Living Environment and Health of Urban Poor

A Study in Mumbai

This paper presents and discusses primary data from a survey of 1,070 households in four poor settlements in Mumbai comprising slum- and pavement-dwellers and squatters on the living environment and health conditions. The study attempts to examine the consequences of socio-economic and environmental factors in terms of income, literacy, sanitation and hygiene for morbidity. The needs of the urban poor and their priorities are seen to be hierarchial. They need first assurance of being allowed to stay where they are and then provision of basic amenities of toilets, water supply, sewerage and drainage.

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Introduction

Urban population in developing countries has grown 6.8 times between 1950 and 2000 [UN 1996]. While it has merely doubled in the developed world in the corresponding period a rapid urbanisation has put tremendous pressure on existing infrastructure and public services; pollution too is on rise and most strikingly, the population of the urban poor is increasing in many developing country cities. Urban poor are largely understood as people living in overcrowded and dilapidated slums or in squatters built on pavements, along railway tracks, besides pipelines, under bridges, on ill-drained marshlands and any vacant land available to them, in the urban areas. Human living conditions in the absence of basic civic amenities such as safe and adequate water supply, sewerage and sanitation and toilets, has been precarious and miserable for the health, safety and comfort in such communities [Hardoy et al 1997]. Due to their unhealthy site location and living and working in pollution-prone environment, it is easily perceived that it is the urban poor who are bearing the brunt of increasing urban environmental problems.

Rural to urban migration has been observed as a major component of urban growth in developing countries, and most of the researchers converge on the opinion that both rural push (rural poverty related) and urban pull factors (city lights) are responsible for this phenomenon [Pernia 1994]. The genesis of slums in the cities, however, is mainly described under the purview of labour market principles, and models such as the Harris-Todaro and Stokes' theory [Pernia 1994, Mehta 1996]. A general observation, however, is that although a newly rural migrant may find it easy to enter the informal job sector in the urban areas, a bulk of such people fail to progress into high wage and formal employment sector. Consequently, the scenario develops somewhat into a shift of rural poverty into urban areas.

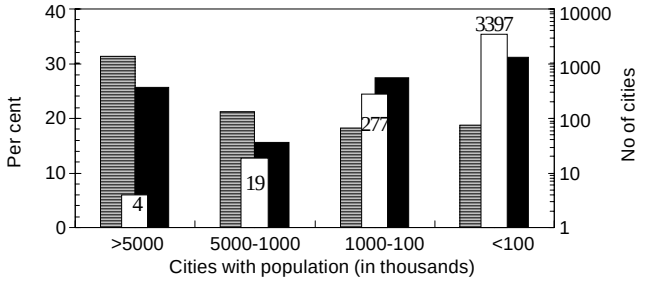
With the rise of the urban poor and degradation of human living environment in developing country cities, a number of notable studies and programmes have been undertaken by academia, government and international agencies in the last few decades. The World Bank, in particular, has been deeply involved in slum improvement programmes in many developing countries since 1970s [Werlin 1999]. The Asian Development Bank in 1995 carried out a comprehensive study on urban poor in Bangladesh to assist government design appropriate policy measures. Swaminathan (1995), has studied the poverty and environmental living conditions of urban poor in particular pavement-dwellers and slums in Dharavi. While many other studies present slum housing problems, environment condition and slum upgrading related policy analyses, fewer studies are found seeking to correlate the degree of health injuries caused by poor human living environment in urban poor communities. In a not completely conclusive study Asthana (1995) relates environmental condition to health status with reference to the slums in Vishakhapatnam, India. Singh et al (1996) has showed that higher incidence of environment related diseases occur in poorer families than in non-poor in a study conducted in Aligarh, India.

This study has been carried out on a relatively larger sample size, about 1,070 households, in four urban poor settlements in Mumbai city, comprising of slums, squatters and pavement-dwellers, in order to study the environmental living conditions and consequent health impacts with particular emphasis on water and sanitation related diseases. The field survey works for this study was completed in the month of May 2000. The main objective of this paper is to present the primary data as obtained in the study as well as some critical analyses on social and environmental health situation of urban poor in Mumbai. Due to limitations in the scope of this paper, however, no attempt has been made to discuss slum policy and management aspects.

Slums in India and Mumbai

In India, the definition of slum is given statutorily under Slum Area (Improvement and Clearance) Act of 1956, which says, "areas where buildings are unfit for human habitation; or are by reason of dilapidation, overcrowding, design of buildings, narrowness of streets, lack of ventilation, light or sanitary facilities or any combination of these factors, are detrimental to

Figure 1: Slum Population in Indian Cities in 1991



☐ Slum population in cities, in percentage.
☐ Share to total slum population in India, in percentage.
☐ Number of cities in the range.

Source: MUD, 1996.

safety, health or morals" [Chakraborti 1995]. Growth of slums in Indian cities seems phenomenonal. Slum population in India constituted 17.5 per cent of urban population in 1981, which rose up to 21.3 per cent in 1991 and the trend has continued [MUD 1996]. The ratio of slum population to total urban population seems ever increasing in bigger cities. For example, the urban areas with population over 5 million (till 1991 they were Mumbai, Calcutta, Delhi and Madras) had, in average, 31.8 per cent slum population in 1991 as compared to 18 per cent in cities less than one million population (Figure 1).

Mumbai (formerly known as Bombay) is presently the largest urban agglomeration in India. With an estimated population of 18 million in 2000, it is the third largest megacity in the world [UN 1996]. It has also the highest absolute numbers of as well as the highest percentage of slum population in India. According to governmental statistics, slum population in Mumbai urban agglomeration (Greater Mumbai Municipal Corporation boundary plus adjoining suburbs) was 4.32 million (34 per cent of total) in 1991, which was estimated to rise up to 5.85 million by 2000 [MUD 1996]. Some literature, however, estimates this figure up to 7.5 million within the boundary of Greater Mumbai Municipal Corporation alone by 2000 ([Sharma and Narender 1996]. Slums in Mumbai are scattered all over but a general distribution is 17 per cent in Main Island City, 46 per cent in inner suburbs and 37 per cent in further extended suburbs [Afzulpurkar 1995 in O'Hare et al 1998].

