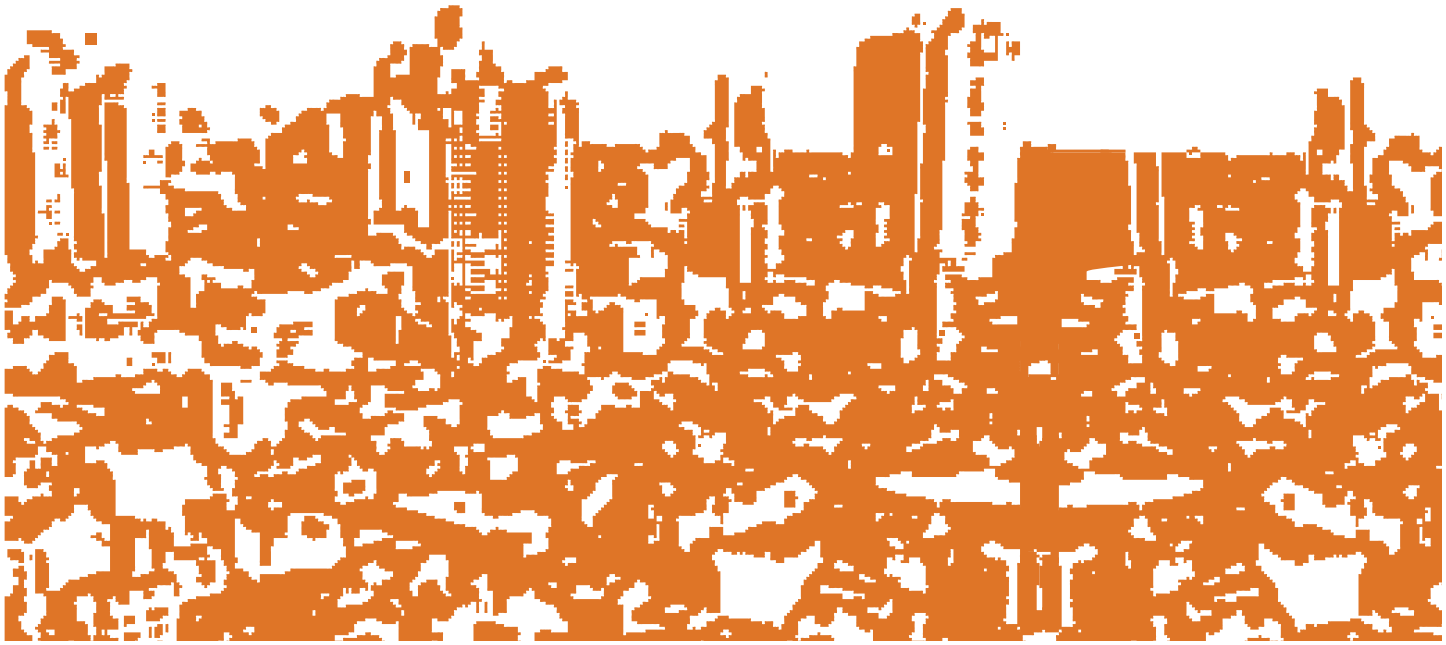
Asian Cities Climate Resilience

WORKING PAPER SERIES 16: 2015

Climate change, livelihoods and health inequities

The vulnerability of migrant workers in Indian cities

BY SUNIL D. SANTHA, SURINDER JASWAL, DEVISHA SASIDEVAN, KAUSHIK DATTA, AJMAL KHAN, ANNU KURUVILLA



About the authors

Sunil D. Santha is Associate Professor at the Centre for Livelihoods and Social Innovation, School of Social Work in Tata Institute of Social Sciences (TISS), Mumbai. He is an academic with keen interests in the field of risk, vulnerability and climate change, livelihood adaptation and social innovation. Sunil can be contacted via sunilds@tiss.edu.

Surinder Jaswal is Professor and Dean, Research and Development at TISS, Mumbai. She leads the Centre for Incubation of Social Work Initiatives at the School of Social Work, TISS. Her research interests include public health and disasters, health inequities and marginalisation, ethics and social work education in South Asia.

Devisha Sasidevan is a doctoral scholar at the School of Social Work, TISS. She has worked extensively in the field of risk and water scarcity. Her current research pertains to climate change adaptation and marginal livelihoods.

Ajmal Khan is a doctoral scholar at the School of Development Studies, TISS researching on state, development and resistance in South Asia. He has considerable experience in researching migration and employment in south India.

Kaushik Datta is a researcher specialising in the field of public health, sanitation and social inequalities.

Annu Anna Kuruvilla is by training an urban planner and has shaped her research interests around disaster risk reduction, environment and urbanisation.

Acknowledgements

We would like to express our sincere gratitude to all our interviewees who participated in this study. A special appreciation to the following individuals and organisations who have helped us with their valuable insights and cooperation: Fr. Sabu Malayil S.J., Dr. Martin Patrick, Mr. Gautam Dua, Mr. Mehul Patel, Dr. Mohammed Irshad, Mr. Mahesh Kamble, Ms. Bindu Gowda, Ms. Ansh Sahai, Dr. Swati Banerjee, The Surat Municipal Corporation and the Kerala Labour Department. We also thank Dr. Diane Archer, IIED for her expert comments and suggestions throughout the research.

Acronyms

DNT	Denotified Tribe
NT	Nomadic Tribe
PAR	Pressure and release
PDS	Public Distribution System

Contents

List of figures

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 change and health inequities. A key assumption is that the progression of vulnerability to climate change and infectious diseases is closely embedded within the wider political economy of migrant workers' day-to-day livelihood struggles. Using a mixed methodology, 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 by the processes and structures of unplanned rapid urbanisation, environmental change and social exclusion. Lack of access to livelihood resources, decision-making structures and power forces the poor to migrate to the cities. If factors such as caste and ethnic-based discrimination also act as a push factor to migrate, the findings show that exclusion continues in the cities, making migrant workers more vulnerable to climate change and infectious diseases. The research also shows that a rise in income is not a sole indicator of reduced vulnerability. Lack of access to other essential livelihood assets, including reliable and affordable health care, reduces the adaptive capacities of migrant workers to deal with extreme climatic events. The paper concludes that migrant workers have very limited opportunities to reduce their vulnerabilities and participate actively in risk reduction and development planning.

1 Introduction

In India, climate change, together with urbanisation, is predicted to increase the rate of population migration from remote agrarian villages and hazard prone regions of the country to the cities (Kumar and Viswanathan, 2013; Raleigh *et al*., 2008; Deshingkar and Akter, 2009). 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, such as rises in temperature, precipitation and heavy rainfall, flooding and water logging, storm surges, as well as health risks, such as the outbreak of infectious diseases.

The research outlined in this paper analyses the interface between migration, vulnerability and livelihoods in the context of climate change in the Indian cities of Surat, Mumbai and Kochi. It also examines the dynamics and nature of contemporary forms of urban vulnerability in terms of livelihoods, assets and the security of migrant workers in the informal sector. It explores in particular the impact of climatic hazard events on the livelihoods of the urban poor, and describes the signifying relationship between urbanisation, climate change and health inequities with specific reference to infectious diseases prevalent among migrant workers.

The progression of population vulnerability to climate change, livelihood uncertainties and infectious diseases from a political economy perspective was analysed in the study. The following section describes the conceptual and theoretical perspective that guided the research.

2 The political economy of vulnerability

The vulnerability of a population 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 (Kelly and Adger, 2000). Such an understanding emphasises the need to focus on the socio-economic 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 (*ibid*). Cannon (2008) has suggested certain significant parameters to study population vulnerability, such as the baseline wellbeing of household members. Cannon elaborates the components of vulnerability as (i) livelihoods strength and resilience; (ii) wellbeing and baseline status; (iii) self-protection; (iv) social protection and (v) governance (*ibid*).

The progression of vulnerability to climate change is closely embedded within the wider political economy of the livelihood struggles of many poor and marginalised communities (Blaikie *et al*., 2004). Vulnerability can be understood as the characteristics of a person or a group and their situation that influence their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard or an extreme natural event or process (*ibid*). 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). In addition, factors such as geographical proximity and exposure to hazards, lack of access to decision-making structures, power and resources, poor public infrastructure and preparedness levels, and lack of access to political and social networks could result in the progression of vulnerability to shocks such as natural hazards and climate change (Blaikie *et al*., 2004).

The most vulnerable social groups to climate change risks are those whose assets and livelihoods are highly exposed and sensitive to the direct and indirect risks associated with climate change, and who lack access to formal and informal risk management arrangements (Heltberg *et al.*, 2009). The characteristics of risks, exposure and sensitivity to these risks, the associated impacts and losses, and risk management capacities determine the nature of vulnerability. Thus, household vulnerability could be understood as the probability of falling below certain benchmark levels of wellbeing, such as the poverty line during risk events (*ibid*). Vulnerability therefore needs to be examined as a dynamic process that takes into account the risk of exposure and susceptibility, such that it also provides sufficient scope to analyse people's adaptive capacity (Ahmed and Fajber, 2009).

2.1 Analytical frameworks

There are a range of frameworks that analyse vulnerability. 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). Heltberg *et al.* (2009) have suggested a unifying conceptual framework that links risks, adaptation, and vulnerability and in its application to examine adaptation strategies at different levels and to identify no-regrets approaches. Such integrative frameworks view vulnerability as depending on both biophysical and societal factors providing the necessary space to examine vulnerability not only in relation to the physical hazards, but also to wider socio-economic risks (Füssel and Klein, 2006; Satterthwaite *et al*., 2007).

Within the discourse of climate change and health equity, public health risks result when biological changes are induced through variations in climatic factors and they interact with the vulnerabilities of the affected population. To trace the capacities of cities to deal with climate change and public health risks, a retrospective analysis that examines the impact of health inequities on vulnerable populations and its social, political, economic and ecological determinants has to be understood (Birkmann, 2006). In addition, the concept of vulnerability includes domains such as social inequalities and exclusion, levels of urbanisation, growth rates and economic vitality (Cutter *et al.*, 2003).

Other approaches such as an entitlements and livelihoods approach depict vulnerability as "lack of entitlements or a lack of sufficient means to protect or sustain oneself in the face of climate events where risk is shaped by society's provision of food, productive assets and social protection arrangements" (Ribot, 2010:52). The entitlements and livelihoods approaches analyse the sensitivity and resilience of individual, household and livelihood systems and give special emphasis to the adaptation strategies of vulnerable populations, such as the poor, women and other marginalised groups (*ibid*). The livelihood approaches also give scope to analyse the dynamics and complexities of vulnerabilities associated with diverse livelihood risks and uncertainties (Blaikie *et al.*, 2004).

Largely integrating the social constructivist framework with the livelihoods and entitlements approach, this research adhered to a political economy framework to analyse the vulnerability of migrant workers to climate change in Indian cities.

2.2 PAR model

This paper draws insights from the pressure and release (PAR) model that was initially proposed by Blaikie *et al.* (1994) and further developed by Blaikie *et al.* (2004). The PAR model outlines the progression of vulnerability in three stages namely; root causes, dynamic pressures, and unsafe conditions. 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 and assets (*ibid*). When impacted by dynamic pressures – such as population growth or urbanisation – at both the micro- and macro- level, the root causes are transformed into unsafe conditions, which are manifested as vulnerability in the context of hazards. 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. The PAR model demonstrates that the potential for people to be exposed to the impact of climate change 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 (*ibid*). The vulnerability of these social groups 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. Historical factors can also play an important role in explaining why the habitats and sources of livelihood of vulnerable sections of society are located in resource-poor areas (*ibid*). The 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).

3 Field setting and methodology

3.1 Field setting

This paper is based on extensive research carried out amongst migrant workers in Surat, Kochi and Mumbai. These cities were selected based on a certain primary understanding of (i) migration characteristics, (ii) health challenges and (iii) climate uncertainties as explained below. 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. As per the Census of India (2001), there were 2,489,552 in-migrants in Mumbai, which meant that 15.1 per cent of the city's population were in-migrants. These live in unsafe conditions 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. Nevertheless, media reports show that there is a very active presence of state, private and civil society organisations in health care and provision. On the other hand, access of migrant workers to safe and affordable health care systems is a matter of concern.

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. As per the Census of India (2001), there were 757,031 in-migrants in Surat 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 have developed a resilient health care system. The city is said to have one of the best public health care services and delivery infrastructure in the country and is considered as a model. It is supposed to integrate vector breeding control measures, provision of safe water supply, collection of solid and biomedical wastes, and wastewater management. Nevertheless, the urban poor are vulnerable to a number of illnesses, such as cholera, HIV/AIDS and viral fever. The city also witnessed a massive flood in 2006, killing some and displacing many migrants. Surat was already prone to vector-borne diseases, rainfall variability, flooding and potentially more prolonged water logging. On a positive note, the city houses the first centre for climate change indicators in the country.

The third city – Kochi in the state of Kerala – is a young, growing city compared to Mumbai and Surat. The Census of 2001 estimates that there were more than 50,000 migrant workers in Ernakulam district (Surabhi and Kumar, 2007). 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. Most are employed in the plywood/construction industry and preliminary reports indicate that these migrants live in congested migrant colonies or rented homes (*ibid*). The health care model of the state of Kerala, where

Kochi is the commercial capital, has been widely appreciated globally. The state was able to achieve higher standards of health care, provide cheaper and universal education, and enhance social security amidst low economic growth. Referred by experts as the 'Kerala Model of Development,' the state has made remarkable achievements in health care in terms of vital health indicators like crude death rate, infant mortality rate and life expectancy (Dreze and Sen, 1995). The universal availability of the public health system is among the factors that has contributed to the high health status of the people in the state. However, recent studies show a decline in the nature of access and quality of health care provided to its citizens (Santha and Bhuvaneswari, 2009). 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 which are prone to water logging. The most significant risks are the impacts on Kochi's water systems (especially drainage) and waste disposal. There are also possibilities of increased variability and intensity of rainfall and the impact of sea level rise on land in the coastal habitats.

3.2 Methodology

We adopted a mixed method design to carry out the research. An in-depth review of literature related to climate change, 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. A two-stage purposive sampling strategy was used to identify the respondents. Firstly, we identified the hazard prone wards or areas of the 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 and other civil society organisations, to collect more information on the location of the migrants' workplaces in these wards of the city. Based on this information, we began to identify the respondents amongst the migrant workers using snowball sampling techniques.

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. There are other limitations to the study as well. We were able to interview only 26 (17 per cent) of women migrants across the three cities. Therefore, this study has not captured gender-specific vulnerabilities, such as challenges to reproductive health.

4 Migration, vulnerability and urban livelihoods

4.1 Historical, climatic and structural specificity

Urban vulnerability is shaped by several important factors, including socio-economic conditions, housing conditions, institutional and power relations, and challenges posed by population pressure and climate change impacts (Parvin *et al.*, 2013). Urban informal settlements are a space where physical and social vulnerability coincide, and caste-based exclusion was found to be a major determinant of vulnerability (Bosher *et al*., 2007). The urban poor are also exposed to multiple risks amidst severe environmental, economic, political, and social constraints (Moser and Satterthwaite, 2010). Such factors also restrict access to resources necessary for social wellbeing, with implications for adaptive capacity (Parvin *et al*., 2013). The low socio-economic status of the urban poor accompanied with their poor adaptive capacity can make them the most vulnerable to the health impacts of climate change (Dhara *et al*., 2013). For instance, studies have shown that the urban poor in cities such as Delhi have very limited access to clean drinking water and sanitation facilities (Bora, 2014), which are necessary for healthy living conditions.

The impacts of climate change on the urban poor need to be contextualised within a larger urban poverty framework (Banks *et al.*, 2011). Climate change impacts could accelerate the processes of urbanisation by displacing a greater number of poor people from hazard prone areas to the cities (McMichael *et al*., 2012). The urban poor are vulnerable, whether as a result of their sources of livelihood, levels of income and asset holdings, social class, gender, age, ethnicity, caste, access to public support, or ability temporarily or permanently to migrate in search of economic opportunities (Mearns and Norton, 2010). These factors also reduce the adaptive capacity of the poor to climate vulnerability (Morrow, 1999; Cutter *et al*., 2003, Arthurson and Baum, 2013).

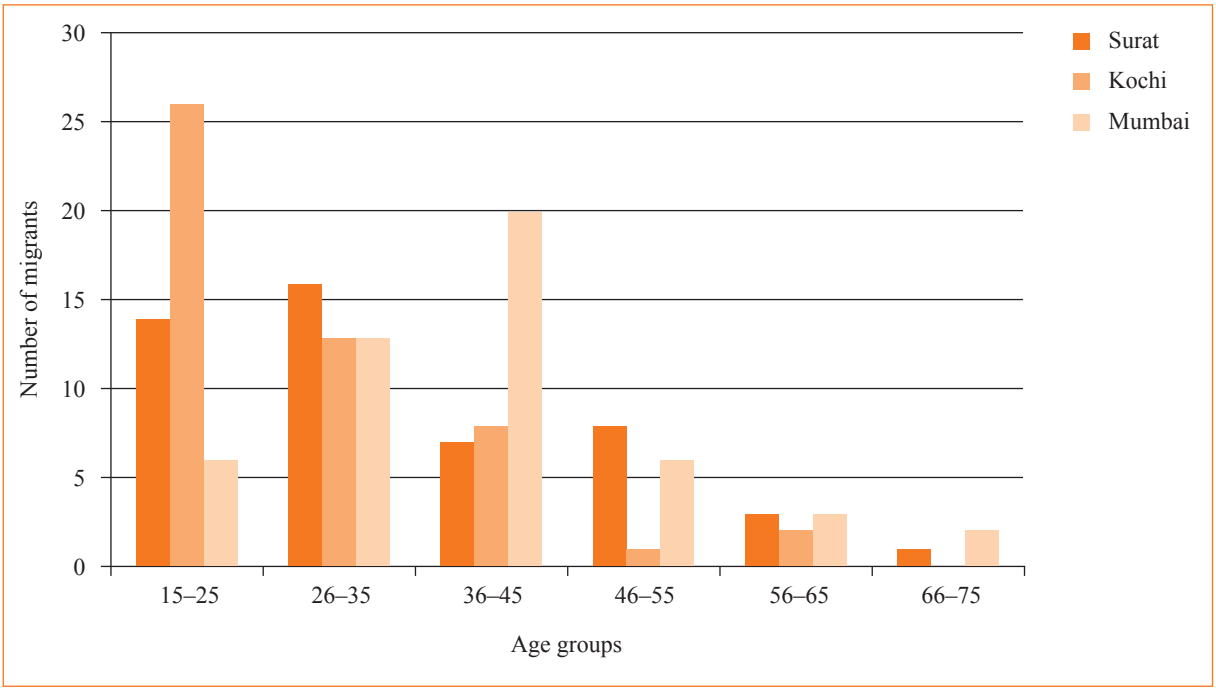
The poor and migrants in the informal sector are vulnerable specifically to livelihood uncertainties such as loss of livelihood spaces, resources and assets in the face of climate variability and change (Cannon *et al*., 2003). The vulnerability contexts increase if the livelihoods of the migrants are tied to a single industry (Karlsson and Bryceson, 2014). It is also predicted that the physical and social impacts of climate change will worsen existing urban problems (Banks *et al*., 2011), and India's cities have become more vulnerable to natural and anthropogenic hazards. 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).

The political economy framework analysing the progression of vulnerability suggests that certain root causes of vulnerability, such as lack of access to resources, decision-making structures and power, are shaped by historical and contemporary socio-political and economic structures in society. Our study indeed shows that the nature and characteristics of migrants varies according to the historical evolution of the city. For instance, Mumbai has evolved as a cosmopolitan city in the last hundred years, witnessing a rich experience of industrialisation and urbanisation since

colonial times. The post independence period has seen a rise in urbanisation trends in Surat associated with the growth of the diamond and textile industries. The city of Kochi has witnessed a growth rate in urbanisation since the 1990s.

