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A Spatial Analysis of Public Healthcare Services: A Case Study of Municipal Corporation of Greater Mumbai

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Abstract

Maintaining and improving health has proved to be a major challenge especially in complex urban situations. The urban population also has an access to a wider range of healthcare options particularly in a metro city like Greater Mumbai. However, both the accessibility and quality of public healthcare services vary within the city.

A spatially well distributed public health service network is a necessary step for the improved health for all; promoting health equity. The Public Health Care sector faces a problem of lack of resources and infrastructure viz. inadequate number of hospital beds, space, medicines and skilled personnel. The bed- population ratio is higher in urban areas than in rural areas and there has not been any significant decline over time. The Municipal Corporation of Gr. Mumbai (MCGM) is the civic body that looks after the governance of Gr. Mumbai, the capital city of Maharashtra. MCGM is also responsible for providing healthcare to the citizens, both at affordable prices and in an accessible manner through the Public Health Department. MCGM runs an elaborate system of healthcare including Medical Colleges, Specialty and Peripheral Hospitals, Maternity Homes, Health Posts and Dispensaries. However, due to the burgeoning population and an influx of people from neighbouring areas seeking medical treatment in Gr. Mumbai; the existing municipal health services are insufficient to fulfill the needs.

The present Paper aims at studying the spatial distribution of Public Hospitals under MCGM and the number of municipal hospital beds in Gr. Mumbai, as well as estimating the centre of gravity of health facilities in the form of Municipal Public Hospitals.

Keywords: Public Healthcare Services, MCGM, Public Hospitals, Municipal Hospital Beds

Introduction:

Health is an important dimension determining the quality of life for individuals. Slums have been an integral part of the growing cities in the developing world characterized

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by poor hygiene, inadequate housing, water, sanitation and overcrowding. The urban population also has an access to a wider range of healthcare options particularly in a metro city like Greater Mumbai. However, both the accessibility and quality of public healthcare services vary within the city resulting in intra-urban health gaps.

Rapid urbanization in Greater Mumbai has led to increased industrialization, migration, change in landuse and land cover pattern and resultant pressure on resources and pollution. According to Census 2001 the population density of Greater Mumbai was19865 per sq. km.which increased to20634 over the next ten years (Census, 2011). However, Mumbai Island City District has recorded a negative population growth rate of -7.60%, while Mumbai Suburban District has an 8.3% growth rate indicating a heavy demand for infrastructure in suburban areas.E.g. Municipal Hospitals catered to more than 1 crore out-patients and 5,94,976 in-patients in 2016(MCGM,2016).

Need for the study:

A spatially well distributed Public Health Service network is a necessary step for the improved health for all promoting health equity. The Public Health Care sector faces the problem of lack of resources and infrastructure viz. inadequate number of hospital beds, space, medicines and skilled personnel. The bed- population ratio is higher in urban areas than in rural areas and there has not been any significant decline over time. Hospital beds are used to indicate the availability of inpatient services. Additional 3 million beds are required in India to achieve the target of 3 beds per 1,000 people by 2025. Data on health infrastructure per 10,000 population (2006 - 2013) reveal that the hospital bed- population ratio for India was 7: 10,000 while the world median was 26(IBEF, 2015).

Table 1. Status of Health System Indicators

Country/	Health Expenditure (2014)			Health Workers		Hospital Beds
	Total (% of GDP)	Public (% of Total)	Per Capita ($)	Physicians (per1000 people, 2008-14)	Nurses & Midwives (per1000 people 2008 to 2014)	Per 1000 people, (2007-2012)
India	4.7	30.0	75	0.7	1.7	0.7
World	9.9	60.1	1059	1.5	3.3	Not Available
S. Asia	4.4	31,2	67	0.7	1.4	0.7
High Income	12.3	62.3	5266	2.9	8.6	4.2

Source: World Development Indicators, World Bank 2017

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Service delivery is an important component of health system. A range of indicators are needed to capture availability, access and distribution of health services delivery. Highlights of India's position in the global health system scenario are shown in Table1. India fares low on health system indicators such as health expenditure, health workers and availability of hospital beds than the world average (World Bank, 2017).