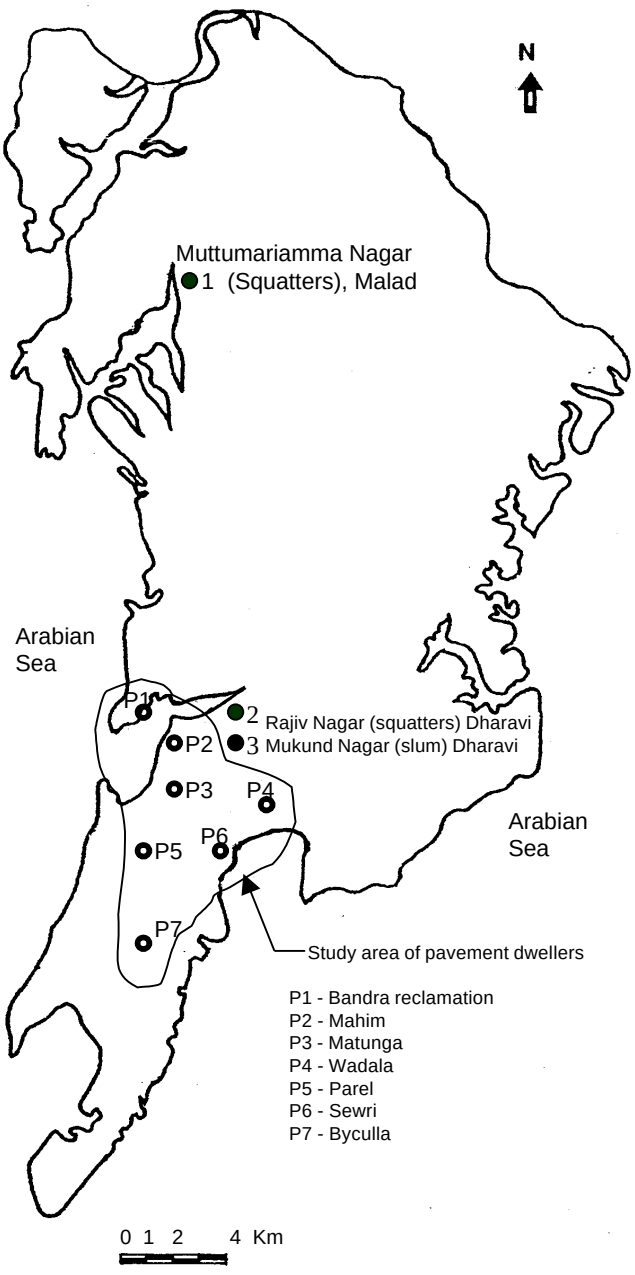
Study Areas and Methodology

Study Sites and Characteristics

Four different urban poor settlements of Mumbai consisting of: one slum, Mukund Nagar of Dharavi; two squatters, Muttumariamma Nagar at Malad and Rajiv Gandhi Nagar of Dharavi; and pavement-dwellers from around Bandra, Mahim, Matunga, Wadala, Parel, Sewri and Byculla, were chosen under this study (Figure 2).

Muttumariamma Nagar is a squatter settlement in Malad, a rapidly growing northern suburb in the northern fringes of Mumbai and has seen a flourishing real estate business. It is settled adjacent to a filthy drainage channel and the entire terrain is low lying, prone to frequent flooding during rain. Mukund Nagar (MN) and Rajiv Gandhi Nagar (RGN) respectively are two slum and squatter communities belonging to Dharavi. Dharavi is notoriously famous for assuming the status of being the largest slum

Figure 2: Map of Greater Mumbai and Location of Study Sites



in Asia [Desai 1988]. It is, in fact, an agglomeration of several small slum communities that has expanded over an area of about 2.1 km^2 and inhabited by over 5,00,000 population. Mukund Nagar and Rajiv Gandhi Nagar, possess a characteristic difference in the sense that the former is a slum, situated in the core zone of Dharavi and inhabited by relatively older and better off families, while the latter is a newer squatter settlement built over the Mahim creek bounded by the Sion station road and Nayak Nagar Road.

Pavement-dwellers surveyed in this study were from central region of Mumbai. Based on the living condition and their legal status, they could also be categorised in two groups. One are the relatively old settlers who have been recognised and tolerated by the government. Apparently their housing conditions are

relatively better and they enjoy some privileges such as ration card, voting right, water supply and electricity connection. Most of them also enjoy care from some NGOs operating in their areas. The other group comprises newer settlers, apparently wanderers and the homeless. It is they who often bear the brunt of house demolition and eviction by the municipal authorities. The authors themselves have seen several scenes of hut demolitions being carried out by the municipality at the time of this study. We have picked up households from both these groups almost in a similar proportion to their numbers in the sites located for study.

Sampling and Data Collection

For data collection, a questionnaire was administered by the interviewer taken at each household door. Sampling was done thoroughly in the ratio of approximately 1 in 5 of the study area households. The target respondent was either head of household or his/her spouse. In few cases, adult children or their close relatives were also considered if judged appropriate. The term household in this study refers to the family members living in a dwelling and sharing the same kitchen. The sample size and total estimated population of the study area is presented in Table 1.

The survey was carried out with the assistance of two local NGOs (Bombay Urban Industrial League for Development, BUILD; and Youth for Unity and Voluntary Actions, YUVA), which particularly facilitated the smooth access to the slums. Keeping in view that target respondents could be illiterate and spoke (Marathi) or other native languages only, bona fide interviewers were appointed, most being from the graduate school of social science at Bombay and SNDT Universities, who were later given orientation training on the proper way of dialogue with urban poor.

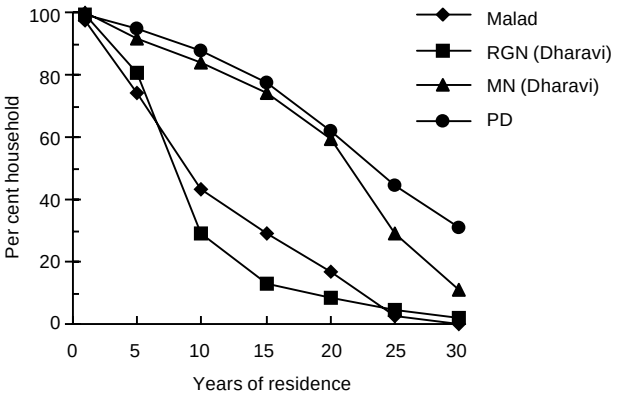
The questionnaire for data collection was organised in such a way so as to get information on four broad perspectives: socio-economy, living environment, environmental health, attitude and environmental awareness. Information that could be self-assessed such as housing structure and their physical condition were noted down by data collectors (interviewer) themselves on a pre-defined checklist. Quantity of daily water consumption has been estimated based on both the information received from the respondent and verifying the size of water storage tank or vessels available in their home. Similarly, identification of true type of morbidity and their frequency were decided after dialogue between respondents and interviewer. Other specific methodologies, assumption and underlying procedures adopted in this study have been explained in the text wherever needed.

All data obtained from questionnaires were fed in MS Excel spreadsheet and SYSTAT 9.0 software package for subsequent analysis. Major statistical analyses performed are Pearson's correlation, Parametric hypothesis tests (one-way ANOVA),

Table 1: Population and Sample Size of Study Area

Settlements	Study Area Total (Estimated)		Sample Size	
	Household	Population	Household	Population
Muttumariamma Nagar, Malad	1200	5700	312	1486
Dharavi, Rajiv Gandhi Nagar (RGN)	1500	7600	358	1822
Dharavi, Mukund Nagar (MN)	800	4300	114	611
Pavements-dwellers (PD)	unknown	unknown	286	1316
Total			1070	5235

Figure 3: Structure of Length of Stay of Slum Residents



non-parametric tests (Chi-square, Kruskal-wallis one-way ANOVA, Mann-Whitney U-test) and Kendall's coefficient of concordance.

