

Climate variability, livelihoods and social inequities: The vulnerability of migrant workers in Indian cities

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Abstract

This paper examines the vulnerability context of migrant workers in the informal sector in three Indian cities (Kochi, Surat and Mumbai), specifically in terms of how their livelihoods interface with climate variability, related hazard events and social inequities. It examines the progression of population vulnerability from a political economy perspective. The underlying assumption is that migrant workers' vulnerability to climate variability in cities is closely embedded within the wider political economy of their day-to-day livelihood struggles. A mixed methodology design was adopted to carry out the study. Data from 50 migrants in each of the three cities were collected using a semi-structured interview schedule. The research demonstrates that urban vulnerability is a condition that shapes and reshapes itself continuously and fiercely, accompanied

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by the processes and structures of unplanned rapid urbanisation, environmental change and social exclusion. A significant feature of migrant workers' vulnerability is its multi-dimensionality. This paper suggests that urban planners involved in environmental governance and risk reduction have to critically reflect on certain terminologies and practices in the field of climate change, while addressing these multi-dimensionality.

Keywords

Vulnerability, livelihoods, assets, climate change, political economy

Introduction

This paper examines the vulnerability context of migrant workers to climate variability in three Indian cities, namely Surat, Mumbai and Kochi. Drawing insights from a political economy perspective, this paper asks what is the nature and what are the factors influencing vulnerability among migrant informal workers in Indian cities, with specific reference to climate variability and livelihood uncertainties. The paper explores how factors such as sources of livelihood, levels of income and asset holdings, characteristics such as ethnicity and caste, or access to social protection schemes and their interface with situations of climate variability shape the vulnerability context of migrant workers in the city.

Population vulnerability can be understood as the ability of individuals, households, social groups and communities to anticipate, cope with, resist and recover from, or adapt to any shocks or external stress placed on their livelihoods and wellbeing (Blaikie et al. , 2004; Kelly and Adger, 2000). Such an understanding emphasises the need to focus on the socioeconomic and institutional constraints that limit the capacity of society to respond to shocks and uncertainties. This definition also places resource availability and entitlements of individuals and groups to access and avail these resources at the centre of any research on social vulnerability and adaptation (Kelly and Adger, 2000). Vulnerability also manifests itself in the diverse forces of self-interest, power, access to decision-making and resources, which interact with physical and ecological systems (Ribot, 2009).

Urban informal settlements are spaces where physical and social vulnerability coincide, and are also exposed to multiple risks amidst severe environmental, economic, political and social constraints (Bosher et al., 2007; Moser and Satterthwaite, 2010). Such factors also restrict access to resources necessary for social wellbeing, with implications for adaptive capacity (Parvin et al., 2013). Factors such as population growth and high population density, lack of access to safe and secure housing or other public services have enhanced the vulnerability contexts of the urban poor (Revi, 2008). It is also predicted that the physical and social impacts of climate change may worsen existing urban problems (Banks et al., 2011). In this context, the poor and migrants in the informal urban sector are vulnerable specifically to livelihood uncertainties such as loss of livelihood spaces, resources and assets in the face of climate variability (Cannon et al., 2003).

Various studies have projected linkages between climate variability and risk of infectious diseases (McMichael et al. , 2012; Patz et al. , 2008). Studies have also pointed out that climate variability may result in alteration of range, distribution and incidence of outbreaks to certain infectious diseases such as dengue or chikungunya, or in many other cases increase the burden of diseases such as diarrhoea (Dhara et al., 2013; McMichael et al., 2012). The urban poor in crowded settlements with limited access to water and sanitation facilities are more vulnerable to climate variability and infectious diseases (Douglas et al., 2008); and also due to the paucity of a clean habitat,

extreme health risks, loss of social networks and livelihood assets (Bardsley and Hugo, 2010). Slums and migrant workers' colonies are thus potential settlement spaces for infectious disease outbreaks such as diarrhoeal disease, measles, meningitis, acute respiratory infections, tuberculosis and malaria, as most of these physical spaces are crowded, and have inadequate shelter, water, sanitation, and access to immunisation and health care facilities.

A major aim of this paper is to examine the impact of climate variability and seasonal environmental changes on the livelihoods of the urban poor and how these processes are shaped by existing social structures and power relations. The primary assumption of this paper is that the poor and migrant workers in Indian cities are more vulnerable to the impacts of climate change and extreme weather events, such as rise in temperature, precipitation and heavy rainfall, flooding and water logging. Further, the vulnerability of social groups such as migrant informal workers in cities is rooted in social processes and underlying causes that may ultimately be quite remote from the climatic event in itself. People become vulnerable due to specific relations of exploitation, unequal bargaining and discrimination within the political economy.

