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Accessibility as a Determinant of Health Expenditures in Primary Health Care Services

Birinci Basamak Sağlık Hizmetlerinde Sağlık Harcamalarının Belirleyicisi Olarak Erişilebilirlik

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Abstract

The present study aims to determine the accessibility of family health centers and to evaluate the factors influencing accessibility in health expenditures from multiple perspectives. In line with the purpose of the study, the study universe comprises 27 family health centers in Erzurum. No sampling method was employed; rather, the entire universe was included in the study. In the study, the accessibility status of family health centers was evaluated with GIS analysis using quantitative spatial analysis method. The findings of the study indicate that four neighborhoods in Erzurum (Rabia Ana, Kazım Karabekir Paşa, Abdurrahman Gazi, Muftü Solakzade) are in compliance with the Spatial Plans Construction Regulation, as they have access to family health centers. It is notable that no neighborhood has 100% access to a family health center, whether within its own neighborhood or in nearby neighborhoods. The highest rate of access to Erzurum on a neighborhood basis is 43.8%. Two neighborhoods (Yarımca and Muratpaşa) are devoid of any family health centers. It is anticipated that the implementation of health strategies tailored to the provision of primary health care services in Erzurum's Yarımca, Hüseyin Avni Ulaş, and Kurtuluş neighborhoods has the potential to reduce health expenditure. Furthermore, it is hypothesized that the undertaking of initiatives to enhance the quality of primary health care services in Yunusemre, Ilıca, and Saltuklu neighborhoods could yield positive outcomes.

Keywords: Accessibility, Health Services, Health Expenditures, Health Economics, Health Geography, GIS Analysis.

Öz

Bu çalışma, aile sağlığı merkezlerinin erişilebilirliğini belirlemeyi ve sağlık harcamalarında erişilebilirliği etkileyen faktörleri çok yönlü olarak değerlendirmeyi amaçlamaktadır. Çalışmanın amacı doğrultusunda, çalışma evrenini Erzurum'daki 27 aile sağlığı merkezi oluşturmaktadır. Herhangi bir örnekleme yöntemi kullanılmamış, evrenin tamamı çalışmaya dâhil edilmiştir. Çalışmada aile sağlığı merkezlerinin erişilebilirlik durumu nicel mekânsal analiz yöntemi kullanılarak CBS analizi ile değerlendirilmiştir. Çalışmanın bulguları, Erzurum'daki dört mahallenin (Rabia Ana, Kazım Karabekir Paşa, Abdurrahman Gazi, Müftü Solakzade) aile sağlığı merkezlerine erişimi olduğu için Mekânsal Planlar Yapım Yönetmeliği'ne uygun olduğunu göstermektedir. Hiçbir mahallenin kendi mahallesi içinde ya da yakın mahallelerde ASM'ye %100 erişimi olmaması dikkat çekicidir. Erzurum'da mahalle bazında en yüksek erişim oranı %43,8'dir. İki mahallede (Yarımca ve Muratpaşa) aile sağlığı merkezi bulunmamaktadır. Erzurum'un Yarımca, Hüseyin Avni Ulaş ve Kurtuluş mahallelerinde birinci basamak sağlık hizmetlerinin sağlanmasına yönelik sağlık stratejilerinin uygulanmasının sağlık harcamalarını azaltma potansiyeline sahip olduğu öngörülmektedir. Ayrıca, Yunusemre, Ilıca ve Saltuklu mahallelerinde birinci basamak sağlık hizmetlerinin kalitesini artırmaya yönelik girişimlerde bulunulmasının olumlu sonuçlar doğurabileceği varsayılmaktadır.

Anahtar Kelimeler: Erişilebilirlik, Sağlık Hizmetleri, Sağlık Harcamaları, Sağlık Ekonomisi, Sağlık Coğrafyası, CBS Analizi.

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INTRODUCTION

Over half of the global population (4.5 billion people) are deprived of access to fundamental health services. Over 1.3 billion people lack sufficient access to medicines and primary health care, while nearly 2 billion people face financial constraints due to limited access to health services (Birleşmiş Milletler Türkiye, 2023). Access to health services is a significant factor in the development and funding of health systems. In line with the World Health Organization's "global strategy for health for all by the year 2000", a series of initiatives have been implemented with the aim of enhancing the affordability of financing health services on a global scale (World Health Organization, 1978). In this regard, the amounts payable under social security systems are designed with due consideration for the ability of individuals to pay. Nevertheless, despite the provision of convenient financing options, various obstacles (geographic, locational, and socio-demographic) may impede access to health services. In order to facilitate access to health services and ensure the optimal management of the service process, health services are offered in numerous countries' health systems (Germany, Slovenia, New Zealand, England, Türkiye, etc.) through a stepwise approach. In this context, primary health care services serve as the foundation of the service process in order to guide patients properly and prevent unnecessary health expenditures.

