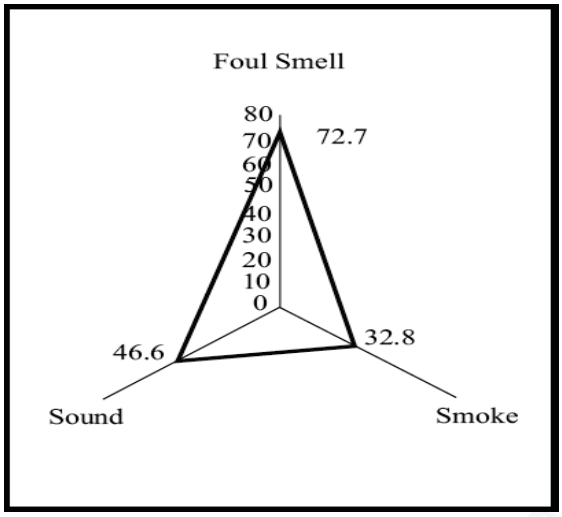
Perceived clean surroundings	19.6
Keeping domestic animals in/very close to house	19.7
Cleaning utensils with ash/mud	4.1
Always keeping food in utensils with cover	91.4
Always cleaning hands before eating	78.5
Members do not clean hands after latrine with soap	9.5
Household members having head lice	28.9
Cutting nails at least once in a week	49.6

Approximately, 9.5% of the households reported that they do not clean their hands using soap after latrine. Around 29% of slum households reported that at least one household member has head lice. Around 4% of households clean utensils with either ash or mud.

2.8 Reported Problem of Pollution

Figure 10 reveals the problem of pollution faced by the slum dwellers. Pollution in the questionnaire includes perceived foul smell, smoke and sound. Foul smell is due to the presence of open *nalla* in front or close to the households. Around 73% of the households reported foul smell. Smoke is due to burning of waste near the dumping ground, smoke from vehicles etc. Approximately, 47% and 33% households perceived problem due to sound and smoke respectively.

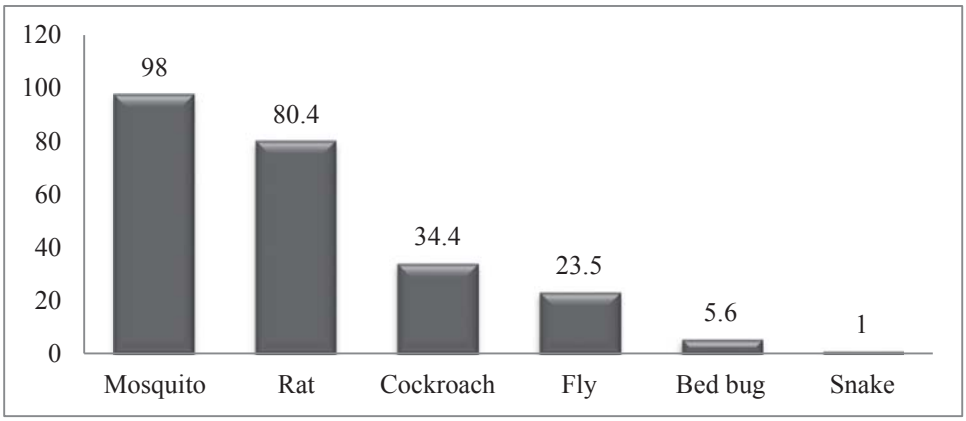
Figure 10: Perceived Problem of Pollution (%)



2.9 Problem of Insects and Animals

Mosquitoes, rats, flies and cockroaches are observed to be very common in the slums (Figure 11). Almost all the households (98%) reported that they suffer more due to problems related to mosquitoes. Around 80% households made complains of rats. Approximately, 34% of the households face problem of cockroaches. Flies (24%) are observed to be very common among the slum community. Only 6% and 1% mentioned about bed bug and snake respectively.

Figure 11: Reported Problem of Insects and Animals (%)



2.10 Reported Morbidity

Reported morbidity of households reflects the health condition of the slum households in the past one year. Health, in our survey includes health problem of any household member, as reported by our respondent. We asked the respondent, whether any of the household members suffered from listed health problems in the past one year.

Table 10: Reported Morbidity

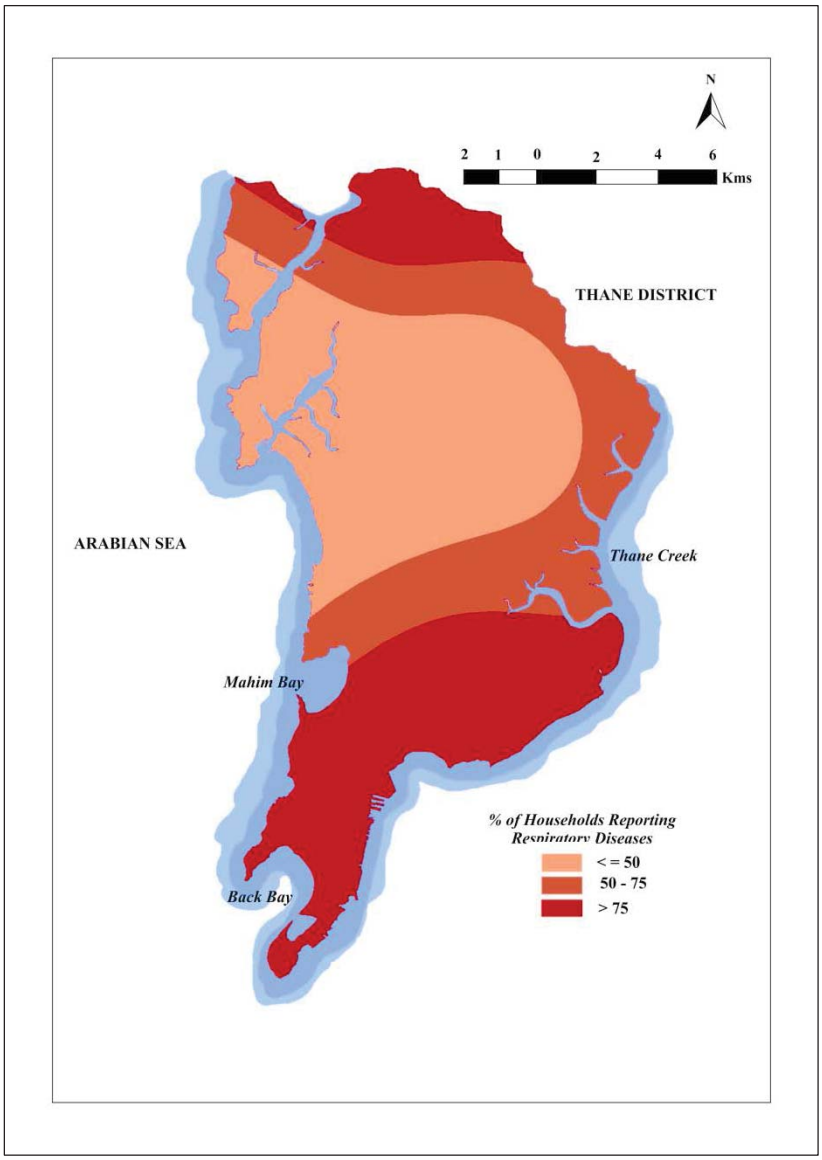
Morbidity*	Percent
Respiratory problem	89.6
Digestive problem	41.6
Aches / Pain	37.8
Eye problem	20.7
BP / Heart Problem	12.8
Skin problem	12.5
Diabetes	9.0

*Note: *reference period is last 1 year*

Table 10 reveals that around 90% of the slum households suffer from respiratory diseases such as fever, cough, cold, breathing, etc. followed by digestive diseases (42%) such as

