GIS BASED ACCESSIBILITY RESEARCH OF THE COMMUNITY PHARMACY SERVICES IN DISTRICTS WITH HIGH NUMBER OF COVID-19 CASES DURING PANDEMIC IN ISTANBUL

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ABSTRACT: Pharmacies are one of the basic components of health services in settlement centers. Providing pharmacy services to the community efficiently can be achieved with the sufficient number of available pharmacies precisely distributed within the settlement areas. Especially in extraordinary times as the Covid-19 Pandemic, the adequate and accessible service of pharmacies contributes surveillance by reducing the potential contacts. In this study, two districts with high number of COVID-19 cases in İstanbul, Bağcılar and Esenler districts, were examined using geographic information technology. In this context, the number of pharmacies in the study area and their spatial distribution were examined and a neighborhood-based service adequacy assessment was provided. In addition, pharmacies with fast pedestrian access were determined by evaluating the defined service area of each pharmacy together with demographic data. Policies for effective pandemic management that can be applied in regions with limited or no service access within international standards were discussed. The main findings of the study are that although there are sufficient number of pharmacies for the living population in both districts where unplanned urbanization is dominant, the population without pedestrian access within the standards is remarkable due to the imbalances in the spatial distribution of the existing pharmacies in the study area. It is important to establish temporary service points in these regions during the pandemic so that this problem, which is especially appeared in neighborhoods with high population density far from the district center, does not adversely affect the pandemic management. After the pandemic, studies should be planned to improve the existing unequal service distribution by considering the service demand and service usage habits of the people of the region.

1. INTRODUCTION

Pharmacist is defined as the healthcare professional who has graduated from the Faculty of Pharmacy or the School of Pharmacy, or who has proven and registered the adequacy of her education in foreign schools according to the Law, and is authorized to carry out pharmacy activities (RPP, 2014). Pharmaceutical care is the responsible delivery of drug therapy aimed at achieving specific outcomes that will improve a patient's quality of life (Hepler and Strand, 1990). Pharmaceutical care involves the process by which the pharmacist develops a treatment plan that will lead to specific therapeutic outcomes for the patient (Sancar et al., 2013). Community pharmacies in Turkey are legally structured as private companies operated by professional pharmacists graduated from based on the law No: 6197 currently in force. All owners and managers must be registered with the regional chamber of pharmacists. Due to the 'Regulation on Pharmacists and Pharmacies' published in the Official Gazette dated 12 April 2014 and numbered 28970, the number of community pharmacies is regulated as one pharmacy for at least 3500 people, according to the population within the district boundaries (Toklu et al., 2010; Tekiner, 2014; Bilgener and Ünal 2019). However, in case of population decrease due to natural disasters and force majeure, the criterion of opening a pharmacy according to the population is not applied in the transfer of pharmacies located in that settlement (RPP, 2014).

In Turkey, local pharmacists act not only as drug smugglers and consultants for patients, but also as trusted and respected professionals in the community. The vast majority of patients prefer to consult a pharmacist first rather than make an appointment with a doctor, which also demonstrates the importance of public pharmacies in achieving better public health outcomes (Tekiner 2006b). During the coronavirus disease (COVID19) pandemic, public pharmacists are the first stop for most people. They are primarily responsible for the delivery of drugs and medical devices, and for the provision (FIP, 2020; Bektay et al. 2021). Community pharmacies operating within the scope of Law No. 6197 are defined as 1st level health institutions with the Circular No. 2019/10 on the cascading of health service providers published by the General Directorate of Health Services of the Turkish Ministry of Health (Circular, 2019). Although Community Pharmacies are positioned as primary health care institutions, they are actually commercial establishments (Bilgener and Ünal 2019).

As pharmacies play an important role in providing information and health advice to people on low incomes especially in developing countries, equal and fair access to the pharmacy service that must be socially available is crucial for the community. However, an unbalanced distribution of pharmacies relative to that of the population will severely limit poor people's access to pharmacy services. Inequities in accessing community pharmacy service as one of the public health services during pandemic period have worse impacts on the public health since pharmacists are now involved in not only drug delivery, COVID19 prevention and medical equipment, but also COVID19 related medical information. With ease of access and accessibility as a first point of contact, pharmacists are committed to early detection, guidance and facilitation of various government measures to prevent or slow the spread of disease and to help raise public awareness (Hoti et al. 2020). Several research studies have already been performed for understanding the availability and the accessibility of the public health services including community pharmacies as well as their role during COVID-19 pandemic across the world (Makuc et al., 1991; Dökmeci et al., 2000; Aliağaoğlu and Uğur, 2010; Kelling, 2015; Bektay et al., 2020; Hoti et al., 2020). Similar to the previous researches this study aims to explore the availability and the accessibility of the community pharmacy services provided in two districts of İstanbul with high number of COVID-19 cases.