Results and Discussion

Socio-Economic Profile

Migration and age of settlement: An immigrant in this study refers to those households whose head was born in an other place than the present residence in the slum or community. On that basis, percentage of immigrants appears to be about 90 per cent in Malad and Rajiv Nagar, 78 per cent among pavement-dwellers and 70 per cent in Mukund Nagar, Dharavi (Table 2).

Most of the immigrants in slums are from outside Mumbai. Of them 68-85 per cent are of rural (village) origin and more than 75 per cent primarily came to Mumbai for employment. The immigrants come from various places around India but one or few groups dominate in certain areas. For example 61 per cent households in Muttumariamma Nagar have come from a certain part of Tamil Nadu. Similarly, a majority of people from Uttar Pradesh are in Rajiv Gandhi Nagar and from Maharashtra and Karnataka states at Mukund Nagar. Regarding pavement-dwellers, about 60 per cent are natives of Mumbai or from within Maharashtra. Most of the slum households retain connections with their native places, visit at least once a year and also host guests (from native places) frequently. The authors observed such guests in a number of families during this survey works. In general, such rural-urban linkages might have played a vital role in the expansion of slums by facilitating the easy access to slums by newer migrants and providing a sense of social support to settle in the slums.

The length of stay of households in a community reveals several aspects of dynamics of the urban poor. Although, the true age of the settlements cannot be ascertained from Figure 3, yet it reflects on the mobility, more specifically influx patterns, in a particular community. Surprisingly pavement-dwellers are found to be the oldest and more permanent residents among all urban poor, followed by Mukund Nagar slum and then the remaining two squatter settlements. About 31 per cent of pavement-dwellers appear to be living in such a state for more than 30 years, i e, for more than a generation. Nearly 60 per cent households in Mukund Nagar have lived for at least two decades. But Muttumariamma Nagar and Rajiv Nagar could be the newest, and probably still expanding ones, evident by the steady influx

of people in the settlement each year and none have lived for more than 30 years.

On such testimonies as the ration card holder and name in the voting list, about 60 per cent in Muttumariamma Nagar and Rajiv Nagar, 68 per cent among pavement-dwellers and 95 per cent in Mukund Nagar have reportedly gained residency status.

Education and employment: Mean family size of households is five in all settlements. Not literacy but attainment of primary education (grade 5) and children attending school were surveyed in this study. Attainment of primary education is found to range between 22 to 53 per cent (average 33 per cent) in females (wife of house head), 38 to 72 per cent (average 56 per cent) in male (house head) and 46 to 90 per cent (average 70.2 per cent) among young children (Table 2). The 1999 statistical data of India presents the current literacy rate in India as 56 per cent (male- 68 per cent, female- 43 per cent) in rural and 80 per cent (male- 88 per cent, Female- 72 per cent) in urban areas [CSO 1999]. Although true comparisons cannot be made, the education level of urban poor appears nearly the same as in rural people but less than the average of urbanites. The pavement-dwellers have the least education of all. Analysing the various levels of education received by the head of the households, it was found that while 62, 49, 38 and 28 per cent people are illiterate or below primary education level; only about 1.3, 2.4, 6.7 and 17 per cent have attended college among pavement-dwellers, Malad, Rajiv Nagar and Mukund Nagar respectively (Figure 4). The data also show that 41 per cent households of pavement-dwellers, 29 per cent in Malad and 13 per cent in Rajiv Nagar weren't sending any of their children to school.

The three major occupations among main wage earners, i e, of the house heads, are – as providing labour (free labour or regular workers in construction/factory), 41 per cent; service (clerical or technical job in public or private offices), 24 per cent; and business 26 per cent (Table 2). While almost half the house heads in Muttumariamma Nagar and Rajiv Nagar, work as labourers, the same proportion in Mukund Nagar are engaged in service and business respectively. This substantiates the fact that education level and location of residence have influence on the employment type. The major businesses run by pavement-dwellers are street vending, hawking, petty shopkeeping and selling handicrafts. Ratio of women engaged in earning jobs is about 53, 19, 25 and 30 per cent in Malad, Rajiv Nagar, Mukund Nagar and among pavement-dwellers respectively, however, in average 38 per cent of all work as housemaids (domestic worker). The higher ratio of working women at Malad is attributed to the greater opportunity of women orientated work in the vicinity of real estates. Among pavement-dwellers, ragpicking is another common occupation among 11 per cent males and 19 per cent females. For children (below age 16) employment ratio was found at 10, 4, 4.4 and 7.4 per cent in Malad, Rajiv Nagar, Mukund Nagar and pavement-dwellers respectively.

Income and poverty: Literature obtained in household survey data on income is often understated and hence obtained information does not necessarily truly reflect the actual income of the household [Islam et al 1996]. Alternatively, researchers frequently choose consumption expenditure as proxy income in poverty determination, but it is also not immune to weaknesses as sometimes expenditure met by loans or credit result in inflated expenditure. In this study, therefore, we followed a combined approach, that is the data on average monthly income and expenditures were interviewed separately and real income was considered as the higher of the two. This might have resulted in some positive biases in income calculation but the minimum percentage of household under poverty line could be better ensured. In calculation, income side made up the aggregate of average monthly incomes of all the members in a household. Similarly, the expenditure side consisted of monthly average expenses on food, land and house renting, utility charges, education, medical expenses, transportation, recreation, regular savings and an added 10 per cent for clothing and miscellaneous

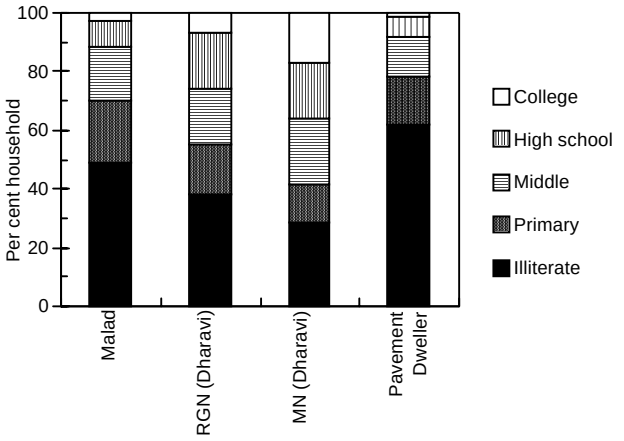
Table 2: Socio-Economic Profile of Urban Poor in Mumbai