In the above-mentioned context, this paper explores the livelihood struggles of migrant informal workers amidst situations of climate variability and seasonal environmental changes. It further analyses their impact on their health and secure livelihoods. The political economy model that this paper has adopted to analyse population vulnerability to climate variability and seasonal environmental changes is described in the next section. Followed by the description of the political economy framework, this paper then describes the research methodology used, and the findings and discussions respectively.

The political economy of vulnerability

The impact of climate variability and seasonal environmental changes on migrant informal workers needs to be contextualised within a larger urban poverty framework (Banks et al., 2011). Urban household vulnerability, therefore, needs to be examined as a dynamic process that takes into account the risk of exposure and susceptibility to various factors (Ahmed and Fajber, 2009; Cannon, 2008; Heltberg et al., 2009). There are numerous frameworks that facilitate the analysis of population vulnerability to climate variability and seasonal environmental changes. For instance, the risk-hazards approach to vulnerability assumes that people are vulnerable to the hazard event in itself (Füssel and Klein, 2006). On the other hand, the social constructivist approaches consider people to be vulnerable to undesirable outcomes embedded within the social, political and economic system (Blaikie et al., 2004; Füssel and Klein, 2006; Ribot, 2009). In addition, the social constructivist approach includes domains such as social inequalities and exclusion, levels of urbanisation, growth rates and economic vitality in their analysis (Cutter et al., 2003).

Largely integrating the social constructivist framework, this paper analyses the progression of vulnerability to climate change-related factors and climate variability from a political economy perspective. This research thus examines how the vulnerability contexts are embedded within the wider political economy of the livelihood struggles of poor and marginalised migrant communities in the cities. The political economy model demonstrates that the potential for people to be exposed to the impact of climate variability and seasonal environmental changes depends fundamentally on how social systems and their associated power relations impact on different social groups represented through their class, gender, caste/race and ethnicity (Blaikie et al., 2004).

The political economy approach to vulnerability (popularly known as the Pressure and Release Model) examines the progression of vulnerability in three stages namely, root causes, dynamic pressures and unsafe conditions (Blaikie et al., 2004). Root causes are historical and contemporary structural processes (economic, demographic and political) of a society that determine and shape

the distribution and inequality of power, capabilities and assets (Blaikie et al., 2004). When impacted by dynamic pressures such as demographic change or urbanisation, the root causes are transformed and manifested as unsafe conditions. In this paper, the root causes of vulnerability among migrant workers are analysed across a rural–urban continuum. Such a theoretical positioning also helps us in pointing out that social vulnerability to environmental and livelihood uncertainties is temporally and spatially related. The migrants’ experiences of vulnerabilities in the cities are reflected as interplay of root causes, dynamic pressures and unsafe conditions. In this paper, dynamic pressures are explored in terms of the contemporary forms of vulnerability that impact upon the livelihood security and adaptive capacities of migrant workers in the cities. When impacted by dynamic pressures – such as population growth or urbanisation – at both the micro- and macro levels, the root causes experienced are transformed into unsafe conditions, which are manifested as vulnerability in the context of hazards (Blaikie et al., 2004). The micro-level attributes include the shrinking of households’ livelihood assets, lack of skills or lack of local investments. The macro-level attributes could be population growth, deforestation or large-scale migration in the region (Blaikie et al., 2004). The political economy model not only explains the factors inducing vulnerability, but also provides sufficient scope to address underlying driving forces and root causes (Birkmann, 2006; Blaikie et al., 2004).

Research design and methodology

Research design

This paper is part of a larger study that examined the vulnerability contexts, health inequities and adaptation strategies of migrant workers in three Indian cities, namely Surat, Kochi and Mumbai. We adopted a mixed methods design to carry out the research. An in-depth review of literature related to climate change and climate variability, health equity and migration was followed by a vulnerability analysis of 50 migrants in each of the three cities using a semi-structured interview schedule. A total of 150 interviews with migrant workers were carried out in total, and our evidence presented here includes descriptive statistics drawn from surveys contextualised with information from semi-structured interviews with participants.