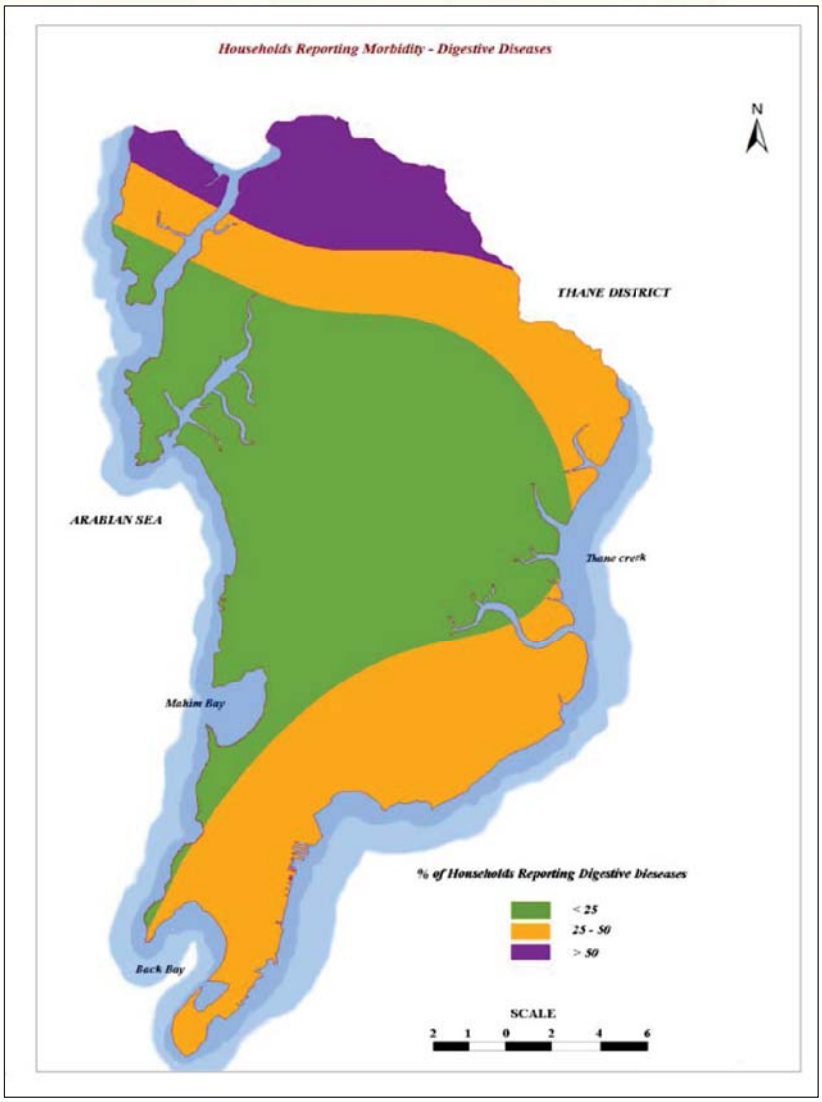
diarrhoea, acidity and gas etc. Approximately, 38% of slum dwellers reported that they suffer from aches / pain. Eye problem is reported by approximately 20% households, heart and skin problems by 13% and diabetes by 9% households. Map 7 depicts the percent distribution of households who reported respiratory illness. More than 75% of the slum households located in the northern, southern and south eastern part of the study area reported respiratory illness.

Map 7: Percent households reported respiratory diseases



Map 8 depicts the percent distribution of households reported digestive diseases. More than 50% of the slum households located in the northern part of the study area suffer more from digestive diseases.

Map 8: Percent households reported digestive diseases



THE WAY OF LIVING: QUALITATIVE INSIGHTS

Qualitative insights were collected through field visit; walk through observation and key informant interviews. The collected qualitative data were imported to the NVivo environ to analyse the frequency of words. The following figure (Figure 12) depicts the word frequency of the qualitative data. The font size of the word in the figure is proportional to their frequency i.e., the words such as slums, water, households, toilets, observed, Mumbai, located etc., have different font size due to the frequency of those words in the qualitative study. Bigger font indicates the issues which are repetitively highlighted by the slum dwellers during our qualitative study.

Key Findings

- Owing to lack of education qualification, the money-earning status of the slum dwellers found to be low and very few among them are proficient in earning a good income to cross the poverty hurdle.
- Many slum households are engaged in variety of economic activities. The strict time followed by the municipal corporation in supplying drinking water is the major hurdle for female members to work outside. It restricts them to involve in money-making activity.
- Women's public toilet is observed to be unclean compared to men's toilet. Women's toilets do not have proper regulation even by external agency other than the municipality to clean or to provide water for them. In Men's toilet water is generally channelized by some private party on payment basis.
- The slums located in the hilly tracts of Mumbai District are mostly neglected by the municipal workers in collecting the garbage.

Figure 12: Word Frequency for Qualitative Insights

3.1 Housing

Housing in the survey includes the type of house, duration of stay, ventilation, ownership of the house and rooms with or without kitchen. Walk through observation shows that slum dwellers mostly live behind the high rise buildings, hills, along the railway line, river bed, near open drainage / *nalla*, coastal areas, near airports, fringe areas and undeveloped areas.

Photo 8: Agriculture by Slum Dwellers Adjacent to Railway Line

Almost all the households in the slums of Mumbai District reside in the same community for more than 10 - 15 years, except a few who are residing in the community recently for less than five years. The slum dwellers are settled due to better employment opportunities compared to their place of origin. Most of the households in the slums are owner of their houses. Some of the households residing in the community are on rental basis. The types of houses in the slums are observed to be mostly *pucca* houses (those with roof and wall made of permanent and sturdy materials such as cement, concrete, bricks etc.) and *semi pucca* houses (those with either roof or walls, but not both made of *pucca* materials). Most of the households have only one room, do not have any window, and the majority of the slums are observed with very poor ventilation. Dingy houses, congested lanes, loitered garbage bins are the most important characteristics of the slums located in Mumbai District. Most of the houses located in the slums of south-western part of Mumbai District are 2 or 3 storied houses with small rooms having kitchen within the main living room. The main road of the slums located in the south-western part of the study area has a thin lane which is observed to be clean. Two or three storied buildings with materials such as tin, asbestos is the characteristics of houses in slums located in the south eastern part of Mumbai District. Most of the households have separate kitchen while, few of them have kitchen separated using a curtain or plywood. However, slum houses located in the northern part of Mumbai District has both *pucca* as well as *kuccha* houses. Slum households located in the north eastern part of Mumbai District consist of *pucca*, semi *pucca* and *kuccha* houses.

Photo 9: Domestic Animals

The above picture was taken in the south eastern part of Mumbai District where most of the households keep animals in front of their houses. The animals eat and excrete at the place where water is stored, making the entire lane unhygienic.

3.2 Occupation and Employment

Employment status is one of the basic indicators of economic condition. Male members of the households are engaged in / as fishing (living in coastal area), construction and renovation labourers, street vendors (vegetable, clothes, etc.), housekeepers (offices), daily wages labour, vadapav - tea - meat - pan - beedi sellers, laundry and barbers garbage cleaner, hotel boy, drivers, carpenter, meson and bus conductor, driver, peon, sweepers, watchman, etc. Some have own business in tailoring, paper mart, shoe making, rain coat making, embroidering, plumbering, electric works, painting. Most of the female members of the households are engaged as housekeeper (offices and in residential buildings), house maid, care taker etc. Many female members do not go to work due to strict water supply timings and to take care of their children. Female members are also found to be involved in small scale business such as stone work fabrics, papad making, garland making, artificial jewellery making, tailoring etc. These activities have a low profit margin. They do not get these works regularly from companies. It is also observed that most of the women in the households have sewing machine and they are actively involved in learning and stitching their own household fabrics.

Photo 10: Cultivation

This is a small agricultural field in the western part of the study area where some vegetables are grown by the slum dwellers for commercial as well as household use.

The occupational pattern of the households shows that as most of them are illiterate, few have studied up to 10th or 12th standard, majority are observed to be wage workers, where there is high risk of unemployment. Those who are working as wage workers in the informal sectors do not get jobs. Sometimes even for a month, they have to sit at home without any work. Figure 13 reveals the word frequencies observed from the qualitative research in NVivo environ. Since, most of the urban poor work for unorganised sector and also they do not have job safety the words such as raincoat, fabrics stitching etc are highlighted during the qualitative study.

Photo 11: Papad Making

The slum is located in the north eastern part of Mumbai District where papad making is one of the major economic activities. The factories near the slums provide them all the materials to make papad. Many women and household members are engaged in papad making to earn their livelihood.

