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Urbanization impacts on health of metro cities in India

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Abstract
India is consistently urbanizing along with the other developing countries. The metropolitan cities in India are witnessing sustained population growth together with urbanization and industrialization. Large cities, in particular, are horizontal to suffer from health, environmental and poor living conditions of slums. The direct effect of poor living conditions is poor health. This paper provides a critical outlook on the factors affecting the health and other living conditions of slum population in metro cities by considering the data of NFHS-3 and Census of India, furthermore the study analyze the factors through logistic regression analysis and computing composite index score and ranks for Health, Slum Living Performance indicators in the metropolitan cities of India.

Keywords: Urbanization, urban health, slum, logistic regression

Introduction
India is urbanizing. Level of urbanization here has increased from 27.8 per cent in 2001 to 31.1 percent in 2011 (Census of India 2001; 2011) [10, 11]. As per the United Nations projections, if urbanization continues at the present rate, then India's urban population is likely to set double and will reach 600 million by 2030, a value twice as high as its present urban population.

For any nation, cities play a vital role in the development of its sound economy. India is not an exception. The Indian cities attracted migrants during their growth, as a result the rural-to-urban migration phenomenon significantly increased. Over the last few years, the cities are attempting to integrate themselves with globalization, as they cannot afford to remain unresponsive to the global requirements. The government is however, aware of the grim situation and is trying its level best to promote the sustainability in all the cities but the enormous growth of slum population in urban areas due to migration and other factors, the problems of health and living environment of urban population has become more ironical in Indian metropolitan cities. Rapid urbanization along with slum population growth especially in the developing countries like India are crucial issues and these are characterized by unplanned and uncontrolled growth leading to urban sprawl.

There are different reasons in growth of urban population; the major contributory factor is migration apart from rate of natural increase. The metropolitan cities in India are witnessing sustained population growth together with urbanization and industrialization. Cities have always been the epicenter of economic growth. The economic vibrancy of these large urban centers offers diverse employment opportunities and means of livelihood. Migration, urbanization and mushrooming growth of slum are direct manifestations of the process of economic development, particularly in the contemporary phase of globalization. Migration from rural to urban areas the people are on constant move from backward areas to potential areas for better employment opportunities and better amenities and facilities (Rasool *et al.* 2012; Dyson 2011; Parkins 2010) [6, 1, 4]. The other reasons may be reclassification of villages and towns. The number of towns have increased from 4,378 in 2001 to 7,935 in 2011 while the number of metropolitan cities having million plus population has increased from 35 in 2001 to 53 in 2011 (Census of India, 2011; 2001) [10].

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In spite of its much constructive aspects, migration to urbanization is not without its harms. Large cities, in particular, are horizontal to suffer from health, environmental and poor living conditions of slums. The direct effect of poor living conditions is poor health.

The health conditions have become uncertain in majority of the cities because uncontrolled urbanization in India has lead to various problems like contamination of environmental conditions in urban centers. The heavy influx of migration from rural areas to urban places has contributed to urban growth which in turn has resulted in the development of squatter settlements and slums especially in metros and in large cities. The slum has now become an inescapable, vulnerable and blighted part of the Indian urban landscape. The slum dwellers are at constant risk of health hazards due to inadequate services particularly water supply, sanitation, clogged drainage, health care facilities; unhealthy site location; living and working in unhygienic environmental conditions, and are bearing the brunt of increasing urban environmental problems (Karan 2003; Parkinson 2007) [2, 5].

This paper provides a critical outlook on the factors affecting the health and other living conditions of slum population like immunization, anemia status, ANC visits, drinking water facilities etc., by considering the data of NFHS-3, Census of India, and analyzing through logistic regression analysis and calculating composite index score and ranks for Health, Slum Living Performance indicators in the metropolitan cities of India.

Trends and Levels of Urban and Slum Population
Urbanization has become a major issue in 21st century and growth of million plus cities is the major concern. Population explosion is one of the most threatening issues which contemporary large cities are facing and are resulting in large scale rural-urban migration and rapid urbanization. In this context, census data from 1901 to 2011 and existing literature has been used to concentrate on some aspects of population growth in the metropolitan cities of India.

