Comparison of spatial distribution of pharmacies in Istanbul between 1997-2022

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Abstract

In this study, the spatial distribution of pharmacies is investigated in Istanbul by taking into consideration their important role for the health care delivery system. First, the growth of the number of pharmacies is compared with the growth rate of population at the city level during the last two decades within perspective of changes in health care delivery policies. Then, the growth of the number of pharmacies is compared with respect to the population growth rate of the core, intermediate and peripheral zones. The second, the changes in the pharmacy market areas are compared at the city level and in the core, intermediate and peripheral zones within the same period. Third, the regression analysis is used to show the relationships between the number of pharmacies in the districts and the population, number of hospital beds and number of physicians during the same period of time. Suggestions are made for more balanced distribution of pharmacies in order to prevent bankruptcies while sufficient accessibility provided for the customers, and for future research.

Keywords: pharmacies, spatial distribution of pharmacies, İstanbul, comparison of the pharmacy market areas

1. Introduction

At the beginning of the 21st century, Istanbul's population grew very rapidly due to heavy migration from rural areas as a result of globalization, closing dawn of the factories at the country side, and being the most important socio-economic and cultural center of the country, and having the higher quality of health and educational facilities as well as other services (Yazgi, et al., 2014; Koramaz & Dokmeci, 2020) Following this trend, the city has expanded in the periphery through large squatter areas, large middle class housing complexes, upper income villas (Dokmeci & Erdogan, 2021; Oruç & Dokmeci, 2017).

As a result of population increase and changes in the policy of health care provision, the number of pharmacies were increased as a significant component of primary health care services at the city level (Dokmeci & Ozus, 2004). The present study investigates the spatial distribution of pharmacies with respect to the growth of the city, multi-center development of urban structure, changes in population density which have affected the spatial distribution of needs and demand for health care facilities between 1997-2022 (Dokmeci & Berkoz, 1994; Ozus, et al. 2012).

Especially, in developing countries, pharmacists play an important role in providing information and advice on health care worldwide. This pharmacist's role as an advisor has been encouraged in order to reduce the burden of demand on physicians (Rogers, et al. 1998). Presently, this is the case in Turkey due to short supply of physicians as a result of their out-migration because of their unsatisfaction with their salaries (https://www.cumhuriyet.com.tr,2022).

Despite the importance of pharmacies, there remained of many countries have wide variations in the practice of pharmacy, not only between countries but also within countries. Nevertheless, in recent years there has been a significant convergence, driven by a number of key factors. These include World Health Organization declarations concerning the role of pharmacies according to changes in the political climate of many countries (Anderson, 2002).

A study by Sabde et al., (2002) describes the spatial distribution of private pharmacies and their characteristics in Ujjain district, Central India. Another study in India is given by Kamat (1998) on the same subject. A study by Hussain and Ibrahim (2011) illustrates that the process of dispensing practices and medication counselling differ significantly according to the location of pharmacies in Pakistan.

Palupi and Fakhruzzaman (2022) developed a model for efficient distribution of pharmacies. However, they claimed that location as a variable may not be a relevant in smaller countries or developed countries, because the shopping cost may not be a problem.

Review of literature reveals that there is a wide range of research on pharmacy location, efficiency and distribution in different developing countries. The present study compares the number, spatial distribution and their market areas of pharmacies between 1997-2022 in Istanbul and explain the relationships between the number of pharmacies and the characteristics of districts such as population, hospital beds and the number of physicians by the use of regression analysis. Background information is given in Section two. In Section three regression analysis is presented. Conclusion and suggestions for future research take place in Section four.

2. Backround

In 2022, investigation of the spatial distribution of urban pharmacies reveals that in the core area there are 341 pharmacies (6.6%) although the population ratio is 3.8 percent since market area of these pharmacies beyond the boundaries of this area supplied by alternative transformation systems. In the intermediate zone, there are 1437 pharmacies (27.9%) while the population ratio of this zone is 17.7 percent since some of the districts in this zone are higher income districts such as Kadikoy which has the highest number of pharmacies (442) in the city. In the periphery, there are 1778 pharmacies (65.5%) with respect to its population ratio is 78.5 percent in the city which has large squatter areas. Still, the large number of pharmacies in this zone, can be explained by the government policy of free medical care and medicine during the last two decades.