Parameters	Malad	RGN-Dharavi	MN-Dharavi	Pavement-Dweller	Total
A Migration					
Immigrant to the city (based on househead's birth place)	89	90	69	78	82
Original place as rural (village)	68	84	71	NA	74
Employment as purpose of migration	86	77	73	83	80
B Household size, persons, mean	5 (2)	5 (2)	5 (2)	5 (2)	5 (2)
C Education: (at least grade 5 completed)					
Adult: male (main couple)	51.9	62.1	72.2	38.1	56.1
Female (main couple)	28.3	29.8	53.3	22	33.4
Average of main couple	39.2	46.2	62.8	29.3	44.4
Children: (attending schools or at least grade 5 drop out)	65.1	80.3	89.3	46.1	70.2
D Employment type					
Househead (male or female):					
Service (public or private office)	25	13	49	8	24
Own business	15	27	13	47	26
Bound labour (in factory/construction)	29	29	26	12	24
Daily wage labour (free)	22	22	7	18	17
Female (wife of male househead):					
working ratio	53	19	25	30	32
Labour as domestic work helper	62	27	32	32	38
E Income and expenditure					
Median household Income, Rs/month	3070	3185	4000	2695	3238
Share of expenditure on food items	50 (17)	56 (17)	53 (17)	57 (18)	54 (17)
F Households in poverty					
Food expenditures becoming more than 75 per cent of total income	3.9	7.8	8.3	13.5	8
Nutrition based poverty line income criteria*	38.5	37.8	29.9	47.9	38.5

Notes: All figures are in percentage unless specified. ( ) standard deviation. NA- Not Available.

* Procedure adopted from Islam et al 1997.

Figure 4: Education Attainment of Heads of Households (Male)



expenses. On this basis, the median family income has been found as Rs 2,695 per month (Rs 32,340 per year) among pavement-dwellers to Rs 4,000 per month (Rs 48,000 per year), the highest, in Mukund Nagar (Table 2). The India Human Development Report, 1999, reports average monthly family income of rural people as Rs 29,929 per year in Maharashtra and Rs 25,653 per year in India [Shariff 1999]. The average income of other urban people could not be available but compared to rural people, these urban poor seem better off.

Regarding poverty, although this paper does not intend to go into deeper analysis, we analysed it for two basic scales of poverty measurement: per cent expenditure (of total income) on food items and poverty line income based on normative food requirement. The calculation procedure and nutritional norms for the latter was followed from Islam et al 1997 incorporating the commodity prices of Mumbai's retail market. This revealed poverty line income as INR 24 per person per day (INR 720 per person month). The families spending more than 75 per cent of their income on food is at the most 14 per cent in pavement-dwellers, others being less than this. However, the poverty line income criteria puts 39, 38, 30 and 48 per cent of households under poverty in Malad, Rajiv Nagar, Mukund Nagar and pavement-dwellers respectively (Table 2). The average of all settlements, which comes to 38.5 per cent, appears comparable to urban poverty level in Maharashtra, 37.5 per cent, but little higher than urban poverty in India, 32.4 per cent, during early 1990s [IDR 2000]. Referring to Operations Research Group's (ORG India) estimate Swaminathan (1995) mentions that households under poverty was 27 per cent in Mumbai metropolitan region, 45 per cent among slum dwellers in 1989.

Environmental Living Conditions

Land and housing: Squatters in Mumbai are seen anywhere in public or private lands. Public lands mainly belong to three governmental authorities; municipality, Maharashtra state and the central government. Tenure in the squatters is of mixed type, some have occupied the land and built houses by themselves, others live as renters, but both illegally. The rent payers probably pay rent to the first occupier, proxy owner, without the notice of real landowner. In this study, 44 per cent households in Malad, 16 per cent in RG Nagar and 11 per cent in pavement-dwellers were found living as renters. However, 85-90 per cent squatter residents seemed scared of possible eviction and house demolition by government.

Housing in slums and squatters has both the anticipated problems of extreme congestion and bad condition (weak structure) of houses. More than 90 per cent households live in a single room tenement. The median floor area of houses is typically 10 m^2 (2.2 m^2 per capita) in slums and 8 m^2 (1.6 m^2 per capita) in pavement-dwellers (Figure 5).

Although Mukund Nagar is relatively better off in terms of household income and education level, the problem of congestion (overcrowding) remains. Streets are along gullies made for sewage and storm water drainage, which can be hardly one metre in width. Condition of housing was assessed in terms of building materials and present livability condition. Depending on materials, the houses were categorised as flimsy-made of clothes, plastics, cardboard and bamboo stems; semi-permanent-weakly fabricated with wood, tin, metal sheets and cement tiles; and permanent-building with cemented brick and reinforced concrete. Though conditions differs considerably from pavement-dweller to squatters and slum, overall 33 per cent houses are flimsy, 39 per cent semi-permanent type and 28 per cent cemented buildings (Table 3).

Table 3: Housing, Water Supply and Sanitary Condition in Urban Poor Community

Parameters	Unit	Malad	RGN-Dharavi	MN-Dharavi	Pavement-Dweller	Total
A Housing						
Single-roomed households	per cent	98	95	74	100	91.8
Housing space per family, Median (80p)	m^2	9.3 (14)	9.3 (14)	11.2 (19)	7.5 (11.2)	9.3
House type (structure):						
Flimsy (clothes, plastic, paper, bamboos)	per cent	31	37	0.4	62	32.6
Semi-parmanent (wood, tile, metals)	per cent	46	32	47.6	29	38.7
Permanent (cemented brick and concrete)	per cent	23	31	52	9	28.8
B Water						
source as municipal tap water	per cent	100	100	96	99	99
Private tap connection	per cent	9.2	14	41	2	16.6
Median nos of households per shared tap	Nos	30	20	13	NA	21
Per capita water use quantity, Median (80p)	l/d	26 (42)	27 (50)	33 (50)	25 (42)	28
C Wastewater discharge						
Access to Sewer	per cent	0	0	6	0	1.5
Discharging in gutter or open outside	per cent	100	100	94	100	98.5
D Toilet						
Households using toilets	per cent	0	42* (64)**	97	56	51
Households practising open defecation	per cent	100	58* (36)**	3	44	49
Population load per toilet seat of public or community toilets, Mean	Nos	NE	129	93	101	108

Notes: NA- Not Available; * Male, ** Female; NE- Toilet not existing in the community.

