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Geographical Transmission of Common Cold and Diarrhea in Jalgaon City: An Analysis with the Help of GIS

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Abstract

Today, nearly half the world population is urban. In India the rate of urbanization is also high in the last decade. It is major challenge for urban health. Indian cities are divided into two parts: one half lives in relatively clean and healthy environs, while the other lives in congested and overcrowded slums. This urban setting reflects that, there are some environmental and other factors behind this. Both common cold and diarrhea are most common contagious human diseases and all people globally are affected. The main objective of this present paper is to study the geographical transmission of common cold and diarrhea diseases in the study area. For this study Jalgaon City is selected. It district headquarter situated in the northern part of Maharashtra State. The study is mainly based on the primary data, collected through well structured schedule, on purposively stratified random sampling method. Surveyed data reveals that, common cold disease, which is recorded in all 69 wards of study area and it is recorded 1924 infectious persons. The average incidence rate of common cold is 5.2 persons per thousand populations. In ward no. 31 and 15 highest incidence of common cold is recorded. There are 14 slum locality wards were incidence rate of common cold are recorded Very High category. The average incidence rate of diarrhea/gastroenteritis is 2.8 persons per thousand populations in the study area. In ward no. 15 (Indira Gandhi Nagar-slum) highest incidence and incidence rate of diarrhea/gastroenteritis are recorded (70 and 13.51 respectively). The incidence rate of diarrhea/gastroenteritis in non slum locality recorded Low category in 17 wards, followed by Moderate (15 wards) and High (10 wards).

Key Words: *Common Cold, Diarrhea/Gastroenteritis, GIS and Jalgaon City.*

1) Introduction:

The urban health and well-being of a population depend on many different factors such environmental and others. Improving the urban health status of population and reducing ill urban health pose challenges to national and local governments in multispectral decision making. The health of people living in towns and cities is strongly determined by their living and working conditions, the quality of their environmental and socio-economic factors as well.

According to the NFHS-3 reports India's 285.4 million population (28% of the total) live in urban areas (NFHS-3, 2008). Out of these 80.8 million people (25.7% of the total urban) live in below the poverty line. Maharashtra is the highly urbanized state in the India (followed by Tamil Nadu, where urban population is 43.9%). It has an urban population 41.01 million comprising 42.4 percent of the state's population. It is estimated that 32.2 percent of the urban population of the state lives below the poverty line. Maharashtra has the highest urban poor population in India and is rapidly growing. Slum population growths will continue to outpace growth rates of India, Urban Indian, and mega cities. This is currently summarized as the 2-3-4-5 syndromes (Ramani, 2009). In the 1991-2001 decade, as India grew at an average annual growth rate of 2 percent, urban India grew at 3 percent, mega cities at 4 percent and slum population increased by 5 percent.

Both common cold and diarrhea are most common contagious human diseases and all people globally are affected typically have two to five infections annually and children may have six to ten colds a year. The common cold is a self-limited contagious illness that can be caused by a number of different types of viruses. The common cold occurs most frequently during the fall and winter months.

Diarrhea disease is a leading cause of child mortality and morbidity in the world and mostly results from contaminated food and water sources.

2) Study Area:

Present study has conducted in Jalgaon City (Figure: 1), is a district headquarter situated in the northern part of Maharashtra state. It lies between 20^0 56' 45" North to 21^0 02' 13" North Latitude and 75^0 30' 51" East to 75^0 37' 31" East Longitude *(City Sanitation Plan, 2010)* and having height from mean sea-level is about 208.5 meters. The study region has an area of 68.2427 sq km. Administratively it is divided in to 69 wards. The climate of the study area is generally hot and dry and average annual rainfall is 525.80 mm. The average minimum temperature is 11^0 C. and average maximum temperature is 43.5^0 C. There some hilly area on south side and south-west side. The city is bounded by the Satpura ranges in the north and Ajanta, Satmala and Chandur hills in the south (DPR, 2008). Due to the continental type of location of the city, climate is very hot and dry. Jalgaon municipal council was established on November 24, 1864. The state government in its notification has announced the formation of Jalgaon city municipal corporation (JCMC) with effect from March 21, 2003 (CDP, 2011). JCMC serves an area of approximately 68.24 sq km including the city and its peripheral areas and provides a range of civic services to around 4.60 lakh (according to the 2011 census) citizens of the city of Jalgaon.