Photo 12: Making Ornaments and Stitching Work in Slums

Figure 13: Word Frequency for Economic Activities

A male member stitching rain coat said "*the work is given by a company. All the necessary material for stitching raincoat is given by them. They pay Rs. 75/- per rain coat and we stitch around 3 to 7 rain coat per day*." Another male member who is engaged in stitching

shirt and pant said "*I regularly get income in stitching. However, during the festive season, I need to engage myself in that work day and night. I earn around Rs. 400 – 500/- per set consisting of a pant and a shirt*." Women who are engaged in designing fabrics reported that "*the company people come and provide me the material such as fevicol, kundan stones of various colors, and the fabric with respective design. They earn Rs. 50 – 75 per fabric work depending upon the work or design of the fabric. However, we are engaged in this type of work only for a week or 15 days. We have to wait for another 10 to 15 days to get the next slot of work order."*

3.3 Drinking Water

Adequate and safe supply of drinking water is recognized as essential for life existence. Almost all the households in the slums rely on municipal water for drinking as well as for other purposes. Slums that are located on the hills face problem of water as they don't have access to piped water. Lack of pipe water supply and stringent timings of water supplied by the municipal corporation to each of the households is the major problem reported by the slum dwellers during our qualitative study. The bundle of pipes along the lanes can be seen commonly in front of the roads and in front of each household. Slum dwellers use this bunch of pipes for walking in the congested lanes. In certain slums we observed that the BMC has placed the water pipe on the open drainage and people use hose pipe to fetch water for their household needs. People often use the drainage space in collecting water by keeping a stand or by directly placing the container inside the drainage. Generally, female members of the households are involved in collecting and storing water. Most of the households do not have piped water connection at home. Four to five households in a lane share a common pipe connected to the source and the water bill shared among those households. There had been cases in the past that people from other households used all the water from the tap though they did not pay for it. Therefore, they keep the tap locked. Female members of the households fail to engage in money-making activity for such stringent water timing. They have to be in the house to collect and store water for their daily use. Field observation shows that the water pipe is kept locked so that no other households can use the same pipe to collect water. Usually, water for drinking is stored in pots and bottles and water for multi-purpose use is stored in tins, drums and cans. Slums located in the south-western part of Mumbai District get water daily at 4.00 A.M. Slums that are located in the south eastern part of Mumbai District gets water daily at 11.30 A.M. Slums located in the northern and north eastern part of Mumbai District get water during

12.00 PM. The water is generally supplied for 3 - 4 hrs daily. However, the major concern that was repetitively highlighted during the qualitative study was the stringent timings of water supplied to the households. The slum dwellers reported that during the rainy season they get contaminated water, which they consume using cloth or boiling or through filtering machine. Slum dwellers residing in hills face water shortage. They access water through pipes connected from the foothills. In certain slums that are located on the hill, water supply is observed to be a good business.

Photo 13: Water Collection

This slum is located in the hilly tracts of the northern part of the study area. This is the only tank serving more than 300 populations. Generally, people nearby the tank collect water using their own cans and pots. Those who are residing far away, use hose pipe to collect water from the tank. As can be seen in the photograph above, the area where the water is collected is very dirty and people have to stand in queue to get a few buckets of water.

This picture is taken in the south eastern part of the study area. The municipal corporation has placed the water pipe just above the drainage. People use the drainage space in collecting water by keeping a stand or by directly placing the container inside the drainage.

3.4 Sanitation

Inadequate sanitation in slums is observed to be a big concern among slum dwellers. Sanitation plays a vital role in keeping good health. However, slum dwellers do not give attention for self health care due to lack of awareness and knowledge. Most of the households do not have toilet facility at home. Most of the slum dwellers use public toilets for defecation. Toilets are located in the middle of the slums or at the periphery. Mostly they are poorly maintained with dirty water and mud outside the toilets and foul smell in and around the place. Irregular cleanliness and maintenance along with no water facility in the public toilets are repetitively highlighted during the qualitative data collection. It is

also observed that the number of toilets per slum is too less to meet the requirements of the ever increasing population in each slum. Each slum community has 2 - 4 public toilets separately for men and women serving more than 200 people. The toilets for men and women are located adjacent to each other. In each public toilet there are 8 - 10 dingy toilets with poor ventilation.

Photo 14: Private Toilet

This picture is taken in a slum located in the south eastern part of Mumbai District.

Out of this, only 2 or 3 toilets are said to be functional, others are completely non-functional. The toilets seem to have heavy rush during the morning hours with a long queue of people waiting outside the toilets. Arguments for taking more time in toilet or leaving the toilets unclean after use are common. Female, children and elderly members of the household face more problems due to lack of toilets. Generally, people have to pay Rs.2-3 to the gatekeeper who takes care of the toilet. Certain slums have a monthly pass system of Rs.200/ - 250/- for using the public toilet. However, people opt for daily pay and in certain slums it is observed that the use of public toilet is free of cost. The public toilet is cleaned daily once or twice by setting a person on payment basis. The set person collects Rs.10/- Rs. 20/- monthly per household to clean the toilets. However, women's toilet is said to be unclean compared to men's toilet. Women's toilets do not have proper regulation even by external agency, other than the BMC to clean or to provide water, which is generally channelized and taken care in men's toilet by some private party set on

payment basis. Water tanks are kept outside the men's toilet with few plastic pipes, whereas in women's toilet there is no such water facility available. Women have to carry water in the bucket. Women not only face problem in carrying water for their use but they do so for their children and the elderly members of the family. Women also face difficulty in disposing their sanitary napkins due to lack of availability of dustbins in women's toilets. The qualitative study infers that the poor condition of toilets is due to poor management of Municipal Corporation and also for poor maintenance by the public. In certain slums, 2 to 5 households share a common toilet and toilets are cleaned regularly by them. Each household takes in charge of cleaning the toilet monthly or weekly. The cleaning materials such as phenoyl, cleaning powder, toilet cleaning brush, etc., are shared commonly among the households on payment basis.

Photo 15: Shared Private Toilet

There are a few private toilets which are shared by 4 to 5 households. The toilets are locked after use.

The toilets located in the hills of Mumbai District do not have water facility. Some toilets do not even have doors. Most of the female members of the households defecate in the open due to inadequate ventilation, unnecessary noise and no electricity facility in the toilets. They have to be accompanied by other member of the household to use the toilet. Indiscriminate excreta disposal of children is common in all the slums. Children defecate

near road sides, open drainage, foot hills of dumping ground etc. Children are even allowed to defecate in front of the house.

Photo 16: Water Supply to Public Toilet

Water for the public toilet is generally supplied through tankers.

When interviewing the local person in charge of the public toilet regarding the cleanliness of public toilets, he responded *"this toilet has water supply and light facility. In the morning hours people have to wait for 20 to 30 minutes, sometimes even more than 30 minutes. The person using the toilet has to pay Rs. 2/- per use. Water for the toilet is supplied by tankers. Toilets are generally cleaned twice a day, at night and evening, but still it is also the people's responsibility to clean the toilets after use."*

3.5 Waste Disposal

The Municipal Corporation of Mumbai is responsible for collecting and disposing the waste. The municipal corporation has placed two to three containers in each slum community. The container provided by the corporation is not sufficient for a slum community with more than 200 households. In certain slums there are 8 - 10 containers (*kachra dabbas*) in the middle of the road and people throw their daily wastes in the dustbins. Corporation workers regularly pick up the wastes in the morning. However, it is common that the dustbin gets filled up and the local public start throwing or dumping their waste around the dustbins. When it starts littering or stinks, they call the municipal workers to pick it up. The slums located in the hilly tracts of Mumbai are mostly neglected by the workers who collect the garbage. The workers feel that collecting waste from hill track is a much difficult task. The people residing in the hilly tracts throw or dump their

daily waste in the open drainage or somewhere else on the hills. When the drainage starts overflowing, people residing nearby clean the drainage for their survival.

Photo 17: Deonar Dumping Ground

This picture is taken in Deonar dumping ground where all kinds of garbages are thrown and scattered. The households near the dumping ground face problem due to foul smell and sometimes burning of these wastes also lead to health problems.

While interviewing a slum dweller on collecting wastes he said "*the unemployed youth group regulated by the Brihanmumbai Municipal Corporation (BMC) are playing a vital role in collecting wastes door to door and sweeping the lanes. SWACCH BHARAT ABHIYAN initiated by the Government can create more awareness among people and they will not only keep their homes clean but also manage to keep their societies clean*".

Photo 18: Open Drainage

This picture was taken in the northern part of the study area. The households and shops nearby the drainage throw all their daily waste into the open drain.

Walk through observation in certain slums infers that the household members usually keep their dustbins on the porch and the corporation workers regularly collect the wastes from each household. It is commonly seen that the garbage waste are also thrown in the open drain though there are dustbins placed by the municipality in and around the slum.

3.6 Cleanliness

Open drainage can be seen in front of most of the slum households. The path and the lanes of the slum remains wet. Flies and mosquitoes are very common due to open drainage. During rainy season the drainage water overflows and the roads are blocked causing foul smell. Beside this open drainage, there are tea stalls, hotels, etc., which is observed to be highly unhygienic. Children playing nearby the house, aged people, do have chances of falling into the drain. Flies are rampant.

Photo 19: House on Open Nala

This picture shows that the house is constructed next to open nala..

When we interviewed a female regarding the measures taken to get rid of flies she responded "*these are due to the waste dumped behind the slum. Corporation spray pesticides weekly once to get rid of flies and mosquitoes but still flies are increasing day by day and it has no solution*".

'Even if we add some turmeric powder and spray in and around the houses to get rid of flies, flies will come... spraying turmeric for the whole house daily will be costly.'

Certain slums observed to be neat and clean because of active involvement of the unemployed youth group and good maintenance by the household members.