Figure 5: Per Capita Housing Space in Urban Poor Settlements

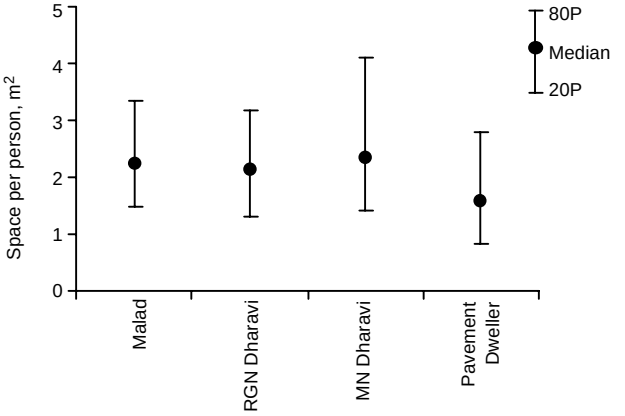
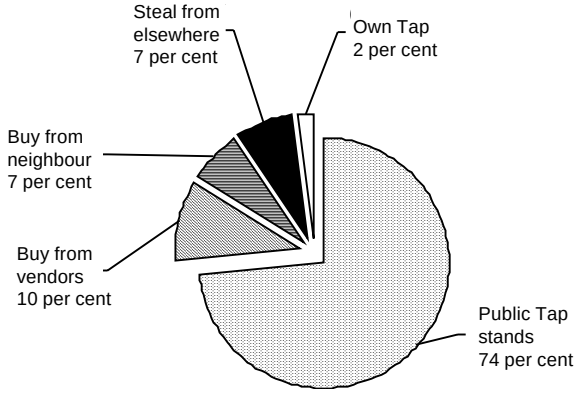


Figure 6: Water Source among Pavement-Dwellers



Water consumption and quality: Almost all households in slum and pavements rely on the municipal water supply for all purposes from drinking and bathing to kitchen and laundry. Metropolitan Corporation of Greater Mumbai (MCGM) is responsible for the delivery of water in Mumbai. Unlike in other civic resident quarters, water tap connections in slums is generally given to a group of households to be shared in common. The main reason, as learnt from an MCGM official, is that the housing conditions and area, which is too small, does not favour the individual tap connection. Therefore the set criterion is five households per tap connection. But in reality the number of households per tap is much higher. It couldn't be known if the situation was due to resident's own choice or authority's failure to supply taps in adequate numbers but, as per data obtained, median number of households sharing a tap is observed as 30 in Malad, 20 in Rajiv Gandhi Nagar and 13 in Mukund Nagar (Table 3). In contrary, however, about 10 per cent households in Malad, 14 per cent in Rajiv Nagar and 41 per cent in Mukund Nagar were also found having individual taps. Regarding pavement-dwellers, they fetch water in various manners and sources such as, 74 per cent from municipal stand posts, 10 per cent buy from vendors, 7 per cent buy from neighbouring house and remaining 7 per cent obtain it free either from neighbour or stealing from elsewhere (Figure 6).

Water consumption among urban poor, in general, seems extremely low. The median per capita daily water consumption has been found as little as 26, 27, 33 and 25 LPCD (liter per capita per day) in Malad, RG Nagar, Mukund Nagar and pavement-dwellers respectively (Figure 7).

This figure is far less than the average consumption of Mumbai, i e, 135 LPCD. Some literature mentions that this situation is likely under present biased water distribution norms of MCGM, which differs greatly across the geographical region and socio-economic groups. YUVA (2000) cites that MCGM has criteria to provide water at a rate of 45 LPCD to slums, 90 LPCD to chawls (lower middle class people's apartments with common bathroom and toilets) and 135 LPCD to flats (middle- to higher-class people's residence). And the tap connections and supply timing have been synchronised accordingly.

The water supply in slum and squatters under study is intermittent, which is usually only four hours a day between 6 and 10 am in the morning. Overall, a number of factors are apparent to aggravate the water scarcity problem in urban poor and consequent low consumption of water. For example, water supply hour is very less, users are too many to a tap, water storage capacity of the residents are limited due to small houses and lack of large vessels, etc.

Table 4: Point Prevalence Rate of Short Duration and Chronic Diseases among Urban Poor

	Short Duration Morbidity,		Major (Chronic) Morbidity,	
	Household with at least One Member Sick at the Time of Survey	Percentage of Persons	Household with at least One Member Sick at the Time of Survey	Percentage of Persons
Muttumariamma Nagar	29	7.3	15	4
RG Nagar Dharavi	26	6.6	16	3.4
Mukund Nagar Dharavi	15	3.8	19	3.9
Pavement-dwellers	32	8.1	25	6.4

Table 5: Point Prevalence Rate of Selected Major Morbidity among Urban Poor

	Prevalence (Per thousand Pop)				Percentage Family Having at least One Patient			
	Malad	RGN	MN	PD	Malad	RGN	MN	PD
TB	13	9	6.5	18	4	4	4	7
Asthma/respiratory	7	8	6.5	11	3	4	4	5
Diabetes	2	2	3.3	9	1	1	2	3
Hyper-tension	0	4	1.6	4.6	0	2	1	2
Gastrics	4	2	4.9	3	2	1	3	1
Heart	5	3	0	3.8	2	1	0	2
Cancer	1	1	0	4.6	1	1	0	2

Table 6: Annual Cases of Select Water-Related Diseases among Urban Poor

	Total Cases Per Thousand Population Per Year			
	Muttumariamma Nagar-Malad	Rajiv Gandhi Nagar-Dharavi	Mukund Nagar-Dharavi	Pavement-Dwellers
Diarrhoea	94*	287	334	614
Typhoid fever	36	38	46	68
Cholera	3	26	7	1
Hepatitis A/jaundice	15	30	13	68
Malaria	59	26	44	126
Poliomyelitis	3	0	2	2
Intestine worms	98	1	133	353
Skin diseases	77	167	31	68
Eye infections	24	38	47	79

Note: * This figure is unlikely lower (authors suspect possible manual error in this part)s.

Figure 7: Per Capita Daily Water Consumption of Urban Poor

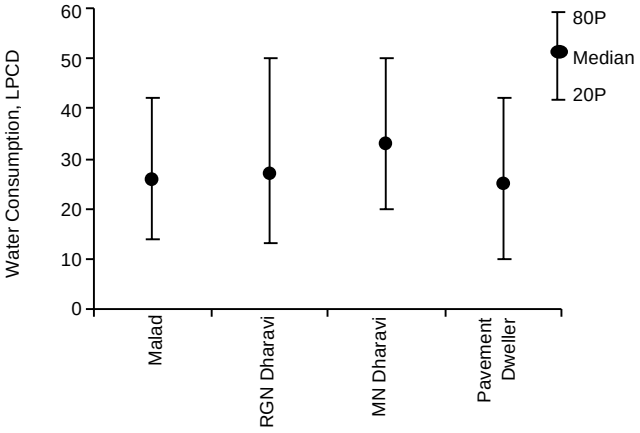
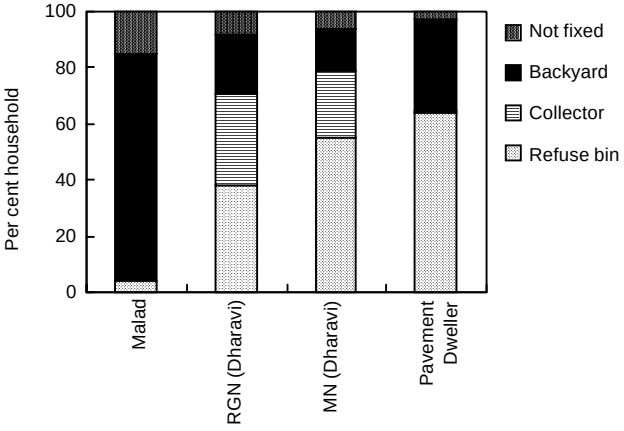


Figure 8: Solid Waste Disposal Practice in Urban Poor Settlements



Contamination of supplied water in the pipeline is also a problem in Mumbai. We examined few samples of drinking water from the taps in slums but could not detect bacterial contamination at the time. However, MCGM's laboratory data reports that 8-10 per cent of water samples taken at consumer's tap were contaminated by coliform bacteria and unfit for consumption in 1997 and 1998 [MCGM 1999]. In slums, none of the households use any kind of scientific devices for pathogen killing or germs filtration. In the study, only about 14 per cent households in Malad, 5 per cent in Rajiv Nagar and 11 per cent in Mukund Nagar have responded that they boil water before consumption whenever they observe it dirty (identification is contamination is merely based on visual examination of dirtiness of water).

