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SPATIAL DISTRIBUTION OF URBAN PRIMARY HEALTH CENTERS: A STUDY OF CHENNAI CITY

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Abstract

Understanding spatial distribution pattern of any geographic feature is considered as an important issue for physical planning, and decision making at spatial level. This paper measures spatial distribution of Urban Primary Health Centers in Chennai City Corporation. Different statistical techniques such s location quotient, health center – population ratio analysis of variance have been used to measure the spatial pattern of health centers in the city. The results reveal that the city has good number of health centers, but simultaneously these facilities are having indicated the uneven distribution at zonal level. Spatial distribution gives an insight to understand the associated locational disparities and help to plan accordingly to enhance the optimal utilization of resources.

Key words: Healthcare Centers, Distribution, Population ratio, disparity

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Introduction

Disparities in geographic access to health care result from the configuration of facilities, population distribution, and the transportation infrastructure (Delamater *et al.,* 2012). The healthcare disparities arise due to problems in optimal health care functionalities such as availability, accessibility and affordability (Steinwachs& Hughes 2008). GIS provides a wide range of techniques and functions used for health services planning. In this concern Murad, (2011) carried out the survey based study on Jeddah city of Kingdom of Saudi Arabia for the demand and supply of health services. The author applied the GIS for the exploration of accessibility to health centers covering three main analytical issues; i.e.; 1) health care supply; 2) location and characteristics; 3) accessibility level to health services. Based on the above mentioned analytical issues the growth and extent of health centers was delineated.

An inequality in health care accessibility depends on a number of factors it is therefore essential to study the nature of the factors (social, geographical, or economic lines) which influences the inequalities in access (Ricketts et al., 2001). Relationships between social disadvantages and availability of the quality and quantity of General Practice services, the geographical access to healthcare services were relatively equal across socioeconomic groups. However, the residents of deprived areas are facing difficulty in obtaining evening and same-day appointments. They conclude that services were available but more travel time and inadequate quality of services for some underprivileged populations (Hyndman et al., 2001).

Spatial Disparity of Health Centers

Inequality in health services distribution has become a concern of challenge among different countries (Mackenbach et al., 2008). Equality in distribution of health services and equal accessibility to such services has become a major principle in most health systems (Horev et al., 2004). Therefore, understanding the geographical distribution of health resources, equal accessibility to such resources and improvement of them may lead to better planning to make health services accessible to all.

The equal and fair distribution of resources in the health sector is one of the most important goals to be achieved by health systems in every country all over the world. It is usually considered to

be one of the main challenges and concerns of policy makers and managers in the health sector (Nishiura et al., 2004). To evaluate the distribution of healthcare resources such as health centers in the study area, Gini coefficient and Lorenz curve methods are being used. This will help to understand the nature of accessibility to health services and assist in reducing the inequality in the distribution of healthcare resources in Chennai city.