Characteristics of selected cities

Some of the characteristics of the cities pertinent to the study are discussed as follows. Mumbai city in the state of Maharashtra is characterised by a very high rural–urban migration rate, and most of the migrant workers are found in the informal sector. These migrant workers live in slums and squatter settlements, many of which are built on encroached/reclaimed wetlands, which are further susceptible to climatic uncertainties. The city is very prone to heavy rains and urban flooding. Tidal waves and heavy rains have the potential to submerge several parts of the coastal city, impacting upon the livelihood security and delivery of lifeline services in the city. The city is also prone to a high rate of infectious diseases. With variations in weather, the city is exposed to a high rate of vector-borne and water-borne infectious diseases in particular.

The city of Surat in the state of Gujarat is also characterised by a very high migration rate, attracting rural populations from backward regions of the country to the diamond and textile industries in the city. Surat’s slums reportedly house migrant workers from Orissa, Uttar Pradesh, Bihar, Madhya Pradesh, Rajasthan, Maharashtra, and Gujarat itself. The city experienced a massive outbreak of plague in 1994. In the post-plague scenario, the government and administration claim to

Table 1. Profile of respondents.

Characteristics	Surat (No.)	Kochi (No.)	Mumbai (No.)
1. Total number of interviewees	50	50	50
2. Scheduled caste	29	16	15
3. Ethnic minorities	2	1	5
4. Other backward class	17	28	25
5. Long-term migrants	41	35	50
6. Mean age of migrants	35	28	36
7. Migrant workers who are married	32	26	38
8. Migrants who have migrated with families	26	26	34
9. Illiterate	36	7	20
10. Approximate average daily income (in US\$)	4	8	6
11. Approximate average monthly income (in US\$)	134	240	230

have developed a resilient health care system. The city also witnessed a massive flood in 2006, killing some and displacing many migrants.

The third city – Kochi in the state of Kerala – is a young, growing city compared to Mumbai and Surat. Annual statistics from the state governments' labour department highlight the increasing migration rate from ecologically fragile regions of the country to the city. Most of these migrants are from the states of Assam, West Bengal, Bihar, Odisha, and Uttar Pradesh. Population density and morbidity rates in the city are very high and, with variations in weather, the city is exposed to a high rate of vector-borne and water-borne infectious diseases. Kochi is prone to heavy rains, cyclonic storms and flooding. Most of the city's new constructions have been built on reclaimed wetlands that are prone to water logging. The most significant risks are the impacts on Kochi's water systems (especially drainage) and waste disposal.

Selection of respondents

A two-stage purposive sampling strategy was used to identify the respondents. Firstly, we identified the hazard-prone wards or areas of each city, which also had a considerable migrant population, using information from the Municipal Corporation and District Disaster Management Cells. We then identified a few key informants, such as representatives from the state government departments, NGOs (non-governmental organisations) and other civil society organisations, to collect more information on the location of migrants' workplaces in these wards of the city. Based on this information, we began to identify the respondents amongst migrant workers using snowball-sampling techniques. There were 60 migrants from our sample of 150 respondents who belonged to the Scheduled Caste and five migrants in the Scheduled Tribe population. Our respondents also included three migrants from the Nomadic and De-notified Tribes (NT&DNT), who are among the most excluded social groups in the city. A significant number of respondents, 70 migrants, belonged to the Other Backward Class, which is classified by the Government of India as castes that are educationally, economically and socially disadvantaged. Table 1 provides a brief profile of the respondents.

Limitations

The findings of this study are based on a very small sample and therefore do not provide ample scope to generalise the findings across the whole migrant population in the three cities, nor to

populations in other cities. Instead, our research design aims to shed light on the different ways that the vulnerability of migrants intersects with climate-related stressors in urban areas. There are other limitations to the study as well. We were able to interview only 26 (17%) female migrants across the three cities. Therefore, this study has not captured gender-specific vulnerabilities, such as challenges to reproductive health and gender-based discrimination.

Climate variability, migrant workers and urban livelihoods: findings and discussion

This section analyses the root causes of vulnerability and its relationship to the dynamic pressures or contemporary forms of urban vulnerability among migrant workers. Following this, we address the unsafe conditions with specific reference to health inequities and infectious diseases among migrant workers in the city. To begin with, this section explores the perception of migrants of the climate-related disturbances that they have faced in the city over the previous 10 years, and the impact of climate variability on their livelihoods. Our findings show that 58% of respondents across the three cities believed that there is very high impact of climate variability on their livelihoods. Only 20% of the respondents believed that the impact is very low. The rest of the respondents felt the impact to be moderate. The respondents perceived flooding and water logging due to heavy rains, flood-induced displacement from city homes and an increase in the duration of summer months as some of the key climatic disturbances. Migrants in Surat perceived the increase in flooding and water logging events due to heavy rains and flood-induced displacement from their city homes as a serious threat. Migrants in Mumbai said that they were witnessing an increase in the duration and intensity of the summer months, decrease in rainfall, and severe unpredictability of weather conditions. Interestingly, 36% of the migrants from Kochi opined that they did not perceive drastic changes in the climatic conditions of the city as they have been witnessing severe and worse natural hazard conditions at their native homes. Some of the significant climatic events and associated hazards that disrupt the livelihoods of migrants were found to be a rise in temperature (49%), an increase in flooding and water logging incidences (47%) and severe intensity of rains (39%).