Sewer, drainage and toilet facilities: None of the urban poor, except 6 per cent of households in Mukund Nagar, under study are served by any conventional sewerage system. In the slums, typically a small narrow gutter (mostly open or partially covered) is found between the rows of dwellings that serves for all types of drainage including the sewage water. Since such drains are also not technically designed and laid out, they often get clogged and water spills over. Most part of Rajiv Gandhi Nagar even lacks such gutters and households simply spill outside the dwelling. In this respect, pavement-dwellers seem to be in a bit better position because they enjoy large open space around or road curbside drain. About 30 per cent of pavement-dwellers responded that they discharged sewage into road side storm water drain.

Toilet is one of the most serious and common problems among all urban poor. Private toilets attached to dwellings is virtually non-existent in slum and squatters under this study. Some settlements are partially provided with community toilets (Mukund Nagar and some pavement-dwellers) or public toilets in the locality. However, a large portion of population practice open defecation in nearby open spaces and drains. There is no single toilet seat in Muttumariamma Nagar with population over 5,000 and everybody defecates in the open. In Rajiv Gandhi Nagar too, there is no toilet as such within the community but about 42 per cent male and 64 per cent female responded they manage to go to far-off public toilets in other parts of Dharavi (Table 3). Some urban poor's expression of the toilet, especially of women as perceived during study, simply meant a nightmare. Among pavement-dwellers, 44 per cent households practice open defecation. In Mukund Nagar, however, almost 97 per cent of the households have access to community toilet.

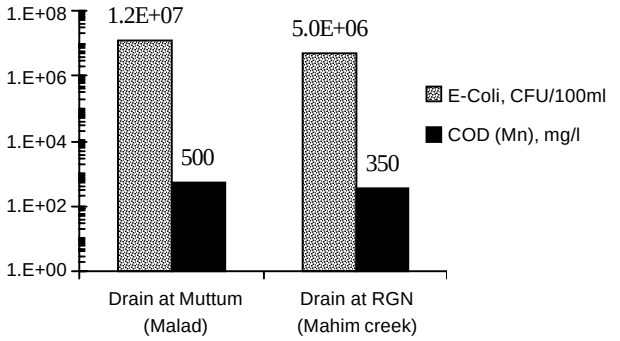
Public toilets in Mumbai have been provided by municipality (on municipal lands), NGOs (such as Sulabh International) and other citizen groups. But the demand always surpasses the supply. As per a report, BMC has so far constructed 12,612 (of them nearly 30 per cent are not functional) municipal toilet seats but the demand is in the range of 1,00,000 seats [Dsouza 1998].

Table 7: Results of ANOVA and Kruskal-Wallis Test

	N	DF	ANOVA			Kruskal-Wallis		
			F-ratio	Probability, Y, P	Null Hypothesis 1Per Cent Significant Level	Test Statistic	Probability, p	Null Hypothesis at 1 Per Cent Significant Level
Per capita housing space								
All four settlements	942	3	9.131	<0.000	reject	39.61	<0.000	reject
Excluding PD (3)	693	2	3.344	0.036	accept	3.296	0.192	accept
Per capita water consumption								
All four settlements	1034	3	4.004	0.008	reject	16.5	0.001	reject
Excluding PD (3)	752	2	2.44	0.088	accept	8.233	0.016	accept
Population per toilet seat								
All four settlements	228	2	2.575	0.078	accept	2.343	0.31	accept
Excluding PD (3)	120	1	3.212	0.076	accept	1227.5	0.102*	accept
Family income								
All four settlements	1069	3	28.47	<0.000	reject	66.34	<0.000	reject
Excluding PD (3)	784	2	20.186	<0.000	reject	27.387	<0.000	reject
Literacy								
All four settlements	1070	3	48.52	<0.000	reject	126.29	<0.000	reject
Excluding PD (3)	784	2	29.592	<0.000	reject	54.853	<0.000	reject

Note: * Mann-Whitney U-test.

Figure 9: Water Quality in Two Drainage Channels in Mumbai



Consequently, existing toilets are overloaded. We attempted in estimating the actual number of users per toilet seat by interviewing some regular users in that locality. Although the replies varied greatly, median value showed as much as 93, 101 and 129 person per toilet seat in Mukund Nagar, pavement-dwellers and Rajiv Gandhi Nagar respectively.

Solid waste disposal and neighbourhood pollution: Solid waste disposal in slum came across both technical (lack of refuse bin in the vicinity) and socio-economic (lack of adequate awareness) problems. This paper, presents briefly the practice of garbage disposal in the study area.

As shown in Figure 8, more than 80 per cent households at Muttumariamma Nagar throw garbage into the adjacent drain. When asked for the reason, while some 21 per cent households said no municipal bin was provided in the community, a majority (60 per cent households) have misconceptions (ignorance) that the drain (which has flowing water in it) is safe to do so. In other communities, 15 to 33 per cent households were found throwing garbage elsewhere than in the designated place. In respect of pavement-dwellers, although as much as 64 per cent households reported they throw garbage in the refuse bin, it seems unlikely that they really did so.

Neighbourhood pollution in this study was mainly dealt with in connection to the water pollution. In study areas, Muttumariamma Nagar and Rajiv Nagar were two such sites right on the banks of storm drainage canals, but heavily loaded by sewage. Therefore we took the samples of drainage water and analysed it for some biological and chemical properties. As per the results, COD_{Mn} (chemical oxygen demand that measures content of organic matters) and Escherichia Coli (indicator for fecal contamination) were found in the range 350 to 500 mg/l and 5×10^6 to 1.2×10^7 colonies/100 ml of water, respectively (Figure 9). This is a characteristic of sewage.

Environmental Health Conditions

Environmental problems and consequent public health impacts have been well studied and documented (for example, see Hardoy et al 1997; World Health Organisation reports). While pollution and poor sanitation are the root of several diseases, overcrowding, poverty and nutrition related factors lead to easy contraction and transmission. In this study, we collected data on short-duration (acute) morbidity and major (chronic) morbidity, both on point of time basis, and annual cases of some selected water-related diseases separately in all four urban poor settlements. Short duration diseases accounted for the illness of short and acute type, such as fevers, cold and coughs, and water-borne diseases. Similarly, major morbidity included chronic diseases such as tuberculosis, asthma, cancer and so on. The term 'water-related' envisages diseases under four categories; water-borne, water-washed, water-based and water-related insect vector as designated by Bradley [White et al 1972, Hardoy et al, 1997]. The illness reported in this study, however, was based on the respondents' used expressions that they had picked up from doctor, paramedical persons or by showing the lay symptoms but this doesn't necessarily constitute clinically confirmed cases. Although deliberate attention was paid, some biases could have been incurred mainly due to shyness of respondents in reporting some diseases.