2. MATERIAL AND METHOD

2.1 Study Area

With more than 15 million inhabitants, Istanbul is the most populated city of Turkey and it is an important socio-economic and cultural center. The tremendous growth of Istanbul after the 1950s is due to both natural growth and rural exodus, which affected the socio-economic and cultural conditions, as well as the physical structure of the city. The city, which bridges the continents of Asia and Europe with Bosporus, composed of 32 districts. Bağcılar and Esenler were selected as study area within the scope of this study due to their high population density and unplanned physical structure. Those districts have also had high number of COVID-19 cases during the pandemic period. The location of the study area in İstanbul is presented through Figure 1.

Figure 1. Study Area

Esenler is composed of 17 neighborhoods, with a total area of 5.227 acres. Apart from being a residential region, it is also an industrial region. Esenler came 11th in size and 12th in population in Istanbul. The district is located northwest of Istanbul, 5 km away from the city center in the Marmara region. Gazi Osman Pasa borders it in the north, Gungoren in the south, Zeytinburnu in the southeast, and Bagilar in the west. Esenler has a unique location on Istanbul's

transport axis, making it easy to access the lively bridges in a short time and connecting Istanbul's European and Asian sides quickly.

Bagcilar Istanbul spans an area of approximately 22 km, consisting of many, 22 neighborhoods, the most famous of which are Gunesli, Mahmutbey, Harriet, Kamal Pasa, Kirazli and Fatih. In Bagcilar, which is one of the most important commercial and industrial centers in Istanbul, there is a great diversity of textile industries, food, metal industries, journalism, small and large workshops, and business and trade centers.

2.2 Data

This study basically used road network and pharmacy locations in two districts covered by the study area. Administrative districts (polygon) and road network (line) vector data were downloaded as shape files from the Open Street Map (Download OpenStreetMap data for this region, 2020) platform (Ramm et al., 2014). This is an open source platform where crowed sourced spatial data of the world is published and shared. Additionally, polygon data of the) neighborhoods in each district, building based population information and locations of the existing pharmacies (point) were also provided by Istanbul Metropolitan Municipality City Planning Directorate. Geodetic reference of the obtained data was set as TUREF-TM30 (Turkish Reference Frame Transfer Mercator zone 30) based on the national standards applied for Geographic Information System (GIS) implementations.

2.3 Methodology

Within the scope of this study, first of all a GIS was established for determining the service areas of each pharmacy located in the study area. For this purpose, road network data was created by using road geometries and then network based service area determination was performed for both study areas. Accessibility and availability of the community pharmacies were evaluated by outlining the population with an easy access to the determined community pharmacy service. Service area determination were carried out by the use of network analysis solutions provided by GIS technology and availability of the services in the study area were examined through GIS by overlaying the service areas with the population data for each district.

3. RESULTS

Table 1 presents the number of the community pharmacies (CPs)allowed by love based on the regulations in act depending on the populations of each neighborhood in Esenler and Bağcılar. The number of the existing community pharmacies by neighborhood also depicted in the table. As presented in the table total number of existing pharmacies in both districts is less than the number allowed by law based on the demographic criteria of sufficient number of CPs by total populations. Although both districts have not the sufficient number of CP service, the gap in between the numbers is greater in Esenler (31) than the one existing in Bağcılar (19). Distribution of the PCs by neighborhood is also presented in the Table 1. When the existing and allowed number of CPs are compared the inequities in the number of CPs based on the neighborhood population can be outlined.