Kolkata, Mumbai and Chennai were developed to facilitate trade of raw material for the imperial power, whereas Delhi functioned as an administrative city. Kolkata was only million plus city in India in 1901. Mumbai was added to this category in 1911 and the number of such cities remained constant at two till 1941. During this period urban population growth was very slow. In the beginning of the century Kolkata and Mumbai recorded slow growth rate of less than 25 per cent but after 1931 both have recorded high growth rate.
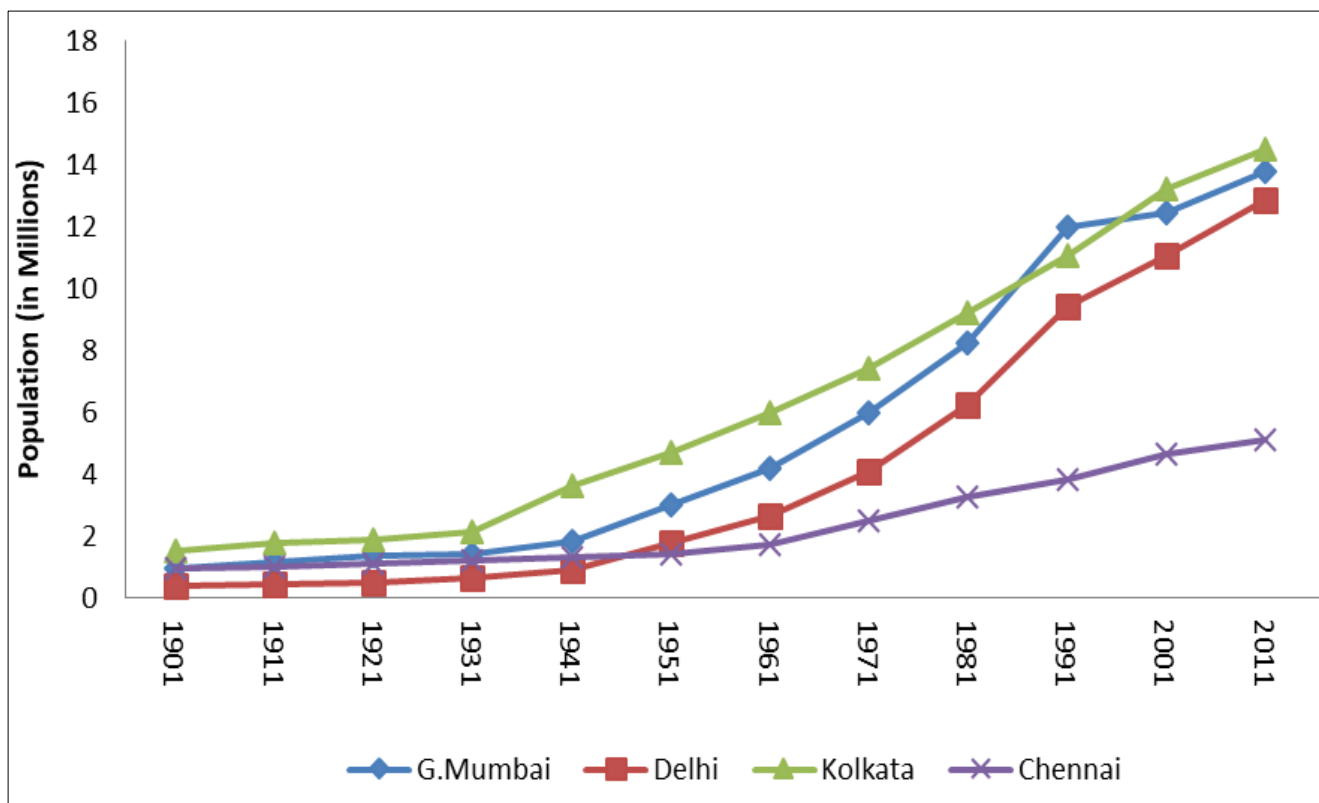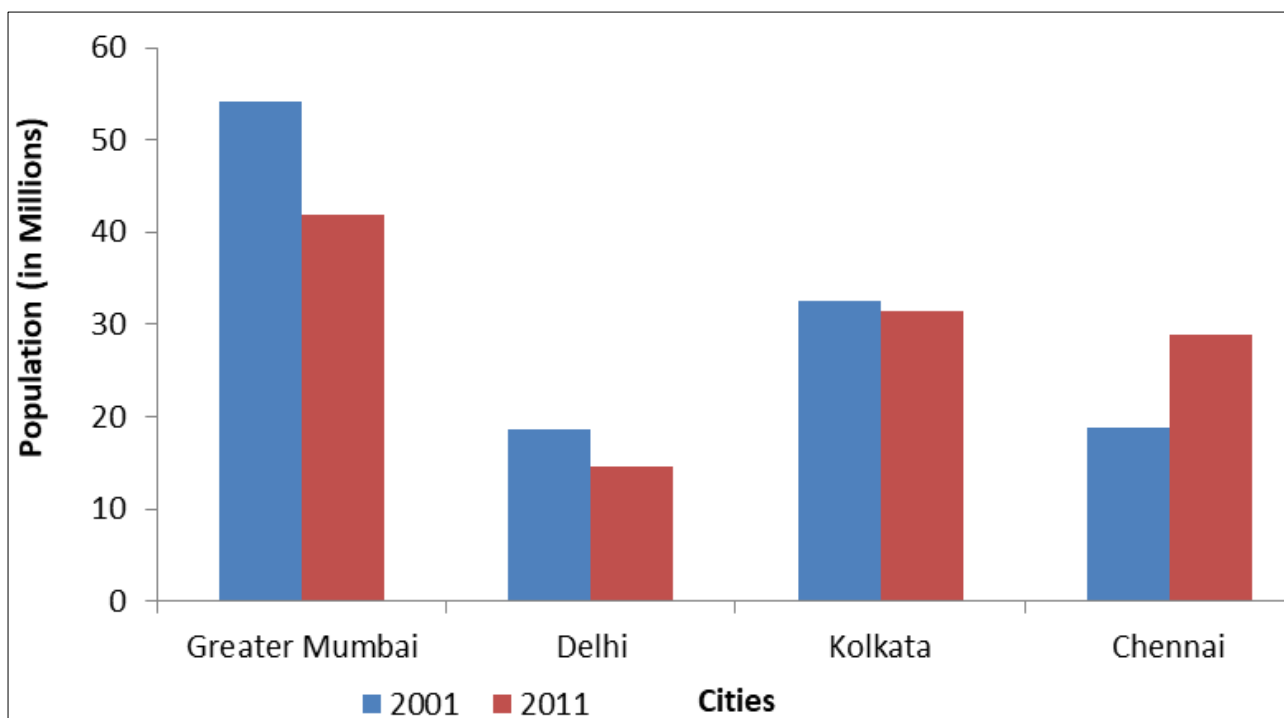