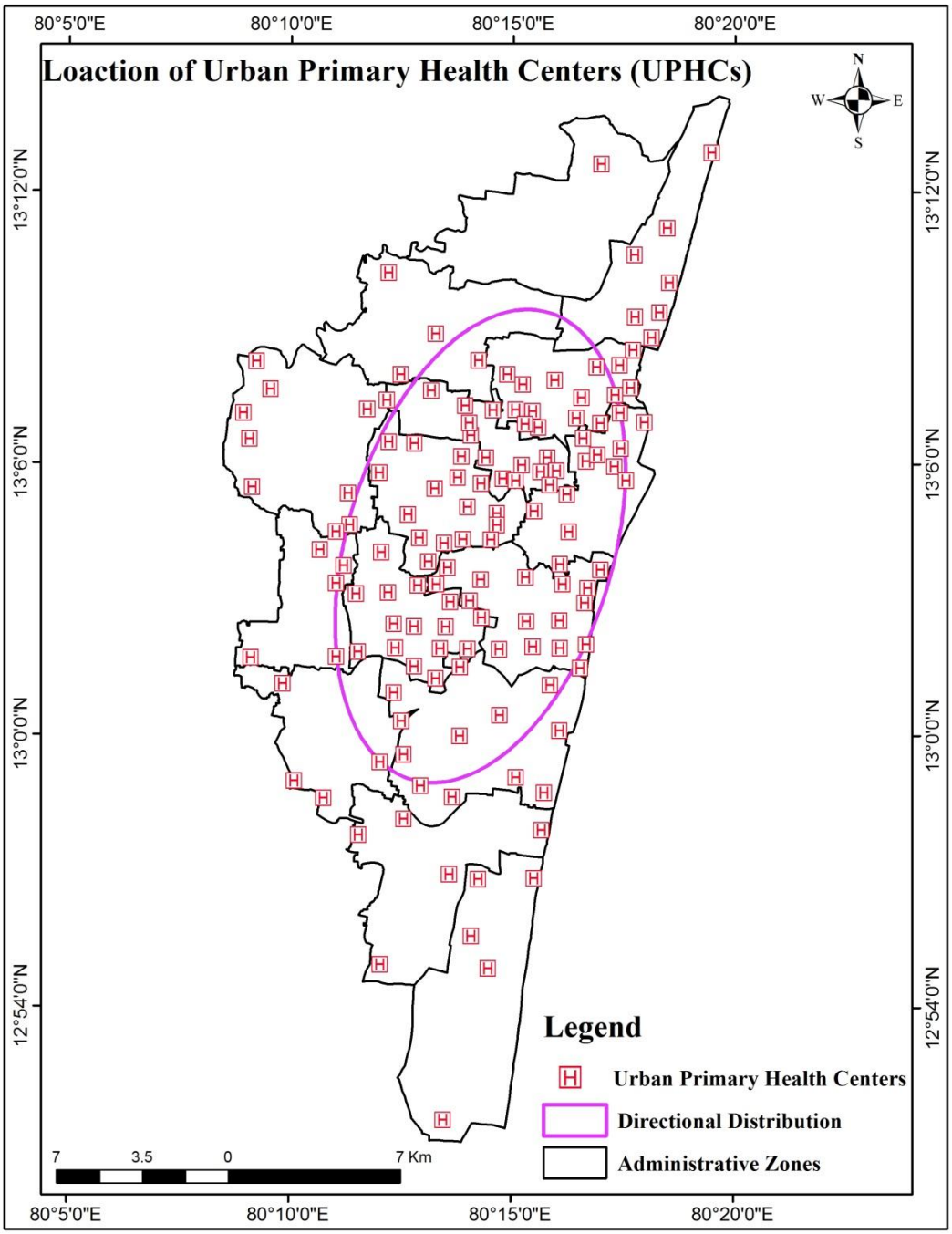

Fig. 1

i. Location quotient

Location quotient provides the spatial concentration pattern of amenities in a particular area. The location quotient is a method for comparing percentage share of a particular facility with its percentage share of population. This method is applied in order to show the variation in the concentration of health centers among zones of the city. For calculating the location quotient (L.Q.) for health centers in a particular zone the following formula has been used.

$$L.Q = \left(\frac{hz}{pz}\right) / \left(\frac{Hc}{Pc}\right)$$

Where:

L.Q= Location Quotient

hz= Number of health centers in particular zone

pz= Population of the concerned zone

Hc= Number of health centers in the City

Pc= Population of the City

If the value of the quotient for a particular facility in all zones equals to 1, it indicates that the facilities are equally distributed. If the value of the quotient for a particular facility in a particular zone exceeds 1, it means that the concentration exceeds the city average. A value lesser than 1 indicates a deficiency in the service, while a value equal to l or close to l indicates self-sufficiency (Isard, 1960).

The primary health care infrastructure provides the first level of contact between the population and health care providers. Realizing its importance in the delivery of health services, the centre, states and several government related agencies simultaneously started creating primary health care infrastructure and manpower. This has resulted in substantial amount of duplication of the infrastructure and manpower.

