

SOME ASPECTS OF VULNERABILITY AND THE URBAN ENVIRONMENT: A STUDY WITH REFERENCE TO THE SLUMS OF KOLKATA

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ABSTRACT

There is enough literature on informal settlement areas, but research on peoples' access to essential services such as water and sanitation in those areas is very limited. Most studies consider issues of access in connection to urban poverty, an approach that eventually reduces the discussion to the income and expenditure constraints faced by households. Examining access to water and sanitation in the slums spurs an appreciation of the multidimensional nature of the problem, including income poverty, infrastructural limitations, asset ownership inequality, and lack of appropriate housing. Since the urban slum dwellers have limited or no control over various 'shocks', this in its turn is likely to affect their access to assets, and also the livelihoods. Thus, we considered some non-material dimensions of poverty before examining the degree of vulnerability faced by our sampled slum households of Kolkata. Fuel stacking has been observed in the surveyed households and shows no sign of abating. With the ever increasing rate of urbanization, household energy use calls for attention. In course of our survey, we observed that majority of our slum households use 'dirty' fuels like firewood, cow dung cakes, coal, and kerosene for cooking. Clean cooking fuels are important for combating high levels of indoor air pollution. Our study looked into some possible determinants of the choice of cooking fuel type by the slum households. Our conclusion from this exercise is that the probability of choosing a cleaner fuel goes up when the head of the household is more educated and experienced as revealed by her/his age. The same probability also goes up for the asset-rich and APL households. The availability of a pucca house and/or a kitchen encourages the households to go in for a cleaner fuel. It is also found that the smaller-sized households and those with limited number of female members are more likely to choose a cleaner fuel.

Keywords: Vulnerability, Urban Environment, Urban slums, kolkata

1. INTRODUCTION

Urbanization has catapulted to one of the most important demographic trends in recent times. Substantiating this claim is the fact that the number of people living in urban centres worldwide has surpassed the number of people living in rural areas in 2008. It has been estimated that the percentage of urban population will reach nearly 70% by 2050 (Birch et al., 2012).

The most important challenge that urbanization has to face is related to water and sanitation management. However, both the developed and the developing countries has to withstand the burden of this problem, but obviously the extent varies. Cities in developed countries struggle with high operation and maintenance costs along with decay in their already existing infrastructure, while the cities in the developing countries are mired with rapidly growing urban slums. In these slums, planning is non-existent and the number of people living without access to basic water and sanitation services is on the rise.

The access to water, sanitation, and electricity plays a vital role in influencing human development outcomes and vulnerability. The impact of such services is direct, as for example, clean drinking water can reduce water-related diseases which are a major cause of children's death in the world. Economic growth is also experienced as an indirect fall out of such services. However, like health and education, these services are also failing the poor people at large.

Kolkata, termed as the 'black hole' of third world urbanization by Roy (2003), has been witnessing urbanization, but it has not been able to conceal the abject poverty, not only at the fringes of the city but also at her core. The quality of life for the poor in urban Kolkata in general, and the slums in particular, is even worse than that experienced in certain rural areas, and this is a fact in the cities of many other developing countries too. The concept of poverty, nowadays have not been limiting itself to income dimension only. Rather the definition of poverty has been encompassing perceptions of non-material deprivations and social differentiation (Wratten, 1995). The ever widening debates on poverty have been including more subjective concepts like vulnerabilities. The poor urban dwellers are subject to an incredibly wide range of vulnerabilities.

This paper examines the quality of some of the basic urban services that are provided to the urban poor of Kolkata and has been structured as follows. Section 2 explains the study locales. Section 3 gives a brief overview of access to water, sanitation, and electricity in the slums of Kolkata. Section 4 deals with the vulnerability to diseases and addiction of the slum-dwellers while section 5 focusses on the housing conditions. Section 6 explores the choice of cooking fuel used by the slum households while the last section concludes the paper.

2. DATA AND METHODOLOGY AND STUDY LOCALE

There has been a scarcity of detailed ward-level information on the slums of Kolkata from the secondary sources to analyse the issues chosen for this study. The scanty information available from the reports of the Third National Family Health Survey (2005-06) provides an aggregative idea about access to some basic urban services by the slum-dwellers in Kolkata. We have used such data wherever necessary. However, the large part of this study is based on primary data collected through a field survey in 2010-11 in some sampled wards of the city of Kolkata.

For collection of primary data, we followed a four-step procedure. In the first step, we purposively selected six wards of the Kolkata Municipal Corporation (which are 1, 2, 6, 28, 29, and 61). These wards are chosen in consultation with the knowledgeable officials of the Kolkata Municipal Corporation, and are known to have relatively higher concentration of slum population (see Table 1). In the second step, we identified the pockets/locations within a ward that have higher concentration of slums, again with the help of the knowledgeable persons at the ward level. In the third step, we identified two pockets/locations from each ward, and prepared a list of all households residing there. The