Source: Census of India

Fig 1: Trends in Total population of four metropolitan cities in India, 1901-2011

Kolkata recorded 69.34 and 28.94 per cent in 1931-41 and 1941-1951, whereas Mumbai recorded 32.7 and 84.1 per cent respectively. Greater Mumbai UA (18.4 million), Delhi UA (16.3 million) and Kolkata UA (14.1 million) are the largest urban agglomerations in the country. Kolkata UA which held the second rank in Census 2001 has been replaced by Delhi UA. The growth in population in these Mega Cities has slowed down considerably during the last decade. Slum Population simply refers to people living in slum areas below the poverty line. As India is still on the path of development, there are a large number of people living below the poverty line. These people usually live in slum areas connected to the city. According to Government sources, the Slum Population of India has exceeds the population of Britain. It has doubled in last two decades. According to census in 2001, the slum-dwelling population of India had risen from 27.9 million in 1981 to 61.8 million in 2001 but it has reached 250 million in 2011.

Source: Census of India

Fig 2: Slum Population in Metropolitan cities Cities, 2001 & 2011

Mumbai being the financial capital of India, it is also home to approximately 6.5 million slum people. Nearly half of Mumbai's population lives in small shacks surrounded by open sewers. Nearly 55% of Mumbai's population lives in slum areas. After Mumbai, Delhi has the second largest slum population in India. Nearly 1.8 million people live in slum areas in capital of India - New Delhi. These people are mostly unemployed or daily wage workers who cannot even afford basic necessities of life.

Performance of health and household living conditions of slums in metropolitan cities, India

Health plays vital role in standard development of the country's population. Table 1 examines the performance of health situation in metropolitan cities by considering different health conditions for understanding the status. Immunization includes children of age group 12-24 months who have received all the basic vaccination (BCG, Polio, DPT etc).

Table 1: Performance of health indicators in Metropolitan cities, India

Cities	Mumbai	Delhi	Kolkata	Chennai
Child received full immunization (in age 12–23 months children (%)	69.8	63.2	67.6	77.7
IMR (Infant Mortality Rate)	30.3	40.6	41.3	18.3
Prevalence of anemia status in children	49.1	56.2	55	62.8
Percentage of children under 5 year with symptom of ARI (acute respiratory infection)	1.7	5.6	6	4.5
Percentage who had three or more ANC visits for currently married women in age group 15–49.	91.3	75.1	86.3	99.7
Institutional delivery	42.5	30.1	56.1	59.5
Contraception in currently married women 15-49 (%)	51.4	56.5	45.6	67.1
Number of persons per 100,000 population suffering from tuberculosis in aged 60 + population	307	524	341	520
Asthma cases per 100,000 population among age group 15–49	1648	591	3313	1281
Households not using government health facility (%)	76.7	71.4	76.1	66

Source: NFHS, 2005-06.

The highest immunization coverage is achieved in the slum areas of Chennai followed by Mumbai and Kolkata. Infant Mortality rate is the sensitive indicator often used to access the child health status of a population. The estimated level of IMR shows that only Chennai and Mumbai have achieved the goal of IMR 30 per thousand while other two cities still have high IMR. Anemia is major nutritional deficiency among India children in India. Findings in the table 5.1 suggest that 50% of the children in all four metropolitan cities are Anemic with high level in Chennai and low level Mumbai. Acute respiratory infection (ARI) is one of the leading causes of childhood morbidity and mortality throughout the world and children in Indian cities are no exception to that. Kolkata and Delhi are having more than 5% of the children who have been reported with ARI. Antenatal care (ANC) or pregnancy-

related health care is a critical requirement for women's health during pregnancy to reduce infant and maternal mortality. More than 90% women in Chennai and Mumbai received three ANCs however; Delhi and Kolkata are lagging behind. The performances in terms of institutional delivery coverage in public health facilities are poor in Delhi and Mumbai when compared with the other two cities. Contraception is the major determinant of many health indicators associated with reproductive process and unwanted fertility however none of the city has achieved more than 70% use of modern contraception. The prevalence of tuberculosis among the population aged 60 and above is high in the Delhi and Chennai, while the prevalence of asthma is high in Mumbai. 70% of the metropolitan cities are not utilising Government health facility because of poor quality of care.

Table 2: Performance of household living conditions of slum indicators in Metropolitan cities, India

Cities	Three or more number of usual members per sleeping room	Households with improved source of drinking water facility (in %)	Pacca houses (In %)	Improved, not shared toilet facility (In %)	Electricity facility (In %)	Cooking gas connections (In %)
Mumbai	55.6	100	90.1	55.1	99.3	67.8
Delhi	55.9	94.1	86.3	23.9	98.2	46.5
Kolkata	49.2	96.5	90.9	24	90.6	35
Chennai	48.2	84.1	83.2	19	94.4	44.9

Living conditions in the absence of basic civic amenities such as safe and adequate water supply, sewerage and sanitation amenities have been precarious and miserable for the health (Marina, 1999) [3]. Analyses of data with reference to housing, sanitation, electricity, cooking fuel and number of persons sleeping per room are included to assess present living conditions of slums in the metropolitan cities. Mumbai slums living conditions show better performance in terms of all the factors considered for the index whereas remaining cities have to come up with the provision of basic amenities (See Table 2).