Table 1: Location Quotient of Urban Primary Health Centers

Zone	Name	Population	No of UPHC	Location Quotient
I	Thiruvotriyur	289181	6	1.07
II	Manali	132025	2	0.78
III	Madhavaram	196067	4	1.06
IV	Tondiarpet.	598547	15	1.30
V	Royapuram	631747	13	1.07

VI	Thiru-vi.ka-Nagar	827891	14	0.88
VII	Ambattur	478134	9	0.98
VIII	Anna Nagar	759493	15	1.02
IX	Teynampet	762634	16	1.09
X	Kodambakkam	716514	15	1.08
XI	Valasaravakkam	433077	5	0.60
XII	Alandur	264497	6	1.18
XIII	Adyar	534699	10	0.97
XIV	Perungudi	325425	5	0.80
XV	Sholinganallur	303600	5	0.85

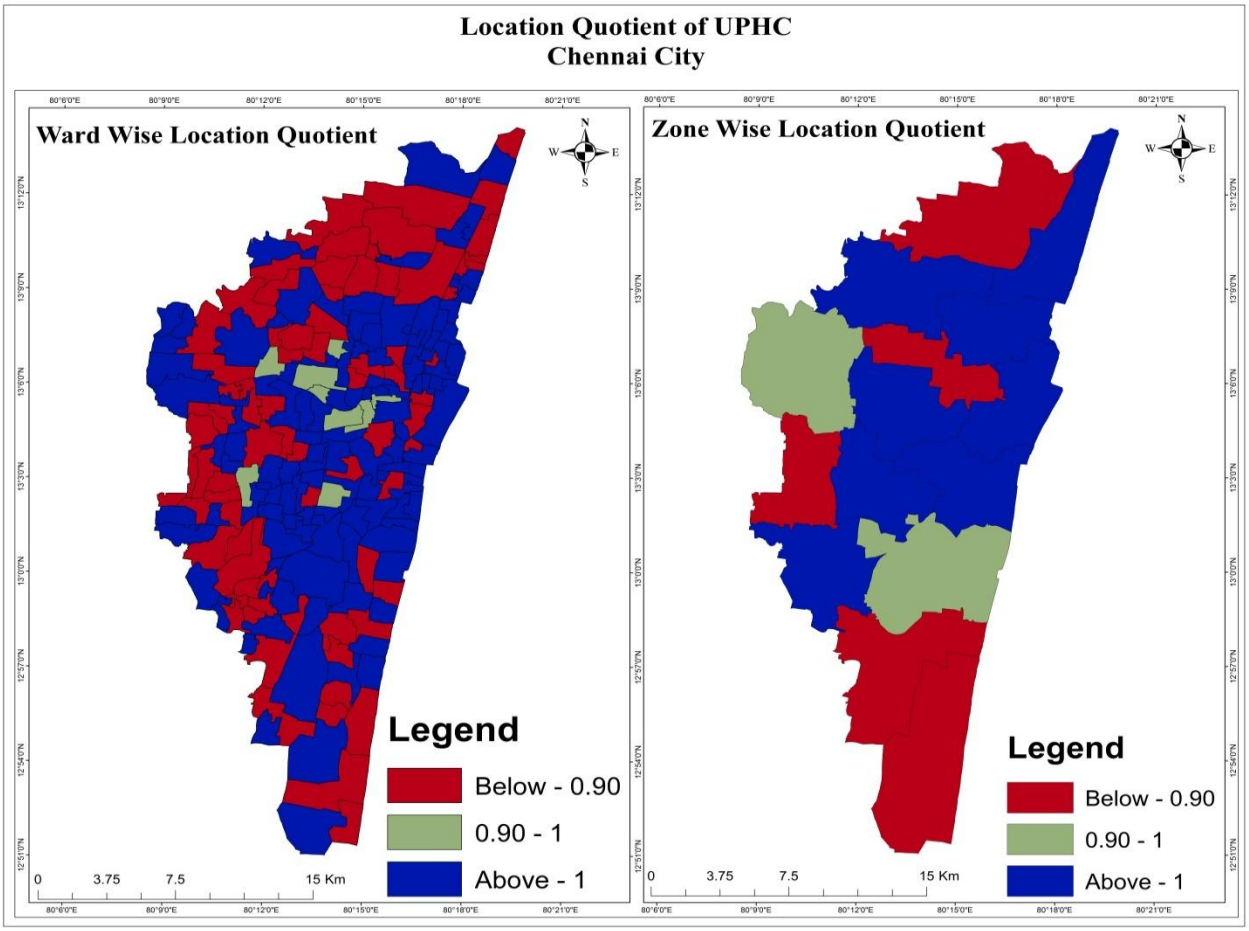

Fig. 2

The table 1 and Fig. 1 depicts that the distribution of urban primary health centers varies at zonal level. The degree of location quotient of UPHC's is higher in eight zones (Anna Nagar, Madhavaram, Royapuram, Thiruvotriyur, Kodambakkam, Teynampet, Alandur and Tondiarpet) which is more than one, which indicates more number of UPHC's are available to its population.