3) Objective:

The main objective of the present paper is to study the geographical transmission of common cold and diarrhea diseases in the Jalgaon City.

4) Data base and Methodology:

The study is mainly based on primary sources of data, collected through structured schedule, which includes ward wise incidence of common cold, diarrhea of households and demographic and socio-economic data as well. Information has been collected by conducting a door-to-door survey of 500 households (each zone consists of 100 households) from 69 wards in Jalgaon City. For primary data collections purposively stratified random sampling method is used. The whole Jalgaon City is divided into five zones viz. Central, East, West, North and South. Again the residential area is divided into two locality viz. Slum and Non-Slum, in order to cater for the variation between different localities of the population. This study is conducted between August-September, 2010 in Jalgaon City. We checked and edited data for accuracy, consistency and completeness. We used Microsoft Excel Software (version 2007)) for data entry and data analysis. With the help of Autodesk Map 2004 and ArcGIS 9.1 base map and other output maps are prepared. Disease incidence rate can be calculated with the help of the following formula:

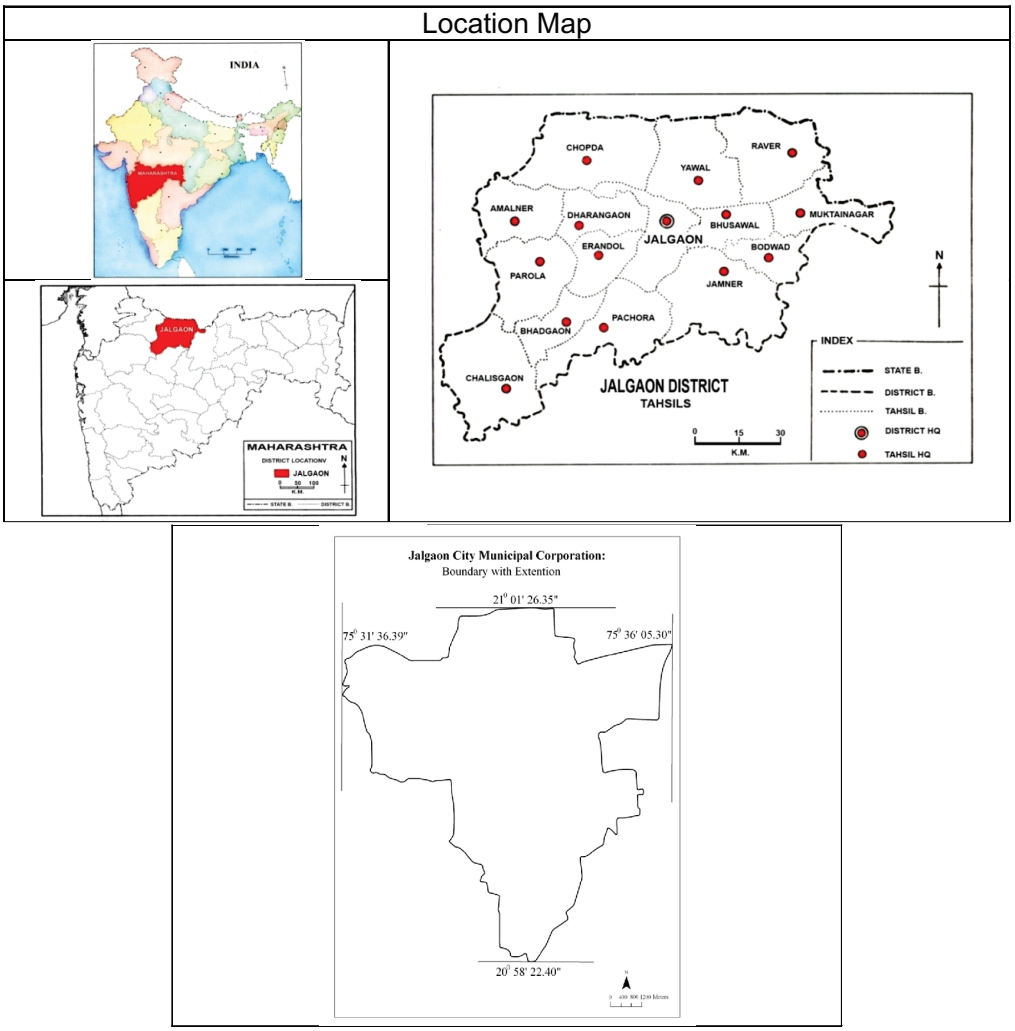
$$1)\quad \text{Disease Incidence Rate} = \frac{\text{No. of Persons Infected by a disease in a Ward}}{\text{Total population in the same Ward}} \times 1000$$