Table 1: Socio-Economic Profile of the Wards

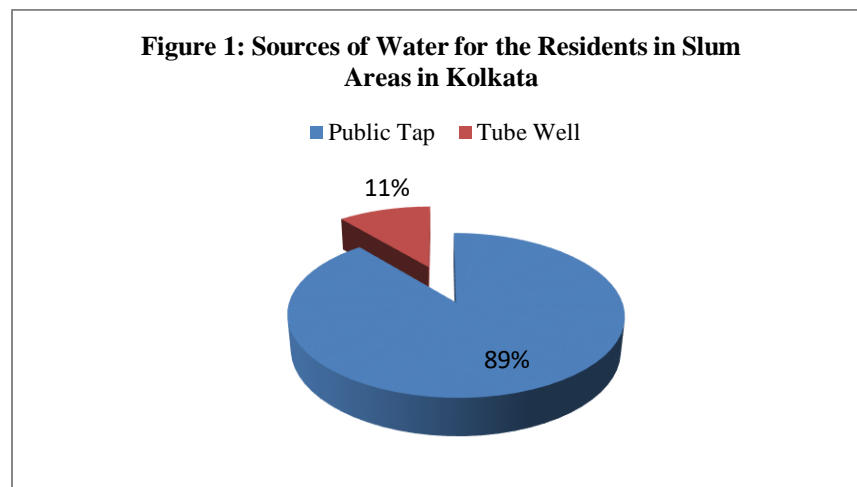
Ward Nos.	1	2	6	28	29	61
Total Slum Households	5183	2632	6964	3992	7357	1446
Total Slum Population	26788	12351	38876	25428	46320	8317
% of Slum Population	56	27	81	62	99	26
% of SC/ST Population	7.96	7.98	7.99	4.32	4.91	6.4
% of Literate Population	68.32	80.11	65.18	59.13	56.81	66.38
% of Total Workers	33.8	37.69	36.23	38.5	35.75	36.77
% of Main Workers	30.54	35.75	34.16	36.27	34.72	35.07
% of Marginal Workers	3.27	1.94	2.07	2.22	1.03	1.7

Source: Census of India, 2001.

final step used that list to randomly select 25 households from the identified location(s) of a ward for the purpose of data collection. In this manner, we gathered data from a total of 300 households. A structured and pre-tested questionnaire was canvassed for collection of data from the sampled households. We collected both household-level and individual level data to analyse the issues that have been identified for our study.

3. ACCESS TO WATER, SANITATION, AND ELECTRICITY

Looking at the data from a nationally representative survey in India (Third Round of National Family Health Survey, 2005-2006, in brief NFHS-3) and using Kolkata's slum information from there, we find that in the informal settlements, 15.67% of households have water connections piped to their houses, and 22.55% of households have water connections piped to their yards. On the other hand, public taps serve the majority of the households (46.92%). Thus, 85.14% of the households in Kolkata slums access water from the taps.



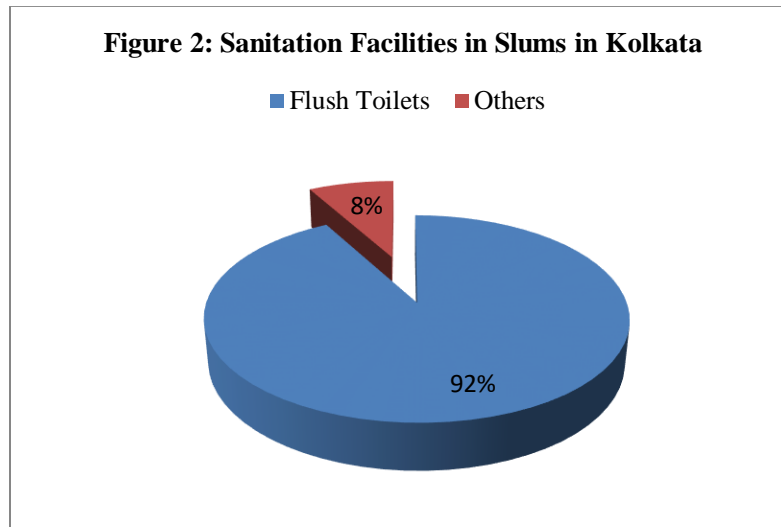
Source: Field Survey, 2010

The primary data collected by us from some sample slum areas in Kolkata reveal that 89% of the households fulfilled their water needs from public tap while the remaining (11%) from tube wells (Figure 1 above). Those accessing water from tube wells do not have taps within their houses or yards. They have to use tube wells for almost 18 hours a day. On the other hand, the taps on the road-side supply water for about six hours a day. There are also the problems of long queues, and frequent 'water wars' among them. In any case, for a vast majority of slum residents, especially those depending of public taps, there appears to be a problem of inadequate and infrequent supply of water.

Access to Sanitation

The NFHS-3 data show that more than 96% of the people in slums in Kolkata have access to flush toilets, and 1.45% have no toilet facility and use the bush, field or canal. Our survey data, however, reveal that 92% have access to flush toilets of various forms while the rest use other forms (Figure 2). Most of the households do not have own toilet and resort to using shared toilets. Nearly 87% of the surveyed households use toilets which are shared by many other households. These toilets are generally dirty, poorly maintained, and shared by a large number of households (ranging from 10 to 12 households), but nobody is willing to shoulder the

responsibility of cleaning them. A professional toilet cleaner is often appointed to clean these toilets on a monthly basis. However, cleaning them once a month in no way serve to maintain the required hygienic standards when such a large number of people are using these toilets.