3.7 Fuel Use and Cooking

LPG and Kerosene are the major energy sources for cooking in slums. However, majority of the households in urban environment do use biomass such as cow dung, charcoal, fire-wood etc., for heating water. It is observed to be very common in the slum households of Mumbai District especially in the hilly tracts where they cook with solid fuel. Indoor cooking with proper ventilation is one of the important factors to reduce the risk of morbidity. Outdoor cooking is common in many slums in Mumbai District. Almost all slum households have LPG connection and have at least 1 LPG cylinder at home. But people who have more number of family members and due to cheaper kerosene rate in the open market, they prefer using kerosene stoves. Kerosene is usually bought either from ration or from market. Slum households situated in the hilly tracts use wood (at no cost), kerosene for cooking. The LPG vendor do not supply cylinder to the slums near hills, instead the household members have to collect cylinder or refill the cylinder in their own cost.

Photo 20: Outdoor Cooking

This picture is taken in the Northern part of the study area located near forest. Most of the women in the area cook outside their houses as they do not have separate kitchen. They cook in open spaces adjacent to their houses. They face problem during rainy season. They use wood collected from the forest area for cooking.

Photo 21: Collecting Wood for Cooking

The women in this picture collect wood from nearby furniture shops / carpenter shops for cooking.

3.8 Education

Almost all the slums have an *anganwadi* or primary schools in their locality. Private schools and Government schools are also found nearby. Certain slums located in the hills do not have *anganwadi* or primary schools. They have to walk 2 km to reach the school. Most of the adult household members are 10th or 12th pass, few said to be illiterate. Keeping in mind the importance of education they wish to educate their children at any cost.

Photo 22: A Municipal School near a Slum

This is a municipal school located close to a slum in the north western part of the study area.

When interviewing a child (Aged 6) she told "*I am keen in studies, but my mother is not allowing me to go to school as the school is located near the foot hills". My mother said, "School neeche ke side hai, accident hone ka dar rahtha hai".*

Out of curiosity many illiterates somehow have learnt to write and sign. It is also found that few children are not interested to go to school. When interviewing those children they said "*Our parents are working and hence we are helpless in getting ready and thus are involved in designing fabrics*".

Photo 23: Girls Engaged in Fabric Design

Girls are engaged in stonework on the fabrics. These children do not go to school as their parents go for work in the morning. These girls are also earning for their families. They spend most of their time in fabric work.

3.9 Morbidity

Variety of sickness can be found among the slum dwellers. In certain slums Malaria, cough and cold (due to open drain, wet lanes), jaundice and diarrhoea (poor drinking water available during the rainy season) are common diseases. Most of the slum communities go to the Government hospitals for any kind of treatment. Almost all the slums have small

clinics for any emergency. However, the consultancy cost in private clinic compared to the General hospital is very high. Certain slums have General hospitals located very near to their household at 2 to 4 km distance. Almost all women reported that aches and pains are quite common. This is due to intensive physical work, inflammation due to any infection or muscle tension.

3.10 Awareness Regarding Slum Redevelopment

The reluctance and apprehensions of the slum dwellers on slum rehabilitation schemes are well understood from the qualitative study. However, certain slums are excited and have positive hope to move to the rehabilitated areas.

When interviewing a slum dweller regarding their views about the rehabilitation scheme, he said "*each flat will be around 270 square feet with one room and an attached toilet. People have a keen interest in resettling in the buildings as the surroundings will be cleaner and everyone can get water and attached toilets. But we are scared that it will be a loss for those who have a larger family size, as everyone will be alloted equal size of flat under the SRA scheme. Rs. 12,000/- will be given to those families who stay in transit camps till the buildings are ready to be shifted. .....compensation is too less, especially for those people who have business in their houses and it will be difficult for them to continue their business without their setup at the transit camps. Unemployment among youths in the slum is a big problem. These unemployed youths are graduates and are not willing to work for low paid jobs.*"

CHAPTER 4

SUMMARY AND CONCLUSION

Housing, Water and Sanitation Survey of Slums in Mumbai was conducted in Mumbai District (Mumbai City and Mumbai Suburban), scientifically selecting 1452 households. The main objectives of the survey are: to study the housing conditions of slums, to investigate the drinking water and sanitation facility available for the slum dwellers, to check the quality of drinking water at source and to understand the cleanliness habits and associated issues of hygiene. The survey was conducted during the month of January-February, 2015. Adult female member of the households who are aware of the household chores were our respondents. The survey scientifically selected slum households from 24 wards in Mumbai District. All wards were divided into two zones, zone I and zone II with higher population concentration and lower population concentration respectively. Out of these two zones, six wards were selected systematically and slum pockets were identified using Google Earth satellite imagery. The survey collected both quantitative and qualitative data. The quantitative data were gathered by face to face interview. The qualitative data were collected through observations, key informant interview and group discussions. Drinking water samples were collected at selected slum locations and tested in the laboratory. Global Positioning System (GPS) were also used for locating coordinates and were imported to GIS environ for analysis and mapping.

The findings represent the overall situation of urban slum dwellers of Mumbai District.

4.1 Housing

Around 70 % of the households stay in the same community for more than 15 years. More than half of the households are living in one room and average household size is 139 square feet. A large number of slum people are migrants from different parts of Maharashtra. Majority of the slum houses are *pucca* or semi *pucca*.

4.2 Economy

The mean monthly income of slum household is Rs. 10,445/-. Around 71% of them work for unorganised sector as industry labors, housekeeper, vendors, drivers, shop keepers etc. Many households are engaged in small scale business.

4.3 Drinking Water

Two-third of households have access to piped drinking water. The quality of drinking water supplied by the Municipal Corporation of Mumbai is observed to be in the acceptable limit.

4.4 Sanitation

Most of the households in the slums do not have latrine facility and they use public toilets that are not properly maintained and also considered to be unsafe for women at night. As a result, women resort to open defecation. It is observed that only 9% of the slum households have private latrine facility at home, others use the community toilet. About 12.5 % households resort to open defecation due to unsafe community toilets. Men's toilets are in a relatively better condition as compared to the women's toilet. The child stool is mostly thrown into the drainage or on the road side.

4.5 Waste Disposal

Dumping containers / dust bins can be found in each slum community. However, the slum dwellers feel that the bins provided by the municipal corporation is not sufficient for a large community. So disposal of waste in drainage, near dustbins are common.

4.6 Fuel Use

About 76% of the slum households use LPG as the main source of cooking fuel. The mean monthly expenses for cooking fuel is Rs. 769/-. Slums near forested areas mainly use wood for cooking.

4.7 Hygiene and Health

Around 44% of the slum households rated the surroundings as unclean. Atleast one member of 30% households have head lice. Around 19% of the households keep domestic animals inside or close to the house.

Out of 1452 households, 89% household reported respiratory problem and 42% household reported digestive diseases in the past one year.

MAJOR FINDINGS

- Large number of households in slums have legal documents indicating their address of current residence. Most of the surveyed households have migrated long back from different parts of Maharashtra.
- Mean monthly income of the households is about 10445/- per month. Though people are engaged in unorganized sectors, they have tremendous potential to develop entrepreneurship, given a proper environment. Almost all households have mobile phone, thus can be used as a mode of knowledge dissemination.
- With an average area of 139 sq. feet, most of the rooms do not have separate kitchen, and they keep domestic animals next to their house. There is a transition of type of house from *pucca* house in the southern Mumbai to *kuccha* houses in northern Mumbai slums.
- Inadequate latrine facility, poor quality of public toilet, unsafe environment in public toilets especially at night, lack of water supply in toilet are some of the major issues that needs policy attention. Adult females practice open defecation in the northern and eastern part of Mumbai District either due to poor quality or for unavailability of public toilets.
- Women's public toilets are worse than men's toilet. So, security, cleanliness, water availability should be made certain. Also, arrangements must be made for elderly people and kids to curb open defecation.
- Pipe drinking water supplied by the municipal corporation is found to be suitable in all slums. However, the way the taps are positioned near or on open drains questions the quality of stored water in the households. Needless to say, the situation worsens in monsoon seasons.

- One out of four households does not cook in LPG. The problem of poor supply of LPG is acute in slums located on hilly terrain.
- Though dustbins are kept in every slum, the numbers of such bins are inadequate. Thus garbage overflows by evening hours and it makes foul smell which is the most common pollution reported by the slum dwellers.
- Respiratory problems are very common among this community. Complaint of cough, cold, malaria, chocked respiration are frequent in slums located in the southern and eastern part. While digestive complaints are common in the extreme northern part of Mumbai. Also to mention, piped water availability needs to be taken care of in the northern part.
- Dissemination of basic hygienic habits, cleanliness needs to be made by the grass root workers.
- Involvement of middlemen in redevelopment and other programs create problem in dissemination of proper information related to varying schemes of government. So, confusion exists regarding different schemes that are meant for these people.