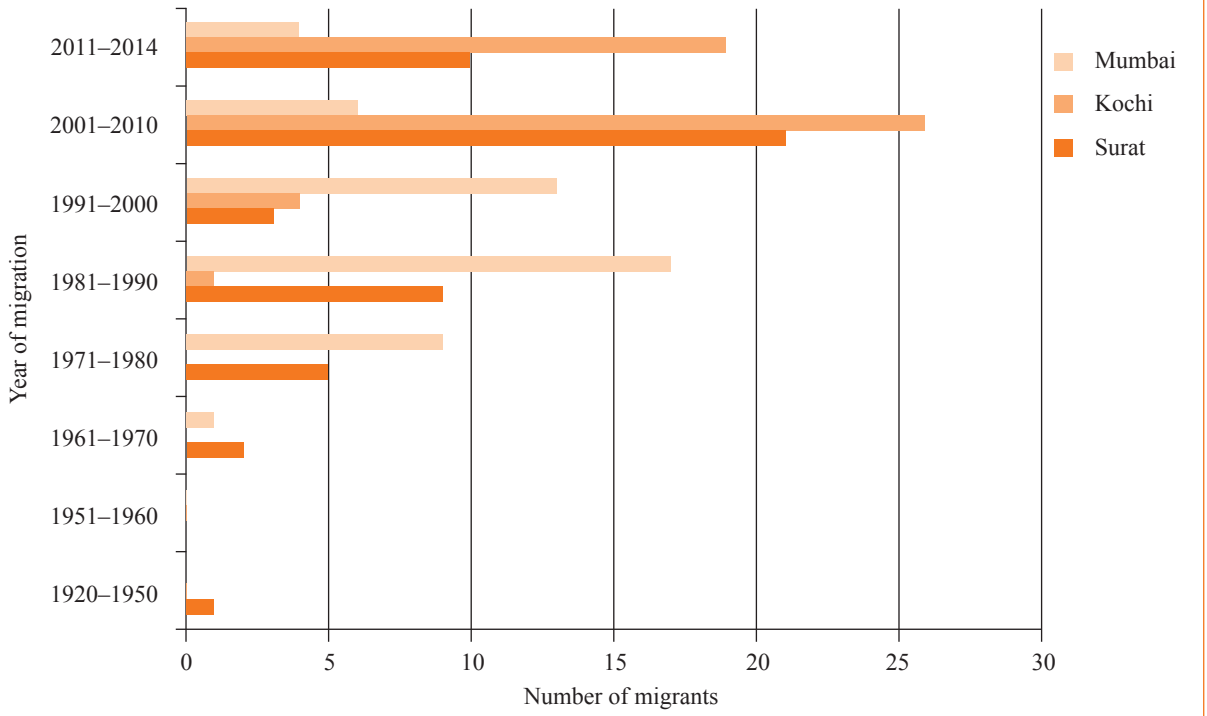
This observation is reflected in the mean age of migrants in the respective cities. While the average age of the overall sample of 150 respondents remained at 34 years, there was a significant variation in the mean age of the migrant population among the respondents in Kochi (28 years), in Surat (35 years) and Mumbai (36 years). In Kochi, 26 (52 per cent) of the migrants interviewed were aged between 15 and 25 years. In Surat, the majority of the migrants interviewed were aged 25–35 years. However, among the sample in Mumbai, 20 migrants (40 per cent) were in the age group of 36–45 years (Figure 1). This variation in age is also related to the historical patterns of urbanisation in the three cities. For example, Mumbai, which evolved as a migratory destination decades prior to the other two cities, has the highest mean age.

Figure 1. Age distribution of the migrants surveyed



The year in which people migrated to the three cities also validates the observations above. Data related to the year in which our sample of migrants moved reveals a trend of migration that starts in the 1920s in Mumbai, in the 1960s in Surat and the 1990s in Kochi. In Mumbai, 27 (54 per cent) migrants who participated in the study had already moved to the city prior to 1991. On the other hand, Kochi is just witnessing its surge in migration, and mainly by youth. The trend in migration has declined considerably in Mumbai over the last three decades, while the trend in Surat shows a marginal decline in the last decade. Interestingly, in Kochi, there is rapid rise in the migration rate (Figure 2). Our discussions with officials in the Labour Department, Social Welfare Department and with health professionals in Kochi have revealed that the rising migration rate in the city has started creating administrative challenges to dealing with issues of housing, water, sanitation, insurances and health care provisions to the migrant workers.

Figure 2. Trends in migration in the cities of Mumbai, Surat and Kochi



Increased migration has been among the most significant demographic changes in India's urbanisation processes. Indian cities have been accommodating diverse types of migrant workers from rural parts of the country and from neighbouring countries such as Bangladesh and Nepal. Migration is sometimes also referred to as an adaptation mechanism or as a risk diversification strategy. In the last ten decades, economic drivers have considerably influenced migration from rural villages to cities. It is evident that climate change and migration have not been at the forefront of the migration nor the climate change discourse (DePaul, 2012). Nevertheless, climate change needs to be considered as an additional, but very important driver of migration in the coming years. The impacts of climate change, such as desertification, flooding, crop failure and sea level rise, will likely further increase urbanisation and put additional pressure on the physical and social infrastructure of cities.

Studies have shown that weather has a significant role in explaining temporary migration and a relatively lesser influence on permanent migration in India (Kumar and Viswanathan, 2013). Both temperature and rainfall are important determinants of temporary migration, while permanent migration is broadly influenced by temperature alone (*ibid*). Climate-induced migration has been significant in many large Indian cities. In addition, coastal location, exposure to the urban heat-island effect, high levels of outdoor and indoor pollution, high population density and poor sanitation have also increased the vulnerability of cities to climate change (Campbell-Lendrum and Corvalan, 2007). Migrant workers usually settle in slums and other vulnerable physical habitats, which are often exposed to new risks and uncertainties. They have limited access to state social protection schemes, secure livelihoods, good quality food, water, and health care services. As population in cities grows, these stresses will become more pronounced.

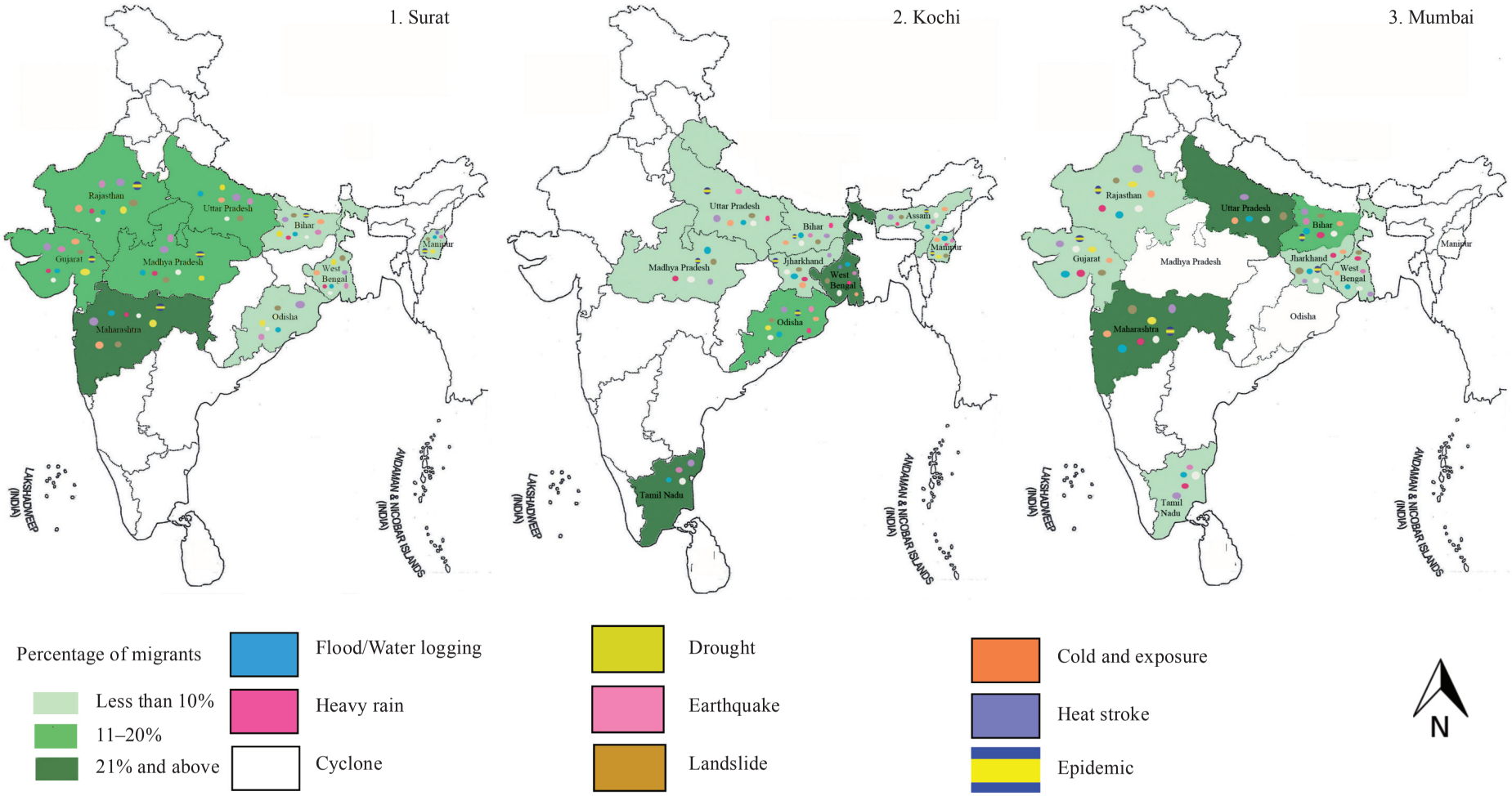
Cities in India are today experiencing both mass urbanisation and increasing vulnerability to climate change impacts. Thus cities are exposed to the risk of dual stresses (DePaul, 2012). Cities like Mumbai are "hotspots of risk from extreme weather events and levels of risks in many cities are likely to grow due to a combination of population growth and development and rising intensities of extreme weather events" (Ranger *et al*., 2011: 140).

It is also interesting to examine the regional contexts of vulnerability, with specific reference to the migrants' native states. Our study shows that the majority of the migrants are from the states of Maharashtra, Bihar, Uttar Pradesh, West Bengal and Tamil Nadu. Other states include the north-eastern states of Assam and Manipur, Gujarat, Jharkhand, Odisha, Rajasthan and Uttarakhand (Figure 3). Our study also demonstrates that the internal, rural-urban migration from the specific parent state (Maharashtra and Gujarat) to the specific cities (Mumbai and Surat respectively) is very high. Around 22 (44 per cent) migrants whom we interviewed in Mumbai are from other districts of Maharashtra. In a similar vein, 8 (16 per cent) migrants from our sample of respondents in Surat are from other remote districts of Gujarat. On the other hand, in Kochi, our sample had only 3 (6 per cent) migrants from other districts within the state of Kerala.

Among the 150 migrants surveyed, 129 (86 per cent) were found to be long-term migrants. The remainder were short-term migrants who migrate to the cities during lean agricultural seasons or when there is a threat to crop production in their native villages. Our findings reveal the fact that apart from the socio-structural and economic conditions of poverty in these regions, most of these states have been prone to regular and intensive climatic variability and hydro-meteorological hazards in the last few decades (Figure 3). For instance, we came across a migrant worker from Tamil Nadu who was working as a peanut vendor in Kochi. He had a stable job in a matchbox factory in his native home. However, the factory was closed down due to lack of rains in Tamil Nadu and prevailing drought conditions in the neighbouring states of Karnataka and Maharashtra. In a similar vein, we also interacted with a few other migrants from Tamil Nadu. Most of these men were farmers in the rainfed regions of Tamil Nadu. However, heightened water scarcity and lack of sufficient water for agriculture 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. However, these were seasonal migrants planning to return to their villages in the next agricultural season.

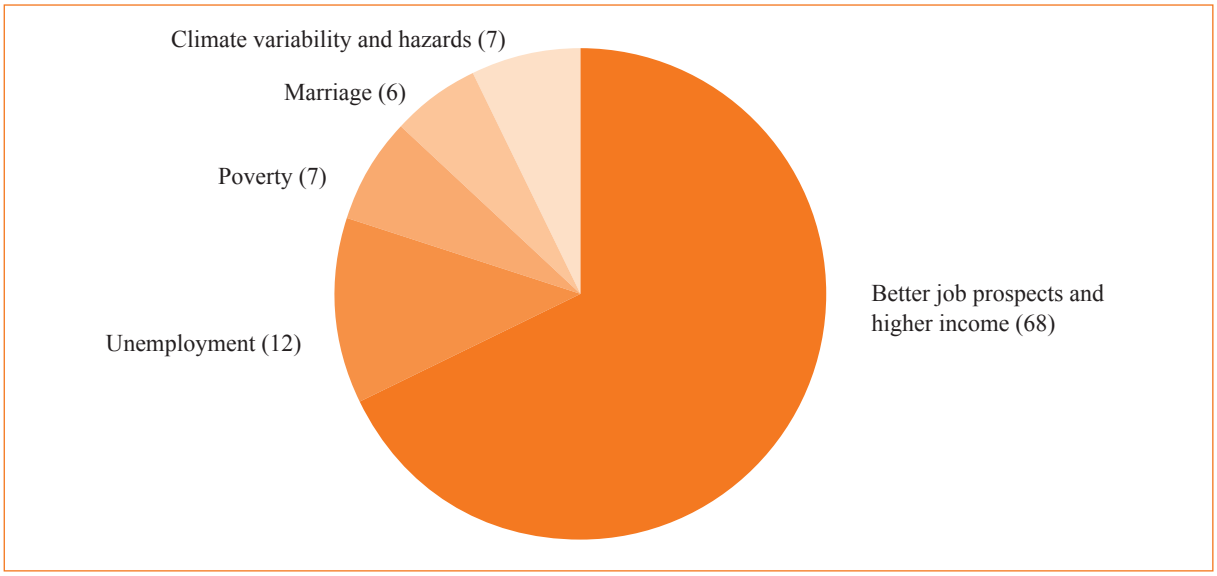
It is important to analyse the main reasons attributed by the migrants of their decisions to migrate. Discussions with migrants highlighted the role of the socio-economic contexts of migrant vulnerability. The majority of the migrants (68 per cent) had migrated to the city with the hope of better job prospects and higher incomes than in their native homes. Around 12 per cent of the participants of the study revealed that they had to migrate to the city due to unemployment in their native homes. More than 7 per cent of the migrants had moved to the city due to severe conditions of poverty and poor living conditions in their villages, while 6 per cent of the migrants, specifically women, migrated to the city after marriage or because their parents moved to the city. Interestingly, 7 per cent of the migrants mentioned that they had to move to cities like Kochi as climate variability and natural hazards in their native homes had severely affected their access to day-to-day livelihood resources. However, in Mumbai and Surat, no respondents specifically mentioned that they migrated due to climate variability and hazard events.

Figure 3. Native states of migrants vis-à-vis hazard events



Source of data: Primary data collected through interviews with migrants, supplemented by news reports from newspapers in the respective states.

Figure 4. Reasons behind decisions to migrate (as a percentage of total respondents)



The caste/ethnic background of the migrants also reveals the nature of social vulnerability and their movements from the rural regions to the city. There were 60 migrants from our sample of respondents who belonged to the Scheduled Caste and five migrants in the Scheduled Tribe population. Historically and even in contemporary rural India, these two groups have been the most marginalised and socially excluded population of Indian society. Our respondents also included three migrants from the Nomadic and Denotified Tribes (NT&DNT), who are the most vulnerable population to present forms of development. 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. 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. Thus, a majority of our respondents were from sections of the population who have been historically marginalised and excluded from mainstream forms of development. These are the populations who had predetermined forms of social vulnerability and were forced to move to the cities in search of a better quality of life. In this context, the following section analyses how pre-existing forms of vulnerability have interfaced or are interfacing with contemporary forms of urban vulnerabilities.

4.2 Contemporary forms of urban vulnerability

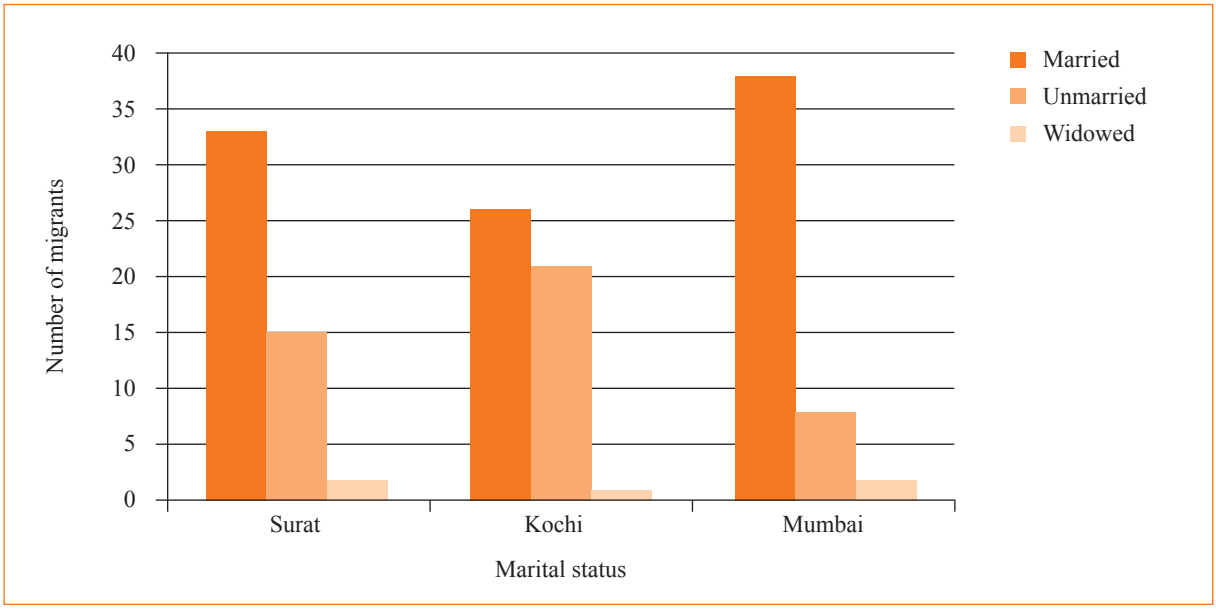
The analysis of certain socio-economic and demographic contexts of migrants can provide insights on the progression of vulnerability at different levels – namely individual and household, livelihoods and institutional levels of vulnerability.

4.2.1 Family ties and social networks

The status of being single, widowed or separated and having weak social ties in the city could accelerate the hardships and struggles of the migrant in dealing with climatic hazards and outbreak of infectious diseases. In our sample, 35 per cent of the migrants were single in terms of marital status. This was relatively high in the cities of Surat (34 per cent) and Kochi (48 per cent), when compared to Mumbai (24 per cent) (Figure 5). This trend is also correlated to the age of the migrants.

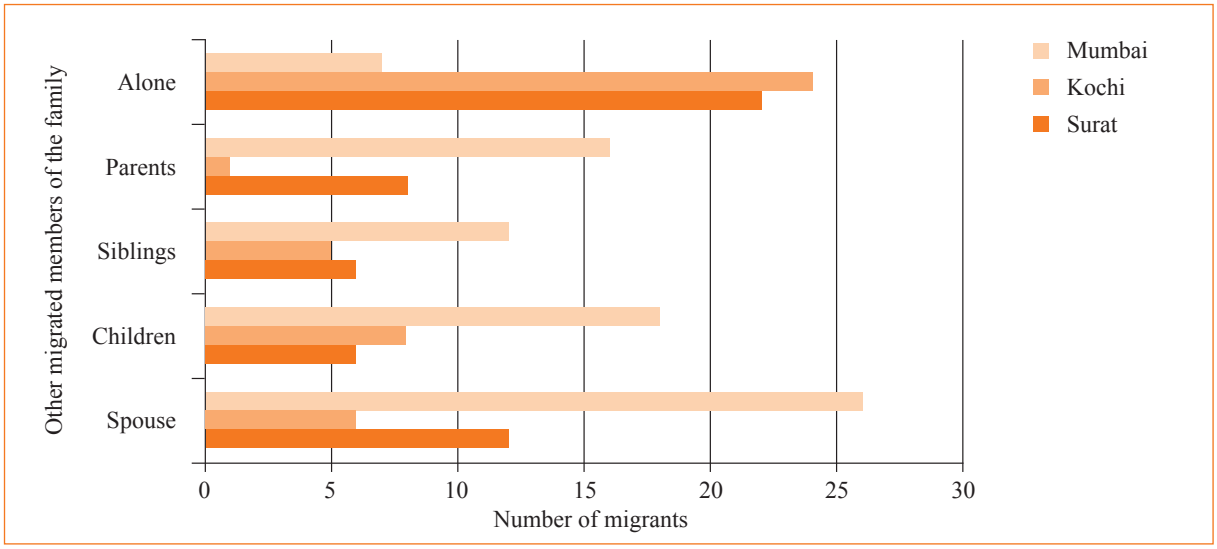
In Kochi, as mentioned earlier, the majority of the migrants belong to the age group of 15–25, and are unmarried. They are relatively new to the city when compared to the migrants in Mumbai. The migrants in Mumbai, on the other hand, are mostly middle-aged, have been staying in the city for a decade or two and have brought their families with them, or have entered into marital relationships with other migrant families in the city.

Figure 5. Marital status of migrants



These findings also need to be analysed in the context of the migration pattern followed by the migrants with respect to whether they migrate alone or with other family members from their households. Our observations show that the migrant behaviour of moving with family members is entirely different in Kochi and Surat, when compared to Mumbai. In Surat and Kochi, 22 and 24 migrants respectively travelled alone to the city, whereas in Mumbai only seven migrants were staying alone (Figure 6). The majority of the migrants in Mumbai stay with their families. In Mumbai, 26 (52 per cent) migrants stay with their spouse, 18 (36 per cent) with their children, 16 (32 per cent) with their parents (32 per cent), and 12 (24 per cent) with their siblings.