In-patient beds density is one of the few available indicators on a component of level of health service delivery. There is no global norm for the density of hospital beds in relation to total population e.g. in Europe, there are 63 hospital beds per 10 000 population compared with 10 per 10,000 in Africa (WHO 2009). The total number of hospital beds available in Mumbai were as follows: Municipal 12000(28%), Government 8000 (22%) and Private 21000(50%). A total of more than 40,000 beds was inadequate for the population of 13 million, with a ratio of 1 to 3000 when the most minimum ratio should be 1 to 1000(Nadkarni,2016).

The importance of spatial planning in health care delivery systems facilitates identification of the locational characteristics of health care facilities. It also brings out relative access to healthcare and concentration of health care resources in the study area. The present Paper aims at studying the spatial distribution of Public Hospitals under MCGM and the number of Municipal Hospital beds in Gr. Mumbai, as well as estimating the centre of gravity of municipal health facilities.

Objectives:

- to understand the dynamics and spatial distribution of Public Healthcare Services of MCGM in Greater Mumbai.
- to comprehend the centre of gravity of health facilities i.e. hospital bedsand the Municipal Public Hospitals.

Data Sources and Methodology:

Secondary data on the location of Municipal Hospitals and the number of hospital beds in them were acquired from the Municipal Corporation of Greater Mumbai (MCGM) in the table format. The individual numbers of beds were not available for maternity homes separately from MCGM hence, have been excluded from the spatial analysis. Analyses of secondary data were done using statistical techniques such as percentages, centrographic techniques, maps and diagrams.The locations of Municipal Hospitals depicting a point pattern are presented in the map of Greater Mumbai (Figure 1). The map was developed in MapInfo v16.0 software creating the appropriate geodatabase.

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The present study has used Centrographic measures which have been used in the past to determine both the 'centre of area' and 'centre of population', as well as to describe and analyse the distribution of points in space (Soot,1975). Medical geographers have also studied locational characteristics of the distribution, access and utilization of healthcare resources such as personnel and facilities, with the help of both centrographic and cartographic methods. These methods have provided a basis for delivering efficient health care planning at regional level (Khan, 1986).Centrographic methods werealso used in the field of Urban Development to describe the pattern of dispersion of historic factories, villas and palaces in the city space ofPoland (Jazdzewska, 2018).

The MCGM hospitals were plotted in the map of Greater Mumbai as points. The data on geographical coordinates of the points (x,y) werecalculated. Centrographic measures were applied to the statistical data for spatial analysis. The choice of technique was according to its relevance e.g. in case of measuring standard distance, distance of the hospitals from the mean was measured. It provided the Mean Centre and the Standard Distance for both Municipal Hospitals and Hospital Beds. Mean Center or Area Mean identifies the central location of thedifferent Municipal Hospitals; giving the center of gravity in terms of 'distance', i.e. a geographic center or concentration. The Weighted Mean gives the concentration of strength of Municipal Hospital beds. The Standard Distance measures the degree to which Municipal Hospitals are concentrated or dispersed around the mean center.

Location of the Study Area:

Greater Mumbai is located on the western sea coast of India between 18^{o}53' North to 19^{o}16'North latitude and between 72^{o} East to 72^{o}59' East longitude. It was originally a cluster of seven islands. Later on, these islands were welded together to form the present Greater Mumbai. Mumbai city is divided into two revenue districts; Mumbai City district in the south and Mumbai suburban district in the north consisting of eastern suburbs and western suburbs. Area of Mumbai above sea level as per the Development Plan is 458.53 sq. km, although the total area specified by the Surveyor General is 603 sq.km., which includes territorial waters extended into the sea up to 12 nautical miles measured from an appropriate base line. Mumbai's maximum width is 17 km. (East to West) and length is 42 km. (North to South) (MCGM, 2015-16).

Status of Public Health Care Services in Gr. Mumbai:

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Municipal Corporation of Greater Mumbai (MCGM) also known as the Brihanmumbai Municipal Corporation (BMC) is the civic body responsible for the governance of Greater Mumbai. The city of Greater Mumbai is divided into 6 administrative zones with 24 municipal wards and further into 88 sections for administrative purpose; understanding population trends and for making provisions such as sanitation, health, education etc. The Mumbai City district has 9 municipal wards and Mumbai Suburban district has 15 municipal wards.