Redevelopment and rehabilitation schemes initiated has a positive approach in transforming the life of the urban slum dwellers. However, slum dwellers feel reluctant about the rehabilitation schemes due to the presence of a third party as they do not disseminate right information. So, they are not able to know about the benefits from the schemes that they are eligible for. The authorities must directly involve the slum dwellers in the redevelopment process of the community without involving the strange men and big contractors to achieve the goal of “Slum free Mumbai”.

The stringent timing followed by the municipal corporation in supplying drinking water to the slum households is the main reason for which the female members of the households are restrained to get involved in income generating activity. They have to be in the house

to collect and store water for their daily use. Hence, there is an urgent need to train the female members of the household in such a way that they could earn money working from home and raise their financial status. In this case, NGO's can play a vital role in forming women self help groups and involve them in small scale industries to enhance their living standard.

The public toilet facility in slums is found to be poor. This is due to the meagre maintenance by the municipality and by the public. Hence, enough number of toilet facility should be made available and the municipality should ensure cleanliness and safety of the toilets made available in slums. Specific rules and regulations need to be established in slums to provide clean and safe latrine facility. Most of the slum dwellers do not have much awareness on cleanliness and sanitation. For this reason, a wider approach is necessary to ensure the basic facilities available in slums, health and hygiene.

Solid waste management is also a concern in slums. The number of bins provided by the municipality for dumping waste is too less and hence the public throw their wastes near the bins which cause severe environmental problems. The municipality should provide enough number of dustbins considering the number of households and waste generated per day per household.

The slum dwellers should adequately be trained to practise self-care. In this case community health workers, community based organisations, NGO's and volunteers can play a vital role in educating and empowering these urban poor.

The slum dwellers can together invest minimum amount of money (Rs. 50 – Rs. 100 per household quarterly or yearly) to resolve issues independently. Such investment helps in resolving the issues such as renovating the toilets, fixing tube lights and can place a pipe or drum for water storage to use the toilets.

Slums generally lack basic services such as housing, drinking water, sanitation and waste management etc. Inspite of lack of basic services the slum dwellers adjusted to live in this congested dwellings. They have enough potential to enhance their earning and a better living. A wider and vibrant initiative is a way forward to achieve the goal of 'Slum Free Mumbai'.

Census of India. (2011). Office of the Registrar General & Census Commissioner, New Delhi.

International Institute for Population Sciences (IIPS). (2015). Population and Environment Bulletin, Housing Water and Sanitation (HWS) Survey of Slums in Mumbai, A Pop Envis Initatiative. ISSN No. 09757287. Vol 12 No 3 (Special Issue).

Indian Space Research Organisation (ISRO). Bhuvan-Indian Geo Platform of ISRO. National Remote Sensing Centre. Retrieved from http://bhuvan.nrsc.gov.in/bhuvan _links.php.

Mumbai City Development plan. (2005-25). Retrieved from http://mcgm.gov.in.

Slum Upgrading Policies of China's Shantytowns. (2015). Retrieved from http://www. springer.com/in/book/9783662439043.

State slum policy. (2010). Support programme for urban reforms in Bihar. Government of Bihar.

WHO and UNICEF.(2006). Meeting the MDG Drinking Water and Sanitation Target: The Urban and Rural Challenge of the Decade. Retrieved from http://www.who.int/water_ sanitation_health /monitoring/jmpfinal.pdf

1. Questionnaire for Data Collection

HOUSING, WATER AND SANITATION (HWS) SURVEY OF MUMBAI SLUMS

Pop-Envis Project

International Institute for Population Sciences, Govandi Station Road, Deonar, Mumbai 400 088

Consent Form

Namaste. My name is Mr/Ms_____ (write name) and I am working with IIPS. We are conducting **'Housing, Water and Sanitation (HWS) Survey of Mumbai slums',** under the ENVIS center of IIPS named Population, Environment and Settlement. The survey is sponsored by the **Ministry of Environment, Forests & Climate Change, Govt. of India**.

Your household is selected for the survey. I would like to ask you some basic questions about the housing conditions, water facility, sanitation, cleanliness and hygiene practices. The questions usually take about 10 minutes. All of the answers you give will be confidential and will not be shared with anyone other than the members of our research team. Your participation in the survey is very important. Your response may help to improve the conditions of the slum population.

If you have any question/query about this survey please feel free to ask me.

(ANSWER ANY QUESTION AND ADDRESS RESPONDENT'S CONCERNS AT THE END OF THE SURVEY.)

Do you agree to participate in this survey? Yes/No

If Yes,

A) SIGNATURE OF THE RESPONDENT/ THUMB IMPRESSION_____

DATE _____ Mobile No.: _____

B) Respondent declined to sign but orally agreed: Yes / No.

C) SIGNATURE OF INTERVIEWER_____

DATE _____, TIME_____, PLACE _____

POP-ENVIS, IIPS Page 1

CONFIDENTIAL

HOUSING, WATER AND SANITATION (HWS) SURVEY OF MUMBAI SLUMS

Population- Environment Settlement Project (MOEF-CC)
IIPS, Mumbai-88

(Respondent should preferably be an adult lady who is well aware of the issues of HWS)

(Circle the coded response or write in the _____ response)

(B) BACKGROUND INFORMATION

B1	Ward No:	
B2	Ward area name:	
B3	Authorized or Unauthorized slum	1. Authorized Slum 2. Unauthorized Slum
B4	Name of the Respondent:	
B5	Sex (Observation):	1. Male 2. Female 3. Others
B6	Age (In completed Years):	_____ Years
B7	Household Address:	
B8	Who owns this house?	1. Someone else 2. Rented 3. Own house 4. Government/Railway/Post trust 5. Don't know
B9	Do you pay hafta / rent for staying here?	1. Gives hafta (Rs. _____ /- month) 2. Gives rent (Rs. _____ /- month) 3. No

		Age	Total	Male	Female
B10	What is the total number of members in the household by age and sex?	1. 0 - 6 yrs:			
		2. 7 - 15 yrs:			
		3. 16 - 35 yrs:			
		4. 36 - 56 yrs:			
		5. 60 & above:			

B11	House is having (Circle all that apply)	1. Bed 2. TV 3. Fridge 4. Phone (Mobile / Landline) 5. Mixer 6. Sewing machine 7. Bicycle 8. Autorickshaw 9. Bike / Scooty 10. Computer / Laptop
B12	What is your Religion?	1. Hindu 2. Muslim 3. Christian 4. Sikh 5. Buddhist / Neo-Buddhist 6. Jain 7. Jewish 8. Parsi 9. No Religion 10. Other _____

B13 Do you belong to Scheduled caste, Scheduled Tribe, Other Backward caste or none of these?

1. Schedule Caste (SC)	2. Schedule Tribe (ST)	3. Other Backward Caste (OBC)	4. None of these (General)	5. No caste / don't know

B14 What is your mother tongue?

1. Assamese	2. Bengali	3. Gujarati	4. Hindi	5. Kannada
6. Konkani	7. Malayalam	8. Manipuri	9. Marathi	10. Nepali
11. Oriya	12. Tamil	13. Telugu	14. Urdu	15. Others

B15	What is your native place? (Write the state (राज्य) name)	
B16	How long your family is staying in the same community?	_____ Years
B17	Are you able to read and write any language with understanding?	1. Yes 2. No
B18	What is the total monthly income of your household in(Rs.)?	Rs._____/month
B19	What is the occupation of all the EARNING MEMBERS of your household? (Circle all that apply)	1. Own Business 2. Industry Labour 3. Service 4. Others _____
B20	Whether the MAIN EARNING comes from organized or unorganized sector?	1. Organized Sector 2. Unorgainzed Sector

(Dw) DRINKING WATER

Dw1	Please tell me the main source of drinking water of your household?	1. Piped water 2. Public tap / standpipe 3. Well/hand pump /borehole 4. Tanker truck	5. Cart with small tank 6. Water pouch 7. Other _____

If the answer to Dw 1 is 1 or 2 then ask Dw2 and Dw3; else move to Dw 4

Dw2	How many hours per day water is available from pipe or tap?	(hours/day)
Dw3	Where is the water source located from where do you collect water?	1. At home (Go to Dw6) 2. Very near 3. Near 4. Away from house

If the answer Dw3=4 ask Dw4 and Dw5; else move to Dw6

Dw4	How long it takes to go there, get water (waiting time) and come back?	_____(minutes)
Dw5	How many trips do your household members make per day to fetch the daily requirement of water?	(trips) _____
Dw6	Do you do anything to make the water safer for drinking?	1. Yes 2. No (Go to Dw8)

If the answer to Dw 6 is 1 then move to Dw7; else move to the next section

Dw7	(If Dw6=1)What do you do generally to make water safer to drink? (Circle all that apply)	1. Boiling water 2. Using Alum 3. Adding chlorine tablets 4. Filtering through a cloth 5. Using water filter (ceramic/ sand/composite/ other)

		6. Using electronic purifier 7. Letting the water stand and settle 8. Others, please specify: _____
Dw8	How much your household need to pay for drinking water per month?	Rs. _____ / month

SANITATION

St1	Do you have toilet - latrine facility at your household?	1. Yes 2. No (Go to St8)

If St 1 = 1 then move to St 2; else move to St 8

St2	Do you always use your toilet or go somewhere else also?	1. Always use own toilet 2. Use others toilet 3. Use community toilet
St3	What type of toilet do you have in your household?	1. Flush toilet 2. Pit Latrine 3. Others _____
St4	*[Ask only if St 3 = 1]* Does the toilet flush to a piped sewer system, septic tank, pit latrine or somewhere else?	1. Flushed to piped sewer system 2. Flushed to septic tank 3. Flushed to pit latrine 4. Flushed to somewhere else
St5	How clean is the toilet used by your household members?	0 = Very bad 1 = Bad 2 = Average 3 = Good 4 = Very good
St6	Do other household members use your toilet facilities?	1. Yes 2. No
St7	How many people use your toilet facilities?	_____ (number of people)

(ask the following section if St1=2 or St2=2 or 3.)