Figure 6. Migrants and their family in cities



Interaction with migrant workers during the interview revealed that they pass through a phase of loneliness and helplessness in the city during times of health crisis. In the words of a migrant worker in Kochi,

> "*These days I am very much stressed. Last year, my brother who migrated with me died in a chamber blast. I am yet to come out of that shock. I am not paid enough, but it is now my responsibility to take care of my family and my brother's family. This has huge financial implications. I do not know how my future is going to be! I am scared! My agricultural fields back home have become uncultivable due to the seepage of salt water. After my brother's death, I returned to my village. However, I had to return to the city as there was no way to survive there. I have also developed some kind of skin allergy. It may be due to dust in my work-site. If I fall sick, no one is there to take care of me here. There is one clergy who visits us in between. When he saw the rashes in my skin, he took me to hospital*."

Furthermore, migrants have relatively weaker social ties with other institutional actors. Studies have shown that social capital can act as an encouraging factor strengthening adaptive capacities (Adger, 2003). However in Surat, none of the migrants had any kind of membership with community-based organisations such as self-help groups, socio-cultural groups or trade unions. Though there are NGOs working on health and climatic change in Surat, migrants were not so familiar with these organisations. On the other hand, 22 per cent of the respondents in Mumbai were members of various organizations like mandals, trade unions, women's associations, occupation-based associations and political associations. Only six per cent of the respondents in the Kochi had membership with organisations associated with financial support and collectivisation.

Migrants who were members of these organisations opined that participation in the organisational activities provided them with a sense of security that comes with these organisational identities, which gave them advantages over other migrants who were not associated with such organisations. These organisations also give the members financial, moral and emotional support during emergency or crisis situations. For instance, one of the respondents from Kochi received 50,000 rupees due to her association with a micro-credit institution in the city. Irrespective of these isolated instances, the majority of migrants in the city are not aware of the facilities and services provided by civil society organisations regarding health care or risk reduction.

We also observed that some of the Tamil migrants in Kochi have developed their own social networks that help them to deal with climatic uncertainties and health crises. In the words of a casual labourer from Tamil Nadu,

> *"During heavy rains, I may not get much work even up to a month. This is the case even when we fall sick. These are difficult times. However, we have established good relationship with the local grocery store owner here. We borrow essential food stuff on loan from his shop during times of unemployment. Later, when we get work, we repay the loan".*

The nature of social networks, as mentioned above, was stronger among migrant workers who hailed from Tamil Nadu. However, the respondents from the north and north-east part of the country did not have such strong social networks with the local host population of the city.

4.2.2 Occupation, assets and livelihood security

A significant component of analysis in the political economy approach of studying vulnerability is to analyse the shift in the nature of occupation and work, related assets and livelihood security of the migrants. The present and past occupational statuses of the migrants in Surat, Kochi and Mumbai are shown in Figures 7a, 7b and 7c. A positive note on the transitions of population vulnerability to capacity is that many migrants who were unemployed (92 per cent) in their place of origin were able to find a means of income in the city. In all the three cities, hawking and vending were a major source of income. The sectoral specificities have also attracted skilled migrants to the respective cities. For example, while Surat has attracted migrants as labourers in the diamond and textile industry, Kochi has seen a rise in migrant labour in the construction sector. The migrant population in Mumbai is involved more in driving, domestic work and fish processing. Among the migrants in Surat and Kochi, there is also a considerable shift from farming as an occupation.

Figure 7a. Present and past occupation of migrants in Surat

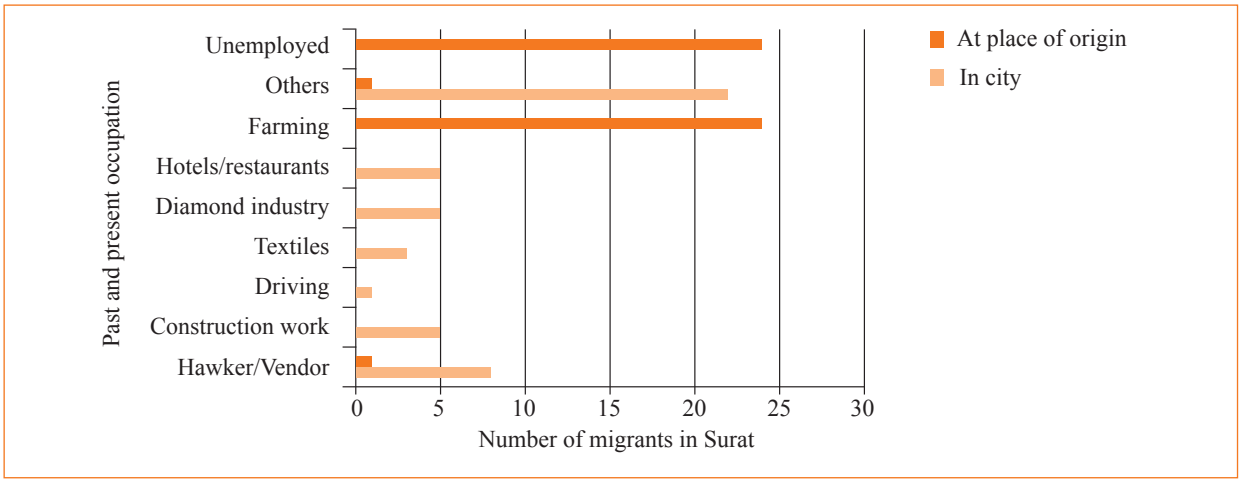


Figure 7b. Present and past occupation of migrants in Kochi

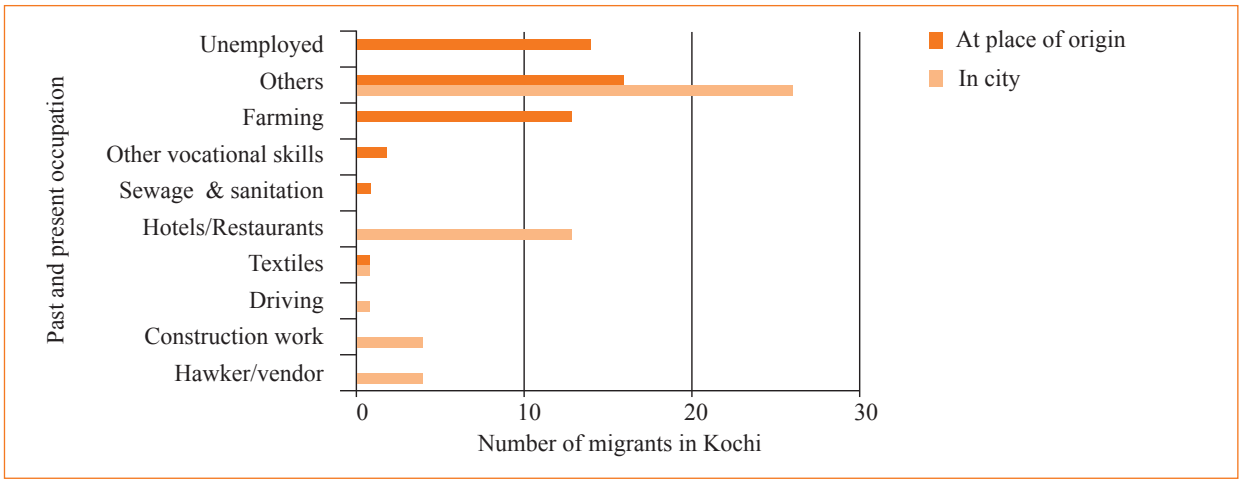
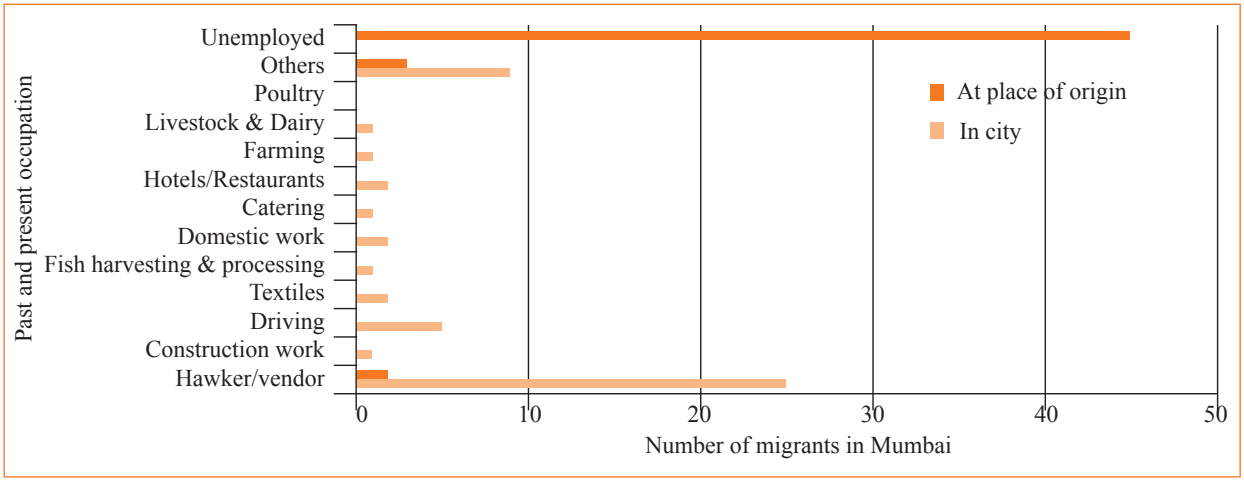


Figure 7c. Present and past occupation of migrants in Mumbai



The new jobs that migrants have taken up in the city are characterised by a unique range of livelihood insecurities and risks in each of the cities. These variations in terms of skills and asset holdings are discussed below.

Human assets: Our findings show that 63 (42 per cent) of the migrants that we interviewed in all the three cities are illiterate. Thirty-seven migrants had a secondary level of education, while just 17 migrants had completed the upper primary level. Twenty-one migrants had completed a primary level of schooling. Our respondents also consisted of 10 graduates and 2 postgraduates working in the urban informal sector. Only two migrants had some kind of technical qualification. This larger picture depicts the knowledge-cum-skill based vulnerabilities of the migrant population.

There is practically very little formal means to impart essential vocational skills to the migrants in all the three cities. On many occasions, the participants of the study were unable to identify the essential vocational skills required for securing their livelihoods in the city. Only two percent of the migrant population in each city had attended some formal skill training workshops. Relatives and friends, who had migrated years ago, gradually evolve as informal master trainers for the later set of migrants. However, this is applicable only to 42 per cent of the total sample population studied. The rest of the population is left to acquire their skills through their own efforts and experiences.

The level of education and the skill sets possessed by the migrants also throw light on the nature of their employment in the city. Only 22 (15 per cent) respondents said that they had a permanent source of income in terms of their job. In our sample, 63 (42 per cent) respondents were daily wage earners and 20 (13 per cent) respondents worked as casual labourers. Only 12 (8 per cent) respondents had a formal work agreement with their employers, while around 33 (22 per cent) respondents were employed based on informal, verbal contracts.

The informal nature of work is also reflected in the fact that migrants have to shift jobs during crisis situations. Around 33 per cent of the migrants from the total population had to shift jobs frequently before settling down to their present occupation. Such job shifts are relatively higher in Kochi (38 per cent) when compared to Surat (28 per cent) and Mumbai (34 per cent). One of the main reasons for this is due to the structures and practices, such as informal work arrangements, that exist between the employer and the employee. When migrants return to their native place after 2–3 years of work, another migrant worker will replace them. On return, the former worker will not be accommodated in his/her previous work place and is forced to seek job opportunities elsewhere. At this juncture, their relatives or friends (if any) will help them to find a new job. Apart from these factors, respondents have also shared that they had to shift jobs due to hazardous work environments. Other major factors that led to migrants' job insecurities in all the three cities were found to be low wages, irregular payment of wages, inability to cope with the demands of the work environment, legal bans on a specific occupation, conflict with the employer, conflicts at the workplace, lack of skills or termination of contract.

Around 21 per cent of the migrant population surveyed also mentioned that their livelihood security in cities was at stake due to climatic variations and natural hazards. Our findings show that approximately 34 per cent of the migrant population in Mumbai believed that climatic variations and natural hazard events such as heat stress, unpredictability, heavy rains and water logging during monsoons in the city have affected their ability to work effectively.

Natural assets: Studies on rural livelihoods and vulnerability contexts have highlighted the importance of natural assets in enhancing adaptive capacities to climatic uncertainties and shock events. However, studies in urban contexts have not emphasised the role of natural assets, including in the lives of migrant workers. . Our findings revealed that among the 150 migrants surveyed, 79 respondents had their own land in their native homes. Out of this, 34 respondents possessed cultivable farmlands, with a mean acreage of 2.21 acres. More than 50 per cent of the migrants in Kochi and Surat had land ownership in their native place, while only 34 per cent of the migrants in Mumbai owned land, which could also be a reflection of the more recent transition of Kochi and Surat migrants to urban areas. In contrast, none of the migrants in Surat and Kochi owned any land in the city, while six migrants in Mumbai owned a few square feet of land in the city. However, this is also a very negligible number when compared to the total population surveyed.

Results show that 78 respondents had livestock at their native homes, suggesting that these migrant households relied on livestock rearing and associated fields as an alternative strategy to diversifying livelihoods. Nevertheless, livelihood diversification through livestock rearing remains a poor option in the context of the city, where only 11 respondents had livestock. However, there are implications in terms of climate change and health concerns amongst these livestock owners, considering the support services available in the city. The livestock owners have very limited access to veterinary support services for the treatment of livestock. Their access to good quality fodder and feed for livestock is also very limited, placing their livelihoods at risk. In addition, the households who owned cattle in Mumbai and Surat did not have cattle sheds which were separate from their homes. Most of the cattle sheds were modified spaces adjoining their living rooms in the slums. This also increases the health risk of migrant households to infectious diseases.

We carried out a similar analysis with respect to access to clean drinking water. Our findings show that 94.67 per cent of the respondents have access to clean drinking water at their current place of residence, and around 84 per cent of the migrants have access to clean drinking water at their work site. Despite these high figures, further probing revealed that access to clean drinking water is a major concern that needs to be addressed in the context of designing suitable adaptation strategies to deal with the challenges of climate change and health inequities. We reached such a conclusion, because 'clean' drinking water is a relatively socially constructed concept. 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. Medical practitioners in Kochi had reported predominant signs of E-coli in drinking water and in Mumbai we found that the homeless such as the NT and DNT population access drinking water from public toilets, which is highly contaminated. Thus, our argument is that although the migrants perceive that they have access to clean water, in reality the water might not be clean at either their place of residence nor at their work site.

Financial assets: To assess the financial capacities of the migrants to deal with diverse risks and uncertainties, we examined aspects such as their average daily income, ability to access better paid jobs and regular wages, access to bank accounts, insurances, pensions and emergency credit, ability to repay debts and remittances. The average daily income for the total population surveyed was 366.68 rupees (approximately US$6) and the average monthly income was 11219.82 rupees (approximately US$187). The wages that the workers receive in Kochi are much higher than the other two cities, with an average daily income of 465.34 rupees (approximately US$8), followed by Mumbai (370.94 rupees or approximately US$6), and Surat (263.75 rupees or approximately US$4). In a similar vein, the average monthly income is the highest in Kochi (14402.04 rupees or approximately US$240), followed by Mumbai (13803.75 rupees or approximately US$230), and Surat (8037.6 rupees or approximately US$134).

Results also show that migrants have been able to earn more in the city when compared to their places of origin. For instance, migrants in Surat and Kochi stated that they are able to earn approximately 230 rupees (US$4) more daily income than they used to earn in their villages. However, there are also wide variations in terms of wage structures across the different sectors in which the migrants are employed. For instance, in Kochi, migrants employed in the hotel industry get an approximate wage of US$5 per day, construction workers receive around US$7–8 per day, and casual wage labourers get around US$10 per day. However, they are not assured of regular employment. During monsoons, there is less demand for casual wage labour compared to the summer months. Another significant observation is that 41 per cent of the migrant workers do not own their own work production equipment and spaces. Consequently, they are forced to spend a larger share of their income in renting equipment or spaces. This is especially high in Mumbai (68 per cent). In Kochi, the employers supply work equipment.

The migrant workers' ability to access diverse economic assets provides important insights about their financial capacities and vulnerabilities to deal with crisis situations. Our findings also show that the main earner in the family is the migrant worker himself or herself (74 per cent). In some migrant households, their spouse (28.67 per cent), siblings (18 per cent), parents (10 per cent) and children (8.67 per cent) are also earning. Only 33 per cent of the migrants in all the three cities believed that they had access to better paid jobs. In Kochi, 38 respondents (76 per cent) felt that they have greater access to better paid jobs. As a contrast, in Mumbai only 12 (24 per cent) migrants had access to better paid jobs. In a similar vein, 37 (74 per cent) migrants in Kochi and 32 (64 per cent) in Surat had provisions for assured regular wages. Only 7 (14 per cent) of the migrants in Mumbai said that they have access to assured regular wages. The reason for such a difference in Mumbai could be due to the fact that a larger section of the respondents in Mumbai were self-employed vendors or hawkers who did not look at their daily income in terms of wages. Nevertheless, our findings show that the migrant workers in Mumbai have the least access to diverse financial assets, which is explained below.

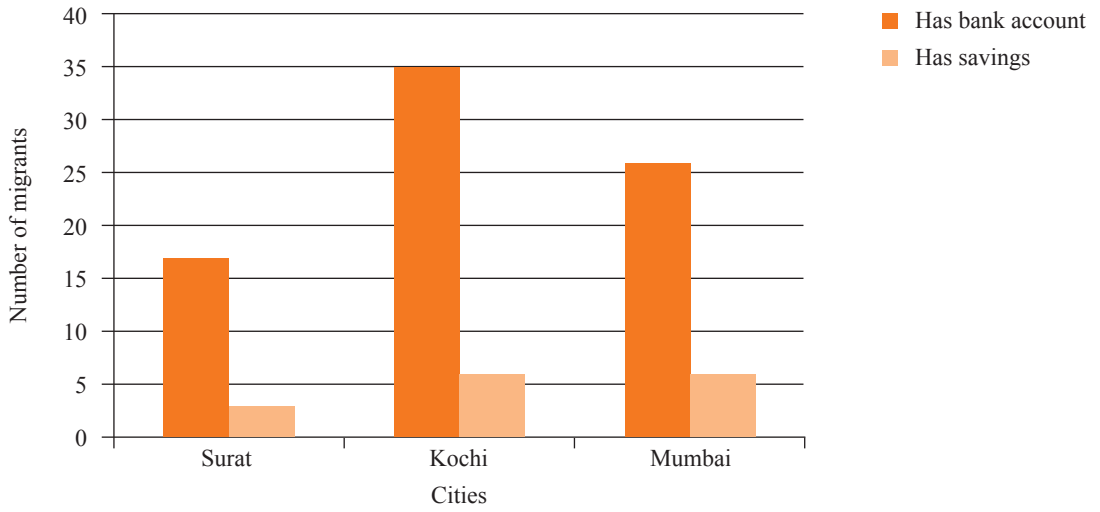
In Kochi, most of the migrants (56 per cent) surveyed send their earnings as remittances (on average Rs. 4500 per month or US$75) to their homes in their native homes. On the other hand, in Mumbai, remittances are very low (18 per cent). The migrant workers' access to insurance was found to be very low (17.33 per cent) in all the three cities. Twelve respondents each in Surat and Kochi respectively were found to have access to insurance, whereas there were only two in Mumbai. Access to informal emergency credit is found to be highest among migrant workers in Kochi (66 per cent) followed by Mumbai (24 per cent) and Surat (20 per cent). Noone among the migrants in the three cities had access to any form of social pension. Only 78 respondents in the three cities had access to bank accounts. While 35 respondents in Kochi had a bank account, only 17 migrants in Surat and 26 in Mumbai had accounts. Further probing with the migrants revealed two main barriers to this: lack of awareness regarding facilities and schemes associated with banking services, and difficulties in setting up a bank account due to lack of a proper identity and proof of residence in the city.

We were also curious to know whether there was any relationship between having a bank account and the ability of migrants to allocate a part of their income as savings. Such an inquiry is relevant given the present government's push to ensure that each and every citizen has access to bank accounts and some of the recent social protection schemes are designed accordingly. The success of such schemes has implications on the adaptive capacities of vulnerable groups. However, our findings show that possessing a bank account does not necessarily culminate into savings (Figure 8). While 52 per cent of the respondents had bank accounts, only 24 per cent of the migrant workers were able to convert part of the earned income into savings. While 35 (70 per cent) migrants surveyed in Kochi had bank accounts, only six of them had any kind of savings with them.