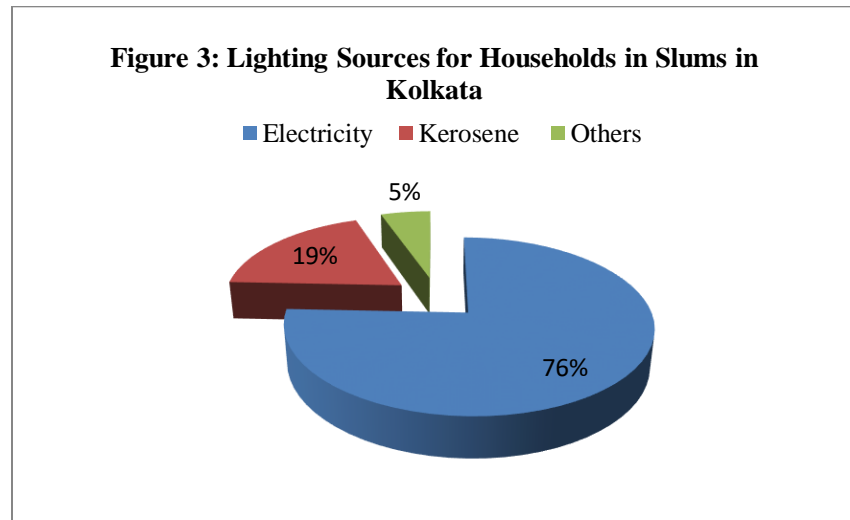
Source: Field Survey, 2010

The payment to the professional toilet cleaners are made after collecting money from all the households using the toilets. Dwellers in the squatter settlements had to sometimes use community pay-and-use toilets. The respondents reported the charges in these toilets to be quite high.¹ An improved sanitation would obviously lead to lower health expenditure, fewer days lost at work through illness or through caring for an ill relative, and time saving by not queuing at shared sanitation facilities or walking some distance for open defecation.

Access to Electricity

Our primary survey showed that around 76% of the slum households have access to an electricity supply, which is generally used for lighting purposes (Figure 3). Some of these households access electricity through illegal connections. Among those households lacking access to electricity, the primary source of lighting is kerosene.

¹ The charges for these community pay-and-use toilets were Rs. 2 for bathroom per visit and Rs. 1 for latrine per visit.



Source: Field Survey, 2010

4. VULNERABILITY TO DISEASES AND ADDICTION

The degraded habitation factors highlighted above predispose slum inhabitants to particularly poor health, and consequently they suffer from a high incidence of communicable diseases such as tuberculosis, diarrhoea, malaria and other waterborne diseases, as well as malnutrition. These factors, in turn, result in very high infant and child mortality rates. Such problems are exacerbated by the fact that the urban poor also find it difficult to access drugs from health clinics or chemists to treat preventable diseases, leading to high levels of inadequately treated morbidity as Razia Bibi, a slum resident in one of our survey areas, confirms: ‘When we fall sick, we generally go to a local medicine shop to get medicine...sometimes it works and sometimes not...even if we go to a hospital, we don’t get medicine there...only a prescription...’.

Poor health can reduce an individual’s capacity to earn income and make them vulnerable. On the other hand, health treatment can also utilize whatever little the households had saved or lead them to debt-ridden situations. Scholars have pointed out that ill health is the most important factor that drives households into poverty and destitution in many areas of South Asia. This effect is all the more magnified when the person with the ill health is the adult income earner, and also a male (Beall 1995). In the course of our survey, we did come across some households who were struggling to make both ends meet as their principal male earning member was sick (refer to Box 1).

Box 1: Vulnerability Owing to the Ailments of the Male Earning Member

Debu Kundu, aged 38, and also an illiterate, lives in the North Range Slum of Park Circus. Belonging to the social group, OBC, he lives with his mother (80, illiterate), wife (28, illiterate) and son (11, class 5) in a 'jhopri'. Suffering from piles for the last three years, he can only manage to go out with his vegetable cart once in a day for about four hours earning about Rs. 2300 per month. His wife also works as a domestic maid and contributes Rs. 800 to the total household income. However, the total household income is totally inadequate to support four members, especially when Rs. 200 is spent per week for medicines and health check-up of Debu. The doctor has advised him to undergo an operation but he is unable to garner cash for it. He states that

"Even if I am able to collect money for my operation, I would not be able to work for more than a month....how is my family going to survive? How will my son continue his studies? It is better to resign myself to my fate, rather than doing what the doctor tells me..."

In our survey, we also came across several households whose principal male earner is addicted to alcohol to such an extent that the whole household suffers not only financially but also has to bear the brunt of social stigma.² Consumption of alcohol drains the poor financially, and the expenditure on it could have been used to finance the other basic human needs of the household, like food, shelter, and education. However, it has been observed that most of the male members of the surveyed households consume alcohol quite frequently but the most addicted ones are those whose households are generally thrown into disarray. Box 2 narrates the story of one such household.

Along with all the above factors that endanger the health of the slum dwellers, we also noticed in the course of our survey that most of the households are using 'dirty' fuels while cooking. This obviously results in indoor pollution³, more so when the only living room acts as their cooking space too. Since women and children spend a large proportion of their time at home than the men, they are generally more exposed to such pollution,

² The friends and neighbours of these addicted persons usually call them as 'matal' in Bengali, meaning drunkard. A ten year son of one of the respondents in our survey area commented that "even the local grocery owner has also denied providing us with any ration on credit. He told me that my 'matal' father would not be able to repay the money." It seemed the social stigma also has a negative mental effect on the young boy.

³ The *Global and Regional Burden of Disease Report* of the World Health Organization (2004) estimates that acute respiratory infections from indoor air pollution, caused by using dirty fuels, kill a million children annually in developing countries. This problem is observed more in the case of poor families of South Asia and Africa.