With respect to pharmacy market areas (number of people per pharmacy) while in 1997, the average pharmacy market area was 2494 people, in 2022, average pharmacy market area was increased to 3123 people since the population growth rate was higher than pharmacy growth rate such as between 1997-2022, the growth rate of pharmacies was % 53.7, while the growth rate of population was %74.3.

Comparison of pharmacy market size according to concentric zones reveals that the core area has the smallest pharmacy market area (1368 people) since the population is smaller than the other zones. In 2022, it almost stayed the same as 1369 people due to conservation policies to control the construction in the core area.

In the intermediate zone, in 1997, the pharmacy market size was 1688 people and it increased to 1978 due to changes in the district boundaries. In the periphery, in 1997, the pharmacy market size was 3723 people, in 2022, it increased to 3747 people. During this period, while population growth rate was %116, the growth rate of the number of pharmacies is %115 in this zone.

Despite various pharmacy market sizes in Istanbul, there is a strict control on the market areas in developed countries, such as in Spain 2118 people per pharmacy, in Japan 2222 people per pharmacy, in Greece 1136 people per pharmacy. Also, pharmacy opening and pharmacy location are heavily regulated in Italy (Mangano, 2010). Italian regulation links market entry in each municipal district to the number of residents and the existence of other pharmacies in close

proximity. A pharmacy to population ratio of 1 to 4000 applies to municipalities with more than 12,500 inhabitants, other municipalities are allowed a ratio of 1 pharmacy to 5000 residents.

As another example, Norris (1997) illustrates that in Norway and Finland, the state controls the number and location of pharmacies through a system of pharmacy licensing and their results on provision of services.

In Turkey, in order to prevent the problems of only market-oriented location of pharmacies, such as bankruptcies because of being located near to each other, in 2012 a legal regulation based on certain population size restriction was implemented. However, this regulation could not provide efficient accessibility to customers.

3. Model

In this study, the relationships between the number of pharmacies and the characteristics of the districts are investigated by the use of regression analysis. The variables of the analysis is chosen from the previous studies such as by Dokmeci and Ozus (2004) in order to be able to compare changes of the forces that effect pharmacy location through time.

It is well known that a pure market mechanism can give rise to a density which may not be optimal. Thus, in order to develop more efficient policies to provide balanced distribution of pharmacies with respect to population, there is a need to study forces which attract pharmacies to certain districts at the expense of others.

Table 1 Population and the number of pharmacies, hospital beds and physicians in the districts in 2022

Districts	Distance to CBD (km)	Population	Number of Hospital Beds (Private Hospitals)	Number of Physicians (Private Hospitals)	Number of Pharmacies	Number of Pharmacies Calculated by the Model
Adalar	40	14,522	0	0	9	20.51917746
Şile	84	30,218	0	0	9	25.50873795
Çatalca	55	63,467	0	0	23	32.32559779
Silivri	72	150,183	332	96	47	80.85779037
B.Çekmece	47	201,077	175	85	71	86.09738600
Tuzla	47	197,657	81	59	71	82.94253721
Arnavutköy	35	206,299	0	15	74	80.62742885
Beykoz	22	246,352	120	68	74	84.14659714
Güngören	14	307,573	86	80	75	85.22199712
Çekmeköy	20	193,182	0	0	80	74.29954692
Bayrampaşa	8	269,774	148	80	83	85.73407289
Sultanbeyli	39	302,388	98	69	91	97.50880063
Eyüp	6	356,512	31	34	100	104.6544480
Zeytinburnu	5	292,407	235	147	101	100.0518166
Beyoğlu	4.5	246,152	40	42	102	69.50927036
Bakırköy	14.5	221,336	188	257	105	98.02487567
Esenler	19	458,694	354	84	108	127.2975941
Sarıyer	28	288,959	321	233	108	123.8294534
Beylikdüzü	38	229,115	356	296	109	141.6752792
Kağıthane	14	421,356	33	81	116	117.3889555
Avcılar	27	395,274	333	147	118	135.8507216
Beşiktaş	5	186,067	261	393	120	106.0809169
Sancaktepe	46	278,998	75	68	130	121.3368291
Kartal	33	443,293	31	136	135	128.7175117