A major reason for the low rate of savings could be the fact that migrants also come to the city with a burden of debt. Our interviews with the migrants revealed that 47 (31 per cent) of them had debt. Though the practice of borrowing money is higher in Mumbai (52 per cent), followed by Kochi (28 per cent) and Surat (16 per cent), what matters in the context of vulnerability reduction and adaptation is their ability to repay the debt. In this regard, we found that 14 (28 per cent) migrants in Kochi and 8 (16 per cent) in Surat were unable to repay the debt. Nine migrants (18 per cent) in Mumbai also pawned gold or other goods during times of crisis, while this was not observed in the other two cities.

An important correlation is that the borrowing behaviour of migrants tends to increase with incidences of climatic events such as heavy rains, water logging and heat stress. In Mumbai, 25 (50 per cent) migrant workers said that they are forced to take debt increases during the monsoons or during flooding and water logging in their place of residence or work. Eight respondents in Kochi recollected that they were forced to borrow money during times of climate-health related uncertainties manifested during seasonal variations and outbreaks of epidemics such as dengue. Reasons for borrowing money during climatic events are associated unemployment, ailments and injuries due to secondary hazards such as electrocution, burns or falls due to slippery surfaces. Migrant workers also tend to borrow money in crisis situations, especially when children and the elderly fall sick and require hospitalisation during seasonal variations.

Figure 8. Access to bank accounts versus ability to save



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, communication and transportation facilities. Our findings show that while 105 (70 per cent) migrants had their own homes in their respective native places, only 22 (14.66 per cent) migrants owned homes in the city. Fifty-two (34.66 per cent) migrants were staying on a rental basis and 47 (31.33 per cent) were staying along with other migrants on a shared accommodation basis. Around 29 (19.33 per cent) migrants were homeless in the three cities. There are stark variations in the nature of housing tenure across the three cities that are explained below (Figures 9a, 9b and 9c).

Eighteen (36 per cent) migrants surveyed in Surat reported that they were homeless and 13 (26 per cent) people responded that they stay in rental homes. This assumes significance as 37 (74 per cent) of the migrants previously stayed in their own home in their respective native places. The contrasts of population vulnerability emerge especially in the context of moving away from the state of owning a home to that of homelessness (Figure 9a). In Mumbai, most of the migrants did not have their own home in their native place nor own one in the city; and a majority of them (62 per cent) stay in rental places (Figure 9c). It is a new adaptive culture that we are seeing in Kochi, which is new to both the migrants and the host population in the city. Around 47 (94 per cent) migrants in Kochi have their own homes in their respective native places (Figure 9b). However, in Kochi, 30 (70 per cent) migrants stay together on a shared accommodation basis, often arranged by the work contractor who hires them. There are also variations in the norms of sharing accommodation, where one group will occupy a room during the day and the same will be occupied by another group of migrants during the night. Thus a shift arrangement in sharing accommodation has also evolved in Kochi and was present to some extent in Mumbai. The average household size of migrants is found to be six people in spaces that are mostly less than 100 square feet. In Mumbai, migrants also have the practice of staying in relatives' or friends' house, which is mentioned as 'others' in the figures below.

Figure 9a. Type of housing tenure among migrants in Surat

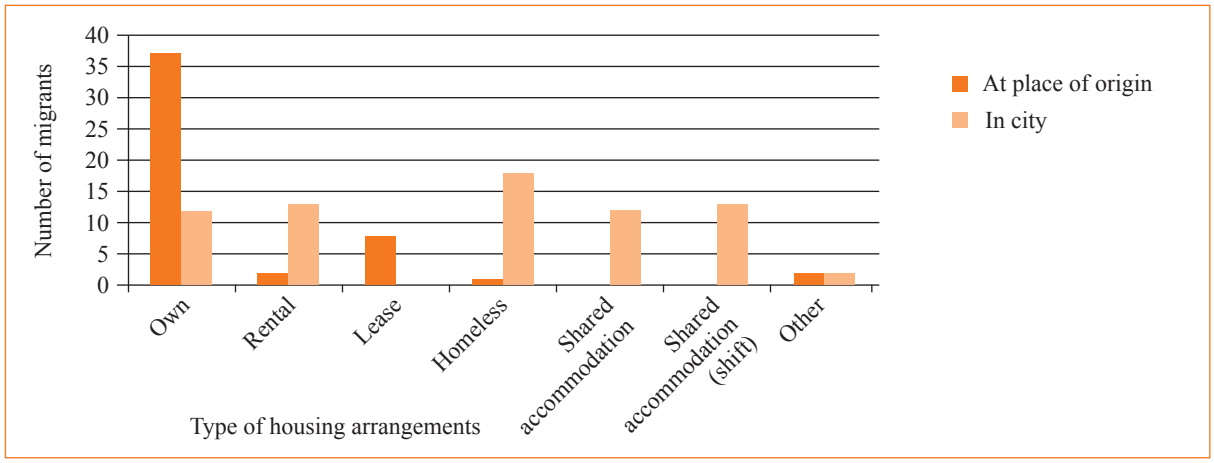


Figure 9b. Type of housing tenure among migrants in Kochi

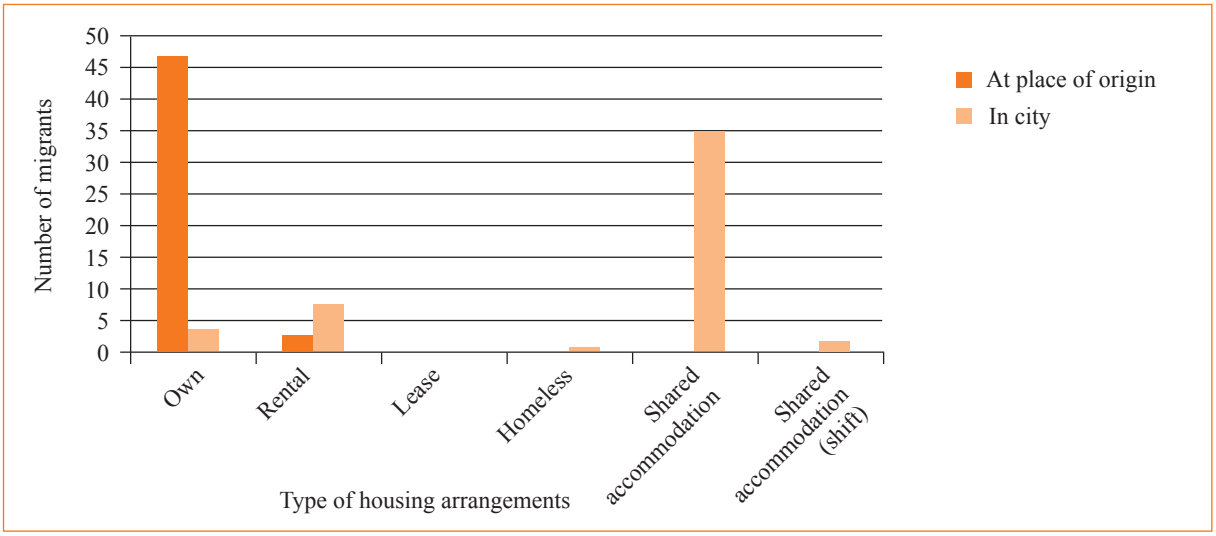
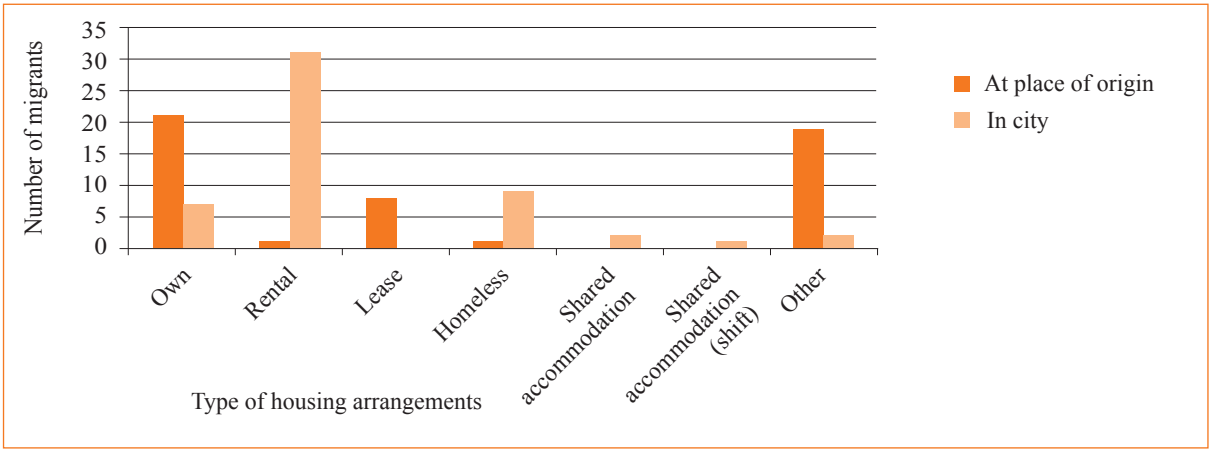


Figure 9c. Type of housing tenure among migrants in Mumbai

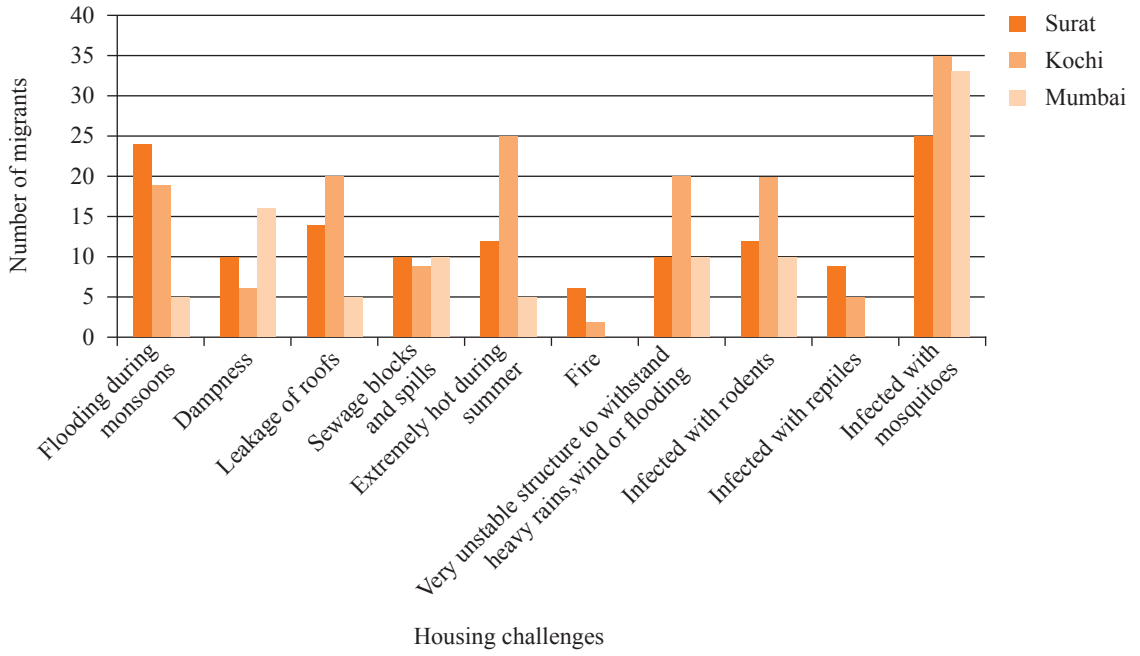


Though migrants do not have many choices over where they stay, there are many factors that influence their decision to stay at a particular location. These factors include proximity to work sites, affordability of accommodation, and scope to improve social networks, especially with migrants from the same region, caste, religion and nativity. We also enquired about the problems that migrants face related to housing needs in the city. Migrants in Surat opined that it was difficult for them to identify a house that was not affected by flooding and water logging issues during the monsoons. Moreover, access to clean drinking water that was not hard and salty was a serious problem in most of the locations where the migrants stayed. Continuous shifts in job resulted in frequent moves from one place of residence to another in the case of Mumbai. Moreover, taking houses on a rental basis was a very expensive option for the migrant informal workers in the city. In Kochi, the responsibility to provide accommodation for a majority of the migrants is the employer's. Kochi appears to be the city in which migrants have relatively better housing conditions and fewer problems related to housing. Even when migrants live in overcrowded contexts such as labour camps, most of them do not perceive that they are living in vulnerable situations. On the other hand, discussions with medical practitioners revealed the relationship between poor, overcrowded housing conditions and the outbreak of epidemics among migrant workers. 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 up 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*".

Our findings also revealed that 63 (42 per cent) migrants live in terraced concrete houses suited to withstand harsh climatic conditions. However, only 8 (16 per cent) migrants in Mumbai were able to access terraced concrete houses. Most of them remained in tiled roof houses covered by plastic sheets or asbestos/tin sheets, this constituted (20 per cent) of migrants in Surat. The prevailing housing conditions have also made the majority of the migrants interviewed vulnerable to climatic uncertainties and associated natural hazards (Figure 10). Ninety-one migrants across the three cities believed that climatic variations and unhygienic housing conditions have exposed them to a rapid increase in infections caused by mosquito bites. While 43 (29 per cent) migrants opined that they felt severe heat stress while working under urban structures, 42 (28 per cent) migrants also pointed out the losses incurred due to flooding and water logging in their residential sites. Problems such as leaking roofs during heavy rains (25 per cent) and dampness of walls and floors (17 per cent) were also pointed out as challenges they faced with respect to their housing assets. Thirty (20 per cent) migrants believed that the existing housing structures were highly unstable and not safe enough to withstand flood hazards or heavy rains. Raising concerns over health issues, 33 (22 per cent) migrants informed us that most of their residential areas are affected by large populations of rodents. Adding to this, 18 (12 per cent) respondents felt that they are at severe risk with the health challenges and infections arising out of sewage blocks and spills during rains and floods. In addition, 18 (36 per cent) migrants in Surat and six (12 per cent) migrants in Mumbai faced the threat of evacuation at any time from their respective places of residence.

Figure 10. Perceived climatic hazards and housing challenges



Yet another important determinant of physical vulnerability is sanitation. Our investigation revealed that there are two main types of sanitation availed by the respondents, namely public (42 per cent) and private latrines (50 per cent). Twelve (8 per cent) respondents did not have access to sanitation facilities and had to defecate in open spaces, out of which,11 respondents were residing in Surat and one in Mumbai. In addition, 14 (28 per cent) migrants in Surat found it difficult to access sanitation facilities during the monsoons, while 28 (56 per cent) migrants in Mumbai found it difficult to access sanitation facilities during the monsoons due to flooding, water logging and the spilling of sewage. A recent newspaper report citing the concern of a district medical officer reflects the poor status of sanitation facilities in labour camps in cities like Kochi:

> "*The District Medical Officer was upset with the deplorable conditions of latrine at the camp site of migrant labourers. The latrine does not have a septic tank and the faecal matter flows into an open drain, which is close to a posh residential colony. There is only one latrine at the camp, and around 60 labourers from Assam stay in the camp…The living rooms are crammed, made of polythene sheets and do not have lighting facility and the workers use a small portion of the room to cook food. The water they use is unhygienic and consumed even after boiling."* (The Hindu, 2014)

In terms of physical vulnerability, the research also explored the nature of access that people have to electricity and other energy sources. Around 41 (27 per cent) respondents did not have access to legally regulated electricity. Twenty-two (44 per cent) respondents in Mumbai and 18 (36 per cent) in Surat did not have access to legally regulated electricity. On the other hand, all the respondents in Kochi had access to electricity. Eighteen (36 per cent) respondents in Surat were dependent solely on fuelwood for cooking. LPG was accessible to only 75 (50 per cent) respondents in the three cities. Seventy-two (48 per cent) migrants said that they faced difficulties accessing electricity or other energy sources during climatic risk events such as heavy rains, lightning and thundershowers.

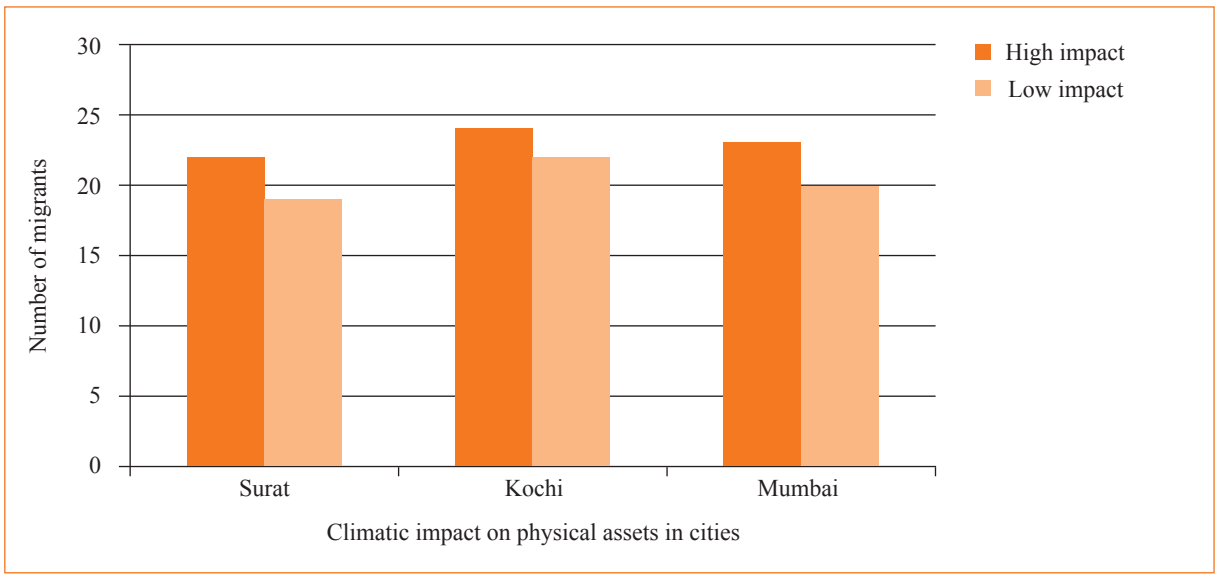
Exploring assets related to communication, 116 (77 per cent) respondents had their own mobile phones. However, contradicting our expectations, only 33 (66 per cent) respondents in Mumbai had their own mobile phones. The highest number of mobile phone users was in Kochi (44), followed by Surat (39). There were relatively few landline telephone users and their prevalence was only found in Kochi (6 per cent) and Surat (2 per cent). None of the migrants used neither letters or emails to communicate. Our study did not find any significant observation on the communication problems associated with climatic and natural hazard events in the three cities.

A significant part of the migrants' life in the city depends on their mode of transportation, on which they mostly depend to travel from their place of stay to their work site and health centres. The mean distances between the places of stay and work site for all the migrants was approximately four kilometres. In this regard, 69 (46 per cent) respondents resided in the inner suburbs, while 60 (40 per cent) stayed within the inner city limits. Twenty-one (14 per cent) migrants stayed in the outer suburbs of the city. Nevertheless, this was a practice only seen among the migrants in the cities of Kochi and Surat. On the other hand, 37 (74 per cent) respondents in Mumbai resided in the inner suburbs of the city.

Our findings reveal that 44 (29 per cent) migrants used to walk to their work sites without preferring any mechanical modes of transportation. This was considerably higher in Kochi (50 per cent), where the workers stayed very close to their worksite (as preferred by their employers). Eleven respondents in Mumbai and eight in Surat used to walk to their worksite. Ninety-three (62 per cent) respondents depended on public transportation such as bus and railway services to commute to their worksite. This dependency was very high in Mumbai (62 per cent). Quite surprisingly, none of the migrants in Surat were found to depend on public transport for their travel. Instead, nine respondents each in both Surat and Mumbai used private rickshaw services for travelling. Most of the migrants opined that they used to face transportation challenges during the monsoons especially when there were heavy rains and water logging in the city.

This research also examined the cumulative perception of migrants on the impact of climate change in relation to their physical assets (Figure 11). Our findings show that 22 migrants in Surat believed that climate change impacts would severely affect them due to the poor conditions of their physical assets. In a similar vein, 23 respondents in Mumbai and 24 migrants in Kochi believed that they would be severely impacted by climate change.