Root causes of vulnerability

Poor socioeconomic conditions of the migrant workers in their villages not only remain one of the important causes of their vulnerability but have also played an important role in their decision to migrate to the city. Our study reveals that 92% of the respondents were unemployed in their native villages, and that a majority of the migrants (68%) had migrated to the city with the hope of better job prospects and higher incomes than in their native homes. Many respondents also mentioned that they had moved to the city due to severe conditions of poverty, lack of skills and poor living conditions in their villages. Among the 150 migrants surveyed, only 53% of respondents had their own land in their native homes. Out of these, only 43% of respondents possessed cultivable farmlands, with a mean acreage of 2.21 acres. Around 70% of the respondents mentioned that they had their own place to stay in the village, but did not have any credible employment options. In addition, 42% of the respondents were illiterate.

Interestingly, 7% of migrants in Kochi mentioned that they had to move to cities as climate variability and natural hazards in their native homes had severely affected their access to day-to-day livelihood resources. For instance, we came across migrant workers who were farmers in the rain-fed regions of Tamil Nadu. Heightened water scarcity and lack of sufficient water for agricultural

purposes had forced them to migrate to Kochi and work as casual labourers in the city. Some of the respondents who belonged to the state of Odisha mentioned that they had to migrate due to the rapid salinisation of their agricultural fields and resultant crop failure. There were also respondents from the north-eastern parts of the country who had migrated due to floods in their native homes.

The caste/ethnic background of the migrants also reveals the nature of social vulnerability and their movements from the rural regions to the city. Among the respondents, forty-three% belonged to Scheduled Caste and Scheduled Tribes population. Historically and even in contemporary rural India, these two groups have been the most marginalised and socially excluded population of Indian society. The case of the Nomadic and De-notified Tribes (NT&DNT) is worse, as they are the most vulnerable, and neglected by the mainstream development processes. These tribes are generally a floating population who do not have a permanent settlement as such, and are often victimised by the administrative and legal systems. These tribes were branded as criminals by birth under the Criminal Tribes Act 1871, enacted by the British Government. In spite of the repeal of the act in 1952, they are still treated as criminals by birth and subjected to harassment and persecution at the hands of the police or other state actors. Apart from these marginalised groups, 46% of our respondents belonged to the Other Backward Classes. The Government of India classifies these groups as castes that are educationally, economically and socially disadvantaged.

Discussing discrimination in the city, 37% of the respondents felt that the status of being a migrant itself made them vulnerable to shocks and uncertainties. They also mentioned that caste and ethnic-based discrimination restricted their access to basic livelihood assets. Caste-based discrimination was a serious issue for 36% of respondents in Kochi and 34% of migrants in Surat. In Kochi, caste-based discrimination existed more amongst the migrants, the contractors and the employers, rather than between migrants and the host population.

As Table 1 shows, a majority of our respondents were from those sections of the population who have been historically marginalised and excluded from mainstream forms of development. In their native villages, these segments of society lacked access to basic livelihood resources and often were unable to nurture meaningful engagement with key decision-making structures and power centres. These are the populations who had predetermined forms of social vulnerability and were often forced to move to the cities in search of a better quality of life.

Dynamic pressures in the city

The root causes mentioned above mostly reflect the vulnerability contexts that the migrants have experienced in their native places. The authors would like to assert that the very act of migration to the city has not resulted in the eradication of these root causes. Instead, as illustrated below, the dynamic pressures in the city have impacted upon the root causes of migrants' vulnerability, making them more vulnerable to the environmental and livelihood uncertainties in the city. These dynamic pressures are explored in terms of the contemporary forms of vulnerability that impact upon the livelihood security and adaptive capacities of migrant workers in the cities.