St8	How far does your household members go for toilet?	_____ (distance in meters)
St9	What type of toilet facility is that?	1. Public Toilet Facility 2. No facility, Open space or field 3. Others, please specify: _____
St10	Where does the female members go for toilet at night?	1. Public Toilet Facility 2. No facility, Open space or field 3. Others, please specify: _____
St11	Is the place of toilet safe at night?	1. Yes 2. No
St12	Does the toilet facility have regular water supply?	1. Yes 2. No
St13	Do you need to carry water to the toilet facility?	1. Yes 2. No
St14	How clean is the toilet facility used by your household members?	0 = Very bad 3 = Good 1 = Bad 4 = Very good 2 = Average.

St15	How much you need to wait for toilet in the morning hours?	_____ minutes
St16	Where do you dispose of Child's stool?	1. Drain 4. No Child 2. Toilet 3. Any where
St17	How much your household pay for sanitation per month?	Rs. _____ / month

CLEANLINESS HABIT

Ch1	How clean is your surrounding?	1. Clean 2. Somewhat Clean 3. Not Clean
Ch2	How often does your household members cut /clean nails?	1. Atleast once in a week 2. Sometimes
Ch3	Does anyone of your household member have head lice?	1. Yes 2. No
Ch4	How often does your household member generally clean hands after latrine with soap?	1. With soap 2. Without soap 3. Depends
Ch5	How often your household members clean hands before taking food?	1. Always 2. Sometimes 3. Irregular
Ch6	Do you keep cooked foods within utensils with cover/ lid?	1. Always 2. Sometimes 3. Never
Ch7	How does your household member generally clean utensils?	1. With soap 2. With ash/mud 3. Others
Ch8	Do you keep any domestic animal inside or close to your house?	1. Yes 2. No 3. Not having
Ch9	What are the common diseases of your household members in last one year? (Circle all that apply)	1. Respiratory (cough/cold, asthma, lung problem) 2. Digestives (acidity, gas, constipation, diarrhoea) 3. Skin problems 4. Circulatory system (heart problem, BP issue) 5. Nerve related 6. Muscle/Bone related (aches/pains) 7. Genital-urinary problems 8. Eye related 9. Metabolic Disorder (diabetis, thyroid) 10. Others Please specify: _____
Ch10	What are the most common insect/animal which creates problem in & around your house? (Circle all that apply)	1. Mosquito 4. Bed bug 2. Fly 5. Choroach 3. Rat 6. Snake

Ch11	Do you face any problem due to sound, smell, smoke?	1. Sound 1. Yes 2. No 2. Bad Smell 1. Yes 2. No 3. Smoke 1. Yes 2. No

(Fu) FUEL USE

Fu1	What does your household use as the source of cooking fuel? (Circle all that apply)	1. Charcoal 2. Coal/Lignite 3. Liquefied Petroleum Gas (LPG) 4. Biogas 5. Kerosene 6. Electric 7. Wood/Shrub/Crop residue/Dung cake 8. Others Please specify: _____
Fu2	Is the cooking usually done inside the house or outdoors?	1. Inside the house 2. Outdoors
Fu3	How do you mainly cook? Is it in stove, chullah, gas?	1. Kerosene Stove 6. Others 2. Electric stove _____ 3. Chullah with chimney 4. Chullah without chimney 5. Gas
Fu4	How much you need to pay for cooking fuel per month?	_____ / month

(Io) INTERVIEWER'S OBSERVATION

Io1	Type of house	1. Pakka (Paved) 2. Kachcha (Raw) 3. Semi-Pakka (Semi-Paved)
Io2	Main material of the **roof**	1. Asbestos/Tin 4. Clay Tiles 2. Cement 5. Others specify 3. Plastic _____
Io3	Main material of **wall**	1. Tin 4. Tiles 2. Cement 5. Others specify 3. Brick only _____
Io4	Main material of **floor**	1. Cement 4. Tiles 2. Mud 5. Others specify 3. Brick only _____
Io5	Total Number of room/s (excluding kitchen/toilet, passage) in the house?	_____ number
Io6	Separate kitchen?	1. Yes 2. No
Io7	Is there proper light and air in the house?	1. Yes 2. No
Io8	Whether the house is having window?	1. Yes 2. No
Io9	How big is the house? **(Multiply लंबाई x चौड़ाई)**	_____ Sq.foot

Thank you for the response

2. Global Positioning System for Coordinates collection

Date : 31/01/2015

मुख्य व्यवस्थापक
महानगर पालिका,
मुंबई.

विषय : विनंती अर्ज

महाशय,

आम्ही महाराजू नगर मानखुर्द मधील साईबाबा चाळ मध्ये वास्तव्यास खूप वर्षापासून आहोत. आमच्या इथे पिण्याच्या पाण्याची बिकट अवस्था आहे. सरकार तर्फे मदतीने व मंजुरीने आम्ही स्वखर्चाने पिण्याच्या पाण्याची नळ योजना होता. परंतु सध्या वस्ती होण्याच्या विकासकामामुळे व भरणी झाल्यामुळे उंची वाढवल्यामुळे ते पाण्याचे नळ जमिनीखाली दबले गेलेत. कृपया आमच्या पाण्याची सोय व्हावी म्हणजेच आपण सहाय्य करावे हिच विनंती अर्ज आम्ही सहिवाशी करत आहोत.

विनंती करणारे :-

सही.

1. आमाराम शिवाजी साळुंखे :- A.S. Salunkhe
2. चंद्रकांत शिवा कुलंग :- C.B. Kulang
3. संजय जगन्नाथ पाटील :-
4. शिवा रामचंद्र कुलंग :-

Appendix C: Sample Report of Tested Drinking Water

equinox LABS
Testing. Compliance. Training.

EQUINOX TEST CERTIFICATE

Reference Number : EQNX:MUM:LAB: W:15:01:1100 Document No. IV.3.4.R

PARTICULARS OF SAMPLE ANALYSED

Client Name	: Pop Envis	Sampling Protocol	: III.4.1.1 & III.4.1.5
Date of Sampling	: 28-Jan-15	Date of Receipt	: 29-Jan-15
Contact Person	: Ms. Sudha	Date of Start of Analysis	: 29-Jan-15
Sample Description	: BMC Drinking Water	Date of End of Analysis	: 31-Jan-15
Sample Drawn By	: Equinox Solutions	Date of Report	: 4-Feb-15
Sample Quantity & Condition	: 1 Ltr. water in a white H.D.P bottle and 130ml water in a amber tinted sterlized glass bottle. Both bottles are intact without any leaks.		