Point prevalence of morbidity: Information on all types of morbidity (illness) occurring in the urban poor at the time of survey was collected and classified under short duration morbidity (SDM) and major morbidity (MM). The incidence of

Table 9: Urban Poor's Willingness Towards Resettlement

Slum	Households, N		
	Agree	Not Agree	Total
Muttumariamma Nagar, Malad	220	71	291
Rajiv Gandhi Nagar, Dharavi	186	143	329
Mukund Nagar, Dharavi	53	55	108
Pavement-Dwellers	250	13	263
Total	709	282	991

Note: Chi-square (χ^2) test: DF = 3, S L = 1 per cent, Critical Chi-square = 11.34 Observed Chi-square = 137, Result: Significant.

Table 8: Urban Poor's Perception and Ranking of Problems (1-Most Serious)

Issues	Malad		MN, Dharavi		RGN, Dharavi		PD		Overall
	Rank	Severity	Rank	Severity	Rank	Severity	Rank	Severity	Rank
Toilet	1	ES	2	M	1	ES	3	M	1
Drinking water	2	M	3	L	2	M	4	M	2
Housing condition	4	M	4	L	3	M	2	M	3
Land ownership	3	M	5	L	4	M	1	M	4
Sewer and drainage	5	L	1	M	5	M	6	M	5
Poverty (food)	7	L	7	L	6	M	7	M	6
Unemployment	8	L	8	L	7	M	5	M	7
Solid waste disposal	6	L	6	L	8	L	8	L	8
Health care facilities	9	L	9	L	10	L	10	L	9
Social safety	10	L	10	N	9	L	9	L	10
Sample size, N=	90	309	22	114	75	343	45	276	4
Kendall's coefficient of concordance, W=	0.44		0.56		0.45		0.58		0.87
Three slums only, W=	0.92								

ES- Extremely Severe, M- Moderate, L- Little, N-No problem.

Figure 10: Type of Short Duration Morbidity among Urban Poor

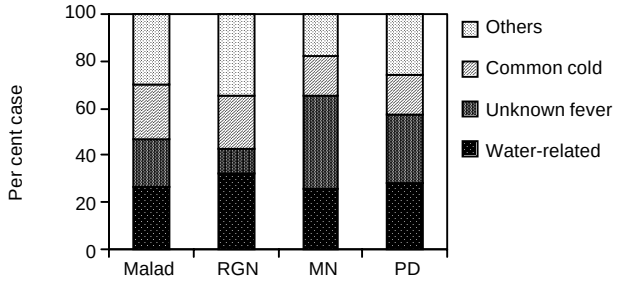
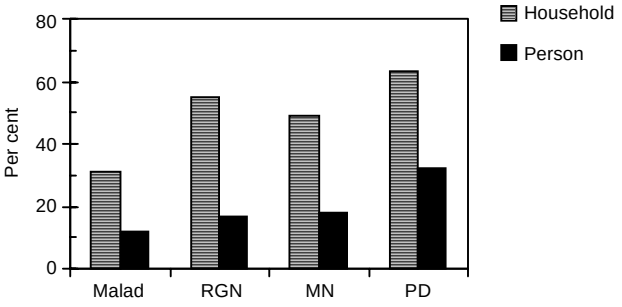


Figure 11: Annual Occurrence of Water-Related Diseases among Urban Poor



cold and cough, unspecified fever, water borne disease were considered under short duration diseases, and nearly 15 diseases including tuberculosis (TB), hypertension, diabetes, heart diseases, cancer, leprosy, and AIDS were assumed under major or chronic diseases.

Based on the result, it is revealed that overall, at any moment about 30 per cent households have at least one person sick, or 4-8 per cent of slum population is suffering from any kind of short duration illness. Similarly, further 20 per cent households have either at least one patient, or 3-6 per cent population, of chronic diseases at any point of time (Table 4).

Among short duration disease, more than one-fourth of sickness is accounted for by water-related diseases (Figure 10).

Regarding chronic diseases, whereas most of the diseases show a higher prevalence rate, tuberculosis and asthma in particular appear the most severe (Table 5). For example, tuberculosis (TB) patients number 7 to 18 per thousand population in urban poor as compared to only 3.3 per thousand in Mumbai as a whole and 4.2 per thousand in India.

Among urban poor, the prevalence rate of all short duration as well as major diseases seems higher among pavement-dwellers than in slums, which could be attributed to greater poverty and harsher living conditions of pavement-dwellers.

Annual prevalence of water-related diseases: Polluted drinking water, insanitary living conditions (lack of sewerage and storm water drainage, improper solid waste disposal and open defecation close to living spaces), poor personal hygiene and food cleanliness, all contribute to water-related diseases. In order to take account of seasonal effects (monsoon or dry weather) on the occurrence of water-related diseases, we attempted to estimate the total morbidity cases of some selected (also common) diseases in a year's period (within last one year back from the time of survey). But the approach again relied on the respondent, who had to give a true account of the previous year's morbidity history. This anticipated some error on individual respondent's part, which might or might not have been offset in the sum for a community. So, we call this result only estimation which is presented in Table 6. It accounts for the total of incidence, including the account of repeated infection of a disease in the same person.

Almost all diseases show a higher incidence among the urban poor than in the outer world. Pavement-dwellers appear the worst sufferers of all, among whom annual diarrhoeal cases is about 614 per thousand population. It was also understood that 30-60 per cent households and 12-30 per cent individuals get affected by water-related diseases a year (Figure 11). Across a family, children share about two-thirds of all cases.

Statistical Analysis of Data

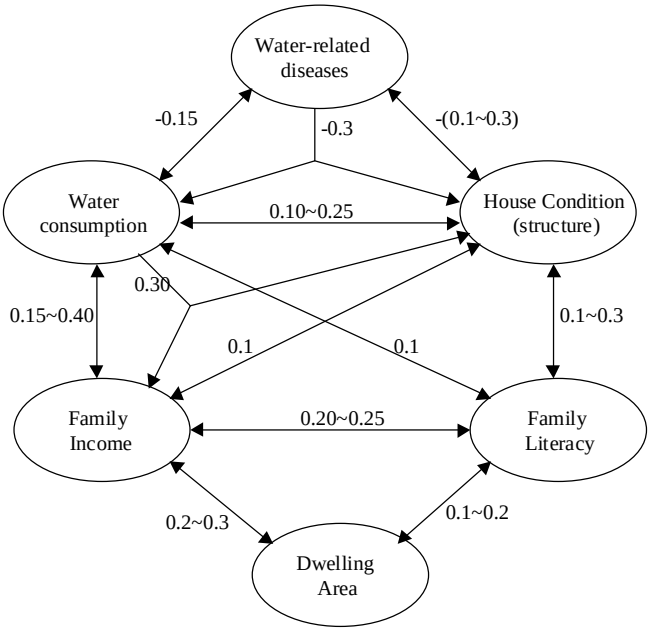
Relationship between socio-economic and environmental conditions: Matrices of Pearson's correlation coefficients and multiple corelation coefficients were determined from the obtained data to identify the possible relationship between socio-economic and environmental conditions in each community. As many variables, both the quantifiable and not easily quantifiable, act upon a state, a strong correlation between only two parameters could not be observed but the data reasonably verified the anticipated positive or negative relationships. The entire result is presented diagrammatically in Figure 12.