Nature of financial assets. In this regard, our study shows that many migrants who were unemployed at their place of origin were able to find some means of income in the city. Nevertheless, only 33% of the migrants in all three cities believed that they had access to better-paid jobs. The average daily income for the total population surveyed was 367 rupees (approximately US\$6) and the average monthly income was 11,220 rupees (approximately US\$187). The wages that the workers receive in Kochi were much higher than the other two cities, with an average daily income of 465 rupees (approximately US\$8), followed by Mumbai (371 rupees or approximately US\$6), and Surat (264 rupees or approximately US\$4). In a similar vein, the average

monthly income was the highest in Kochi (14,402 rupees or approximately US\$240), followed by Mumbai (13,804 rupees or approximately US\$230), and Surat (8038 rupees or approximately US\$134).

In addition to low income levels in the city, our study also found that a majority of the migrant workers and their families had limited access to diverse economic assets. In this regard, our findings show that the main earner in the migrant households was the migrant worker himself or herself (74%). Only members of a few migrant workers' households (namely, spouse (28.67%), siblings (18%), parents (10%) and children (8.67%)) were contributing to the household income. Other instances of diversifying economic assets among migrant workers was also observed. In Kochi, 56% of the migrants surveyed used to send their earnings as remittances (with an average of 4500 rupees per month or US\$75) to their homes. On the other hand, in Mumbai, remittances were very low (18%). Among the respondents from Surat, there was no case of remittance behaviour. The migrant workers' access to accident, life and health insurances was found to be very low in all three cities. Only 39% of the respondents had access to some kind of insurances. On the other hand, most of the migrant workers relied on informal emergency credit mechanisms such as moneylenders, employers or fellow migrant workers to deal with crisis situations. Migrants who had to borrow from moneylenders had to pay a high interest rate, creating a relationship of debt and bondage. Our findings show that access to informal emergency credit was highest among migrant workers in Kochi (66%) followed by Mumbai (24%) and Surat (20%).

None among the migrants in the three cities had access to any form of social pension. Our findings also show that only 66% of the respondents had access to some kind of state-sponsored welfare schemes. Only 78 respondents (52%) in the three cities had access to banks; while just 18% of respondents in Kochi, 8.5% of respondents in Surat and 13% of respondents in Mumbai actually had active bank accounts. Difficulties in setting up a bank account due to lack of a proper identity and proof of residence in the city and lack of awareness regarding facilities and schemes associated with banking services acted as barriers to opening accounts. Moreover, our findings also show that possessing a bank account does not necessarily transform into savings. While 52% of the respondents had access to bank accounts, only 24% of the migrant workers were able to convert part of their earned income into savings.

A major reason for the low rate of savings could be the fact that their income is very low. In addition, migrants also come to the city with a burden of debt. Our interviews with the migrants revealed that 31% of them owed some form of debt. The practice of borrowing money is higher in Mumbai (52%), followed by Kochi (28%) and Surat (16%). We also found that 28% of migrants in Kochi and 16% of respondents in Surat were unable to repay their debts. Of Mumbai migrants, 18% also pawned gold or other goods during times of crisis, while this was not observed in the other two cities. An important qualitative inference from the discussions that we had with migrants is that the borrowing behaviour of migrants tends to increase with incidences of climatic events such as heavy rains, water logging and heat stress. Reasons for borrowing money during climatic events are associated with unemployment, ailments and injuries as a result of secondary hazards such as electrocution, burns or falls due to slippery surfaces. Migrant workers also tend to borrow money when children and the elderly fall sick and require hospitalisation during climate variations and related hazard events. In Mumbai, 50% of the migrant workers said that their debts increase during the monsoon months, when flooding and water logging events impact their livelihoods. Some respondents in Kochi recollected that they were forced to borrow money during times of climate variations and corresponding outbreaks of epidemics such as dengue.

Some migrants also recollected that the unpredictability of weather conditions and the resultant loss of employment on those days caused the erosion of their financial assets. In Surat and Mumbai, the massive floods in 2005 and 2006 led to a complete depletion of their savings, and they had to

start rebuilding their financial base from scratch. Some also had to borrow money at high interest rates in the post-flood phase to rebuild their livelihoods. Migrants in Kochi observe that their remittances to home were affected during the monsoons, especially when they were infected with diseases such as malaria, dengue or hepatitis. Diagnosis, treatment and medicines are so expensive that neither they nor their employers were able to afford them. Both in Mumbai and Kochi, people stated that they are forced to terminate treatment halfway through due to the prohibitive cost. On many occasions they are forced to borrow from their friends or local moneylenders and often find it difficult to repay the loans. Such situations are extremely hard for single-headed households, either in the city or back in the native home. On many occasions, self-employed migrant workers in particular are forced to mortgage or sell their work equipment. For instance, a cobbler in Surat had to sell his shoe-making unit when he fell sick after the floods, and now has to rent the equipment to sustain his livelihood.