Box 2: Addiction of Household Head and Vulnerability

Ramayan Das (58) was lying in a corner of the room, sleeping at a very odd hour of the day. When his wife, Durga Das was questioned regarding her husband's condition, she just broke down. The story she narrated is reflective of many marginalized households where the men are alcoholic and remain addicted most of the time. Ramayan works in a pipe factory and earns Rs. 2500 monthly. However, after much coaxing and cajoling, he doles out only Rs. 300 per month. A major part of his earning is spent on alcohol and occasional food that he has in the nearby hotel. Domestic violence is also a story that is generally shared by the women of these households. Durga works tirelessly the whole day as a domestic maid in four houses. She also washes the utensils of a nearby hotel three times a day. Apart from money, the hotel owner also gives her some left over food which she is too glad to receive. She has a son studying in class five whose education expenses have to be taken care of by none other than Durga. Her step-son (Ramayan's son from an earlier marriage) also stays in this household and earns Rs. 50 daily as a van-puller.

mainly from household fuels⁴. As a result, they suffer from respiratory diseases and other health consequences (Surjadi and McGranhan, 1995, Hood et al., 2004).

5. HOUSING CONDITIONS

The housing conditions of the families living in urban slums are deplorable. A high percentage of their dwellings are constructed of semi-permanent materials, and many of them are severely dilapidated and over-crowded. These informal settlements are found in

⁴ We cannot afford to ignore the fact that traditional solid biomass, firewood, charcoal, and residuals dominate the energy balance of the developing countries like India. With the ever increasing population of the country and a still higher rate of urbanization, household energy use and carbon dioxide emission are issues that need to be strictly looked into and appropriate policies need to be devised by the policy-makers. Keeping in mind the welfare of the global poor, the Millennium Development Goals (MDGs) have stressed the reduction of biomass consumption. MDGs particularly pointed out that women and children are mainly responsible for collecting firewood and dung and are also the ones making the dung cakes. Hence, they should be released to pursue their education or other more productive activities. This would be possible only when the households switch to clean fuels.

Table 4.2: Distribution of Households According to Type of Housing and Number of Rooms Shared

Characteristics	No. of Households
Housing Type	
Kutcha	2 (0.67)
Semi-pucca	193 (64.33)
Pucca	15 (5)
Jhupri	57 (9)
Tin shed	4 (1.33)
Others	29 (9.67)
Total	300 (100)
No. of rooms	
1	258 (86)
2	38 (12.67)
3	3 (1)
4	1 (0.33)
Total	300 (100)

Note: Figures in the brackets denote percentages

Source: Field Survey, 2010

marginalized locations, and the inhabitants are also vulnerable to environmental hazards and climate changes, in particular during urban floods, the effects of which can be devastating in poorly planned and rapidly growing cities like Kolkata. Urban floods dismantle the dwellings of these slum dwellers, as well as ruining their assets and incomes. This further exposes them to food and income insecurity eroding their assets as well as being a source of disease.

Moreover, the households having no titles over the lands on which their housing structures, in whatever form, are built (tenants) are continually living an edgy life. They are always under constant threat of eviction from the lands, and they fear demolition of the only shelter that they had painstakingly built. Most of them are migrants who had come to the city as they were displaced due to environmental hazards, like Aila⁵ (affecting those who had migrated to Kolkata

⁵ Chattopadhyay (2009) records the impact of Aila in the following words, “Hamlets have been reduced to wasteland – with submerged crops, uprooted trees, shattered homesteads and emaciated [and dead] cattle all around. Ponds which have been only source of potable water lay contaminated and stinking. Not even stray dogs that survived the disaster would go near them”. The cyclone Aila also increased the salinity of the soil making them unfit for cultivation.

from the Sunderbans⁶) or river erosion (affecting those who had migrated from the Murshidabad and Malda districts of West Bengal⁷) or were political refugees fleeing the strife torn nation of Bangladesh⁸. Thus, they live a doubly-edged life full of fear of losing their homes yet again (see Box 4.3). This type of covariate shock⁹ increases the vulnerability of the urban slum households, especially those who have no or meager source of income.

Our survey reveals that 64.67% of the households live in semi-pucca houses having brick walls but the roofing is constructed either with red tiles or tin shed while around 19% live in 'jhopris' with only a plastic sheet as shed. 86% of the sampled households generally huddle in a single room, increasing the probability of health problems, and other corresponding social problems arising due to married couples being denied any sort of privacy. 12.67% of the households have two rooms to share and only 1% of them have three rooms (Table 4.2 above). Marginalized locations, and the inhabitants are also vulnerable to environmental hazards and climate changes, in particular during urban floods, the effects of which can be devastating in poorly planned and rapidly growing cities like Kolkata. Urban floods dismantle the dwellings of these slum dwellers, as well as ruining their assets and incomes. This further exposes them to food and income insecurity eroding their assets as well as being a source of disease.

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⁶ The Indian Sunderbans lies on the southern peripheries of the State of West Bengal where the Gangetic plain meets the Bay of Bengal. It is an archipelago of several hundred islands which are low, marshy, alluvial plains. The people residing here are poor and vulnerable, with extremely limited access to resources or facilities. Some islands are fast vanishing from the map rendering thousands of people permanently homeless and displaced from their original habitat.

(see <http://cseindia.org/userfiles/Living%20with%20changing%20climate%20report%20low%20res.pdf>)

⁷ The problem of the Ganges Bank erosion has assumed enormous proportions in the Malda and Murshidabad districts of West Bengal. Mukherjee (2008) notes that more than 7 lakh people in these two districts have already been displaced because of the Ganges bank erosion. Rudra (2005) also points out that the river has eroded 356 km² of fertile land from the district of Murshidabad and more than 200km² of fertile land from the Malda district. So the people in these districts faces a "continuous forced migration" (Laha and Bandyapadhyay, 2013). The frequent "displacement and settlement" of victims as a result of bank erosion makes them more vulnerable and they are compelled to migrate elsewhere for their livelihood (Das et al., 2014).