Similarly the actual spatial distributions of diseases are shown with help of following ways:

$$2)\quad \frac{\text{No. of persons infected by a disease in a ward}}{\text{Total No. of persons infected by all diseases in that ward}} \times 100$$

$$3)\quad \frac{\text{No. of persons infected by a disease in a ward}}{\text{Total No. of persons infected by the same disease in JCMC}} \times 100$$

Figure: 1



5) Results and Discussions:

An important function of epidemiology is to study the distribution patterns in the various sub groups of the population by time, place and person (Park, 2007). Geographical epidemiology studies the determinants, incidence and distribution of diseases. Diseases are not evenly distributed in human population. The basic tenet of epidemiology is that the distribution of diseases occurs in patterns in a community. It helps to identify etiological factors in the causes of diseases and to provide the data essential to the planning, implementation and evaluation of services for the prevention, control and treatment of disease. The following Table: 1 A are shows the details about the ward wise disease incidence rate of communicable diseases per thousand populations of surveyed households. **Table: 1 B** is explain about the proportion of morbidity cases of communicable disease in a ward to total number of morbidity cases of all communicable diseases in that ward of surveyed households. Table: 1 C are shows the proportion of morbidity cases of communicable diseases in ward to total number of cases of communicable diseases in the study area of surveyed households. For demarcating the incidence rate and ward wise proportions of morbidity cases of these communicable diseases are

grouped into four categories as follows:

i.	**Low**	: Up to First Quartile value.
ii.	**Moderate**	: More than First Quartile to Second Quartile value.
iii.	**High**	: More than Second Quartile to Third Quartile value.
iv.	**Very High**	: More than Third Quartile to Maximum value.

I. Common Cold:

The common cold is the most frequent viral infectious disease in humans. Common symptoms include a cough, sore throat, difficulty breathing through nose, swelling of sinuses, sneezing, headache and tiredness. There is no cure for the common cold, but symptoms usually resolve in 7 to 10 days. Common cold is seasonal, occurring more frequently during winter.

Surveyed data reveals that, common cold disease, which is recorded in all 69 wards of study area and it is recorded 1924 infectious persons. The average incidence rate of common cold is 5.2 persons per thousand populations in the study area. In ward no. 31 (Ambedkar Nagar-slum) highest incidence of common cold (83) is recorded. While the highest incidence rate of common cold (14.86) is recorded in ward no. 15 (Indira Gandhi Nagar), which is also slum locality. There are 14 slum locality wards were incidence rate of common cold are recorded Very High category. However, 11 non slum locality wards where incidence rate of common cold is recorded High category and 16 wards in Moderate category (Table: 3 A). This is because of poor environment conditions and overcrowding households particularly in slum localities common cold are recorded high in the study area. In ward no. 23 (Pimprala Dandekar Nagar) though it is declared slum, the incidence rate of common cold is Low.