Access to physical assets. The nature, type and quality of physical assets are an important determinant of cities' resilience to climatic and hazard events. In this regard, we examined the access of migrant workers to diverse physical assets in terms of housing, sanitation, energy, drinking water and transportation facilities. Our findings show that only 15% of migrants owned homes in the city, 35% were renting property and 31% were staying with other migrants on a shared accommodation basis. The most significant finding is that around 19% of migrants were homeless in the three cities, particularly NT and DNT tribes living on the streets with no proper shelter or housing arrangements. Around 20% of the migrants also faced the threat of eviction at any time from their respective places of residence. In addition, migrants in Surat opined that it was difficult for them to identify an affordable house that was free from flooding and water logging issues. We also noted that migrants staying on a shared accommodation basis or living in overcrowded housing conditions in Kochi were prone to infectious and communicable diseases. As illustrated by a medical practitioner in Kochi:

The chances for infectious diseases to spread increases when migrant workers are forced to stay together especially in labour camps or in shared accommodation sites. They are often overcrowded and congested with poor hygiene and sanitation facilities. The high humidity levels add to their vulnerabilities, as they are more prone to infectious diseases that spread through sweat and touch. Most of these migrant workers who report to me have skin infections. There were also incidences where the migrants had come to the city with 'imported' malaria. Many a times they visit doctors only when the illness (especially skin disease) aggravate and reaches a bad condition.

Across the three cities 91 migrants (61%) believed that climatic variations and unhygienic housing conditions have exposed them to a rapid increase in infections caused by mosquito bites. While 29% of migrants opined that they felt severe heat stress while working under urban conditions and structures, 28% of migrants also pointed out the losses they incurred due to flooding and water logging in their residential-cum-work sites. Problems such as leaking roofs during heavy rains (25%) and dampness of walls and floors (17%) were also pointed out as challenges they faced with respect to their housing assets. With respect to existing housing structures, 20% of migrants believed that they were highly unstable and not safe enough to withstand flood hazards or heavy rains. Raising concerns over health issues, 22% of migrants informed us that large populations of rodents affect most of their residential areas. Adding to this, 12% respondents felt that they are at severe risk from the health challenges and infections arising out of sewage blocks and spills during rains and floods.

Yet another important determinant of physical vulnerability is sanitation; 8% of respondents did not have access to sanitation facilities and had to defecate in open spaces. Most of these migrants were residing in Surat and one in Mumbai. In addition, 28% of migrants in Surat found it difficult

to access sanitation facilities during the monsoons, while 56% of migrants in Mumbai found it difficult to access proper sanitation facilities during the monsoons due to flooding, water logging and sewage spillage.

We carried out a similar analysis with respect to access to clean drinking water. Our findings show that 95% of the respondents had access to clean drinking water at their current place of residence, and around 84% had access at their work site. Despite these high figures, further probing revealed that access to clean drinking water is still a major concern. We found that in Surat, the water available is very hard, and there is a high prevalence of water-borne diseases such as typhoid and jaundice. Migrants in Surat also complained that the water they get is salty and increasingly full of sand deposits.

Several other issues related to water were also raised. Some commented that their options to store food grains and other essential commodities reduce considerably during flooding and water logging, not only due to the resulting dampness, but also because of a rapid rise in the population of rodents and reptiles. Medical practitioners in Kochi had reported predominant signs of E-coli in drinking water. In Mumbai, during seasons of heavy rains and flooding, we found that the homeless such as the NT and DNT population, had to access drinking water from public toilets, which are unhygienic and highly contaminated. Thus, our argument is that although the migrants perceive that they have access to clean water, in reality the water may often not be clean, resulting in epidemic outbreaks and infectious diseases.

In the above-mentioned context, the socially constructed nature of risk and uncertainties needs to be further examined. For example, though our data show that the migrants had access to clean drinking water, we need to question the notion of 'clean' in the context of risk and survival. For the migrant, the water is clean because they did not have easy access to water of this quality back in their village, due to factors such as caste, drought or salinity. Therefore, for the migrant, the ability to access water near their squatter residence or work site in the city is in itself progress. However, this step may not result in building resilience, as the urban ecosystem is maintained in such a way that the 'clean' drinking water is actually a pathway to new forms of risk or unsafe conditions.