Districts	Distance to CBD (km)	Population	Number of Hospital Beds (Private Hospitals)	Number of Physicians (Private Hospitals)	Number of Pharmacies	Number of Pharmacies Calculated by the Model
Başakşehir	20	316,716	0	0	138	116.7089342
Sultangazi	25	492,212	269	112	142	146.5616951
GOP	14	488,258	819	359	145	183.4883939
Ataşehir	23	395,758	790	469	147	181.9225440
Şişli	22	318,217	607	916	162	197.9725845
Bahçelievler	14	600,162	751	659	182	237.2640046
Ümraniye	22	645,238	391	297	189	207.9196467
Maltepe	28	460,955	176	182	190	147.7650766
Üsküdar	13	535,916	672	512	191	202.1273531
Bağcılar	20	749,027	974	535	194	258.3729727
Pendik	52	625,797	182	227	194	195.8028178
K.Çekmece	18	721,911	299	428	222	235.2210278
Fatih	3	428,857	69	98	239	106.4125467
Esenyurt	34	553,369	306	121	248	234.6180706
Kadiköy	20	521,005	1022	657	443	222.6349879

Table 2 Regression Results

Regression Statistics	
Multiple R	0.791485160
R Square	0.626448758
Adjusted R Square	0.594430080
Standard Error	49.63267204
Observations	39

Table 3 Regression Results

ANOVA					
	df	SS	MS	F	Significance F
Regression	3	144590.1	48196.72	19.56510	1.2721E-07
Residual	35	86219.07	2463.402		
Total	38	230809.2			

Table 4 Regression Results

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	17.2846067	17.91349	0.964892	0.341218	-19.0817	53.6509	-19.0817	53.65093
Population	0.00019756	0.000042	4.625220	0.000049	0.000110	0.000284	0.000110	0.0002842
Bed Number	0.03438596	0.053980	0.637001	0.528268	-0.07520	0.143973	-0.075201	0.1439731
Number of Physicians (Private Hospitals)	0.11315341	0.067924	1.665868	0.104666	-.024740	0.251047	-0.024741	0.2510476

The variables of the analysis such as the number of pharmacies, population, the number of hospital beds and the number of doctors are given for the year 2022 in Table 1. The results of the analysis are given in Table 2. According to the results of the regression analysis, adjusted R^2 is 0.59 and the most important variable to attract the pharmacies is the number of hospital beds in 2022 (0.11). However, in 1997, the most important variables to affect pharmacy location were population (0.51, the number of physicians in the districts (0.31) and hospital beds (0.26). The reasons for this change can be the growth of hospital beds in the districts to an unplanned degree. The pharmacies are clustered around hospitals according to their capacity. They fill the gap by supplying drugs which cannot be provided by the hospital pharmacies to in- and out-patients as in some other countries (Dokmeci & Ozus, 2004; Kaplan & Leinhardt, 1975).

Thus, the results of the study reveal that with the help of the government free medical care end medicine, although densities of pharmacies in the districts are close to the Italian regulations, their distributions in the districts don't take into consideration accessibility to the customers.

4. Conclusion

This study investigated the spatial distribution of pharmacies in Istanbul by taking into consideration the growth of population, hospital beds, physicians and changes in the government health care policy between 1997-2022.

The health care delivery system is characterized by a gross disparity between different districts according to their rapid development and differences in their socio-economic level. However, spatial distribution of pharmacies reflects quite balanced distribution at the city level due to support of government free health care delivery system and medicine.

Comparison of the pharmacy market areas between 1997-2022, reveals that they increased from 2546 to 3123 people which is smiler to some developed countries such as Spain, Japan and Italy. This varies among the zones of the city but still similar values to developed countries. On the other hand, spatial distribution of pharmacies within the districts, not convenient neither accessibility of customers nor maximization of their profits due to clustering of pharmacies in certain areas result in sometimes in bankruptcies.

It is necessary to develop models for pharmacy location which provides efficient accessibility for the customers and sufficient profits for the pharmacies. Investigation of the purchasing drugs through the internet left for future research.

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Resume

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