While as, in two zones (Adyar and Ambattur) the location quotient value is close to 1, which indicates that the facilities are self-sufficient to the population of the zone. In five zones of the city (Valasaravakkam, Manali, Perungudi, Sholinganallur and Thiru-vi.ka-Nagar) the value is less than 1, which reveals that the facilities are deficit to the population. The location quotient of the zones indicates that higher the value more facilities are available to the population and vice versa. While as the ward wise scenario indicates that location quotient 76 of wards is lea than one and 9 wards have equal to one and location quotient of 116 wards is more than one.

ii. Health Center Population Ratio

As per the norms of National Health Mission (NHM) the population norms for the provision of SC's, PHC's and CHC's are suggested 5000, 30000, and 120000 people respectively in plain areas, whereas in the Hilly/Tribal regions it is 3000, 20000 and 80000 respectively.

Table 2: Population – UPHC Ratio

Zone	Name	Population	No of UPHC	Ratio
I	Thiruvotriyur	289181	6	48197
II	Manali	132025	2	66013
III	Madhavaram	196067	4	49017
IV	Tondiarpet.	598547	15	39903
V	Royapuram	631747	13	48596
VI	Thiru-vi.ka-Nagar	827891	14	59135
VII	Ambattur	478134	9	53126
VIII	Anna Nagar	759493	15	50633
IX	Teynampet	762634	16	47665
X	Kodambakkam	716514	15	47768
XI	Valasaravakkam	433077	5	86615
XII	Alandur	264497	6	44083
XIII	Adyar	534699	10	53470
XIV	Perungudi	325425	5	65085
XV	Sholinganallur	303600	5	60720
Total		7253531	140	51811

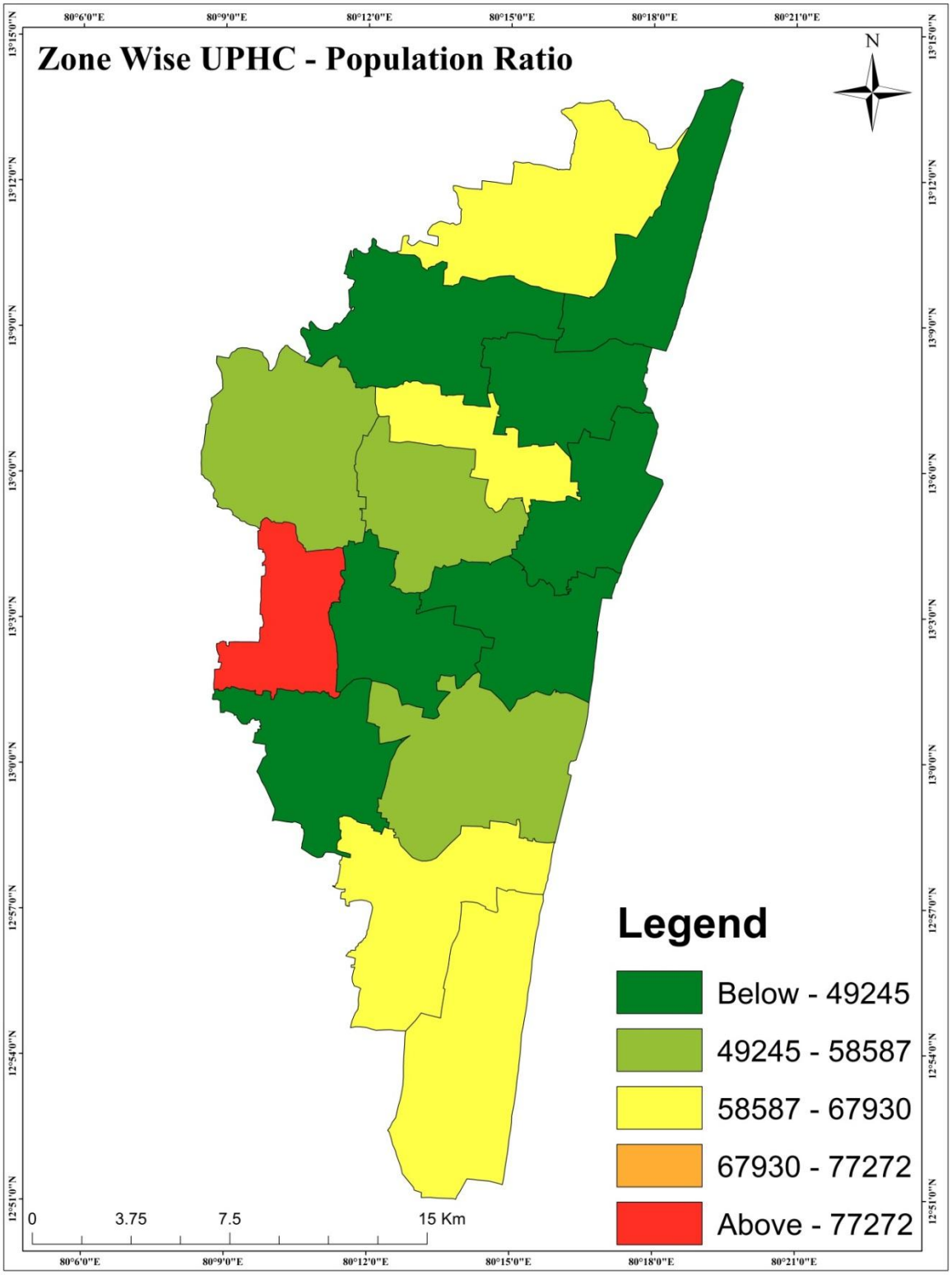
Zone Wise UPHC - Population Ratio
N
80°6'0"E
80°9'0"E
80°12'0"E
80°15'0"E
80°18'0"E
80°21'0"E
13°15'0"N
13°12'0"N
13°9'0"N
13°6'0"N
13°3'0"N
13°0'0"N
12°57'0"N
12°54'0"N
12°51'0"N
Legend
Below - 49245
49245 - 58587
58587 - 67930
67930 - 77272
Above - 77272
0
3.75
7.5
15 Km