From the above discussions on root causes and dynamic pressures, it is also evident that the urban poor are exposed to multiple risks amidst severe environmental, economic, political and social constraints (Moser and Satterthwaite, 2010). This research shows that a rise in income or remittances is not a sole indicator of reduced vulnerability. Urban housing has also not yet evolved to tackle these challenges. The process of moving from a home in the village to homelessness in the city itself demonstrates the progression of population vulnerability and the need for resilient housing and habitat conditions. In fact, the root causes or the dynamic pressures that forced people to migrate from rural or hazard-prone regions of the country have not completely vanished with migration or urbanisation. Instead, along with the traditional forms of vulnerability such as caste-based discrimination, migrant workers are exposed to new structures and processes that manifest into newer and more complex forms of vulnerability. Having discussed here the dynamic pressures contributing to urban vulnerability, the following section will discuss the unsafe conditions in which these vulnerabilities are manifested.

Unsafe urban conditions and the case of infectious diseases

The unsafe conditions in urban areas are characterised by people living in dangerous and life-threatening habitats, whose life and livelihoods are at risk, and who are governed by weak civic authorities and institutions. This section elaborates the characteristics of these unsafe conditions, by illustrating the exposure of migrant workers to certain infectious diseases. It further describes the nature of health inequities that migrants face in their day-to-day life.

Our findings show that approximately 23 migrant households had members who suffered from food- and water-borne diseases in the previous three years. Most of these cases required hospitalisation and took 1–3 weeks to cure, affecting the livelihoods of the migrants or their family members. Migrant households in Surat had higher disease prevalence, followed by Mumbai and Kochi. We observed that in 2014 alone, 32% of migrants in Surat were infected with typhoid fever. In a similar vein, 4% of migrants in Kochi and Mumbai were affected with acute diarrhoea. Both human and financial security was compromised during such situations.

At an even higher rate, 66 migrant households had members who were affected by vector-borne diseases. A matter of concern is that 28 migrant households in Surat and 30 households in Mumbai were affected by vector-borne diseases in the previous three years. Malaria was rampant among 28 migrant households in Surat. Migrants in Mumbai were infected with different types of vector-borne illnesses, namely malaria (56%), dengue (8%), chikungunya (6%) and yellow fever (2%). Though the incidences of chikungunya and dengue have become rampant in Kochi, the city was considered to have eradicated malaria. However, our findings show that during the year 2014, two migrants were infected with malaria and one migrant each with dengue, chikungunya and yellow fever respectively. These diseases had repercussions on not only their bodies and mental health, but also affected migrants' livelihoods. In the words of an elderly migrant woman in Mumbai:

I make my living by selling flowers, garlands or spinach. From morning to night, I have to sit in this street to sell these items. These days, my livelihood gets affected during the rainy season. I have become old and getting wet makes me shiver. The rains also pour during times when we least expect them. And this street gets flooded within a few hours of rainfall. Though the water recedes immediately after the rain, I cannot afford to get wet and fall sick. I am a widow and no one is there in my home to take care of me. Even if I get a small cold, I rush to the hospital. I have to take care of myself and cannot afford to fall sick.

One of the main determinants of health equity is having equal access to affordable and effective health care services. The majority of the migrants interviewed, however, do not have access to affordable and effective health care services. Among migrants, 98% informed us that they did not have regular access to the government doctor, while 86% respondents mentioned that they did not have access to any kind of health care professionals in the city. Only 66% of respondents had direct access to doctors during health crises. The fact that almost 50% of the migrants did not have access to regular doctors in the public hospitals is a serious cause for concern. In Mumbai in particular, we observed that the homeless migrants including the NT and DNT did not have access to any health care facilities. Moreover, during epidemic outbreaks, such as diseases like tuberculosis or malaria, the approach of the Municipal Corporation was to practically evict these migrants from the city.

Several challenging factors were found to prevent migrants from seeking effective health care. These factors have their genesis in the root causes and dynamic pressures discussed earlier. Migrants avoid going to doctors, as they are unable to afford their services. As repeated visits are required to cure some of the infectious diseases, most of the migrants also avoid going to the hospital or clinics. According to a migrant worker based in Surat:

We [including family members] are scared of falling sick. With my meagre income, I cannot afford to go to hospitals. If we have to go to hospitals, I have to borrow money from the local moneylender at high interest rates. To repay the loan, I have to borrow again from others. Thus I end up in a never-ending debt trap.