Figure 11. Perceived impact of climate change due to prevalent conditions of physical assets

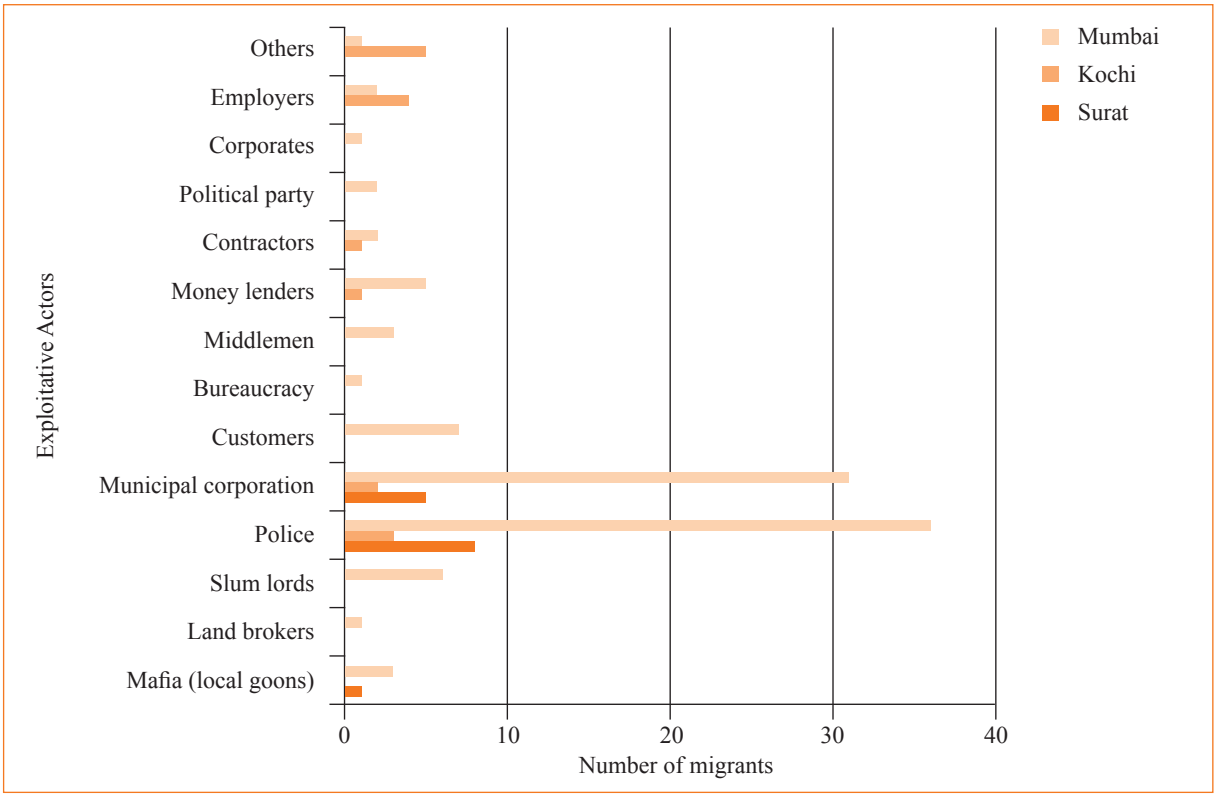


Political assets: One of the key assumptions of this research is that political assets also constitute an important asset base in the processes of vulnerability reduction. This is specifically significant in the context of designing appropriate social protection schemes to reduce population vulnerabilities to climate change and hazard events. Our findings show that only 66 per cent of the total migrant workers' population had access to the respective state-sponsored welfare schemes meant for the migrant workers and the poor in the city. Interestingly, none were aware of any social protection schemes. The associations of migrants with rights-based civil society organisations were also limited. Around 12 per cent of the migrants in Mumbai had association with some charity based NGOs, but were not receiving any welfare benefits from these organisations.

Being one of the most vulnerable sections of society, the migrant population is discriminated by various exploitative actors and institutions (Figure 12). The police and the authorities of the Municipal Corporation were found to be one among these actors who threaten the day-to-day survival strategies and livelihood security of migrants. Our study shows that 47 (31.33 per cent) respondents considered the police as exploitative actors. This fear of police is specifically very high among the surveyed migrants in Mumbai (72 per cent), while the police are least threatening in Kochi (6 per cent). In a similar vein, 38 (25.33 per cent) respondents considered the authorities in the Municipal Corporation as threatening. Illustrated by a street vendor in Surat:

> *"We, street vendors are threatened by police more than any other political actors. However, those migrants who survive on daily wage and who live illegally in the open space are often threatened by the officials of the Surat Municipal Corporation. Sometimes, prior to the visits of ministers or top-level bureaucrats to the city, the officials of the municipal corporation come and demolish their houses. They also confiscate their belongings. To retrieve these belongings, they have to go to police station. In the meantime, most of their belongings would have been displaced, lost or stolen."*

Figure 12. Exploitative actors in the day-to-day lives of migrants



In the above contexts, it is also important to discuss the plight of the NT and DNT tribes who have migrated to the city of Mumbai. We found that the NT and DNT tribes are historically marginalised groups who lack access to basic social, economic and physical resources both in their place of origin (Sholapur) or in the city. We could see these population groups along the pavements in Laminton Road or near Parel, literally living on the streets with no proper shelter or housing arrangements. The women in these groups are teased and sometimes abused by men, and their children are subjected to abuse and stones are thrown at them in the city. The men and children are often taken into custody by the police and the municipal authorities even if they are not involved in any illegal activities such as vending on the streets without a license. Although most of them have received multiple identification cards, they are not at all aware of the utility of these cards. Therefore, these documents remain useless during interrogation by the police or other authorities and they are subjected to forced eviction from the streets of the city. These groups have no fixed income or any decent form of housing. They have practically no access to clean drinking water sources and sanitation and hygiene facilities. On the other hand, they have tremendous faith in their goddess in their native place at Sholapur and end up spending their annual income (approximately US$200) on their yearly visit to the temple. Faith is an element that aids their coping capacity to deal with the never-ending crisis they face in the city.

5 Climatic hazard events and urban livelihoods

This section analyses the migrant workers' experiences and perceptions of climate change and its impacts. It explores the perception of migrants on climate related disturbances that they have faced in the city over the last 10 years, and the impact of climate variability on their livelihoods.

Migrants who were surveyed across the three cities perceived climatic disturbances and variability in terms of flooding and water logging due to heavy rains (23 per cent), flood induced displacement from city homes (19 per cent) and an increase in the duration of summer months (11 per cent) (Figure 13). Interestingly, 12 per cent of the migrants also opined that they did not perceive drastic changes in the climatic conditions of the city as they have been witnessing worse and severe changes in climatic conditions at their native homes. This observation was specific to those migrants who were interviewed in Kochi (36 per cent).

Migrants in Surat perceived the increase in flooding and water logging events due to heavy rains (23 per cent) and flood induced displacement from their city homes (19 per cent) as a serious threat. Six percent of the respondents in Surat also opined that infectious diseases, such as plagues, could make a comeback in the context of climate change. Migrants in Mumbai said that they were witnessing an increase in the duration and intensity of the summer months (28 per cent), decrease in rainfall (16 per cent), and severe unpredictability of weather conditions (12 per cent).

This research also examined the impact of climate variability and related disturbances on the livelihood security of the migrants. Our findings show that approximately 58 per cent of the respondents across the three cities believed that there is very high impact on their livelihoods, while 20 per cent believe that the impact is very low (Figure 14).

Figure 13. Perceived climate-related disturbances in the last decade

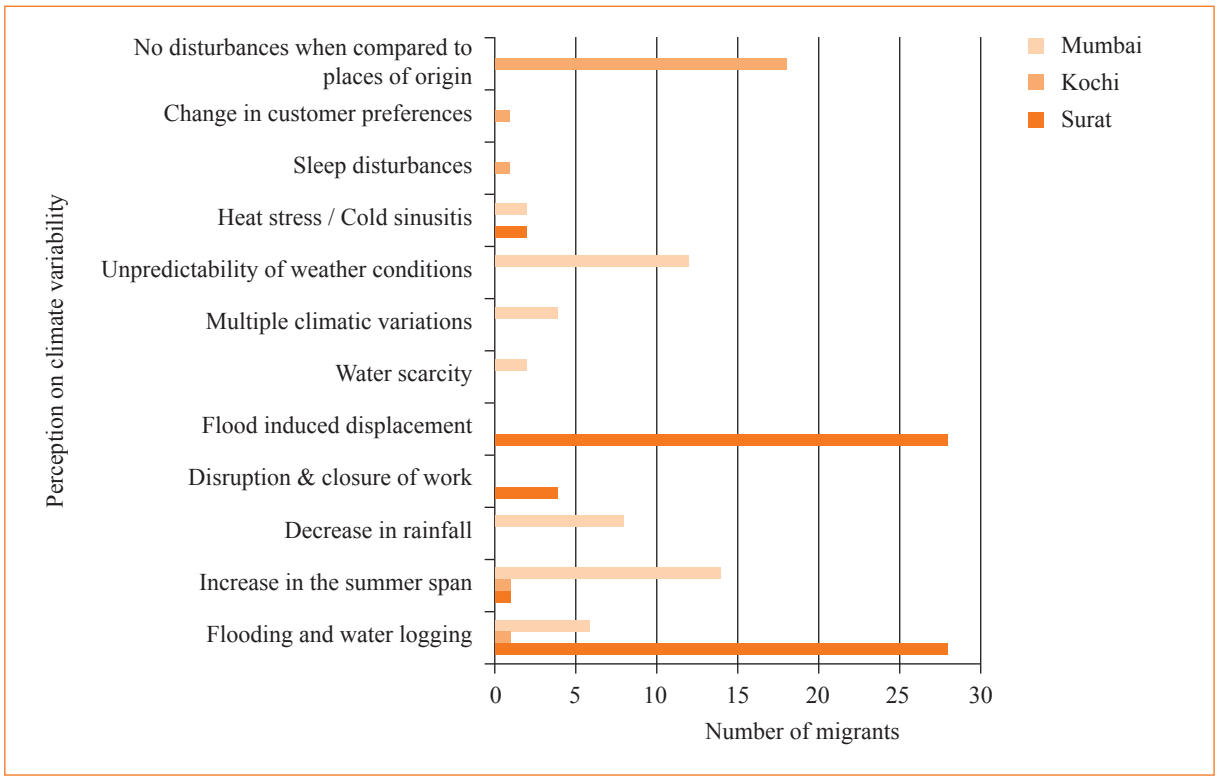
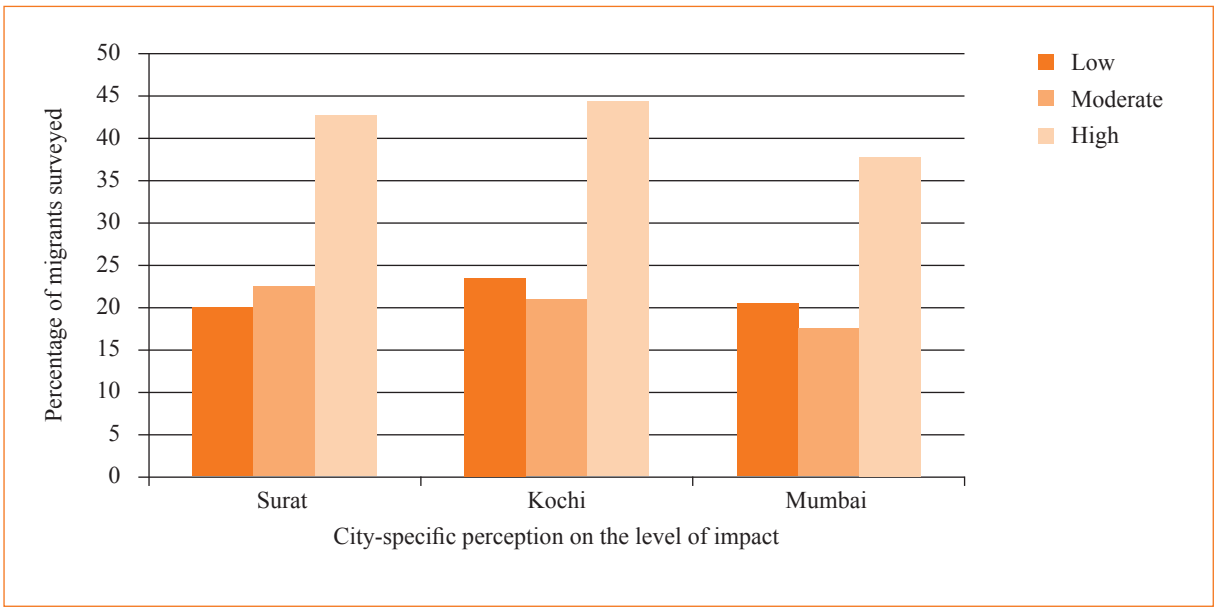
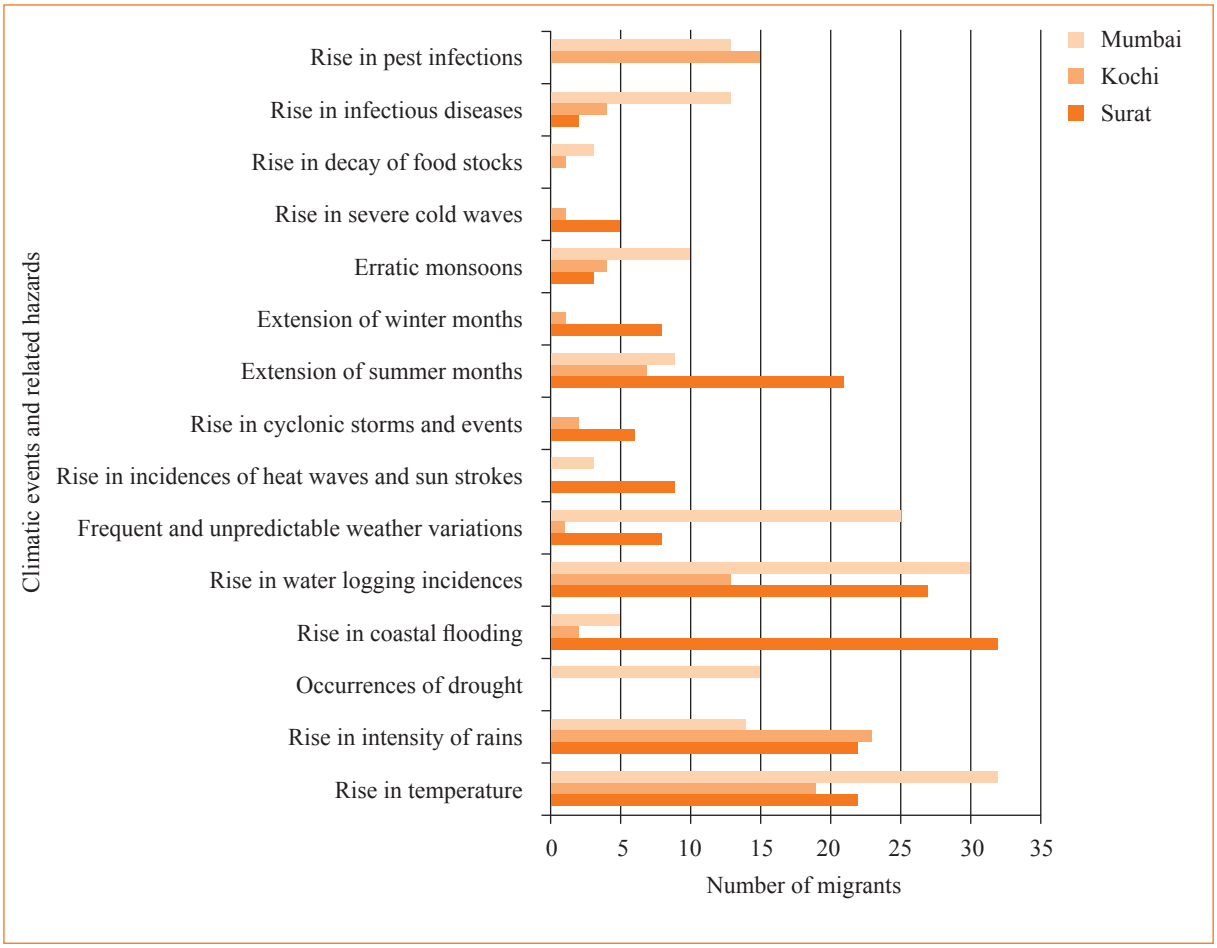


Figure 14. Impact of climate variability on livelihood security



Some of the significant climatic events and associated hazards that disrupt the livelihoods of migrants were found to be a rise in temperature (49 per cent), an increase in flooding and water logging incidences (47 per cent) and severe intensity of rains (39 per cent). The city-specific climate variations impacting livelihoods are shown in Figure 15.

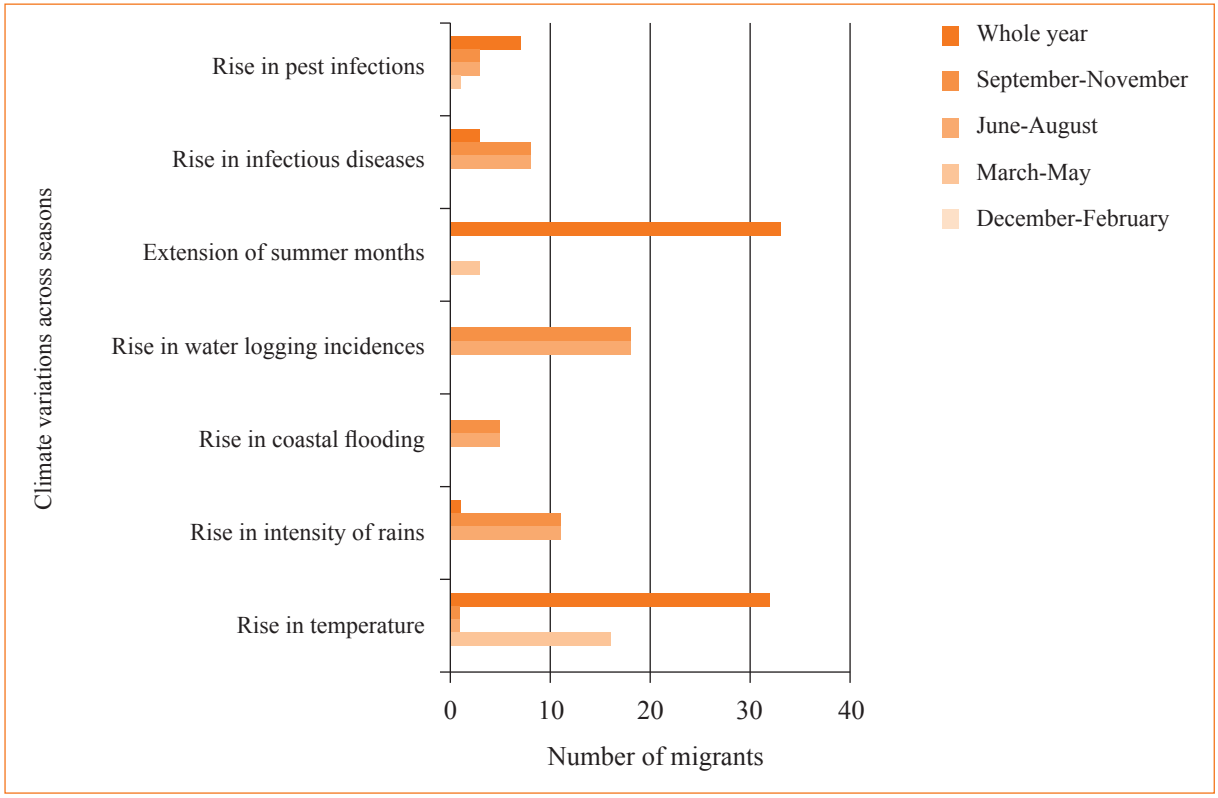
Figure 15. City-specific climate variations impacting livelihoods



Identifying some of the significant climatic variations, we also mapped out a seasonal calendar, which is illustrated in Figure 16. From the figure, it is evident that most of the climatic variations, such as rises in temperature, an extension of summer events and an increase in infectious diseases, are experienced throughout the year. Otherwise, it is the monsoon season that manifests most of the climate variability. 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."*

Figure 16. Seasonal calendar showing climatic variations



Our findings also show that the livelihoods of all migrant workers need not be negatively affected by extreme variations in climate. Some migrants consider such extreme events as opportunities for them to earn a better income. As illustrated by a lemonade vendor in Mumbai:

> *"It is true that with extreme heat events, our lives will become miserable. We have to move our shops to places where there is some shade from the sun. However, prolonged summer and rise in temperature is a blessing in disguise for people like us. My income is directly dependent on the rise in temperature. There will be a high demand for my lemonade juice or soda water. Last year, the temperature was high even during the month of December. We were able to earn consistently for six months!"*

This was a common observation among street vendors across the three cities who sold cold drinks, lemonade or soda as part of their livelihoods. In contrast, this also indicates that the livelihoods of many other vendors, such as vegetable and flower vendors or construction workers, will be affected due to the rise in temperature. This is because that they do not have any mechanisms to preserve their goods from the heat, and most begins to decay within a few hours.

Yet another important dimension is that the cities not only get affected by to climatic events in the city, but also due to hazards happening in the neighbouring states or districts. In the words of a migrant worker who witnessed the Surat flood of 2006:

> *"The flood in Surat happened not exclusively due to heavy rains in the city. It was monsoon time and there were heavy rains pouring in the border villages of Maharashtra. The heavy rains in the regions upstream thus led to floods in Surat. We were caught unaware of the floods and had to take refuge in a school".*

6 Climate change, infectious diseases and health inequities in cities

From the findings presented earlier in this study, it is evident that a rise in infectious diseases and pest infections are an important indicator and consequence of climate change in the cities. This section examines the nature of health inequities that migrants face in their day-to-day life. Subsequently, we attempt to infer the implications of these inequities in the context of population vulnerability to climate change. We also examine the diverse factors that make migrants vulnerable to both climate change and infectious diseases.