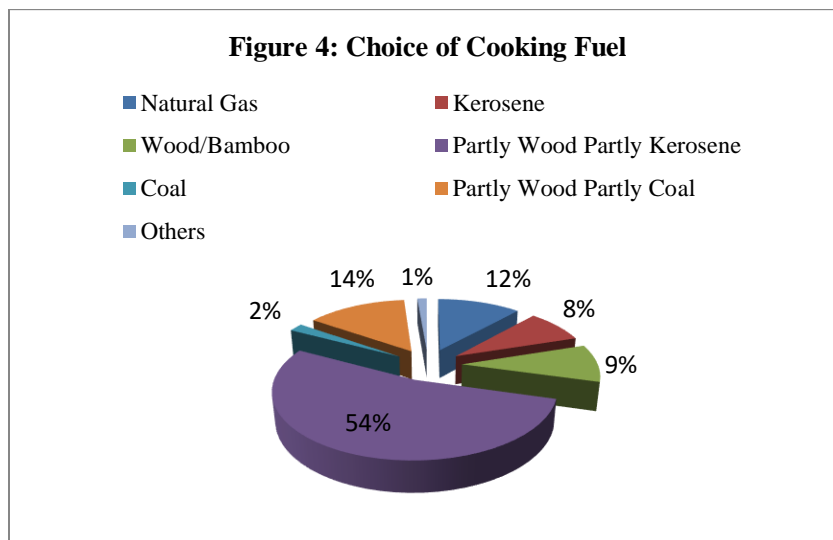
⁸ From 1947 to 1971, the region of Bangladesh was a province of Pakistan and was officially known as East Pakistan. In 1971, it became an independent nation after its Liberation War and was renamed as Bangladesh. If the largest single stream of movement is considered, it has to be the Bangladeshi refugees entering India during and after the Liberation War in 1971. However, it should be kept in mind that undocumented migration from Bangladesh to West Bengal is a continuous process (Datta, 2004).

⁹ Covariate shocks refer to common adverse effects within a given site. Dornan and Portela (2014) reports that households in Ethiopia, however refer to idiosyncratic shocks (illness and death) as most important events affecting their households as compared to covariate shocks.

constant threat of eviction from the lands, and they fear demolition of the only shelter that they had painstakingly built.

6. CHOICE OF COOKING FUEL

We collected data on types of fuel used by our sampled households (Figure 4). It is found that only 20% of the households use natural gas or kerosene. Wood/bamboo is used as fuel by 9.33% of the households; 53.33% use partly wood and partly kerosene while 14% use partly wood and partly coal.¹⁰ Thus, it is very clear from our survey data that most of the households do not use clean fuel and many of them do resort to fuel-stacking¹¹ as opposed to fuel-switching. Heltberg (2005) reasons that the households resort to fuel



Source: Field Survey, 2010

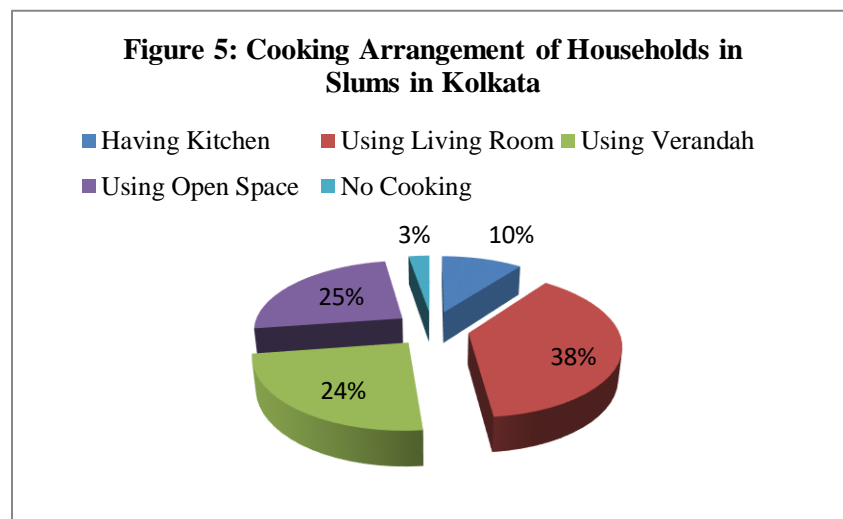
stacking mainly to have better taste of food (in their perception). Hence, any whole-hearted policy aiming to displace dirty fuel with a cleaner one is unlikely to be fully successful under such circumstances.

¹⁰ Dutt and Haldar (2008) had carried out a survey of the Calcutta Metropolitan Development Authority in 1996-97 of 4500 samples covering 69 wards of Kolkata. They noted that “the use of coal was universal before the 1960s when air in the evenings was filled with smoke in the congested areas of Kolkata, but in the 1990s only one in every ten households uses coal ovens for cooking in Kolkata.”

¹¹ Fuel stacking implies multiple fuel use and is a very common phenomenon in India. There seems to be no end to fuel stacking in the case of cooking. For lightning, the households are gradually making a transition from fuel stacking to electricity (Cheng and Urpelainen, 2014).

In the existing literature, the households’ fuel choices have been explained by the ‘energy ladder model’¹². This model shows that a household essentially follows a simple linear movement from an inefficient or ‘dirty’ fuel to efficient or ‘clean’ fuel and stoves as the income of the household rises (Alam et al., 1998; Davis, 1998; Leach, 1992). It is well-known that the modern fuels such as LPG are clean, efficient, and convenient to use. However, the factors constraining its use are not only its high cost but also the relatively high start-up cost of connection and the stability in its supply. In addition, the initial endowment of the household is deemed to be an important factor that goads the household to opt for a modern fuel.