Figure 2 represents samples of the road network created and some services areas determined for selected pharmacies. The final results of the service area determination process were presented in the Figure 3 as thematic maps of Esenler and Bağcılar districts.
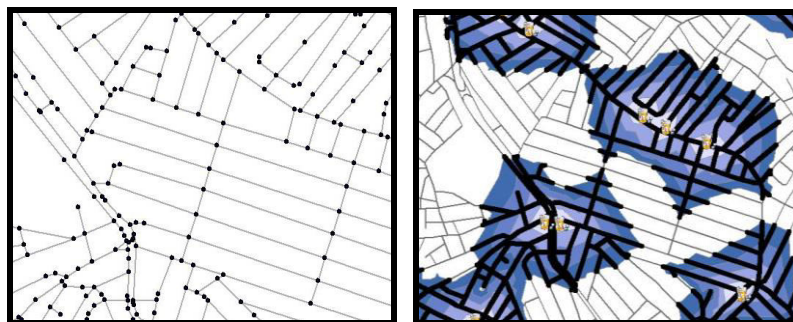

Figure 2. Sample network data (left side) and sample service areas of the community pharmacies (right side)

Table 1. Detailed information by neighborhoods in Bağcılar and Esenler

District Name	Neighborhood Name	Population (2016)	Area (ha)	Num of CPs	Num of Existing CPs
Bağcılar	100. Yıl	49848	113	14	12
	Bağlar	15241	137	4	4
	Barbaros	21995	44	6	9
	Çınar	36783	64	11	12
	Demirkapı	55978	107	16	9
	Evren	51288	189	15	11
	Fatih	45976	62	13	15
	Fevzi Çakmak	36001	77	10	6
	Göztepe	36300	157	10	11
	Güneşli	46053	123	13	20
	Hürriyet	25017	58	7	7
	İnönü	24755	50	7	6
	Kazım Karabekir	28662	50	8	5
	Kemalpaşa	34773	55	10	4
	Kirazlı	43541	96	12	8
	Mahmutbey	24411	459	7	7
	Merkez	26225	76	7	10
	Sancaktepe	19742	40	6	7
	Yavuz Selim	29202	62	8	7
	Yenigün	23448	27	7	6
	Yenimahalle	35620	78	10	8
	Yıldıztepe	40651	60	12	11
Bağcılar Total		751510	2184	215	196
Esenler	Military Area	0	796	0	
	Birlik	28331	61	8	8
	Çifte Havuzlar	2582	119	1	2
	Davutpaşa	16751	21	5	1
	Fatih	46199	51	13	7
	Fevzi Çakmak	34166	49	10	9
	Havaalanı	33776	62	10	13
	Kazım Karabekir	36141	42	10	4
	Kemer	22245	76	6	5
	Menderes	33418	44	10	8
	Mimar Sinan	12996	17	4	6
	Namık Kemal	16393	24	5	2
	Nine Hatun	43561	50	12	10
	Oruçreis	45169	275	13	10
	Tuna	34069	72	10	7
	Turgut Reis	47529	59	14	6
	Yavuz Selim	3905	24	1	2
Esenler Total		457231	1842	131	100

Figure 3 and Figure 4 represents the service areas of each community pharmacy as 50, 100, 150 and 200 m walking distance bands in Esenler and Bağcılar respectively. As presented in both thematic maps existing community pharmacies in both districts have a limited coverage in terms of their services areas with respect to the district areas.

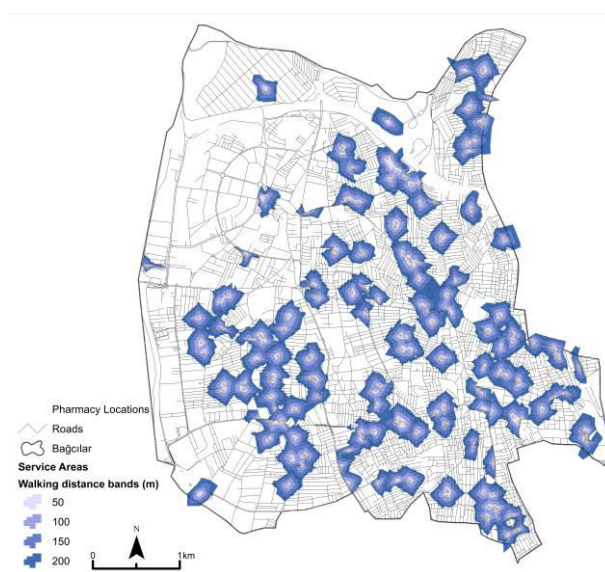**Figure 3.** Service areas of the community pharmacies in Esenler