Binary Logistic Regression Analysis: Binary logistic regression is the method of choice if your dependent variable is binary (dichotomous) and you wish to explore the relative influence of continuous and/or categorical independent variables on your dependent variable, and to assess interaction effects between the independent variables. To understand the influence of various sustainable, health and basic facilities factors on migrants in cities. The binary logistic regression has been carried out to comprehend these aspects. The response for the dependent variable (y) is binary i.e., migrants and non-migrants. The model can be written as fallows.

$$\log\left(\frac{p(y)}{1-p(y)}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots\dots + \beta_k X_k \tag{1}$$

Where, p(y) is the probability of being migrated and {1-p(y)} is the probability of not being migrated.

Here X1, X1, X1 ……. , Xk denotes the independent variables. β_0 is the intercept and β_1, β_2, ………., β_k are the regression coefficients.

The results of logistic regression estimates for the effect on migrants with sustainable living have been shown in the Table 3. Educational level plays a significant role in migration to cities. The significant results revels that educational level is the primary motive for risk of migration. The regression co-efficients for primary, secondary and higher educational levels are 0.97, 0.80 and 0.516 respectively. The corresponding odds ratios are 2.64, 2.24 and 1.67, which implies that the migrants having primary, secondary and higher educational levels are more likely to migrate to cities than not having education.

Table 3: Logistic regression estimates for the effect on migration with sustainable factors

Characteristics	β	P-Value	Odds Ratio
Educational level			
No Education®	-	-	1.00
Primary	0.971	0.000*	2.64
Secondary	0.807	0.000*	2.24
Higher	0.516	0.000*	1.67
Occupation			
Daily Wage Work®	-	-	1.00
Higher Professionals	-0.131	0.001*	0.87
Clerical	0.015	0.841	1.01
Sales	0.253	0.025	1.28
Self Employed	-0.02	0.790	0.98
Services	1.601	0.000*	4.95
Not working	-0.219	0.000*	0.80
Wealth Index			
Poorest®	-	-	1.00
Poorer	1.097	0.000*	2.99
Middle	0.699	0.000*	2.01
Richer	0.546	0.000*	1.72
Richest	0.428	0.000*	1.53
Standard of Living			
Low®	-	-	1.00
Middle	0.211	0.000*	1.23
Highest	-0.131	0.000*	0.87
Constant	0.035	0.490	1.03

The regression co-efficients of the migrants with higher professional, self-employed and not working are having negative values -0.131,-0.02 and -0.219 with odds ratios 0.87, 0.98 and 0.80 respectively. These results imply that the high professional and self-employed migrants are less likely to

migrate and same thing happens in case of not working migrants who are mostly house dependents.
The regression co-efficients of migrants engaged in clerical, sales and services are positive with 0.015, 0.025 and 1.060 respectively. The migrants engaged in clerical, sales are 1.01

and 1.28 times more likely to migrate to cities for better opportunities. The migrants who involved in services are 4.95 times more likely to migrate to cities than daily wage workers.

Wealth acts as vital effect in case of migration to cities. The regression co-efficients of the migrants with NFHS classification for wealth index as poorer, middle, richer, richest is 1.09, 0.69, 0.54 and 0.42 respectively. They are

positive and significant with adequate odds ratios. This implies that migrants are more likely to migrate with 2.99, 2.01, 1.72, and 1.53 times respectively than the poorest. Standard of living is a major determinant factor for opting migration to cities. The migrants of middle standard of living are 1.23 times more likely to migrate and who is having higher standard of living less likely to migrate with odds ratio 0.87.