Sr.No.	Chemical Parameters	Units	Methods	Results of Analysis	Desirable Limits (IS 10500)
1	Turbidity	N.T.U	IS:3025:Part 10:1984	<1	Max 1
2	Colour	Hazen units	IS:3025:Part 4:1983	<1	Max 5
3	pH-Value	-	IS:3025:Part 11:1983	7.28	6.5-8.5
4	Odour	-	IS:3025:Part 5:1983	Agreeable	Agreeable
5	Taste	-	IS:3025:Part 8:1984	Agreeable	Agreeable
6	Electrical Conductivity	µS / cm	IS:3025:Part 14:1984	104.3	Not specified
7	Total Dissolved Solids	mg / l	IS:3025:Part 16:1984	68	Max 500
8	Total Alkalinity, as $CaCO_3$	mg / l	IS:3025:Part 23:1986	18.8	Max 200
9	P - Alkalinity, as $CaCO_3$	mg / l	IS:3025:Part 23:1986	<1	Not specified
10	Total Hardness, as $CaCO_3$	mg / l	IS:3025:Part 21:1983	34	Max 200
11	Chlorides, as Cl	mg / l	IS:3025:Part 32:1988	10	Max 250
12	Calcium, as Ca	mg / l	IS:3025:Part 40:1991	7.6	Max 75
13	Magnesium, as Mg	mg / l	IS:3025:Part 46:1994	3.7	Max 30
14	Sulphates, as SO_4	mg / l	IS:3025:Part 24:1986	<1	Max 200
15	Reactive Silica, as SiO_2	mg / l	IS:3025:Part 35:1988	20.1	Not specified

S.No	Microbiological Parameters	Units	Methods	Results of Analysis	Desirable Limits (IS 10500)
1	Total Bacterial Count	Cfu / ml	IS:5402, 2002	2.4×10^1	Not specified
2	Coliforms	in 100 ml	IS:1622:1981	Absent	Absent
3	Escherichia coli	in 100 ml		Absent	Absent

Remark: *All the parameters tested conform to the desirable limits. Hence Sample is Suitable for Drinking based on the Tests carried out.*

Asst. Manager - Microbiology
(Authorised Signatory)
Ms. P. Gandhalikar

Asst. Manager - Chemistry
(Authorised Signatory)
Mrs. S. Pradhan

EQUINOX SOLUTIONS MUMBAI 400 025.

Note:

1. This report is valid for the tested sample only.
2. Test report shall not be reproduced except in full & with written approval of Equinox Solutions.
3. This report should not be used for advertisement / judicial purpose.

Corporate Office : Equinox Center, R65, TTC, Rabale, Navi Mumbai, 400701
Head Office : 224, Unique, Off V. S. Marg, Prabhadevi, Mumbai, 400025
+91 22 276 44 111 | info@equinoxlab.com | www.equinoxlab.com

An
Equinox Solutions
Company

The Indian EXPRESS

Women in slums forced to defecate in open, say community toilets are unsafe at night

Written by Anjali Lukose | Mumbai | Published:June 28, 2015 12:07 am

12.5 % women defecate in open despite BMC making a provision of Rs.5.25 crore for pay-and-use toilets.

The country's richest civic body has made a provision of Rs 5.25 crore for pay-and-use toilets in the city this year, but women in Mumbai's slums defecate in the open. As many as 85 per cent of those surveyed recently said they perceived community toilets as unsafe at night.

The survey found 12.5 per cent of women in Mumbai's slums defecate in the open at night. The study titled 'Housing, water and sanitation survey of slums in Mumbai 2015', conducted by the International Institute of Population Sciences (IIPS), found that women prefer to take this risk to walking 58 metres, the average distance of the community toilet from their homes.

"Community toilets do not have lights, making it difficult for women to use toilets at night due to safety issues such as theft, being stalked or physical abuse. Men's toilets are relatively better and men pay Rs 2-3 per use if there is a private party providing water and regulating toilets. No such system was found in toilets for women," the report stated.

The study of housing conditions in slums including sanitation facilities was conducted by the Population-Human Settlement- Environment centre (Pop-Envis) of IIPS.

The study found that more than 10 per cent women defecate in the open in slum households of Chembur, Gorai, Borivali East, Dahisar and Kandivali. More than 60 per cent households in the same areas reported unsafe toilets. Slumdwellers in Govandi, Parel, Matunga, Byculla and South Mumbai reported safety concerns with community toilets.

While half the population of slum dwellers in surveyed wards were Maharashtrians, 25.6 per cent were from Uttar Pradesh. A significant 57.9 per cent of the population admitted to disposing of children's faeces in drains or passageways. Despite each household spending an average of Rs 76 per month to use community toilets, 83.5 per cent of the population spoke of poor cleanliness in community toilets and 84.6 per cent complained of irregular water supply.

"With an average waiting time of 20 minutes in morning hours, most slum dwellers skip community toilets and defecate in the open," said Aparajita Chattopadhyay, Pop-Envis project coordinator.

With just an average of six hours of water availability every day and an average of 96.5 minutes spent on water collection per day, hygiene takes a hit. It was found that 28.9 per cent of those surveyed admitted to having a member in the household with lice, 18.9 per cent continued to clean utensils with mud and ash.

"Women in all slums reported strict water timing as the biggest hurdle from productive work for earning as they have to be at home at odd hours to collect water," the report stated.

"The burden on water collection falls not only on women, but also girl children, affecting education. On one hand, we talk of Mumbai being a world class city and it is sad that we cannot provide water to every resident, despite a high court order mandating it.

Moreover, the Human Development Index report of 2009 showed there is one toilet for 200 people. Because of this and poor

The Indian EXPRESS

89.6% of morbidity in slums due to respiratory diseases, reveals IIPS survey

Written by Mihika Basu | Mumbai | Updated: August 7, 2015 1:33 am

The total number of households covered in the survey was 1,452 and the findings represent the overall situation of slum conditions in Mumbai, says the paper.

A huge 89.6 per cent of people living in slums suffer from respiratory diseases followed by digestive problems (41.6 per cent) and aches and pains (37.8 per cent), reveals a survey of slums in Mumbai by the International Institute for Population Sciences (IIPS). The study, which had asked if any member of the household had suffered from the listed morbidity in the past one year, was conducted by the Population-Human Settlement-Environment Centre (Pop-Envis) of IIPS under the aegis of the Ministry of Environment, Forest and Climate Change. The others included eye- related problems (20.7 per cent), blood pressure or heart problems (12.8 per cent), skin problems (12.5 per cent) and diabetes (9 per cent).

The paper says that while cold and cough, seasonal flu and diarrhea are common diseases in the slum areas, most of these slums do not have public hospitals nearby and go to local quacks for treatments.

According to the authors, the survey scientifically selected slum households from six wards that belong to two zones of slum concentration in the Mumbai metropolitan region, that is, one zone with higher concentration of slum population and second zone with lower concentration of slum population. The sample size was calculated based on 42 per cent slum population in Mumbai according to Census 2011.

The total number of households covered in the survey was 1,452 and the findings represent the overall situation of slum conditions in Mumbai, says the paper.

The study shows that the reported pollution problems include sound (46.6 per cent), foul smell (72.7 per cent) and smoke (32.8 per cent).

“Garbage dumping bins are present, generally in the middle or nearby slums, which mostly overflow with garbage leading to scattered garbage thrown on the ground nearby causing foul smell and flies. The municipality provides garbage clearance services in most of the notified slums, but that is irregular and unsatisfactory. Unauthorised slums have no proper system of garbage disposal and most slums experience water-logging during monsoon,” says the study.

It further revealed that while clean fuel, that is, gas is mainly used for cooking, most households do not have a separate kitchen and chimney facility. While 76 per cent use LPG, 48 per cent use kerosene and 14 per cent use wood or dung cake. The perceived unclean slum surrounding stands at 43.8 per cent, whereas the perceived poor cleanliness of community toilets figures at 83.5 per cent. This despite the fact that the mean monthly expenses for using community toilet is Rs 76.

With 85 per cent of the community toilets having irregular water supply, the paper says that none of the community toilets surveyed has adequate water facility inside the toilets and people have to carry water with them. The toilets are generally in poor condition, primarily because of lack of care by the users and poor maintenance by the municipality. “It is more troublesome for children and the elderly, who have to be accompanied by someone to carry water to the toilets. In authorised slums, toilets are cleaned by the municipality and since the services are not regular, almost all slums surveyed have a private party to regularly clean the toilet on payment basis, ranging from Rs 10-20 per household every month. Toilets also lack disposal facility, facility for hand wash or bathing,” it says.

The study also shows that while most residents of authorised slums know about the slum rehabilitation scheme, they have poor experience and apprehensions about the slum transition camps as they are not well-structured for families to live and it especially affects those who work from home or have businesses set up at home.

“They also fear that the contractor and mediators may take a share of this slum development project and will use low quality materials, and may take money for allotments of houses within the building,” it says.

mihika.basu@expressindia.com

The Indian EXPRESS

Dirty Mumbai: 6,400 tonnes of solid waste, 40 pc sewage go untreated

Written by Anjali Lukose | Mumbai | Published:August 10, 2015 1:12 am

Waste segregation at source in the city is at a dismal 10-12 per cent. (Express Archive)

Taxpayers in Mumbai have spent over Rs 13,000 crore towards cleanliness over the past decade. But the city has a lowly 140th rank to show for this massive spending. The Brihanmumbai Municipal Corporation (BMC) had allocated Rs 8,839.5 crore for solid waste management in the last five years, of which Rs 683.56 crore was used for development work and at least over Rs 5,000 crore for sewage disposal. Despite this, the city ranked 140th in the country on the Swachh Bharat survey of clean cities.