Climate change affects health in numerous ways, from the direct consequences of an increase in waterborne diseases, to indirect consequences such as malnutrition. It also influences the incidence rate of various infectious diseases, such as malaria, diarrhoeal diseases, and cholera (Confalonieri *et al.*, 2007; McMichael and Lindgren 2011; Tanser *et al.*, 2003). Climate variability and natural hazards, such as floods and heavy rains, pose a high risk to the outbreak of infectious diseases, for example leptospirosis, hepatitis E, malaria and diarrhoea (de Souza *et al*., 2012). Women, children and migrant workers are the most at risk (Toole, 2005). Infectious agents can move with migrants and this can then lead to an increased risk of infectious disease in host populations as well (Palinkas et *al*., 2003).

Various studies have projected the linkages between climate change and risk of infectious diseases (Patz *et al.*, 2008; Frier *et al*., 2010; McMichael *et al.*, 2012). Studies have pointed out that climate change may result in alteration of range, distribution and incidence of outbreaks to certain infectious diseases such as dengue, chikungunya, or in many other cases increase the burden of diseases such as diarrhoea (Dhara *et al.*, 2013; McMichael *et al.*, 2012). With rises in temperature and associated climate change, it is envisaged that bacterial survival time, proliferation and thus the incidence of certain infectious diseases may further increase (*ibid*). Thus, vector-borne diseases may exhibit changes in transmission intensity or geographical ranges due to the impact of climate variations on the vector populations (Dhara *et al*., 2013). Studies across the world have demonstrated that climate change impacts could be amplified by urban heat island effects, which could cause a rise in health risks such as acute heat stress, cardiac problems and kidney failure (Huq *et al.*, 2007; Kjellstrom and McMichael, 2013). Research carried out in Vietnam has demonstrated the correlation between the health impact of heat stress and the economic and social insecurity of migrant workers (Hoa *et al.*, 2013). These factors, when clubbed with chronic environmental problems such as air and water pollution in cities, and the mixing of toxic and solid waste in habitats, do worsen health inequities among the urban poor (Kjellstrom *et al*., 2007; Martine *et al*., 2007).

Climate change impacts on health could be highly complex and dynamic (McMichael *et al.*, 2012). For instance, critiques point out that studies of malaria-climate linkages have often assumed that factors affecting the distribution of malaria such as disease and vector control effects remain constant (de Souza *et al.*, 2012), yet various complex social and demographic factors could determine the distribution of infectious diseases. Factors such as human population density and behaviour, housing types and location, water supply, sewage and waste management systems, availability and use of vector control programmes, and access to health care could seriously determine the resurgence of infectious diseases with the change in environment and climate conditions (Dhara *et al*., 2013). Thus, the present study highlights the significance of examining the linkages between population vulnerability to climate change and infectious diseases.

Researchers across the world are examining evidence from local communities on levels of climate variability and unpredictability beyond what they are normally used to (Maddison, 2006; Nelson and Stathers, 2009; Nelson, 2011). Analysing vulnerability to the risks of HIV/STI, Smith-Estelle and Gruskin (2003) have identified three levels of vulnerability; namely the individual level, programme level, and societal level. Individual level vulnerability consists of physical, mental and behavioural characteristics, while programme-related vulnerability is associated with the existence, content and delivery of health and development programmes (*ibid*). Political, governmental and socio-economic factors constitute the societal level dimensions of vulnerability (*ibid*).

A key argument of this research is that the vulnerability of the urban poor, in particular migrant groups, to infectious diseases is not exclusively due to climatic or environmental factors, but also due to lack of access to affordable, good quality health care services (Marschang, 2014). The vulnerability contexts of urban slums, for example lack of basic infrastructure, poor sanitation and drainage facilities, and paucity of clean drinking water could be further stressed under conditions of climate change induced extreme weather events resulting in the rapid outbreak of epidemic diseases (Frier *et al*., 2010). Thus, we can conclude that the urban poor in crowded settlements with limited access to water and sanitation facilities, are more vulnerable to climate change and infectious diseases (Douglas *et al*., 2008).

The health of vulnerable groups such as migrant workers in city slums is more at risk from climate change (Confalonieri *et al.,* 2007). First time migrants are also exposed to disease vectors for which they have not developed behavioural controls or population-level immunity (Kloos, 1990). They are subjected to high pre-existing levels of health problems and their risk of infectious disease (e.g. cholera, measles, malaria, meningitis) could increase with a combination of weakened immune system, inadequate health care systems, low immunisation coverage, lack of clean water, and poor sanitation (Zarocostas, 2011). They are also vulnerable 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 potential settlement spaces for the outbreak of 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 (Rajabali *et al*., 2009; De Bruijn, 2009; Montgomery *et al*., 2003).

Among the urban poor, migrant workers in the informal sector and their family members are the most vulnerable as they are susceptible to continued environmental, physical and psychosocial health threats (Revi, 2008; Black and Sward, 2008; McMichael *et al*., 2012). Smith (2002) has observed that stigma associated with certain diseases also adds to the vulnerability of migrants in cities and their family members in villages. Moreover, risk factors associated with vulnerable migrants and ethnic minorities are also related to their legal status that determines their access to health and social services (Marschang, 2014). Studies have observed that the vulnerability of migrants to infectious diseases is very high as they have limited access to health information in their own languages, difficulty to access affordable health care and at many times are unable to disclose their health problems to others with the fear of being expelled by their employers (Smith-Estelle and Ruskin, 2003). The inability of many migrants to seek effective health care in cities also make their family members in their villages vulnerable to infectious diseases as they return home with the burden of the disease (*ibid*). Many migrants also do not have access to social security and health insurance schemes (Wolffers *et al*., 2002).

In the context of this study, we first examined decision-making related to health issues in migrant households. Taking into account that most of the migrants stay away from their families, we found that 115 (76.67 per cent) migrants themselves make decisions related to health care. On many occasions, the parents of the migrants (22 per cent) play an important role in health care decision-making. This is specifically true with respect to the migrants in Kochi, who return to their native place if they fall extremely sick. Our findings showed that 99 (66 per cent) migrants who were interviewed rarely fell sick. Nevertheless, 32 migrants were persistently ill and around 14 respondents fell sick two to five times a year. The percentage of respondents with persistent illness was high in Mumbai (32 per cent) and Surat (22 per cent).

We also surveyed the prevalence of illness in the respondents' households in the city during the last three years. Our findings show that 47 households had members infected with acute illnesses, and 14 households had members with chronic illnesses. The number of members with acute illnesses was observed to be high in Surat followed by Mumbai. The migrants do not perceive acute illness as that serious. The symptoms are usually body pain, headache, weakness and fatigue, seasonal illnesses like cold and slight fever and pain due to cuts and bruises that they incur during work or otherwise. According to them, these are illnesses, which will fade away within 2–3 days. However, migrants considered chronic illnesses as serious with symptoms like weakness and fatigue, preventing them from being productive at work. The amount of time it took to recover and how it affected their livelihood is therefore an important factor for them when considering whether these diseases are serious. Expense is also a consideration; for many of these diseases, medicines have to be taken for a long time, and a good diet also has to be followed.

We also found that approximately 23 migrant households had members who suffered from food and water-borne diseases, and many cases of hospitalisation were reported that took almost 1–3 weeks of cure, affecting the livelihoods of the migrants or their family members. Thirty-two percent of migrants in Surat had been infected with typhoid fever in the last year, and four per cent of migrants in Kochi and Mumbai had been affected with acute diarrhoea. Both human and financial security was affected during such situations. We also observed that migrant households in Surat had higher disease prevalence, followed by Mumbai and Kochi respectively.

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 had been affected by vector-borne diseases in the last three years. Malaria has been rampant among 28 migrant households in Surat. Migrants in Mumbai have commented that they had been infected with different types of vector-borne illnesses, namely malaria (56 per cent), dengue (8 per cent), chikungunya (6 per cent) and yellow fever (2 per cent). Kochi was once known to have eradicated malaria, though the incidences of chikungunya and dengue had become rampant. However, our findings show that two migrants were infected with malaria and one migrant with dengue, chikungunya and yellow fever respectively. Some of them have reported cases of malaria and issues due to disability, which took one week to get cured. These diseases were found to be serious as they affected not only their health, but also their livelihood. Prasad-Aleyamma (2011:176) has summarised one such incident that happened in the city of Kerala as follows:

> "*Bambholi Sahni and Sudo Pandit died due to malaria which could have been triggered off by the inadequate food and long hours of arduous labour. The misfortune of falling ill and having to encounter the health system in an alien land is dreaded so much that after this incident, the workers of Banma when they went to work in the Delhi metro took the village healer, called 'guruji'. The guruji does massaging besides ritual forms of healing, mainly to ease body pain felt after long hours of hard work. He is a handicapped person and has a tri-cycle. He does not work at the site. He lives of the fee he gets when he does healing. He gets food for free from the common kitchen of the workers from the village."*

The mean age of members affected by food and water-borne diseases is 18 and for vector-borne diseases, the mean age is 28. Food and water-borne diseases have affected children mostly in the cities of Kochi and Mumbai. Vector-borne diseases have mainly affected the youth in the three cities. The mean age of the members in migrant households with acute illness is 31, while for chronic illness it is 38. In Kochi, migrant elderly women workers who have migrated from other districts of the state were affected by chronic illness such as cardiac and kidney failures. A gender-based comparison was also carried out to see the diversification of disease prevalence among the migrants' households. It could be seen that even from a sample that had less representation of women, disease prevalence (vector-borne infections) among women were considerable in numbers in Mumbai and Surat. Prevalence of acute illness among both men and women in Surat and Kochi is a matter of concern.

The challenges faced by migrants in accessing health care facilities in the city are illustrated below. For this study, we firstly we examined the various sources of health care that migrants seek during times of crisis. Our findings show that health practices are vary widely in the three cities. While public hospitals were preferred by 30 (20 per cent) migrants, 29 (19 per cent) respondents visited private hospitals. Migrants in Mumbai prefer private clinics (34 per cent) and public hospitals (27 per cent). Self-medication is a practice noted among three respondents in Surat and four in Mumbai respectively. In Kochi, six migrants treat themselves by visiting the pharmacy. In addition, six respondents in Surat visit quacks for their treatment. These are mostly daily wage labourers and workers employed in the textile units. In the words of a woman 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."*

We also observed that some of the respondents in Kochi return to their native places during medical emergencies instead of seeking health care in the city. This is due to factors such as the lack of social support and the high cost of diagnosis and treatment in the city. The vulnerability context of the migrants can be further illustrated by the newspaper report below:

> "*We need them, but we don't want them. That in essence is the sorry state of migrant labourers in the city. Following protests and pressure from local leaders and residents of Palluruthy, a migrant worker, who was detected with malaria, was sent home by the contractor. He was also forced to shut his labour camp and shift all 98 workers housed in the building…The labourer, who developed fever, was first detected as having malaria by a private hospital. Following an alert, the health department immediately tested 98 workers, including the person who contracted malaria, living in the labour camp on Wednesday…But despite assurance given by the health department, the residents' association in the locality,… wanted the owner of the building housing labourers to shift them out immediately…*" (Times of India, 2014)

We also observed that not all migrants have equal access to effective health care services, which is one of the main determinants of health equity. In this regard, 65 migrants informed us that they do not have regular access to the government doctor and 57 respondents do not have access to other health care professionals. Quite strikingly, only 44 respondents in the three cities had direct access to doctors during times of health crises. The fact that almost 50 per cent of the migrants do not have access to regular doctors in the public hospitals is a serious cause of concern. With respect to most respondents, the long waiting hours in the public hospitals make it difficult for them to leave their livelihoods. Thus most of them go to private doctors during illnesses, which is not affordable to many. In Mumbai, we observed that the homeless migrants including the NT and DNT did not have access to any health care facilities. Moreover, during times of epidemic outbreaks, such as diseases like tuberculosis or malaria, the approach of the Municipal Corporation was to practically evict them from the city.

During flooding and water logging, it is very difficult for the migrant workers to access health care services. 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".*

Yet another important determinant is the time taken to reach the health care facilities. Most of the respondent in all the three cities could reach health care facilities in less than an hour. An exception was in Mumbai, where 17 of the respondents said that they usually take 1–2 hours to reach the health centres. In Surat, 10 respondents said that they take 1–2 hours to seek care from a medical centre. Other challenging factors that prevent migrants from seeking effective health care are explained as follows. Around 30 respondents said that they lacked the necessary social support to take care of them when they are ill, particularly in Kochi (44 per cent). Migrants also avoid going to the 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 avoid going to the hospital or clinics. Moreover, the diagnostic tests are deemed to be expensive and demotivate migrants from visiting the doctor or the health facility. 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 per cent).

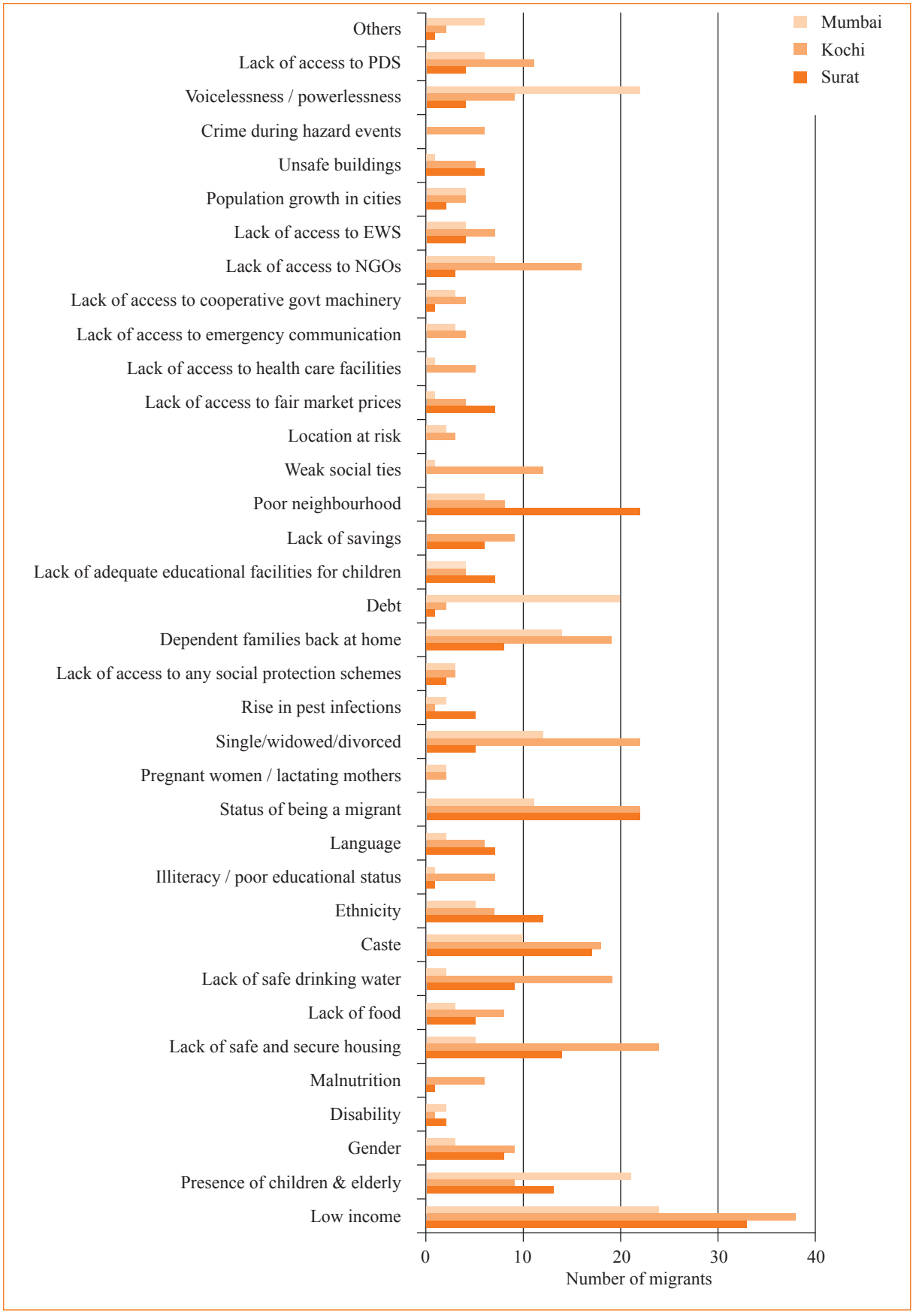
This research also examined the migrants' perceptions of other factors besides infectious disease that make them vulnerable to climate change. Two thirds of the migrant respondents across the three cities felt that low income was a factor. According to a migrant worker based in Surat:

> "*We (including his 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 money lender 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".*

Fifty-five respondents felt that the status of being a migrant itself was considered a threatening factor. Forty-five respondents said that caste-based discrimination also made them vulnerable to accessing good quality health care and having the capacities to deal with livelihood crises. Thirty-five migrants also believed their status of voicelessness and powerlessness in the city heightened their vulnerability context. Other important factors were the presence of children and the elderly in families (28.67 per cent), lack of safe and secure housing (28.67 per cent), being single/widowed or divorced (26 per cent), having dependent families at their native home (27.33 per cent), and poor neighbourhood ties (24 per cent).

Carrying out city-specific analyses of the various factors that induce vulnerability to climate change and infectious diseases (Figure 17), 38 (76 per cent) migrants in Kochi (76 per cent) and 33 (66 per cent) respondents in Surat respectively considered low income as the main factor. In Mumbai, 24 (48 per cent) respondents believed that their low income status made them vulnerable to climatic hazards and infectious diseases. The presence of the elderly and children was a major challenge to 21(42 per cent) respondents in Mumbai. Gender-based discrimination was also pointed out by nine (18 per cent) respondents in Kochi and eight (16 per cent) in Surat. Twenty-four (48 per cent) migrants in Kochi considered lack of safe and secure housing as an important factor; most of the migrants are staying on a shared accommodation basis and often at the worksite itself. Lack of safe drinking water was considered a challenge by 19 (38 per cent) migrants in Kochi (38 per cent) and nine (18 per cent) respondents in Surat (see Figure 17).

Figure 17. Factors inducing vulnerability to climate change and infectious diseases in each city



Caste-based discrimination was a serious issue for 18 (36 per cent) respondents in Kochi and 17 (34 per cent) migrants in Surat. In Kochi, caste-based discrimination was more amongst the migrants, the contractors and the employers, rather than between migrants and the host population. In this regard, Prasad-Aleyamma (2011) has observed that in Kerala, the recruitment and labour processes of migrant workers are defined by caste and ethnicity (2011: 180):

> "*The supervisory hierarchy at the worksite made use of these (caste and ethnic) identities to regiment and control the work process. These identities also determined the kind of work as workers belonging to a specific caste or region were considered to be skilled at doing certain tasks. Moreover, workers were paid different wage rates for the same work if they belonged to different caste or region. This was especially true in the case of Adivasi workers who were paid the lowest of wages and lived in the worst of conditions."*

In a similar vein, the status of being a migrant itself was considered a disadvantage in both Surat (44 per cent) and Kochi (44 per cent). Seven (14 per cent) migrants in Kochi pointed out their poor educational status was a threatening factor. Moreover the phase of being alone – single, widowed or divorced was also a decisive factor for 22 (44 per cent) respondents in the city. Debt was a key issue for 20 (40 per cent) migrants in Mumbai. Poor neighbourhood ties were of significant concern for 22 (44 per cent) migrants in Surat. Twenty-two (44 per cent) migrants in Mumbai also believed that their status of being voiceless and powerless was an impending factor against strengthening their resilience to climate change and infectious diseases. Lack of access to the Public Distribution System (PDS) was a cause of concern among eleven (22 per cent) migrants in Kochi.

In-depth discussions with the migrants also helped us to gather certain insights on the interrelationships between climate change and infectious diseases and their impact on the livelihood asset base of the poor. Migrants in Mumbai observed that with climatic events such as heavy rains, floods and water logging, water quality has declined considerably resulting in the outbreak of water-borne diseases. The plight of the NT and DNT is even more pathetic, as the only usable water that they are able to access for drinking during heavy rains is from the public toilets, as mentioned earlier. Migrants in Surat complained that the water they get is hard, salty and increasingly full of sand deposits. Some also commented that their options to store food grains and other essential commodities weakens considerably during flooding and water logging, not only due to the resulting dampness, but also due to the rapid rise in the population of rodents and reptiles.

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 building 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 home were affected during the monsoons, especially when they were infected with diseases such as malaria, dengue or hepatitis. The diagnosis, treatment and medicines are so expensive that neither they nor their employer can afford them. Both in Mumbai and Kochi, people have 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. He now has to rent the equipment to sustain his livelihood. 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.