Table 4: Logistic regression estimates for the effect on migration with basic facilities factors

Characteristics	β	P-Value	Odds Ratio
Source of Drinking Water			
Unsafe Water®	-	-	1.00
Pipe Water	.191	0.002*	1.21
Outside Safe Water	-.315	0.000*	.730
Type of Toilet Facility			
Safe ®	-	-	1.00
Unsafe	-.362	0.000*	.696
Type of Cooking Fuel			
Safe ®	-	-	1.00
Unsafe	-.404	0.000*	.667
Type of House			
Kachha®	-	-	1.00
Semi-Pucca	.478	0.000*	1.61
Pucca	.296	0.000	1.34
Constant	1.504	0.000*	4.50

The results of logistic regression estimates for the effect on migrants with basic facilities factors have been shown in the Table 4. The basic facilities are the fundamental issue for survival in cities. Source of drinking water is the main factor among the basic facility factor for living. The regression co-efficients of the pipe water and outside safe water are 0.919 & -0.315 which are significant. The subsequent odds ratios are 1.21 and 0.730 which reflects that the effect on migration is more likely to pipe water and less likely to outside safe water than unsafe water. Sanitation facility is an essential element for sustainability. The regression co-efficients of the unsafe

toilet facility is -0.362 which is significant and corresponding odds ratio is 0.696 which shows less likely to safe sanitation.

Apart from sanitation cooking fuel and type of the house is also a prominent factor for living. The beta co-efficients for unsafe cooking fuel, semi-pucca and pucca houses are -0.404, 0.478 and 0.296 and are statistically significant. The subsequent odds ratio for unsafe cooking fuel is less likely to opt than the safe one. In case of type of houses the both, semi-pucca and pucca houses odds ratios is more likely to decide on for migration than kachha houses.

Table 5: Logistic regression estimates for the effect on migration with health factors

Characteristics	β	P-Value	Odds Ratio
Anemia level			
Severe®	-	-	1.00
Moderate	-.032	.779	.969
Mild	-.151	.000*	.860
Not Anemic	-.107	.000*	.899
Antenatal visits for Pregnancy			
No visits	-	-	1.00
Visited more than 3 Visits	.172	.000*	1.188
Immunization			
Not Received Immunization®	-	-	1.00
Received Immunization	.559	.000*	1.749
Government Health Facility Used			
Not Taken Governments Facilities®	-	-	1.00
Taken Governments Facilities	-.070	.211*	.932
Suffers from TB			
Not Stated TB®	-	-	1.00
Stated TB	-1.192	.000*	.304
Constant	1.743	.000*	5.717

The results of logistic regression estimates for the effect on migrants with Health Factors have been shown in the Table 5 Urban health is very important factor for migration to cities. The regression co-efficients of the migrants with anaemia level moderate, mild, not anaemic are -0.032, -0.151 and -0.107 correspondingly which are negative. This implies that anaemia level with moderate, mild and not anaemic is less

likely to migrate to cities with 0.96, 0.86 and 0.89 respectively. The regression co-efficients of the migrants who visited more than three antenatal visits for pregnancy is 0.172, which is positive and significant. This explains that the risk of migration is 1.18 times more likely than the non-visits.

The regression coefficients of the migrants who have received immunization are 0.559 which is positive and significant. This

gives that the risk of migration is 1.74 times more likely than not received immunization. The beta value of the migrants who have taken government facilities and suffered from TB is -0.070 and -1.192 which are negative and insignificant. The corresponding odds ratios are 0.932 and 0.304 which indicates that the event is less likely to occur.