In the year-long survey, researchers studied 476 first-tier cities with two parameters — how "minimal" open defecation was in the city, and how robust the municipalities were with the solid waste management system. Swachh Bharat Mission is the flagship sanitation programme of the NDA government, which aims to bridge gaps between sewerage and solid waste management and construct several million toilets in the urban centres. In Mumbai, more than 40 per cent of the city is not connected to sewer lines even now. Navi Mumbai, Mumbai's satellite city, though, saw itself ranked third in the survey.

Of the 9,400 tonnes of municipal solid waste generated in Mumbai each day, the Deonar dumping ground, which has been staring at closure since 2011, receives 3,500 tonnes and Mulund dumping ground 2,200 tonnes. Neither of these dumping grounds currently in use have a waste processing unit, and mostly unsegregated and untreated garbage is simply dumped there, and the garbage catching fire due to the gases formed are common. The recently-opened Kanjurmarg dumping ground now processes 3,000 tonnes of waste. It is the city's only scientific landfill site, where the garbage is processed and methane gas is generated.

According to officials from the solid waste management department, however, the methane gas generation will still take some more months to reach a quantum, when electricity can be generated from it.

The civic body has in its 2015-16 budget proposed to acquire 126 hectares at Taloja outside Mumbai to ease the burden on existing dumping grounds, but the BMC continues to wait for the land to be transferred by the state. To increase awareness on waste management alone, the civic body has made a provision of Rs 15 crore in the 2015-16 budget. Still, waste segregation at source in the city is at a dismal 10-12 per cent.

Despite another solid waste management scheme — clean-up marshals — failing to make a visible impact in the city, the civic body is in the process of re-introducing these 'marshals' who can fine people for spitting and littering in public.

"What we need is a permanent mechanism to not only segregate the waste in our homes (at source) and give incentives to such buildings, but also have permanent employees to enforce penalties on those who litter. The Sena-BJP in all these years has not come up with a policy to address industrial waste from the large informal sector that operates in the city. To make matters worse, there is a bankruptcy of ideas and institutionalisation of solid waste management — the previous AMC was interested in de-centralised waste management and the current one is interested in dumping grounds," said Rais Shaikh, Samajwadi Party corporator.

"Clean-up marshals failed because they became corrupt and a nuisance by themselves by harassing people," he added.

Meanwhile, the data didn't escape political rivals either. At a press conference Friday, former chief minister Narayan Rane said, "The Swachh Bharat campaign will fail in the city as long as Shiv Sena rules it." Interestingly, he was a Sena corporator when the Clean Mumbai campaign was launched. But high population, paucity of land and lax attitude of people are what officials from the BMC's solid waste management department blame for the city's low rank in the survey — something they have raised doubts over.

“The survey has compared small as well as large cities. Navi Mumbai would amount to a ward in Mumbai, in terms of population and size. Further, according to the census report, open defecation in Mumbai is just 2 per cent, much less than Navi Mumbai. We face severe land constraints and all these factors should be looked into while doing such surveys,” said Patil.

The other aspect that the survey considered was open defecation. According to sewerage operations department, at least 60 per cent of the city’s households are connected to sewer lines.

“Most of the unconnected households belong to illegal slums. Around 95 per cent of the developed areas (buildings) are connected to sewer lines, while the remaining are connected to septic tanks that are routinely cleaned by the civic body. We face a lot of constraints in areas that come under defence land, Bombay Port Trust and forest land to get permission to lay sewer lines. In slum areas, there is simply no place to either make public toilets or more importantly to lay new sewer connections,” said Vipinkumar Pandey, Chief Engineer, Sewerage Operations.

“We treat nearly 70 per cent of the sewage before disposing it into the sea. It is quite a challenge given the volume the city generates,” he added.

In the country’s richest municipal corporation, human waste from 36,883 households of the total 26,65,479 are disposed into open drains, according to the Ministry of Social Justice and Empowerment Survey of Manual Scavengers in Statutory Towns. In comparison, Raigad district that includes Navi Mumbai has 5, 96,514 households, of which human waste from 2,704 goes into open drains.

Further, the BMC has made a provision of Rs 5.25 crore for pay-and-use toilets in the city this year, but women in Mumbai’s slums still defecate in the open. As many as 85 per cent of those surveyed recently said they found community toilets unsafe at night. According to the survey, 12.5 per cent of the women in Mumbai’s slums defecate in the open at night. The study titled ‘Housing, water and sanitation survey of slums in Mumbai 2015’, conducted by the International Institute of Population Sciences (IIPS), found that women preferred to take this risk to walking 58 m, the average distance of the community toilet from their homes.

The new plan

A City Sanitation Plan is being formulated by the All India Institute of Local Self-Government in Andheri. According to Prakash Patil, Deputy Municipal Commissioner, Solid Waste Management, the plan for the first ward should be ready in three months.

Former municipal commissioner Jairaj Pathak said strong decision on closure of dumping grounds, bringing private players into waste collection would go a long way in making the city cleaner.

“Deonar and Mulund dumping grounds are oversaturated and they need to be scientifically closed. More garbage should be treated scientifically at Kanjurmarg. In the BMC, solid waste management projects get relegated in the background over other pressing issues. We often forget that no matter how beautiful our drawing rooms are, if our toilets are unclean, there is no point. Mumbai wouldn’t even have come in the top 10 because of its sheer size. Part of Navi Mumbai’s waste collection and management is privatised. In BMC, the safai workers are the highest paid in the country, but often there is dereliction of work or outsourcing. If we privatise to some extent, work can be ensured,” he said.

anjali.lukose@expressindia.com

Appendix E : Photographs

Field investigators collecting quantitative data from the slums. The female respondents are very much active and eagerly participated in the interview.

Ms. Sayyed Rubina

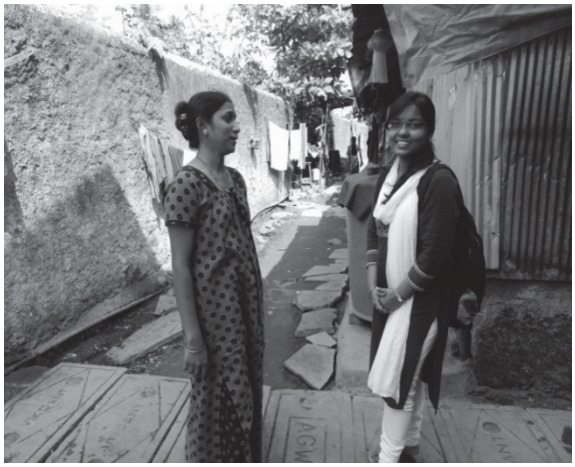
Ms. Priyanka Pawar

Ms. Rani Singh

Mr. Vishal Vasant

Student Volunteers collecting qualitative data from the slums. The respondents are very much active and eagerly participated in the interview.

Ms. Aparna Mukerjee



Ms. Aishwarya

Ms. Arpita Paul

Mr. Rajan Kumar Gupt

Ms. Sudha

Ms. Kaveri Patil

CONTRIBUTORS

Financial Assistance
Ministry of Environment, Forest and Climate Change (MoEF&CC)

Questionnaire, Training and Field Management
Aparajita Chattopadhyay, Chandrakala Ramnayan, Sudha

Quantitative Data Collection
Rani Santkumar Singh, Vishal Vasant Raste, Sayyed Rubina Mohd. Ali, Priyanka Chandrakant Pawar

Qualitative Data Collection
Sudha, Aishwarya, Arpita Paul, Kaveri Patil, Aparna Mukherjee, Rajan Kumar Gupt

Drinking Water Testing
Equinox Labs, Mumbai

Photography
Motilal Mohare, Field Investigators and Students

Cover Photo
Kaushik Dutta – Kids of Govandi Slums, M Ward

Chapter Writing
Aparajita Chattopadhyay
Sudha

Mapping
Sudha

Data Entry Operator
Vaishali D

Process of Printing
M. K. Kulkarni, Dhananjay W. Bansod, Rajesh Art, Sunny Kandera

Special Thanks
Anandi Subramanian
F.Ram
Abhay Kumar, Surjith Karthikeyan, Kumar Rajnish
R.B.Bhagat, Laishram Ladu Singh, K.C Das
Anuradha Mukherjee, Sangeetha Gupta

Suggested Citation: International Institute for Population Sciences (2016)
Housing, Water and Sanitation (HWS) Survey of Slums in Mumbai, 2015;
Population-Environment and Settlement Project (Pop-Envis)

Published on March 30, 2016

Please contact:

Pop-Envis Project
International Institute for Population Sciences,
Govandi Station Road, Deonar, Mumbai 400088
Telephone : 91-22-42372417 / 756
Email : Popenvis@iips.net, iip-env@nic.in, apachat@rediffmail.com
Website: iipsenvis.nic.in

Funded by Ministry of Environment, Forest and Climate Change (MoEF & CC)
Conducted by Pop- Envis, IIPS, Mumbai