In our survey areas, for a good proportion of the households, cooking is done in the same room where they live or sleep, and this obviously can also be detrimental to their health. Our primary survey shows that only 2.67% of the households do not cook at all as they do not have the means to do so (Figure 4.5). They generally eat the left-over food given away by the nearby eateries or hotels. Only 10.33% of the households have a separate



Source: Field Survey, 2010

kitchen to cook their food. Our survey reveals that 38% of the households cook in their living rooms; another 24% cook in their verandahs. The verandah is generally a small space attached to

¹² The energy ladder model basically comprises of three stages- the first level shows that the households have a strong dependence on biomass fuels such as firewood and animal dung cakes; the second level shows that as the incomes of the households rise, they cease to use firewood and start to use coal, charcoal and kerosene; the third level shows that with significant rise in income, the households can afford to purchase improved stoves and move to the cleanest fuels such as electricity and LPG (Leach, 1992).

their living room. Cooking in the verandah, in fact, adds to the problem of indoor air pollution discussed before.

Factors Determining Choice of Cooking Fuel by the Urban Slum Households

To develop a clearer understanding of the factors responsible for opting for a type of cooking fuel by the households, we carried out a binary probit regression analysis where the choice of fuel by the household is the categorical dependent variable (called FUEL) that is assigned value '1' if the household uses clean fuel, and '0' if dirty fuel.

The Explanatory Variables and Hypotheses

The explanatory variables considered by us are more or less similar to those highlighted in past studies on fuel adoption (Hosier and Dowd, 1987; Heltberg, 2003a; Farsi et al., 2007; Mekonnen and Kohlin, 2008). These are as follows:

Age of the Household Head (AGE): The age of the household head is considered to be an important determinant in choosing the type of cooking fuel. Older heads compared to their younger counterparts are more inclined to use modern and clean fuels. This might be because their age does not permit them all the inconveniences associated with the usage of dirty fuels like coal and wood. At the same time, usage of clean fuel is time-saving as they do not need to set up a 'chullah'¹³ and then wait for it to be ready. Using stoves like 'chullah' and preparing and gathering fuel for them can be both difficult and time consuming. More time spent on a traditional stove like 'chullah' might also result in members of the household developing respiratory diseases. Thus, the hypothesis is that there is a positive relationship between the age of the household head (AGE) and the value of the dependent variable.

Sex of the Household Head (SEX): The sex of the household head is expected to influence the fuel choice of the household. The drudgery of collecting and preparing a 'chullah', which is often borne by the women and children, goads the female member of the household to opt for a cleaner fuel (WHO, 2009). Moreover, the unpleasantness of cleaning the stoves that use 'dirty' fuel and also the time required for it prods the usage of clean fuel by many female household heads. The sex of the household head has been captured by a dummy variable that assumes value '1' if the head of the household is male and '0' otherwise. We hypothesize a negative relation between the value of the dependent variable and sex of the household head.

¹³ 'Chullah' is the primary traditional cooking stove used for cooking in India. Wood, animal dung cakes and coal are generally used as fuel for the 'chullahs'.

Education of the Household Head (EDU): Education in our study is measured by the years of schooling. It is likely that the level of education of the household head would exert some influence on the household's choice of fuels. Our hypothesis is that the household head's educational attainments are positively related to the value of the dependent variable. This may be due to improved awareness of risks associated with the usage of dirty fuels and also the relatively higher opportunity cost of collecting fuels like firewood by the more educated ones.

Household Size (HSIZE): The size of the household is likely to determine the choice of fuel type. In a large household, more hands would be available for the collection of wood, straw, and dung. So, other things remaining the same, they are more likely to go in for dirty fuel. Hence a negative relation is hypothesized between HSIZE and the value of the dependent variable.

*Proportion of Females in the Household (PROPFEM)*¹⁴: It is possible that with availability of more female members in the family, usage of dirty fuel would go up. This is because women members (apart from children) are the ones engaged in collection of dirty fuel (like firewood, straw, etc.) and also preparing the profusely used cow dung cakes. We hypothesize a negative relation between PROPFEM and the value of the dependent variable.

Current Value of Assets (ASSET): Households with higher current value of assets are expected to be economically better-off. So they are likely to prefer clean fuel as they are capable of financing the high start-up cost (like getting a LPG connection or buying a stove for clean fuel) of using a clean fuel. Thus, we hypothesize a positive relation between ASSET and the value of the dependent variable.

Poverty Status of the Household (POVSTAT): Poverty Status of households in our study imply whether a household falls below the poverty line or not. The below poverty line households are expected to use more of dirty fuels than their richer counterparts. The poverty status of the household has been captured by a dummy variable that assumes value '1' for BPL¹⁵ (Below Poverty Line) households and '0' otherwise. Our hypothesis is that there exists a negative relation between POVSTAT and FUEL.

Availability of Kitchen (KITCHEN): Availability of a kitchen is likely to influence choice of fuel type by the households. Those possessing an organized kitchen are likely to go in for clean fuel. Hence the relation between KITCHEN and FUEL is hypothesized to be positive. Here KITCHEN

¹⁴ This variable is calculated by finding the ratio of women in the total household.

¹⁵ The Poverty Line is calculated using the Tendulkar Committee Recommendations and is found to be Rs.915 for a household in Kolkata.

is quantified by a dummy variable that assumes value ‘1’ for households having kitchen and ‘0’ otherwise¹⁶.