7 Conclusion

This paper has examined the progression of vulnerability to climate change and infectious diseases among migrant workers in three cities in India. Analysis of the transition and dynamics in vulnerability has been approached from a political economy perspective. A significant feature of migrant workers' vulnerability is its dual structure: firstly, a lack of access to resources and decision-making structures results in the vulnerability context. Secondly, the resulting vulnerability context widens the equity gap, reinforcing and perpetuating the structures and processes inducing vulnerability. The duality and dynamic nature of vulnerability also shows the interface between the root cause, dynamic pressures and unsafe conditions. The dual structure implies that vulnerability is a condition that shapes and reshapes itself continuously and is fiercely accompanied by the processes and structures of unplanned rapid urbanisation, environmental change and social exclusion. To highlight the political economy dimensions of vulnerability, some of the key findings are summarised below.

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. Nevertheless, this research provides certain significant insights on the diverse types of vulnerabilities faced by migrant workers and the underlying drivers of vulnerability. Migration in Indian cities is showing new trends in newer cities. However, the cities are neither prepared to meet existing challenges of climate change nor the health crises of the present or the future. Lack of access to resources, decision-making structures and power shaped by political and economic forces creates unsafe conditions in rural areas for migrants. Caste and ethnic-based discrimination is a major force behind rural-urban migration. These practices of exclusion continue further in the cities making the migrants more vulnerable to climate change and other hazards. Adding to these, climate change and natural hazards in rural areas are scaling up rural-urban migration in India.

The nature and characteristics of vulnerability amongst migrant groups varies with the historicity of cities. Tier I cities like Mumbai are characterised by vulnerable groups – mostly children and the elderly. In contrast, in Tier II cities like Surat and Kochi, the youth represent the vulnerable migrant group. Though the migration of the youth to new cities has resulted in greater remittances and better employment opportunities, it has not helped in reducing vulnerability. The findings of this research show that a rise in income is not a sole indicator of reduced vulnerability. Planners involved in risk reduction have to face multiple challenges. For example, while mitigation and adaptation strategies need to evolve and be shaped appropriately for the elderly and children in cities like Mumbai, appropriate mechanisms need to be designed for the youth in cities like Kochi and Surat. Such efforts will be meaningless unless steps are taken to reduce risk and mainstream climate change adaptation and disaster risk reduction in the rural areas as well. Thus, climate change adaptation and risk reduction needs to evolve as an interlinked process across temporal-space dimensions of the village and the city.

Climate change and infectious diseases could result in the drastic erosion of the livelihood assets of migrant households. Urban housing has not yet evolved to meet the challenges of climate change nor the threat of infectious diseases. 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. The social ties and networks of migrant workers are very weak, preventing them from claiming their rights or accessing a dignified way of life, including better housing, health care and employment. There is a complete absence of workplace ethics, negating the basic rights of dignified labour in all the three cities. This is irrespective of the fact that a state like Kerala has enacted legislation to guarantee the rights of migrant workers in cities such as Kochi. Poor skills and limited livelihood assets, accompanied by a lack of compliance by the state and the employers to protect the rights of migrants make them vulnerable. Largely characterised by informal agreements and support systems in the workplace, crisis events in the migrants' life make them more vulnerable to climatic events and infectious diseases.

Most of the migrants did not have regular access to doctors and other health services. Both the public and private health care systems are shaping up in such a way that they exclude the poor in cities, as justified by the situation of migrant workers in Mumbai, Surat, and to some extent Kochi. The migrant workers have very limited opportunities to reduce their vulnerabilities and participate actively in risk reduction and development planning. A comprehensive analysis shows that the context of their vulnerability has become more complex and often unpredictable, and traditional and linear approaches to understanding vulnerability might prove ineffective. The root causes, dynamic pressures and unsafe conditions are neither linear nor static. They are continuously shaped and reshaped by various actors and processes. 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, migrant workers are exposed to new structures and processes that manifests into newer and more complex forms of vulnerability.

There is an urgent need to critically reflect on certain terminologies and practices in the field of climate change and risk reduction. The socially constructed nature of some risk reduction concepts needs to be further examined. We need to relook at concepts such as 'adaptation', 'access', 'impact', 'development' and many more from the perspective of migrant workers in the informal sector. For example, our data shows that the migrants had access to clean drinking water. But, 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 his or her village, due to factors such as caste, drought, or salinity. Therefore, for the migrant, the ability to access water near their squatter residence or worksite in the city is in itself a progress and to many vulnerability scholars, this situation is a step towards building resilience. However, when studying risk from an ecosystem cum rights-based perspective, 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. This is exemplified by the high rate of water-borne diseases among the migrants in Surat, yet most of the migrants who were infected by typhoid said that they had continuous access to clean drinking water. Similar responses were found in Mumbai and Kochi. This is specifically relevant when we engage in such a debate in the context of climate change and infectious diseases.

A balance between social constructivism and critical realism might then be called for to deal with climate change and strengthening urban resilience. Vulnerability to epidemics need not always be a threat. Instead it could be considered as an opportunity opened up by a disturbance to build resilience in innovative ways (Folke, 2006). This also implies that local communities and institutions in urban planning, public health management, climate change adaptation and disaster governance should be alert and responsive to changing socio-economic and environmental conditions of the city.

References

Adger, WN (2003) Social capital, collective action and adaptation to climate change, *Economic Geography*, 79(4), p. 387–404.

Ahmed, S and Fajber, E (2009) Engendering adaptation to climate variability in Gujarat, India. *Gender and Development*, 17 (1), Climate changes and climate justice (March 2009), p. 33–50.

Arthurson, K and Baum, S (2013) Making space for social inclusion in conceptualising climate change vulnerability. *Local Environment*, DOI: 10.1080/13549839.2013.818951.

Banks, N, Roy, M and Hulme, D (2011) *Neglecting the urban poor in Bangladesh: research, policy and action in the context of climate change,* BWPI Working Paper 144, Brooks World Poverty Institute.

Bardsley, DK and Hugo G (2010) Migration and climate change: examining thresholds of change to guide effective adaptation decision-making. *Population and Environment*, 32(2–3), p. 238–262.

Birkmann, J (2006) *Measuring Vulnerability to Natural Hazards: Towards Disaster- Resilient Societies*. Tokyo: UNU Press.

Black, R and Sward, J (2008) *Measuring the Migration-Development Nexus: An Overview of Available Data*. Briefing No. 13, Development Research Centre on Migration, Globalisation and Poverty.

Blaikie, P, Cannon, T, Davis, I and Wisner, B (2004) *At Risk: Natural Hazards, People's Vulnerability and Disasters*, New York: Routledge. 2nd edition.

Bora, RS (2014) Migrant Informal Workers: A Study of Delhi and Satellite Towns. *Modern Economy*, 5, p. 562–579.

Bosher, L, Penning-Rowsell, E and Tapsell, S (2007) Resource Accessibility and Vulnerability in Andhra Pradesh: Caste and Non-Caste Influences, *Development and Change* 38(4), p. 615–640.

Campbell-Lendrum, D and Corvalan, C (2007) Climate Change and Developing-Country Cities: Implications For Environmental Health and Equity, *Journal of Urban Health: Bulletin of the New York Academy of Medicine*, 84 (1), p. i109–i117.

Cannon, T, Twigg. J and Rowell, J (2003) Social Vulnerability. Sustainable Livelihoods and Disasters, Report to DFID Conflict and Humanitarian Assistance Department (CHAD) and Sustainable Livelihoods Support Office, available at:

Cannon,T (2008) *Reducing People's Vulnerability to Natural Hazards: Communities and Resilience*, Research Paper Number 2008/34, UNU-WIDER.

Confalonieri, U, Menne, B, Akhtar, R, Ebi, KL, Hauengue, M and Kovats, RS (2007) Human Health. In Parry ML, Canziani OF, Palutikof JP, van der Linden PJ, Hanson CE, eds: *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, UK: Cambridge University Press, p. 391–431.

Cutter, SL, Bryan, JB and Shirley, WL (2003) Social Vulnerability to Environmental Hazards, *Social Science Quarterly*, 84(2), p. 242–261.

Deshingkar, P and Aket, A (2009) *Migration and Human Development in India*, Human Development Research Paper 2009/13, UNDP.

Dhara, VR, Schramm, PJ and Luber, G (2013) Climate change and infectious diseases in India: Implications for health care providers, *Indian Journal of Medical Research*, 138, p. 847–852.

Douglas, I, Alam, K, Maghenda, M, Mcdonnell, Y, Mclean, L and Campbell, J (2008) Unjust Waters, Climate Change, Flooding and the Protection of Poor African Communities, *Environment and Urbanization,* 20, p. 187–205.

Dreze, J and Sen A (1995) *India: Economic Development and Social Opportunity*, Oxford: Oxford University Press.

Füssel, H-M and Klein, RJT (2006) Climate Change Vulnerability Assessments: An Evolution of Conceptual Thinking, *Climatic Change,* 75, p. 301–329.

Heltberg, R, Siegel, PB, and Jorgensen, SL (2009) Addressing human vulnerability to climate change: Toward a 'no-regrets' approach, *Global Environmental Change*, 19, p. 89–99.

Hoa, DTM, Nguyet, DA, Phuong, NH, Phuong, DT, Nga,VT, Few, R, and Winkels, A (2013) *Heat stress and adaptive capacity of low-income outdoor workers and their families in the city of Da Nang, Vietnam*, Asian Cities Climate Resilience Working Paper Series 3, IIED.

Huq, S, Kvats, S, Reid, S and Satterthwaite, D (2007) Editorial: Reducing risks to cities from disasters and climate change, *Environment and Urbanization*, 19(1), p. 3–15.

Karlsson, M and Bryceson, I (2014) Continuity and change: understanding livelihood shifts and adaptation in coastal Belize 1830–2012, *Local Environment: The International Journal of Justice and Sustainability*. DOI: 10.1080/13549839.2014.926871.

Kelly, PM and Adger, WN (2000) Theory and Practice in Assessing Vulnerability to Climate Change and Facilitating Adaptation, *Climatic Change,* 47, p. 325–352.

Kjellstrom, T and McMichael, AJ (2013) Climate change threats to population health and well-being: the imperative of protective solutions that will last, *Global Health Action* 2013, 6, p. 20816 http://dx.doi.org/10.3402/gha.v6i0.20816

Kjellstrom, T, Friel, S, Dixon, J, Corvalan, C, Rehfuess, E, Campbell-Lendrum, D, Gore, F and Bartram, J (2007) Urban Environmental Health Hazards and Health Equity, *Journal of Urban Health,* 84, p. 86–97.

Kloos, H (1990) Health aspects of resettlement in Ethiopia. *Social Science and Medicine*, 30(6), p. 643–656.

Kumar, KSK and Viswanathan, B (2013) Weather and Migration in India: Evidence from NSS Data, Working Paper, Madras School of Economics, Chennai: India.

Maddison, D (2006) *The Perception of and Adaptation to Climate Change in Africa,* Policy Research Working Paper 4308*,* The World Bank.

Marschang, S (2014) Report of the eHealth Stakeholder Group. Health inequalities and eHealth.

Martine, G, McGranahan, G, Montgomery, M and Fernandez-Castilla R (2007) Introduction. In Martine, G, McGranahan, G, Montgomery, M, Fernandez-Castilla, R. (eds.) *The New Global Frontier. Urbanization, Poverty and Environment in the 21st Century.* Earthscan, pp.1–16.

McMichael, AJ and Lindgren, E (2011) Climate change: present and future risks to health – and necessary responses. *Journal of Intern Med*, 270(5), p.401–413.

McMichael, C, Barnett, J and McMichael, AJ (2012) An Ill Wind? Climate Change, Migration, and Health, *Environmental Health Perspectives,* 120(5), p. 646–654.

Mearns, R and Norton, A (2010) *Social Dimensions of Climate Change: Equity and Vulnerability in a Warming World.* Washington DC: The World Bank. https://openknowledge.worldbank.org/handle/10986/2689 License: CC BY 3.0 IGO

Morrow, BH (1999) Identifying and mapping community vulnerability, *Disasters*, 23(10), p. 1–18.

Moser, C and Satterthwaite, D (2010) `Toward Pro-Poor Adaptation to Climate Change in the Urban Centers of Low and Middle-Income Countries' in Mearns, R and Norton A (*eds*) Social Dimensions of Climate Change: Equity and Vulnerability in a Warming World. Washington DC: The World Bank.

Nelson, V and Stathers, T (2009) Resilience, power, culture, and climate: a case study from semi-arid Tanzania, and new research directions, *Gender & Development*, 17(1), p. 81–94.

Nelson, DR (2011) Adaptation and resilience: responding to a changing climate, *WIREs Climate Change* 2, p. 113–120.

Palinkas, L, Pickwell, S, Brandstein, K, Clark, T, Hill, L and Moser, R (2003) The journey to wellness: stages of refugee health promotion and disease prevention. *Journal of Immigrant Health* 5(1), p.19–28.

Parvin, A, Alam, AFMA and Asad, R (2013) *Climate Change Impact and Adaptation in Urban Informal Settlements in Khulna: A Built Environmental Perspective*, International Workshop on Living in Low-income Urban Settlements in an Era of Climate Change: Processes, Practices, Policies and Politics, 9–10 September 2013, University of Manchester, UK.

Patz, JA, Vavrus, SJ, Uejio, CK and McLellan, SL (2008) Climate Change and Waterborne Disease Risk in the Great Lakes Region of the U.S., *American Journal of Preventive Medicine*, 35(5), p. 451–458.

Prasad-Aleyamma, M (2011) Caste, Ethnicity and Migration: Linking Recruitment and Labour Process, in Rajan, S. I. (*ed*.) *Migration, Identity and Conflict: India Migration Report 2011*, New Delhi: Routledge, p. 173–182.

Raleigh, C, Jordan, L and Salehyan, I (2008) *Assessing the Impact of Climate Change on Migration and Conflict,* Paper presented at the World Bank workshop on the Social Dimensions of Climate Change, Washington, DC, March 5–6.

Ranger, N, Hallegatte, H, Bhattacharya, S, Bachu, M, Priya, S, Dhore, K, Rafique, F (2011) An Assessment of the Potential Impact of Climate Change on Flood Risk in Mumbai. *Climatic Change*, 104 (1), p. 139–67.

Revi, A (2008) Climate change risk: an adaptation and mitigation agenda for Indian cities, *Environment and Urbanization,* 20(1), p.207–229.

Ribot, J (2009) Vulnerability does not Fall from the Sky: Toward Multi-scale Pro-Poor Climate Policy, in Mearns, R. and Norton, A. (eds.), *Social Dimensions of Climate Change: Equity and Vulnerability in a Warming World*. Washington, DC: The World Bank, p. 47–74.

Santha, SD (2015) Adaptation to coastal hazards: the livelihood struggles of a fishing community in Kerala, India, *Disasters*, 39(1), p. 69−85.

Santha, SD and Bhuvaneswari, S (2009) A Malady amidst Chaos: Examining Population Vulnerability to the Chikungunya Epidemic in Kerala, India, *Loyola Journal of Social Sciences*, 23(2), p.111–129.

Satterthwaite, D, Huq, S, Pellimn, M, Reid, H and Lankao, PR (2007) *Adapting to climate change in urban areas: the possibilities and constraints in low and middle income nations,* Human Settlements Discussion Paper Series, Climate Change and Cities – I, IIED.

Smith-Estelle, A and Gruskin, S (2003) Vulnerability to HIV/STIs among Rural Women from Migrant Communities in Nepal: A Health and Human Rights Framework, *Reproductive Health Matters*, 11(22), pp. 142–151.

Smith, MK (2002) Gender, poverty, and intergenerational vulnerability to HIV/AIDS, *Gender & Development*, 10(3), p.63–70.

Surabhi, KS and Kumar, NA (2007) *Labour migration to Kerala: A study of Tamil migrant labourers in Kochi*, Working Paper No. 16, Centre for Socio-Economic and Environmental Studies.

Tanser, F, Sharp, B, le Sueur, D (2003) Potential effect of climate change on malaria transmission in Africa. *Lancet*, 362(9398), p. 1792–1798.

The Hindu (2014) `Dingy shacks, unhygienic environs at Pippinmoodu near Thiruvananthapuram', 23rd July 2014, The Hindu, Accessed at www.thehindu.com/news/cities/Thiruvananthapuram/dingy-shacks-unhygienic-environs-at-pippinmoodu-near-thiruvananthapuram/article6240798.ece

Times of India (2014) `Migrant workers forced to flee over malaria scare', 12th December 2014, Times of India, Accessed at http://timesofindia.indiatimes.com/city/kochi/Migrant-workers-forced-to-flee-over-malaria-scare/articleshow/45486036.cms

Toole, MJ (2005) Forced migrants: refugees and internally displaced persons. In: *Social Injustice and Public Health* (Levy B, *ed*.). Oxford, UK: Oxford University Press, 190–204.

Annex 1: Semi-Structured Interview Schedule

ID No. Date.

1. City: (1) Surat / (2) Mumbai / (3) Kochi

2. Demographic Profile

2.1 Name:

2.2 Age:

2.3 Gender: Male/Female/Transgender

2.4 Language:

2.5 Marital Status: Married/Unmarried/Widowed/Divorced/Separated

2.6 Family Size:

2.7 No. of Men in the Family:

2.8 No. of Women in the Family:

2.9 No. of Children in the Family: (a) Less than 5 Years (b) 5–14 years

2.10 Present Occupation:

2.11 Occupation at Native Place:

2.12 Educational Qualification of the respondent:

2.13 Religion:

2.14 Caste: (a) SC (b) ST (c) OBC (d) Others

3. Migration Profile

3.1 Year of Migration:

3.2 State of Origin:

3.3 Village/City of Origin:

3.4 Present Place of Stay:

3.5 Nature of Migration: (a) Short-term / Long-term (b) Seasonal / Annual

3.6 Reason for Migration:

3.7 Among the other family members who else have migrated with you?

a) Spouse b) Children c) Siblings d) Parents e) None

4. Livelihood Strategies, Assets and Vulnerability Analysis

Livelihood Activity

4.1 What activities do you undertake for a living during a 'Normal' year?

Livelihood Activity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
i) Construction Work (Buildings & Roads)												
ii) Diamond Industry												
iii) Textile Industry												
iv) Casual Wage Labour												
v) Street Vending												
vi) Driving												
vii) Fish-harvesting / Processing												
viii) Leather Work												
ix) Carpentry												
x) Domestic Work												
xi) Catering Work												
xii) Hotels / Restaurants												
xiii) Beauty Parlours / Saloons												
xiv) Sewage & Sanitation												
xv) Other Vocational Skills												
xvi) Crop-cultivation												
xvii) Pre-season loans												
xviii) Harvest of the main crop												
xix) Harvest of the subsidiary crop												
xx) Fodder Collection												
xxi) Livestock Sales												
xxii) Dairy Production												
xxiii) Poultry												

Livelihood Activity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
xxiv) Storage & Sales of Food Stocks												
xxv) Migration to other towns and city												
xxvi) Migration to other industrial zones												
xxvii) Migration to other sectoral work												
xxviii) Unemployed												
xxix) Any Others												

4.2 What activities do you undertake for a living during times of uncertainties in the city (that is characterised by heavy rains/drought/flood/extreme heat events/epidemic outbreaks/economic slowdown etc.)?

Livelihood Activity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
i) Construction Work (Buildings & Roads)												
ii) Diamond Industry												
iii) Textile Industry												
iv) Casual Wage Labour												
v) Street Vending												
vi) Driving												
vii) Fish-harvesting/ Processing												
viii) Leather Work												
ix) Carpentry												
x) Domestic Work												
xi) Catering Work												
xii) Hotels/ Restaurants												
xiii) Beauty Parlours/ Saloons												
xiv) Sewage and Sanitation												
xv) Other Vocational Skills												
xvi) Crop cultivation												
xvii) Pre-season loans												
xviii) Harvest of the main crop												
xix) Harvest of the subsidiary crop												

Livelihood Activity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
xx) Fodder Collection												
xxi) Livestock Sales												
xxii) Dairy Production												
xxiii) Poultry												
xxiv) Storage & Sales of Food Stocks												
xxv) Migration to other towns and city												
xxvi) Migration to other industrial zones												
xxvii) Migration to other sectoral work												
xxviii) Unemployed												
xxix) Remain at the same place												
xxx) Any Others												

Asset Profile

Human Assets

4.4 What is the nature of your employment?

a) Permanent b) Contractual c) Daily Wage d) Casual Labour e) Others

4.5 Did you have a previous job in the city?

a) Yes b) No.

4.5(a) If Yes, please specify its nature.