The spatial distribution of common cold infectious persons is shown in Figure: 2, 3 and 4. The proportion of morbidity cases of common cold to total no. of morbidity cases of all communicable diseases in that ward are concentrated in High (13 wards) and Very High (17 wards) category in non slum locality (Table: 3 B). However the proportion of morbidity cases of common cold to total no. of morbidity cases of all communicable diseases in the study area concentrated in Low (18 wards) and Moderate (18 wards) category in non slum locality (Table: 3 C).

II. Diarrhea/Gastroenteritis:

Diarrhea is most commonly due to viral gastroenteritis with rotavirus. Gastroenteritis often involves stomach pain or spasms, diarrhea and/or vomiting. Viruses and bacteria can cause of gastroenteritis. Diarrhea is defined as the passage of loose, liquid or watery stools. These liquid stools are usually passed more than three times a day (Park, 2007). Diarrhea can cause dehydration. Loss of electrolytes through dehydration affects the amount of water in the body, muscle activity and other important functions. Individuals may also become infected by eating or drinking contaminated foods or beverages. Lack of personal and domestic hygiene is all contributory factors.

Diarrhea/gastroenteritis infectious persons are found 1038 (23.30%) in 66 wards, which is recorded second in all 22 diseases in surveyed households. The average incidence rate of diarrhea/gastroenteritis is 2.8 persons per thousand populations in the study area. In ward no. 15 (Indira Gandhi Nagar-slum) highest incidence and incidence rate of diarrhea/gastroenteritis are recorded (70 and 13.51 respectively). The incidence rate of diarrhea/gastroenteritis in non slum locality recorded Low category in 17 wards, followed by Moderate (15 wards) and High (10 wards). Whereas, in slum locality Very High category in 12 wards are recorded (Table: 2 A), due to unsafe drinking water and unhygienic condition. In ward no. 23 (Pimprala Dandekar Nagar) though it is declared slum, the incidence rate of diarrhea/gastroenteritis is Low.

Figure: 5, 6 and 7are shows the spatial distribution of diarrhea/gastroenteritis infectious persons. The proportion of morbidity cases of diarrhea/gastroenteritis to total communicable diseases in that ward are concentrated Very High in 10 wards, High in 11 wards and Moderate in 13 wards in slum locality (Table: 4 B). Proportion of morbidity cases of diarrhea/gastroenteritis to total no. of morbidity cases of all communicable diseases in the study area concentrated in Low (19 wards) and Moderate (15 wards) category in non slum locality (Table: 4 C).