The long waiting hours in the public hospitals also make it difficult for them to leave their work sites. Thus most of them go to private doctors during illnesses, which is not affordable for many. There are also many migrants who are not granted leave during times of illnesses, so they prefer to

continue working. Such a trend is high in Kochi (32%). Furthermore, during flooding and water logging, it is very difficult for the migrant workers to even access health care services; and it is also difficult for doctors and other aid organisations to reach the migrants. As narrated by a doctor who volunteered to treat victims of the 2006 flood in Surat:

The flood situation was very grim. It was so difficult for us to access the migrants' settlements as all these localities were severely flooded. We were able to access these places only after the receding of the water level.

Given these challenges accessing health care services, self-medication is a practice noted among many respondents. In Kochi, a small number of migrants treat themselves by visiting the pharmacy. On the other hand, migrant workers in Surat often reported visiting quacks – who provide unlicensed and questionable services – for their treatment. Those migrants using these services are mostly daily wage labourers and workers employed in the textile units. In the words of a female migrant worker who regularly visits a quack:

I cannot afford to go to a hospital as my employers pay me very less. Therefore, I go to the 'neighbourhood doctor'. He is easily accessible and charges very less consultation fee. His medicines are also effective than other doctors in the hospitals. Once I was down with typhoid. I went to the neighbourhood doctor and he gave me some fish bones to hang around my neck. After a few days, I was cured of typhoid.

Some respondents also said that they lacked the necessary social support to take care of them when they are ill, particularly in Kochi (44%). We also found that these respondents return to their native places during medical emergencies instead of seeking health care in the city, likely due to factors such as the lack of social support and the high cost of diagnosis and treatment in the city. Yet another concern of migrants is the impact of infectious diseases such as chikungunya and dengue on their physical ability to work. They opine that these illnesses have long-lasting side effects on the body such as severe joint pains, inability to stand for a long time and fatigue. Such illnesses prevent them from undertaking jobs that require a high amount of physical labour.

The migrant workers who we surveyed in the cities are thus characterised by several unsafe conditions such as poor and unhygienic habitat conditions, are greatly exposed to infectious diseases, have limited access to equitable health care services and maintain insecure and unstable livelihood assets.

Conclusion

This paper raises an ongoing concern that in the face of greater migration to Indian cities, the governance mechanisms in cities may be unprepared to meet the needs of urban migrants or to address existing or emerging environmental challenges. In addition, when considering vulnerability to climate variability, climate scientists and urban planners need to recognise urban vulnerability as rooted in social and historical processes of exclusion and exploitation, which may ultimately be quite isolated from the climatic event in itself. As evidence taken from survey data and interviews here suggests, a significant feature of migrant workers' vulnerability is its multi-dimensionality across temporal and spatial dimensions, which is reflected in the migrant workers' lack of access to resources, power and decision-making structures in the city. As our research design does not present causal evidence of links between climate variability, vulnerability and exclusion, we caution that findings should not necessarily be considered representative either within or across cities. However, they do highlight a range of different ways that risks and uncertainties related to climate

variability and seasonal environmental changes could result in drastic erosion of the livelihood assets of the urban poor.

Several public policy implications may emerge given that climate variability and infectious diseases could deepen the vulnerability of the urban poor. The issues of public health, sanitation, water supply, housing, urban environment, financial inclusion, social security systems, and the educational and infrastructural needs of migrant workers needs to be given greater attention. Toilet construction and provision of accessible and hygienic sanitation facilities are important. Additionally, migrant settlements will benefit from access to clean drinking water. Housing is key, and health maintenance will improve if authorities can facilitate the construction of safe low-cost houses. Participatory decision-making with migrant workers in local governance and urban development projects such as the 'smart city' projects could enhance the effectiveness of vulnerability reduction processes.

Also, there is a need for integrated, health-focused urban planning with provision of adequate and appropriate public services. Collaborative and participatory public health surveillance programmes could help in timely mitigation of risk to infectious diseases, and in this regard, city-specific programmes to deal with infectious diseases should be introduced. Regular medical check-ups in all labour camps and informal urban settlements with a specific emphasis on communicable diseases would benefit the health of migrant workers and the urban population as a whole. Public health preparedness programmes should be designed in such a way that health professionals and social workers are able to access the residential spaces of migrant workers to analyse the nature of intervention that is required and develop suitable action plans. Incorporating these types of policy and planning measures is likely to be of still greater importance in the future as migration to cities and the challenges of climate variability increase in India's urban settlements.

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