Composite index for assessing performance of metropolitan cities by ranks
The formulae defining the composite indices promulgated by the United Nations Development Program (UNDP) are based on the methodology used prior to the UNDP Report, 2009. The methodology of computation includes two steps.
In the first step, computation of the dimension index (Di) for each of the indicators considered for specific composite index. To transform a variable, say x, into a unit-free index between 0 and 1 (which allows different indices to be added together), the following formula is used.

$$Di = \frac{[x - \min(x)]}{\max(x) - \min(x)}$$

Where x is the actual value of the indicator, min(x) is the minimum percentage value of the indicator in distribution and max(x) is maximum value which is also termed as goal post in the index.
In the second step, computation of the composite index (CI), equal weight is given to all the indicators considered for all three composite indices. A composite index is estimated by using the following formula.

$$CI = \frac{1}{N}\left(D_{i1} + D_{i2} + D_{i3} + \ldots\right)$$

Where Di is the dimension index and N is the number dimension indices considered for the composite index.
The study attempts to rank the selected cities based on the composite index score with reference to two indicators. To assess the overall performance of the metropolitan cities in terms of public health and slum living condition composite performance index have been computed.

Table 6: Composite index score and ranks for health, slum living performance indicators

Cities	Public health Performance Index		Slum living Condition Index	
	Value	Rank	Value	Rank
Mumbai	0.3715	4	0.9762	1
Delhi	0.4406	3	0.5652	2
Kolkata	0.6174	2	0.3414	3
Chennai	0.6886	1	0.1231	4

The results from table 6 exhibit that in terms of public health performance Chennai stands first followed by Kolkata, Delhi and Mumbai stand in last rank for providing public health facilities in the city. The slum living condition index indicates that Mumbai has better slum environment compared to Delhi and Kolkata. Chennai shows poor living conditions in slums and its fails to make available basic facilities like drinking water and proper sanitation.

Conclusions
In India, Migrant population constitutes a large proportion of population in urban areas. They also suffer from large number of health problems. Further, they are not able to utilize the existing health services. This study focuses on the health implications of poor unskilled/semi-skilled migrants of Indian metropolitan cities in the context of public health as well as in relation to the health of the individual and the existing barriers of access to health services at the destination cities. Though health facilities in the private sector have a wide presence in urban areas, they are often not accessible to the poor because of the high cost. The poor are therefore forced to fall back on the unqualified private providers who provide poor quality services. Moreover, these informal providers do not provide preventive health services such as immunization, antenatal care, health education and family planning services as these services do not have any demand and therefore not profitable. Slums are characterized by overcrowding, poor sanitation, access to safe water and garbage disposal facilities. About half of urban poor households do not receive piped water supply and about two-thirds do not have a toilet. Above all, poverty is an overarching factor which intervenes through poor nutrition, compromised ability to seek health care and poor living conditions resulting in poor health outcomes among slum communities. The factors that increase the health risks and health outcomes either directly or indirectly are not exclusive. The above factors of poor access to services, poor health behaviors and nutritional status among the urban poor result in high infant and child mortality which are considerably higher among the urban poor as compared to national and state averages.

Key Policy Recommendations
- As rural-urban migration acts as a fundamental role in growth of urbanization, efforts should be undertaken to encourage rural progress and reduce rural poverty to minimize migration.
- The decentralization of economic and administrative activities should be given serious consideration to reduce pressure on cities.
- The industrial and economic zones could be setup outside the cities and the devolution of authority to the local level should be ensured with the increasing emphasis on employment creation as a planning goal, small towns may act as generators off-farm job opportunities.
- Apart from home-based cottages industries, many rural industries requiring a sizeable labor force are located near large or medium-sized cities. Given the resource constraints, public and private services such as health, education and marketing can also be provided at minimum cost only by delivering them in medium-sized cities.
- The national urban health mission has to work in the direction of strengthening the health and demographic conditions like TFR, IMR, disease prevalence, antenatal care, institutional delivery and immunization etc., of slum population in all the metropolitan cities.
- The Government should provides basic facilities like drinking water, electricity, pacca houses, sanitation and cooking gas etc., to all households of the slums for better living conditions in metropolitan cities.
- Reducing the gap between sewage generation and treatment capacity it's required to have an action plan for re-utilization of treated sewage water.
- Utilization of public transport has to be highlighted to reduce the vehicular population in the city.
- Monitoring the nutrition levels across the country must be enhanced in core cities because of developing slums and growing migrants to prevent malnutrition.

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