Table: 3

		A JCMC: Ward wise *Incidence Rate of Common Cold*, 2010. (Incidence Rate per 1000 Population)		B JCMC: Ward wise *Proportion of Morbidity Cases of Common Cold* to total no. of Morbidity Cases of *All CD* in that Ward, 2010.		C JCMC: Ward wise *Proportion of Morbidity Cases of Common Cold* to total no. of Morbidity Cases of *All CD* in the Study Area, 2010.	
Category	**Locality**	**Values**	**Ward Numbers**	**Values**	**Ward Numbers**	**Values**	**Ward Numbers**
Low	Slum	(Less than 2.85)	**(01)** 23	(Less than 48.01)	**(08)** 7, 11, 12, 15, 16, 31, 33 & 57	(Less than 0.84)	**(01)** 23
	Non Slum		**(17)** 8, 18, 19, 20, 21, 22, 24, 32, 34, 35, 36, 44, 45, 59, 61, 64 & 69		**(10)** 2, 3, 5, 6, 10, 18, 19, 21, 45 & 46		**(18)** 8, 18, 19, 20, 21, 22, 24, 32, 34, 35, 36, 39, 44, 45, 59, 61, 64 & 69
Moderate	Slum	(2.85 to 4.49)	**(01)** 9	(48.01 to 55.88)	**(10)** 1, 4, 9, 23, 38, 40, 50, 56, 58 & 67	(0.84 to 1.30)	**(01)** 9
	Non Slum		**(16)** 6, 10, 13, 14, 17, 26, 27, 29, 37, 39, 42, 46, 51, 53, 60 & 68		**(07)** 13, 14, 25, 26, 36, 43 & 47		**(18)** 6, 10, 14, 17, 25, 26, 27, 28, 29, 37, 42, 46, 51, 53, 54, 60, 65 & 68
High	Slum	(4.50 to 7.34)	**(06)** 4, 12, 16, 40, 57 & 66	(55.89 to 61.22)	**(04)** 48, 49, 55 & 66	(1.31 to 1.98)	**(07)** 4, 12, 16, 40, 48, 57 & 66
	Non Slum		**(11)** 2, 25, 28, 30, 41, 43, 47, 54, 62, 63 & 65		**(13)** 17, 28. 29, 30, 34, 37, 41, 52, 60, 61, 63, 64 & 69		**(08)** 2, 13, 30, 41, 43, 47, 62 & 63
Very High	Slum	(7.35 to 14.86)	**(14)** 1, 7, 11, 15, 31, 33, 38, 48, 49, 50, 55, 56, 58 & 67	(61.23 to 100.00)	**(00)** 0	(1.99 to 4.31)	**(12)** 1, 7, 11, 15, 31, 33, 38, 50, 55, 56, 58 & 67
	Non Slum		**(03)** 3, 5 & 52		**(17)** 8, 20, 22, 24, 27, 32, 35, 39, 42, 44, 51, 53, 54, 59, 62, 65 & 68		**(04)** 3, 5, 49 & 52

Figures in **Bold** Parenthesis show Total Number of Wards.
Source: Field Work Data Computed by Researcher, 2010.

Figure: 2
JCMC: Ward wise *Incidence Rate of Common Cold*, 2010.
(Incidence Rate per 1000 Population)

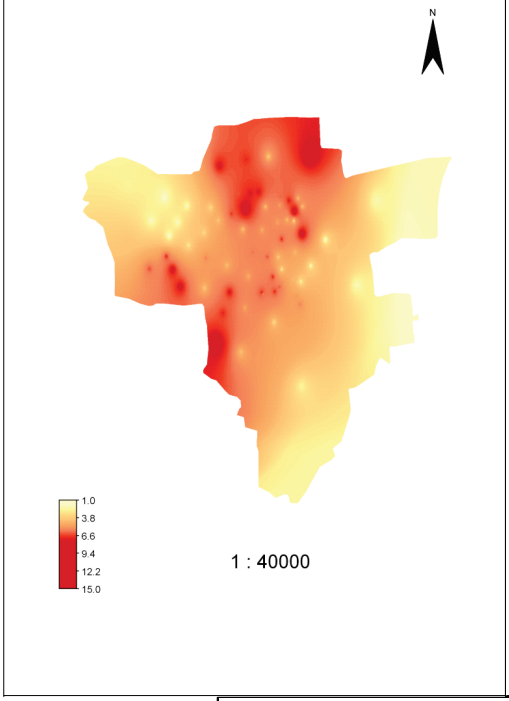


Figure: 3
JCMC: Ward wise *Proportion of Morbidity Cases of Common Cold* to total no. of Morbidity Cases of *All CD* in that Ward, 2010.