4.6 If you had a previous job, why did you shift from that job?

a) End of Contract b) Low Wages c) Conflict with Employer d) Unable to Cope

e) Irregular payment of wages f) Lack of Skills g) Others

4.7 What skills are essential to carry out your present job?

4.8 How did you acquire those skills and knowledge required for your job?

4.9 How many years did it take for you to acquire the essential skills in your field of work?

4.10 Have you joined or attended any vocational training programme to enhance your skills?

4.11 If your work is contractual, what will you do when your contract gets over?

4.12 If your work is contractual, how long does the period of contract exist?

4.13 In case of end of contract, how long does it take for you to find a new job?

4.14 If you are a casual labourer, what will you do when you are not able to get work?

4.15 Do you have any disability that prevents you from doing certain skilled work?

4.16 Is your work in the city dependent on the weather and seasonality?

4.17 Has there been any time when you were not able to do your work due to bad weather? Kindly illustrate.

Natural Assets

4.19 Do you own any land in your place of origin? Yes / No

4.19(a) If yes, is this land cultivable? Yes / No.

4.19(b) If yes, how many acres of land do you have?

4.20 Is land an important asset for your present form of livelihood? Yes / No.

4.21 Do you own any land in the city? Yes / No.

4.21(a) If yes, how many sq. feet do you own?

4.22 Do you have access to water sources at your place of origin? Yes / No.

4.22(a) If yes, what are the sources?

a) Hand Pump b) Tap water at home c) Tap water at the street d) River/lake/canal

e) Pond f) Wells g) Water tankers h) Others.

4.23 Do you have access to clean drinking water at the place of your present stay? Yes / No

4.23(a) If yes, what are the sources of clean drinking water?

a) Hand Pump b) Tap water at home c) Tap water at the street d) River/lake/canal

e) Pond f) Wells g) Water tankers h) Others.

4.24 Do you have access to clean drinking water at your work site? Yes / No

4.24(a) If yes, what are the sources of clean drinking water?

a) Hand Pump b) Tap water at home c) Tap water at the street d) River/lake/canal

e) Pond f) Wells g) Water tankers h) Others.

4.25 Does your access to safe water get affected during summer or monsoon months? Yes / No.

4.25(a) If yes, please illustrate how?

4.26 Do you own any livestock at the place of origin? Yes / No

4.27 Do you own any livestock at your current place of residence? Yes / No.

4.27(a) If yes, what are the different types of livestock you own and how many?

(a)…… (Nos……), (b…… (Nos……), (c)…… (Nos……).

4.27(b) Do you have a separate cattle shed from your home? Yes/ No

4.28 If you have livestock, are you able to access veterinary support services to treat livestock diseases? Yes / No.

4.29 Are you able to access good quality fodder/feed for your livestock? Yes / No.

4.30 What are the problems that you face in providing adequate care for your livestock during extreme weather events or seasonal changes?

Weather / Season	If yes, please √	Kind of problems for livestock care
a) Monsoons / Heavy Rains, Floods, Wind		
b) Summer / Heat Waves		
c) Winter / Extreme Cold events		
d) Others		

Physical Assets

4.32 Type of house at the place of origin

(a) Own (b) Rental (c) Lease (d) Homeless (e) Others.....

4.33 What type of housing structure do you have in the place of origin?

(a) Terraced Concrete (b) Thatched tiles (c) Thatched leaves (d) Others

4.34 What type of housing arrangement do you have in the city?

(a) Own house (b) Rented house (c) Shared accommodation (d) Shift houses (e) No place to stay

4.35 What type of housing structure do you have in the city?

(a) Terraced Concrete (b) Thatched tiles (c) Thatched tin/plastic sheets (d) Others

4.36 What kind of problems do you face in finding a place to stay in the city?

4.37 Distance between work site and current place of residence: ……Kms

4.38 Is your current address a permanent residence? Yes/No.

3.10(a) If No, why?

4.39 Do you face the threat of evacuation at any point of time from your place of stay? Yes / No.

4.40 In a year, how often you would have to shift your place of stay?

4.41 Where is the location of your house? Inner city / Inner suburb / Outer suburb

4.42 Did any of the following factors influence your decision to stay in the present house?

Housing Choices	**If yes, please √**
a) Convenient for work	
b) Cheap / Affordability	
c) Close to relatives and friends	
d) Safety	
e) Convenient for family	
f) Convenient for school	
g) Convenient for health care	
h) Commutability	
i) Presence of respondent's native community in the neighbourhood	
j) Same Religion / Caste	
k) Same language	
l) Allocated by employer / contractor	
i) Others	

4.43 How many people stay at the same time in your house?

4.44 Do you think that your house is overcrowded?

4.45 What problems do you face in your housing needs with change in weather or seasonal uncertainties?

Housing Problems due to Weather Changes	If yes, please √
a) Flooding during monsoons	
b) Dampness	
c) Leakage of roofs	
d) Sewage blocks and spills	
e) Extremely hot during summer	
f) Fire	
g) Very unstable structure to withstand heavy rains, wind or flooding	
h) Infected with rodents	
i) Infected with reptiles	
j) Infected with mosquitoes	
k) Others	

4.46 What kind of sanitation facilities do you have access to?

Latrine and Sanitation Facilities	If yes, please √
a) Public latrine	
b) Private Latrine	
k) Open	
l) Others	

4.47 Do you face any kind of problems in accessing sanitation facilities with extreme weather events or change of seasons?

Weather / Season	If yes, please √	Kind of accessibility problems
a) Monsoons / Heavy Rains		
b) Summer / Heat Waves		
c) Winter / Extreme Cold events		
d) Others		

4.48 What are the major sources of energy that you depend upon?

a) Solar …… b) Coal …… c) Fuel-wood ……

d) Petrol …… e) Diesel …… f) Kerosene ……

g) LPG …… h) Others ……

4.49 Do you have access to legally regulated electricity? Yes / No

4.50 Do you have any problem in accessing energy supply during extreme weather events or with change of seasons?

Weather / Season	If yes, please √	Kind of accessibility problems
a) Monsoons / Heavy Rains, Floods, Wind		
b) Summer / Heat Waves		
c) Winter / Extreme Cold events		
d) Others		

4.51 What channels of communication do you depend upon for interacting with your family members and friends?

a) Telephone (land-line) b) Mobile-phones c) letters d) e-mails e) Others

4.52 In what ways does your communication get affected during extreme weather events or with change of seasons?

Weather / Season	If yes, please √	Kind of communication problems
a) Monsoons / Heavy Rains, Floods, Wind		
b) Summer / Heat Waves		
c) Winter / Extreme Cold events		
d) Others		

4.53 What mode of transportation do you normally avail to reach your work-site and back?

a) Walk b) non-motorised vehicles c) Public transport (bus or train) d) Private bus

e) Auto-rickshaw f) Shared services g) Jugaad vehicles h) Others.

4.54 Do you have any problem in accessing normal transportation services during extreme weather events or with change of seasons?

Weather / Season	If yes, please √	Kind of accessibility problems
a) Monsoons / Heavy Rains, Floods, Wind		
b) Summer / Heat Waves		
c) Winter / Extreme Cold events		
d) Others		

4.55 Do you own your work-production equipments? Yes / No.

4.56 If you do not own them, how do you manage access to the production equipments?

4.57 Do you have school going children staying with you? Yes / No

4.58 If yes, how far is the school from your house? …… Kms.

4.59 What are the problems that school-going children face in going to school during extreme weather events or seasonal changes?

Weather / Season	If yes, please √	Kind of accessibility problems
a) Monsoons / Heavy Rains, Floods, Wind		
b) Summer / Heat Waves		
c) Winter / Extreme Cold events		
d) Others		

4.61 What do you think is the level of the city's efficiency of physical assets to deal with hazard events such as floods, with specific reference to your place of residence and work-site? Please √in any one of the columns for each of the items mentioned in each row.

Physical Asset Characteristics	Very High (5)	High (4)	Moderate (3)	Low (2)	Very Low (1)
a) Are there efficient storm water drains in the city?					
b) What is the frequency of flooding events in the city?					
c) What are the chances of your residence getting flooded?					
d) What are the chances of your work-site getting flooded?					
e) What is the proximity of the city to storm surges, tidal waves or swell waves?					
f) What is the efficiency of sewers, culverts and bridges such that it allows smooth passage of water?					
g) What are the chances of rapid flooding during rains due to soil type?					
h) What are your chances of getting uninterrupted electric supply during storms and floods?					
i) What are the possibilities of people in your locality getting electrocuted during rains and floods?					
j) What is the quality of drinking water that you get during times of storms, floods and drought?					
k) Are there chances of domestic sewage getting mixed with drinking water sources during hazard situations?					
l) Is your locality close to solid waste dumping yards in the city?					
m) What are the possibilities of accessing evacuation routes in your locality during hazard situations?					
o) What is the likeliness of buildings in your locality collapsing during heavy rains, wind and floods?					
p) What is the quality of temporary shelters in your locality?					
q) What is the quality of sanitation facilities in the temporary shelters?					

Social Assets

4.62 Do you have membership to any organisations/ Mandals / socio-cultural groups / trade unions/ CBOs etc.? Yes/No.

4.62(a) If yes, which are these organisations?

4.63 What is the nature of your participation in these organisations?

4.64 How do you become a member in these organisations?

4.65 What are advantages of joining these groups?

4.66 Who helps when you are in a crisis such as health issues or sudden onset events?

4.67 How do the members of these organisations / neighbourhood help each other during such crisis?

4.68 When do members of your network come together?

4.69 What is the role of local NGOs in your locality during times of crisis?

Financial Assets

4.71 What was your average daily income in your place of origin?.....Rs.

4.72 What is your average daily income in this city?.....Rs.

4.73 What is your monthly household income? .....Rs.

4.74 Who are the major income earners in your family?

(a) Self b) Spouse c) Siblings d) Parents e) Children f) Others

4.75 Are you able to access better paid opportunities in the city? Yes / No

4.75(a) If No, why?

4.76 Have you taken any kind of insurances? Yes / No.

4.76(a) If No, why?

4.76(b) If Yes, what kind of insurances have you taken?

4.77 Do you have access to emergency credit? Yes / No

4.77(a) If Yes, what are the sources of credit?

4.78 Are you assured of regular wages without fail? Yes / No.

4.78(a) If No, please explain.

4.79 Are there any deductions of your wage at source? Yes / No.

4.79(a) If yes, why does that happen?

4.80 Do you have bank account? Yes / No.

4.81 Have you saved enough money to cover essential living cost(such as accommodation/food/transportation) in the city? Yes / No.

4.82 Do you have any debt? Yes / No.

4.83 Were you able to repay your debt? Yes / No.

4.84 Do you have the practice of pawning gold/jewellery to deal with crisis situations? Yes / No.

4.85 During which season are you required to borrow money from other sources?

Weather / Season	**If yes, please √**	**Reasons for Borrowing**
a) Monsoons / Heavy Rains, Floods, Wind		
b) Summer / Heat Waves		
c) Winter / Extreme Cold events		
d) Others		

4.86 How much money do you sent to your native home per month?.....Rs.

4.86(a) How do you transfer the money?

4.87 Do you get any kind of pensions?

Political Assets

4.89 Which all government departments / actors do you regularly interact with?

4.90 Which all government departments / actors do you interact mostly during times of crisis?

4.91 Are you able to access the benefit of the various schemes that the government has announced for the welfare of migrant workers? Yes / No

4.92 Are there any support programmes to enhance labour opportunities for distressed migrants? Yes / No

4.93 Are you discriminated or exploited by the following actors?

Discriminating / Exploitive Actors	**If yes, please √**
a) Mafia (local goons)	
b) Land brokers	
c) Slum Lords	
d) Police	
e) Municipal Corporation	
f) Customers	
g) NGO/Civil Society Organisations	
h) Media	
i) Bureaucracy	
j) Middle-men	
k) Money lenders	
l) Contractors	
m) Political Party	
n) Corporations	
o) Employers	
p) Family members	
q) Others	

4.94 What all documents do you use to prove your identity and claim your entitlements?

Documents	**If yes, please √**
a) Ration Card	
b) Voters' ID	
c) Aadhar Card	
d) Driving License	
e) Passport	
f) PAN Card	
g) Bank documents	
h) Employee ID	
i) Others	

4.95 Do you associate with any NGOs or trade unions to claim your entitlements? Yes / No

5. Risk, Vulnerability and Climate Change

5.1 What are the various climate-related disturbances that you face in the city over the last 10 years?

5.2 Has the disturbances became more frequent, more severe and far more widespread over time and how?

5.3 Are these disturbances a singular event (a Shock) or a series of continuous events (i.e gradual change)?

5.4 Do you remember any disaster like situation that you faced in the last 20 years?

5.5 How do you come to know about the onset of such hazard events?

5.6 How do you perceive these trends and changes?

5.7 Please identify the observed climatic variability that you consider are crucial for your survival and livelihoods. Please √ in any one of the columns for each of the items mentioned in each row.

Observed Climatic Variability	Very High (5)	High (4)	Moderate (3)	Low (2)	Very Low (1)
a) Rise in Temperature					
b) Rise in Intensity of Rains					
c) Occurrences of Drought					
d) Rise in Coastal Flooding					
e) Rise in Water logging incidences					
f) Frequent and unpredictable weather variations					
g) Rise in incidences of heat waves and sun strokes					
h) Rise in cyclonic storms and events					
i) Extension of summer months					
j) Extension of winter months					
k) Erratic monsoons					
l) Rise in severe cold waves					
m) Reported events of hailstorms					
n) Rise in decay of food stocks					
o) Rise in infectious diseases					
p) Rise in pest infections					
q) Others					

5.8 Please identify the observed climatic variability across the different months in a year. Please √in the relevant columns for each of the items mentioned in each row.

Observed Climatic Variability	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
a) Rise in Temperature												
b) Rise in Intensity of Rains												
c) Occurrences of Drought												
d) Rise in Coastal Flooding												
e) Rise in Water logging incidences												
f) Frequent and unpredictable weather variations												
g) Rise in incidences of heat waves and sun strokes												
h) Rise in cyclonic storms and events												
i) Extension of summer months												
j) Extension of winter months												
k) Erratic monsoons												
l) Rise in severe cold waves												
m) Reported events of hailstorms												
n) Rise in decay of food stocks												
o) Rise in infectious diseases												
p) Rise in pest infections												
q) Others												

5.9 What factors make you vulnerable to climatic variations/hazards and to infectious diseases?

Factors inducing vulnerability	Climate variability and hazards	Infectious diseases
Low Income		
Presence of children and elderly in the family		
Gender		
Any kind of disability		
Malnutrition		
Lack of safe and secure housing		
Lack of food		
Lack of safe drinking water		
Insecure job		
Chronic Illness / health problems		
Caste		
Ethnicity		
Illiteracy / Poor Educational Status		
Language		
Status of being a migrant		
Presence of pregnant women and lactating mothers in the family		
Being single/widowed/divorced		
Lack of access to any social protection schemes		
Dependent families back at home		
Debt		
Lack of adequate educational facilities for children		
Lack of savings		
A very poor neighborhood		
Weak social ties		
Location at risk		
Lack of access to fair market practices		
Lack of access to health care facilities		
Lack of access to emergency communication facilities		
Lack of access to cooperative government machinery		
Lack of access to NGOs		
Lack of access to early warning systems		
Population growth in cities		
Unsafe buildings		
Religion		
Corruption		
Crime during hazard events		
Riots		
Lack of access to insurance schemes		
Voicelessness / Powerlessness		
Lack of access to Public Distribution System		

6. Health Inequities and Climate Variability

6.1 Who is the main health care decision maker in your family?

6.2 Is your health affected by the nature of your work? Yes / No

6.2(a) If yes, How?

6.3 How often do you fall sick?

6.4 What do you do to recover from health problems that prevent you from going to work?

6.5 Has anyone in the household been ill in the past year with an acute illness (An acute illness is a condition that appears suddenly: the person did not have it immediately before becoming ill)? Yes / No.

6.5(a) If yes, how many persons had an acute illness over the past year?

a) Adults ..... b) Children ..... c) Infants .....

6.5(b) If yes, what is the age of the youngest person who was ill?

6.5(c) If yes, what is the sex of the youngest person who was ill?

6.5(d) If yes, what type of problems did this person have during the illness?

a) Fever b) Head ache c) Body ache d) Fatigue e) Nausea/Vomiting

f) Loose motions g) Rashes h) Swelling i) Redness of eye

j) Bleeding k) Other

6.5(e) How serious do you think the illness was?

6.5(f) How many days did this illness last?

6.6 Has anyone in the household ever been told by a doctor or other health care provider that they have a chronic illness (A chronic illness is an illness that will not go away or takes along time to go away, even when treated.)? Yes / No.

6.6(a) If yes, how many persons in the household have a chronic illness?

a) Adults ..... b) Children ..... c) Infants .....

6.6(b) If yes, what is the age of the oldest person with a chronic illness?

6.6(c) If yes, what is the sex of the oldest person with a chronic illness?

6.6(d) If yes, which illness does he/she have?

6.6(e) If yes, has this person been told by a doctor or other health care provider that he/she should be taking medicines to treat this illness? Yes / No

6.6(f) If yes, the duration of medication that has been suggested…

6.6(g) If yes, expenditure per month for

a) Medicines .....Rs b) Consultation .....Rs c) Transportation .....Rs

d) Other .....Rs

6.7 Has anyone in the household been ill in the past one year with any food-borne or water-borne disease (Please √if relevant) Yes / No.

6.7(a) If yes, what was the infection?

a) Acute Diarrhea b) Hepatitis A c) Hepatitis E d) Typhoid fever

e) Cholera f) Enteric Fever g) Leptospirosis h) Other

6.7(b) If yes, how many persons had the illness over the past one year?

6.7(c) If yes, what is the age of the youngest person who was ill?

6.7(d) If yes, what is the sex of the youngest person who was ill?

6.7(e) If yes, what type of problems did this person have during the illness?

6.7(f) How serious do you think the illness was?

6.8 Has anyone in the household been ill in the past year with any vector-borne disease (Please √if relevant) Yes / No.

6.8(a) If yes, what was the infection?

a) Malaria b) Dengue c) Chikungunya d) Yellow fever

e) Japanese Encephalitis f) Filariasis g) Other

6.8(b) If yes, how many persons had the illness over the past one year?

6.8(c) If yes, what is the age of the youngest person who was ill?

6.8(d) If yes, what is the sex of the youngest person who was ill?

6.8(e) If yes, what type of problems did this person have during the illness?

6.8(f) How serious do you think the illness was?

6.9 Do you have access to doctors during times of illness? Yes / No

6.10 Do you have access to other health care professionals during epidemic outbreaks like malaria, dengue etc.? Yes / No

6.11 Do all the members of your family have access to healthcare facilities? Yes/No.

6.11(a) If No, why?

6.12 From which of the following sources of care do you receive care at any time during illness?

a) Public Hospitals b) Private Hospitals c) Private Clinics d) Pharmacy

e) Home-remedy f) Quacks g) Self h) Other

6.13 How much time does it take to reach the above-mentioned health care facilities or providers?

a) Less than an hour b) 1–2 hours c) More than 3 hours

6.14 How many visits did you have to make to the respective health care centre before completely getting cured?

6.15 Have you taken any vaccinations to prevent infectious diseases? Yes / No.

6.15(a) If No, why?

a) Not aware b) No money c) Not very important

d) No time e) No facilities f) Not interested

6.16 What are the relevant preventive programmes that you are aware of?

6.17 What is your average monthly expense on health (per family)?

6.18 How do you manage to meet these expenses?

6.19 Do you depend on any one of the following actors to meet the expenses?

a) Government b) Insurance Companies c) Contractors d) Money lenders

e) Self f) Relatives g) Friends h) Employers i) Other

6.20 What other challenges do you face in seeking health care during epidemic outbreaks?

a) Lack of people as carers b) Lack of money for consultation

c) Long waiting time at hospitals d) Lack of professionals to provide care

e) Repeated visits f) Expensive diagnostic tests

g) Unable to take leave from work h) Expensive treatment (including medicines)

i) Other

6.21 Do you notice any relationship between the occurrence of infectious diseases and seasonality? (Please √ if relevant)

Infectious Diseases / Season	Summer	Monsoons	Winter
Symptoms of Food-borne diseases			
Symptoms of Water-borne diseases			
Symptoms of Vector-borne diseases			
Others			
There is no specific seasonal observation related to the occurrence of illnesses ……..			

Climate change, livelihoods and health inequities: the vulnerability of migrant workers in Indian cities

Asian Cities Climate Resilience Working Paper Series

This working paper series aims to present research outputs around the common theme of urban climate resilience in Asia. It serves as a forum for dialogue and to encourage strong intellectual debate over concepts relating to urban resilience, results from the ground, and future directions. The series is also intended to encourage the development of local research capacity and to ensure local ownership of outputs.

The series has arisen out of the Asian Cities Climate Change Resilience Network (ACCCRN, www.acccrn.org), an initiative funded by the Rockefeller Foundation.

The series is intended to present research in a preliminary form for feedback and discussion. Readers are encouraged to provide comments to the authors whose contact details are included in each publication.

Published by IIED April, 2015

IIED order no: 10728
http://pubs.iied.org/10728IIED.html
ISBN 978-1-78431-176-6

80-86 Gray's Inn Road, London WC1X 8NH, UK
Tel: +44 (0)20 3463 7399
Fax: +44 (0)20 3514 9055
email: humans@iied.org
www.iied.org