Figure 4. Service areas of the community pharmacies in Bağcılar

3. CONCLUSIONS

As a result of this study, it has been seen that GIS technology can be used both to examine the spatial distribution of

existing data and to evaluate the potential need and to guide future studies. It will be useful to use and interpret this analysis effectively for strategic decision making in public services and for an effective process management in emergencies. In future studies, by determining the network paths with the minimum maximum walking distance range, it will be possible to determine the regions where pharmacies are needed on a district basis. Service Network Analysis, an available too provided by GIS technology, can facilitate understanding and resolving issues of this nature. Executing the service area analysis process on the network creates service area polygons. The population distributions within the service areas created according to the determined impedance can also be summed up and if there is any inequality on the basis of pharmacies according to this population, it can be revealed. In addition, with a socially inclusive approach, the transportation accessibility needs of the elderly in the neighborhoods can be taken into consideration.

References

Aliağaoğlu, A. and Uğur A., 2010. Spatial Distribution of pharmacies in City of Ankara, Eastern Geographical Review – 29

Bektay, M.Y., Okuyan, B., Sancar, M., Izzettin, F.V., 2021. Insight into Turkish community pharmacists' services in the first wave of the COVID-19 pandemic. Disaster Med Public Health Prep. doi: https://doi.org/10.1017/dmp.2021.185.

Circular, 2019. T.R. Ministry of Health, Circular on the Cascading of Health Service Providers, General Directorate of Health Services, Number: 2019/10, Access Address: https://dosyamerkez.saglik.gov.tr/Eklenti/30975,tara0006pdf.pdf?0.

Dökmeci, V., Özus, E., 2000. Spatial Analysis Of Urban Pharmacies In Istanbul, 40th Congress of the European Regional Science Association: "European Monetary Union and Regional Policy", August 29 - September 1, 2000, Barcelona, Spain, European Regional Science Association (ERSA), Louvain-la-Neuve

Erkal, T., 2013. Eskişehir'de acil durum yönetiminde ağ (network) analizlerinin kullanılması. Türk Coğrafya Dergisi, (61), 11-20.

FIP, 2020. International Pharmaceutical Federation FIP. Coronavirus SARS-CoV-2/COVID-19 pandemic: information and interim guidelines for pharmacists and the pharmacy workforce. 2020. https://www.fip.org/files/content/priority-areas/coronavirus/COVID-19-Guidelines-for-pharmacists-and-the-pharmacy-workforce.pdf. Accessed March 22, 2021.

Hepler, C.D., Strand, L.M., Opportunities and responsibilities in pharmaceutical care, Am J Hosp Pharm 47, 533-543. 1990.

Hoti, K, Jakupi, A., Hetemi, D., Raka, D., Hughes, J., Desselle, S. 2020. Provision of community pharmacy services during COVID-19 pandemic: a cross sectional study of community pharmacists' experiences with preventative measures and sources of information, International Journal of Clinical Pharmacy (2020) 42:1197–1206. https://doi.org/10.1007/s11096-020-01078-1

Kelling, S.E., 2015. Exploring Accessibility of Community Pharmacy Services. Inov Pharm. 2015;6(3): Article 210. http://pubs.lib.umn.edu/innovations/vol6/iss3/6

Makuc, D. M., Haglund, B., Ingram, D. D., Kleinman, J. C., & Feldman, J. J., 1991. The use of health service areas for measuring provider availability. The Journal of Rural Health, 7, 347-356.

Ramm, F., Names, I., Files, S. S., Catalogue, F., Features, P., Features, N., & Cars, C. (2014). OpenStreetMap Data in Layered GIS Format. Version 0.6, 7.

Sancar, M., Okuyan B., Apikoğlu Rabus, S., İzzettin, F.V., 2013. Opinion and Knowledge Towards Pharmaceutical Care Of The Pharmacists Participated In Clinical Pharmacy And Pharmaceutical Care Continuing Education Program. Turk J Pharm Sci 10 (2), 245-254, 2013

Tekiner, H., 2014. Pharmacy in Turkey: past, present, and future, Pharmazie 69: 477–480 (2014) doi: 10.1691/ph.2014.3878

Toklu, H.Z., Akıcı, A., Oktay, S., Cali, S., Sezen, S.F., Keyer Uysal, M. 2010. The pharmacy practice of community pharmacists in Turkey. Marmara Pharm J. 2010;14:53–60