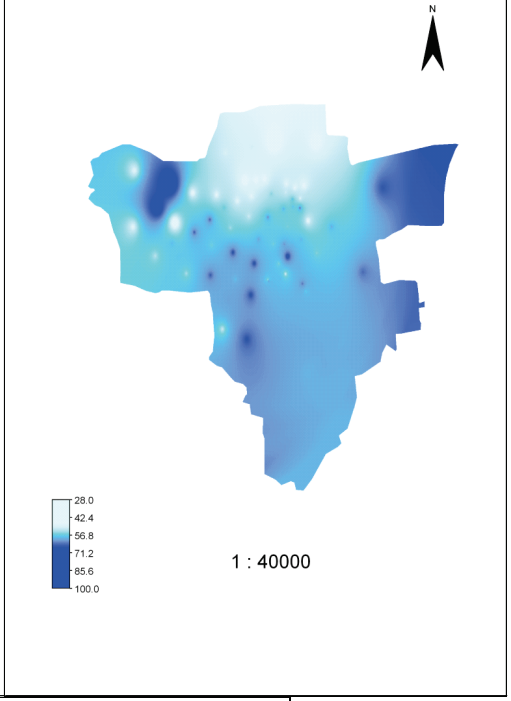


Figure: 4
JCMC: Ward wise *Proportion of Morbidity Cases of Common Cold* to total no. of Morbidity Cases of *All CD* in the Study Area, 2010.

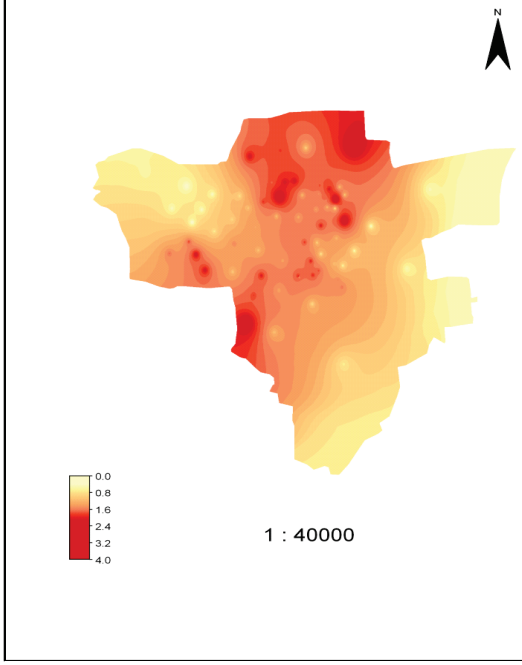


Table: 4

		A JCMC: Ward wise *Incidence Rate of Diarrhea/Gastroenteritis*, 2010. (Incidence Rate per 1000 Population)		B JCMC: Ward wise *Proportion of Morbidity Cases of Diarrhea/Gastroenteritis* to total no. of Morbidity Cases of *All CD* in that Ward, 2010.		C JCMC: Ward wise *Proportion of Morbidity Cases of Diarrhea/Gastroenteritis* to total no. of Morbidity Cases of *All CD* in the Study Area, 2010.	
Category	**Locality**	**Values**	**Ward Numbers**	**Values**	**Ward Numbers**	**Values**	**Ward Numbers**
Low	Slum	(Less than 0.88)	**(01)** 23	(Less than 17.66)	**(04)** 9, 38, 56 & 66,	(Less than 0.49)	**(02)** 23 & 66
	Non Slum		**(17)** 8, 19, 20, 22, 24, 32, 34, 35, 36, 39, 44, 45, 51, 59, 61, 64 & 65		**(14)** 8, 20, 22, 32, 39, 44, 47, 51, 59, 61, 62, 64, 65 & 68		**(19)** 8, 19, 20, 22, 24, 32, 34, 35, 36, 39, 42, 44, 45, 51, 59, 61, 64, 65 & 68
Moderate	Slum	(0.88 to 1.93)	**(02)** 9 & 66	(17.66 to 22.86)	**(05)** 4, 23, 48, 55 & 67	(0.49 to 1.06)	**(02)** 9 & 48
	Non Slum		**(15)** 14, 17, 18, 21, 26, 27, 29, 37, 42, 53, 54, 60, 62, 68 & 69		**(12)** 17, 24, 27, 29, 34, 35, 36, 37, 42, 53, 54 & 60		**(15)** 14, 17, 18, 21, 26, 27, 28, 29, 37, 47, 53, 54, 60, 62 & 69
High	Slum	(1.94 to 3.62)	**(07)** 4, 38, 40, 48, 55, 56 & 57	(22.87 to 30.00)	**(06)** 1, 40, 49, 50, 57 & 58	(1.07 to 1.83)	**(06)** 4, 38, 40, 49, 55 & 56
	Non Slum		**(10)** 6, 10, 25, 28, 30, 41, 43, 46, 47 & 63		**(11)** 14, 18, 19, 25, 26, 28, 43, 46, 52, 63 & 69		**(08)** 6, 10, 25, 30, 41, 43, 46 & 63
Very High	Slum	(3.63 to 13.51)	**(12)** 1, 7, 11, 12, 15, 16, 31, 33, 49, 50, 58 & 67	(30.01 to 46.15)	**(07)** 7, 11, 12, 15, 16, 31 & 33	(1.84 to 6.74)	**(12)** 1, 7, 11, 12, 15, 16, 31, 33, 50, 57, 58 & 67
	Non Slum		**(05)** 2, 3, 5, 13 & 52		**(10)** 2, 3, 5, 6, 10, 13, 21, 30, 41 & 45		**(05)** 2, 3, 5, 13 & 52