Fig. 3

Table:3 Analysis of Variance

Zone wise UPHC – Population Ratio Variance					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	34060401795.224	14	2432885842.516	8.421	.000
Within Groups	53737138961.764	186	288909349.257		
Total	87797540756.988	200			

Zone Wise Health Center Variance					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	13.186	14	.942	3.704	.000
Within Groups	47.301	186	.254		
Total	60.488	200			

The available PHC's at zonal level are considered for assessing the nature of availability of health services as per the Health Policy norms of the Government of India (Table.4). In Chennai City there are 140 UPHC's, and it is estimated that on an average each PHC in the district is serving 51811 persons indicating better status in terms of ratio between the health centers and population served by each UPHC. The high concentration of UPHC's is observed in Tondiarpet, Alandur, Teynampet, Kodambakkam, Thiruvotriyur, Royapuram and Madhavaram (75) serving the population at the ratio of below 5000; hence there is lower population ratio than the city average. Anna Nagar, Ambattur, Adyar and Thiru-vi.ka-Nagar zones have medium concentration of health centers (48 health centers) in total with the population of 2600217 thus serving the population at the ratio of from 5000 to 6000. A less number of health centers are found in Sholinganallur, Perungudi, Manali and Valasaravakkam (17 health centers) in total and serving the population at the ratio of above 6000 which is higher than NHM norms

This reveals that the UPHC's in zone II, XI, XIV and XV are under more pressure than other zones. But when we compare the UPHC population ratio in zones with the NHM it is less than the prescribed norms. Hence the people in these zones are having good healthcare facilities. The analysis of variance (Table) of UPHC and population ratio and also the health centers distribution among the zones varies significantly ($P< 0.1$).

Conclusion

Health service facilities in urban area context are an important geographic feature as they are providing one of the basic services to city dwellers. However, the city dwellers are not always getting equal accessibility to health services for several reasons, and locational disparity is one of them. Spatial distribution gives an insight to understand the associated locational disparities and help to plan accordingly. The above analysis reveals that the people of the city have good availability of health centers as a whole as the serving population ratio of UPHC's is according to NHM norms. Though the facilities are good enough to serve the population of the city, but while analyzing the spatial pattern of these facilities at zonal level using location quotient, the results revealed that there is unequal distribution of urban primary health centers.

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