Structure of the Dwelling House (HOUSE): We expect the quality of dwelling house to be another determinant of fuel choice by the households. The households having dwellings with roofing done by using durable materials are more likely to adopt cleaner fuels. The variable HOUSE has been quantified by a dummy variable that assumes value ‘1’ for households having ‘pucca’ structure and ‘0’ otherwise. We hypothesize that the relationship between the value of the dependent variable and HOUSE is positive.

Binary Probit Regression Results

Our results of the binary probit regression are presented in Table 4.1. Although most of the estimation results are broadly in line with the hypotheses outlined above, the sex of the household did not have any statistically significant relation with the value of the dependent variable, i.e., choice of fuel type. It is found that the probability of choosing a cleaner fuel goes up with increasing age, education, and asset-holding position of the household head. The probability of choosing a cleaner fuel also goes up if the household

Table 4.1: Binary Probit Results of Determinants of Urban Slum Households' Choice of Fuel Types

Explanatory Variables	Dependent Variable: FUEL=1 for Clean Fuel Usage; 0 for Dirty Fuel Usage	
	Estimated Coefficients	Marginal effects
AGE	0.0182* (2.65)	0.007
SEX (Male=1; Otherwise=0)	-0.248 (-1.18)	-0.099
EDU	0.0576*** (2.29)	0.023
HSIZE	-0.0711*** (-1.65)	-0.028

¹⁶ The dummy variable ‘KITCHEN’ takes the value ‘0’ when the household’s cooking arrangement is something other than kitchen. It might be the only living room the household has, or the verandah or open space. The impact of cooking outdoors on fuel choice may imply the use of simple techniques for cooking in open fire, and therefore may encourage the adoption of smokier fuels relative to cooking indoors.

PROPFEM	-0.713** (-2.03)	-0.283
ASSET	0.000427** (2.29)	0.0001
POVSTAT (BPL=1; Otherwise=0)	-0.276*** (-1.50)	-0.109
KITCHEN (Available=1; Otherwise=0)	0.397*** (1.40)	0.157
HOUSE ('Pucca' House=1; Otherwise=0)	0.945** (2.02)	0.346
CONSTANT	-0.399	
LR statistic	51.03[9]	
Pseudo R2	0.1242	
No. of observations	300	

Notes: i) * significant at 1%, ** significant at 5%, *** significant at 10%; (ii) Figures in first brackets are estimated Z-coefficients; and (iii) Figure in third bracket is degrees of freedom for computed log-likelihood ratio statistic.

Source: Field Survey, 2010.

belonged to the non-BPL (i.e., APL) category, and has a pucca house and kitchen. The same probability becomes higher for a household with smaller family-size, and limited number of female members in the family.

7. CONCLUSION AND POLICY IMPLICATION

There is enough literature on informal settlement areas, but research on peoples' access to essential services such as water and sanitation in those areas is very limited. Most studies consider issues of access in connection to urban poverty, an approach that eventually reduces the discussion to the income and expenditure constraints faced by households. Examining access to water and sanitation in the slums spurs an appreciation of the multidimensional nature of the problem, including income poverty, infrastructural limitations, asset ownership inequality, and lack of appropriate housing. Since the urban slum dwellers have limited or no control over various 'shocks', this in its turn is likely to affect their access to assets, and also the livelihoods. Thus, we considered some non-material dimensions of poverty. The poor urban dwellers are subject to an incredibly wide range of vulnerabilities. We observed that, in our sampled areas, most of the households did not have access to 'critical services' like water, sanitation, and electricity.

The access to water is facilitated by widespread public water points such as public standpipes or taps. However, the access to water by the households in our study areas got limited due to inadequate number of water points. As a result, the households faced several difficulties such as standing in long queue, carrying water to a long distance, and not having adequate supply of water. This picture obtained in the context of the slums in Kolkata is broadly similar to the trend prevailing in some African countries (Gandy, 2006). Thus, for a vast majority of the slum dwellers of Kolkata, adequate access to water is a major problem that they have to deal with. Their lives, from morning to night, is a saga of how to wage 'water wars' and get the requisite amount of water needed for their households. Secondly, as regards sanitation, our survey revealed that 92% of households in our survey areas use a pit latrine, and can be accounted as having access to improved sanitation. However, our data revealed that on average ten households used a single toilet. Under the circumstance, it is extremely difficult to maintain hygienic condition in a shared sanitation facility, where the usage by a large number of people is involved. As a result, people sometimes resort to open defecation in these slums. Thirdly, as regards access to electricity, we found that 76% of the slum households in our survey areas have electric connections in their houses, which they primarily use for lighting purposes. However, some of these households are illegally connected to electricity. These unsafe connections pose risk to their life and property. Kerosene is the primary source of lighting for those households with no electrical connections.

Poor health of the slum dwellers are exacerbated all the more because of their difficulty in accessing medicines from hospitals. Thus, they mostly suffer from inadequately treated diseases. Households having the main earning member sick are the most affected. Addiction to alcohol by the principal earning member also increases the vulnerability of the households. The appalling housing conditions of those living in slums also push them into health shocks thereby raising their level of vulnerability. Only 30% of the households have kitchen and the rest either cook in their living room, verandah or open space giving rise to severe respiratory problems.