Figures in **Bold** Parenthesis show Total Number of Wards.
Ward Numbers in Red Colours indicate Nil incidences.
Source: Field Work Data Computed by Researcher, 2010.

Figure: 5
JCMC: Ward wise *Incidence Rate of Diarrhea/Gastroenteritis*, 2010.
(Incidence Rate per 1000 Population)

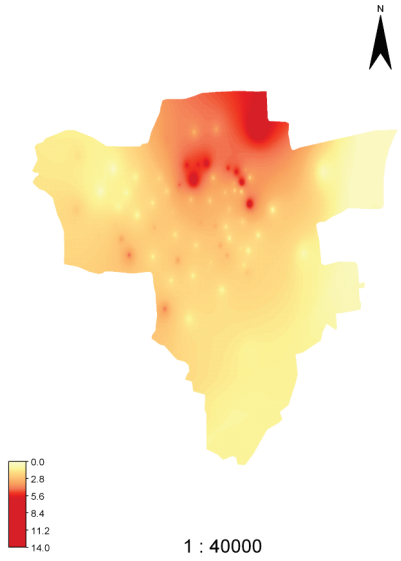
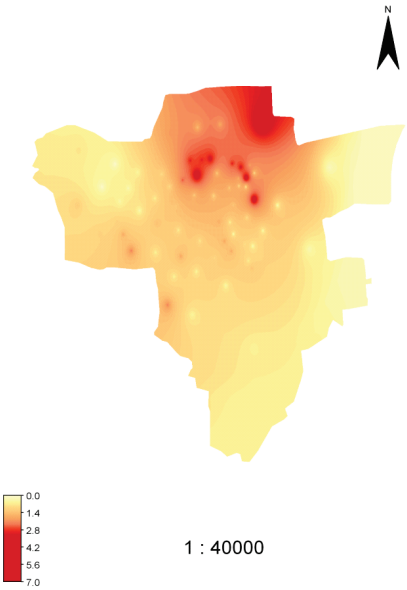


Figure: 6
JCMC: Ward wise *Proportion of Morbidity Cases of Diarrhea/Gastroenteritis* to total no. of Morbidity Cases of
All CD in that Ward, 2010.

Figure: 7
JCMC: Ward wise *Proportion of Morbidity Cases of Diarrhea/Gastroenteritis* to total no. of Morbidity Cases of
All CD in the Study Area, 2010.



6) Conclusions:

Both common cold and diarrhea/gastroenteritis are very much affected in the study area. The proportion of morbidity cases of both diseases are found high in slum locality. To improve the prevailing situation, the problem of slum dwellers is to be addressed with holistic approach. Which should bridge the gaps and improve the quality of slum dwellers life is the current need.

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