Multiple correlation data ascertains the combined impact of two or more variables on the state of affairs in urban poor. For example, as Figure 12 shows, higher water consumption in urban poor is positively correlated with the higher family income and better housing condition but to a lesser degree to the family literacy rate. Similarly, occurrence of water-related disease appears less in the family with higher consumption of water and better housing condition. Apparently less water consumption appears to induce water-washed diseases, but it is only a component of water-related disease. Many more problems are linked to the family income (in other term poverty) and literacy rate, which are again positively correlated to each other.

Intra-urban poor differences: Parametric and non-parametric one-way analysis of variance (ANOVA) tests were performed on several socio-economic and environmental conditions between all four samples (slum and pavement communities) in order to see if the independent samples come from same population of urban poor or significant disparities exists among them. Since the sample size was sufficiently large, results from both the parametric and non-parametric tests were expectedly similar and equally meaningful. The non-parametric one-way ANOVA has been compared to Kruskal-Wallis test by ranks. But in the case of only two samples, Mann-Whitney U test was performed. All this design and tests were carried out in SYSTAT 9 statistical software.

The socio-economic and environmental indicators tested by ANOVA were housing space per person, water consumption per person, population load per toilet seat, family income and family literacy rate. The null hypothesis assumed has no significant difference in the means of independent samples at 1 per cent significant level. As revealed from results presented in Table 7, the conditions of pavement-dwellers differ significantly from that of the slums. In slums, water consumption and dwelling space is fairly comparable at each place but income and family literacy rates differ significantly. However, the extent of toilet problem

Figure 12: Pearson's Correlation Coefficients (Pair and Multiple) between Socio-Economic and Environmental Parameters



in terms of population load per seat is quite similar to all urban poor i e, both in slums and pavement-dwellers.

People's Attitude and Priority Issues

Awareness and prioritisation of critical problems: Not only the environment or public utility services but also socio-economic problems such as poverty and employment are acute to urban poor. This could be a reason why urban poor live in slums and as squatters despite lack of basic amenities. Due to different social and educational backgrounds, it is likely that slum resident's view and attitude to their problems could differ considerably from alien researchers. To this end, we identified 10 potential issues pertinent to the urban poor and asked them to rank from 1 to 10 as per severity (i e priority to solve) in their family and community. In addition to this ranking, they were also asked to specify the magnitude of each problem on a 4 level scale; extremely severe, moderate, little and no problem. The overall ranking was determined based on weightage of all respondents in each slum. The degree of agreement among respondents within and across slums were measured by Kendall's coefficient of concordance, W, given by:

$$W = \frac{\Sigma\left(R_j - \frac{\Sigma R_j}{N}\right)^2}{\frac{1}{12}k^2\left(N\right)\left(N^2-1\right) - k\sum_k \frac{\Sigma\left(t^3 - t\right)}{12}}$$

where, R_j is the sum of ranks of the entities, N is number of entities ranked (i e, 10 in this case), k is the number of sets of ranking (i e, respondents), t is the number of observations in a group tied for a given rank and Σ directs to sum over all groups of ties within any one of the k rankings, and $\sum_k$ directs to sum the values for all k rankings.

The results are presented in Table 8. As it is observed, toilet, drinking water and housing condition are three topmost priority problems for the urban poor followed by land, sewerage, poverty, unemployment, solid waste disposal, healthcare facilities and social safety respectively. In terms of severity, toilet problem has been expressed as extremely severe while others are moderate to little problem. The Kendall's coefficient of concordance, which ranges from 0.45 to 0.58, reveals a fair degree of agreement between respondents in a settlement. The problem and priorities overall too are alike, depicted by very high value of Kendall's coefficient, 0.87 across all urban poor settlements and 0.92 in case of only 3 slum and squatters considered.

Attitude to resettlement: Considering the difficulties that crowded dwellings pose in delivery of public services and as the land is unhygienic for habitation, respondents were asked if they are willing to rehabilitate by resettling to another place if offered by government. The reaction significantly differed among various groups analysed by chi-square (χ^2) test of homogeneity (Table 9). In general, people who are living in relatively newer squatter settlements and who remain in high risk of eviction by municipality some day were willing to accept the proposal. But others such as in Dharavi have more affection for their present social life and the type of employment, which they fear would be lost otherwise. Environmental problems appear tolerable to them when compared with the degree of social security, their present habitation offered.

Conclusion

This paper presents and discusses facts of life of urban poor of Mumbai in two ways. Firstly, it presents primary data on the present situation of living environment and health condition in four urban poor settlements in Mumbai. It is aimed to demonstrate a collective profile on several categories of urban poor in Mumbai. In this respect, living environment of urban poor could be basically characterised by nearly 70 per cent households living in flimsy shacks and temporary dwellings, 2 m^2 housing space per person, 28 LPCD water consumption, 1.5 per cent households having access to sewer and only half of the people having access to toilets. Similarly, health status were shown as nearly 11 per cent people sick at any point of time; and TB and asthma patients numbering as many as 18 and 11 per thousand population respectively. The annual cases of water-related disease such as diarrhoea, typhoid and malaria is estimated as 614, 68, 126 cases per thousand of population respectively. Secondly, this study attempts in linking socio-economy and environmental factors to the health consequences of the people. This fact has been substantiated by data that income, literacy, sanitation and personal hygiene (in terms of water consumption rate) have had impact on the morbidity of the people. The impact of poverty and environmental factors has been evidenced by intra-urban-poor gradient seen in four groups of urban poor studied, which is particularly pronounced between slums and pavement-dwellers; the latter has been hit most hard by environmental pollution and lack of basic amenities. The needs of the urban poor and their priorities seem hierarchial. They first needed approval to stay in the place, i e, securing land and housing and then provision of basic amenities in the order of toilet, water supply, sewer and drainage and so on. Overall, the more the community has gained living stability and socio-economic

prosperity, the higher is the concern on environmental pollution and sanitation related factors. EPW

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[The authors express thanks to Aliyah Asghar, staffs of BUILD and YUVA for various help received during the field survey works and related management in Mumbai.]

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