Fuel stacking has been observed in the surveyed households and shows no sign of abating. With the ever increasing rate of urbanization, household energy use calls for attention. In course of our survey, we observed that majority of our slum households use 'dirty' fuels like firewood, cow dung cakes, coal, and kerosene for cooking. Clean cooking fuels are important for combating high levels of indoor air pollution.¹⁷ The exposure to such type of pollution is particularly high among women and children, who spend a substantial portion of their time near the domestic hearth, cooking for their family. Our survey shows that only 12% of the households use natural gas as a fuel, which is predominantly considered a 'clean' fuel. The rest of the households use

¹⁷ Indoor air pollution is the world's fourth largest killer, causing nearly 4.3 million deaths a year.

different varieties of ‘dirty’ fuels and there is a common tendency amongst the households to ‘stack’ fuels. We also looked into the place of cooking within the houses to have a notion of whether indoor air pollution percolates into other areas of the houses, and also the type of ventilation available in the houses. It is found that almost one-third of the households use a small corner in the only available room in their houses for cooking purposes while 24% of them use their balcony which serves as their kitchen. A proper kitchen is available only to 10% of the households in our survey areas, and 25% of them cook in open spaces.

Our study looked into some possible determinants of the choice of cooking fuel type by the slum households. This is an issue that did not find much of research attention in the context of slums in India although the foreign scholars viewed this as an important issue (Leach, 1992; Heltberg, 2003a, 2003b). To identify some determinants of choice of cooking fuel type by the slum dwellers in Kolkata, we employed the technique of Probit regression. In our Probit regression model, choice of fuel type by the households is considered as the dependent variable.¹⁸ The explanatory variables are so chosen that they represent the socio-economic characteristics of the households. Our main conclusion from this exercise is that the probability of choosing a cleaner fuel goes up when the head of the household is more educated and experienced as revealed by her/his age. The same probability also goes up for the asset-rich and APL households. The availability of a pucca house and/or a kitchen encourages the households to go in for a cleaner fuel. It is also found that the smaller-sized households and those with limited number of female members are more likely to choose a cleaner fuel.¹⁹

The irresistible desire for a shelter compels the urban poor to encroach on any piece of available land in the city. Apart from being the most unaesthetic spots to a city’s landscape, slums with its deplorable housing conditions showcases the most visible manifestation of poverty in the city. The houses are usually built gradually by the urban poor over a number of years. Most of them use flammable building materials like bamboo and tarpaulin. Some semi-pucca houses built of tiles and bricks are also seen in the slums. They are unwilling to spend much of their earnings to improve housing structures as they lack ownership titles on the land. The reality is that there are high levels of overcrowding in their homes coupled with adverse environmental conditions that cause rapid deterioration in the health status of their members. Thus, the poor quality of housing adds to vulnerability of the slum dwellers. In our study of slum households in Kolkata, we

¹⁸ The dependent variable (called FUEL) is assigned value ‘1’ if the household uses a ‘clean fuel’ (i.e., LPG) and ‘0’ if ‘dirty fuel’.

¹⁹ Presence of more female members in the family might lead to more usage of ‘dirty fuel’. This is because the females would be able to collect firewood, straw and so on. They are also more likely to be engaged in preparing the cow dung cakes that are used plentifully in the urban slum households.

observed that around 65% of them use semi-pucca houses as their homes while 19% live in 'jhopris' or tents with tarpaulin/plastic sheets serving as roofs. As high as 86% of the surveyed households lived in houses with a single room.

Safe drinking water, adequate sanitation, and proper housing are essential for the sustenance of human lives and exhibit positive gains in the form of reduced rates of illness and mortality. Associated with these are the gains from reducing the number of workdays lost and the medical cost of treating waterborne diseases (Jalan and Ravallion, 2003; Evans, 2005). However, in the slums of Kolkata and other cities, it is found that water, sanitation, and hygiene infrastructure are severely strained as infrastructure investment has not kept pace with rapid and unplanned urbanization (WaterAid, 2007). As the slum-dwellers are subjected to 'infrastructure poverty', this might exacerbate their vulnerability levels all the more.

In terms of findings emerging from our analysis of micro data collected from the slums of Kolkata, we point out a number of areas that require immediate attention:

(1) Studying the infrastructure facilities in the slums of Kolkata, we observed that most of the households use public taps. There is a fixed time every day for the collection of water which is mainly done by the women and children of the households. Inadequate number of public taps and the ever increasing slum population results in long queues and large amount of time lost by them, which could have been used in doing something more productive (by the women) and studying (by the children). Obviously, a good solution would have been to have water access within the houses or yards of these slum households. However, the physical conditions of these slum settlements along with the quality of the materials used to build housing units (like mud, bamboos, tin boards, etc.), are unsuitable for permanent water pipes and taps. Thus, keeping these constraints in mind, it is extremely important for the concerned authorities to increase the density of public water taps in the slum areas, as elsewhere.

(2) Another infrastructural drawback in the slum areas of Kolkata is that most of the slum-dwellers use shared-sanitation; sometimes the number of user per toilet exceeds ten households. This raises the issue of proper cleaning and maintenance of these shared toilets. Poor maintenance of these toilets generates faecal worms, which adversely affect the health of the users. Sometimes, the female members of the households face abuse while using the shared-toilets during night-time. The municipal authorities would have to take initiatives to construct more toilets wherever land for this purpose is available, and also assign more sweepers to clean these toilets more frequently. In this context, the NGOs could also play an important role in educating the slum people about importance of maintaining the toilets as clean through community/group initiatives. In many countries (e.g., Kenya), the NGOs played an important role in providing health education to the slum-dwellers that paid good dividends.

(3) As a major portion of the slum-dwellers of Kolkata use ‘dirty’ fuels, efforts should be to make people aware of the problems such as indoor air pollution and its related health effects that are associated with the usage of ‘dirty’ fuels. Although the LPG cylinders are provided at a subsidized rate, the new connections require a one-time cash payment which many of them are unable to arrange. So the government should think of devising a scheme of paying this money as one-time grant to them.

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