The Public Health Department of the MCGM provides a range of basic healthcare facilities, as well as management of preventive and social or community medicine. The Department is divided into 7 zones for administrative purpose covering 24 wards. Mumbai City district accommodates Zone 1 and 2with 52 Health Posts, Eastern Suburbs House Zone 5 and 6 with 71 health posts and Western Suburbs have Zone 3, 4 and 7 with 85 health posts available in them. The Deputy Municipal Commissioner (DMC) handles each zone. There is a separate ward office for each ward where the respective Public Health Department is headed by the Ward Medical Health Officer.

Table 2: Greater Mumbai: Public Health Infrastructure under MCGM, 2017

Area	**Medical Colleges & Major Hospitals**	**Peripheral Hospitals**	**Special Hospitals**	**Maternity Homes**	**Health Posts**	**Municipal Dispensaries**
Mumbai City	4	0	5	5	52	70
Western Suburbs	1	8	0	14	85	58
Eastern Suburbs	0	8	0	9	71	47
Total	**5**	**16**	**5**	**28**	**208**	**175**

Source: MCGM, 2017

The health services for people in Mumbai are met through hospitals and dispensaries run by the Municipal Corporation of Greater Mumbai (MCGM), Maharashtra State and the private sector. Table 2 depicts that MCGM runs 4 medical college cum major hospitals, 1 dental college, 16 peripheral hospitals, 28 maternity homes, 5 special hospitals, 175 dispensaries and 208 health posts (MCGM, 2017).Each of the peripheral hospitals is connected to one of the four special hospitals. The health posts and the dispensaries are linked to the peripheral hospitals. The objective behind the establishment of health posts is to provide basic integrated health and family welfare services to the urban poor within walking distance from the slum localities where they reside.According to a report from

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BCPT, in addition, the Maharashtra State government has one Medical College Hospital, three General Hospitals and two Health Units located in Mumbai with 2871 beds(BCPT).

Results and Discussion:

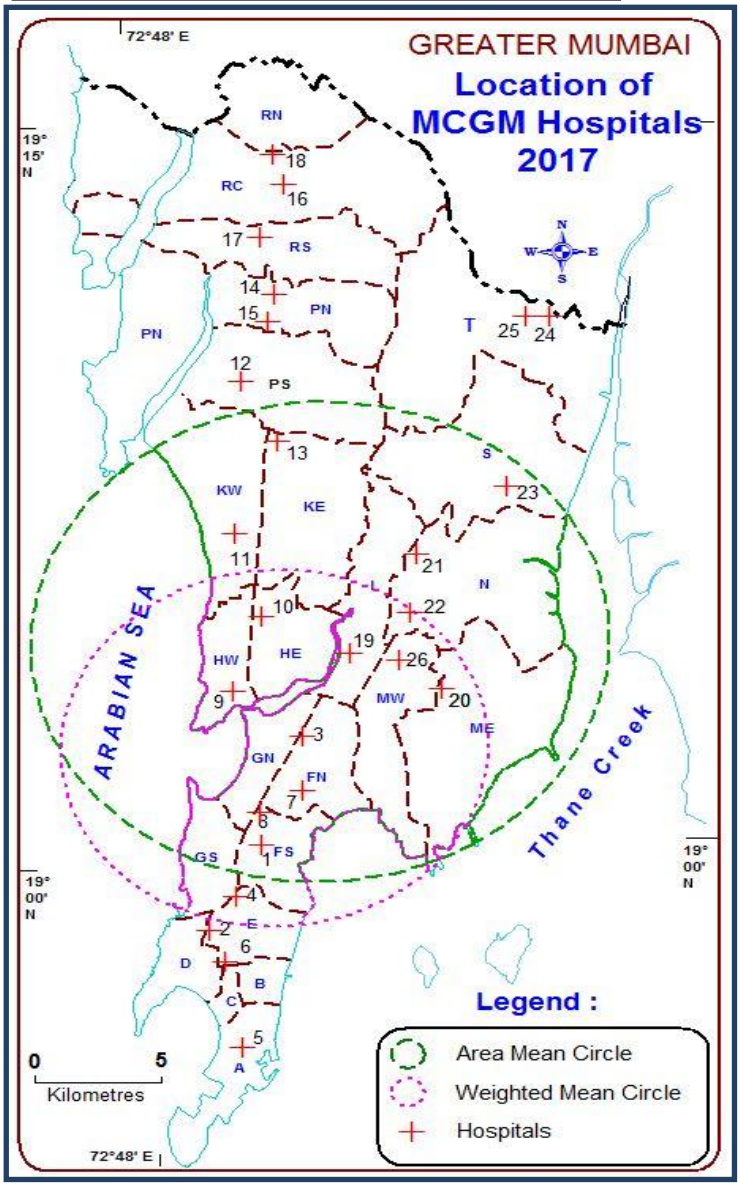
Finding Centre of Gravity of Municipal Hospitals in Relation to the Availability of Municipal Hospital Beds:

The Following map of Greater Mumbai (Figure 1) includes locations of 26 Municipal Hospitals functioning under MCGM in 2017. These hospitals provide 12,689 beds in total available for in-patients (Table 3). Apart from these hospitals there are there are 28 Municipal Maternity Homes with a total of 945 beds in them. These hospitals are not shown in the map as the individual numbers of beds were not available for each of the maternity homes separately from MCGM.

Table 3: Number of Municipal Hospital Beds in Greater Mumbai-2017

Sr. Number of the Hospital	Number of Municipal Hospital Beds*
1	2250
2	1800
3	1900
4	515
5	100
6	80
7	240
8	1200
9	436
10	259
11	636
12	172
13	304
14	50
15	180
16	105
17	324
18	373
19	306
20	210
21	109
22	596
23	140
24	105

Figure 1. Location of MCGM Hospitals with Area Mean and Weighted Mean circles



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25	225
26	74
Total	**12,689**

* Excluding Maternity Hospital Beds

In pre-independence times, Gr. Mumbai, then Bombay was a colonial port city and its initial growth and development took place in the southern part of the city. Post-independence growth implied northward expansion and suburbanization along the western, central and harbour railway lines. Municipal Hospitals are found located in groups(Figure 1). One is near C.S.T. station, another near Byculla-Parel and thirdly, in north-central parts of Gr. Mumbai. The prime cluster concentration near C.S.T. Station is due to its maximum accessibility and centrality as a terminus. It is also the Central Business District (CBD) of Gr. Mumbai. Concentration near Byculla is because it is a wholesale and retail trade area. Clustersare also associated with different types of land-usesuch as residential areas of the lower middle class in the heart of the industrial area around Elphinstone, Parel, Worli and Prabhadevi. The locational pattern also shows linear extensions along the Western Railway and Central Railway corridors which are the two main transport arteries of Gr. Mumbai.

By studying the given map (Figure 1) and the distribution of various points in space, along with the location of the area mean and weighted mean, one could explain the locational pattern of the given phenomenon. This analysis would also help to understand the process and nature of urban growth and its expansion in Greater Mumbai.

Table 4: Standard Distance of the Data

	X Co-ordinates	Y Co-ordinates	Standard Radius From Mean Center: r (km.)
Area Mean (km)	4.1	10.9	5.48
Weighted Mean (km)	3.3	8.6	4.06

Table 4 provides the Standard Distance of the data. The centre of gravity in terms of ‘area’ i.e. location of Municipal Hospitals when used in a comparative analysis with the ‘weighted mean centre’ pertaining to Municipal Hospital Beds aptly describes the dispersion of points in the city space, in the context of availability of hospital beds.

Area Mean lies near Bandra(Figure 1),which is the periphery of the main island City. The corresponding Standard Distance Circle is neither too small nor big implying dispersion not without concentration. It occupies 215.8sq.km. area. The analysis demonstrates that 54% of

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the data points lie within one standard radius. There are some pockets in the city which offer more public hospital facilities than the others.

Weighted Mean has shifted to south of the Area Mean because the strength of Municipal Hospital beds is much more concentrated in the south than just the location of hospitals. There are specialty hospital facilities which not only cater to the local population, but also to the distant parts of the country and people come from beyond Mumbai city limits. The analysis demonstrates that the Weighted Mean Circle covers 110.1sq.km. area. It occupies 24 per cent of the total geographical area and 63 per cent of the Municipal Hospital beds.

Conclusions:

When there is no planned urban development, the earlier developed areas attract more and more facilities. When peripheral areas also get incorporated within the municipal limits, there is a time gap or lag in development facilities.There are large residential areas waiting for the adequate facility of public hospitals, such as Mumbai Suburban District which has recorded higher growth rate of population than the Mumbai City District according to Census 2011.The analysis not only shows higher concentration of Municipal Hospitals in south Mumbai but also a comparatively higher status of these hospitals. At the same time suburban hospitals mostly cater more locally.

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