Primary healthcare services are individuals' first line of contact with the healthcare system when they experience a medical issue (Allen et al., 2002). This characteristic of primary healthcare services allows for the cost-effective and systematized management of healthcare services (Forrest and Starfield, 1998; Franks et al., 1992). The "World Health Report 1998" published by the World Health Organization states that there are several key principles in achieving the goals of the healthcare service provision process. These include emphasizing primary healthcare services, designing hospital systems to support primary healthcare services, establishing the necessary integration between services, and implementing a referral chain that incorporates inter-service feedback (World Health Assembly, 2002). As a matter of fact, the implementation process of primary health care services differs according to each region and country.

While the specifics of primary health care services may vary depending on the particular characteristics of the country in which they are implemented, the referral system represents one of the fundamental tenets of the family medicine model. The referral system has been demonstrated to result in a notable reduction in unnecessary expenditures on hospitals and medicines. According to previous studies on the referral system in the family medicine system, total health expenditures decreased by a range of 8% to 80% in countries where this system is implemented (Etter and Perneger, 1998; Holdsworth et al., 2006). However, it should be noted that the findings are not entirely consistent, with some studies reporting greater reductions than others. Conversely, the implementation of the referral chain has been shown to reduce emergency room visits (Etter and Perneger, 1997; Bektemür et al., 2018) and the number of patients per day in hospital outpatient clinics (Escarce et al., 2001; Olivarius et al., 1994; Laditka and Laditka, 2001).

In Türkiye, studies on the referral system commenced within the context of the family medicine model. In 2003, the importance of the referral system was emphasized in the context of the "Health Transformation Program" published under the title "Effective, Graded Chain of Referral" with the statement "*We are aware that the majority of patients' problems can be solved in primary care and that hospital outpatient clinics are full of such patients*" (T.C. Sağlık Bakanlığı, 2003). The implementation of a referral chain within the family medicine system has the potential to facilitate advancements in various areas. The family medicine system facilitates a more effective and economical utilization of resources in the provision of secondary and tertiary health care services. This is achieved by ensuring that individuals are directed to the most appropriate health institution and that the diagnosis and treatment of diseases are carried out at the optimal step for the type of disease. This approach allows for the prevention of patients being directed to inappropriate health institutions, unnecessary health expenditures, overuse of secondary and tertiary health services, irregularities in services, prolonged waiting times, and instances of patient mistreatment (Aile Hekimliği Türkiye Modeli, 2004; Resmi Gazete, 2013).

The implementation of the referral chain represents a fundamental tenet of the family medicine system. The objective is to avert overcrowding in secondary and tertiary health services through the implementation of a preventive health services and

referral system, as outlined by the General Directorate of Public Health (2024). The Family Medicine Law (Resmi Gazete, 2004) stipulates the development of primary health care services, with due consideration given to the specific needs of individuals, the maintenance of comprehensive health records, and the accessibility of services. Following the enactment of the 2004 "Law No. 5258 on Family Medicine Pilot Implementation," the 1961 "Law No. 224 on Socialization of Health Services" was amended, and the "Family Medicine Model" was introduced in Türkiye (Resmi Gazete, 2004a; Resmi Gazete, 1961).

The Ministry of Health seeks to achieve a number of positive outcomes in the field of health services for individuals, including an increase in life expectancy at birth, a rational use of medicines, greater equity, a reduction in maternal and child mortality, effective human resources management, sound material management, and so forth. These outcomes are to be achieved through the implementation of a robust primary health care service and an effective referral system. In addition to the aforementioned issues, the objective of improving "access to health services between rural and urban areas and between east and west" through the family medicine model and referral system is also a priority (T.C. Sağlık Bakanlığı, 2003). This situation once again highlights the importance of ensuring access to family health centers/primary health care services.

The location and architectural design of health institutions are selected in accordance with a number of legal bases and objectives. In determining the location of a hospital, consideration is given to the placement of the health institution in a location that is easily accessible to all. In this context, a number of regulations have been issued, including the Unsanitary Establishments Regulation (1995), the Spatial Plans and Construction Regulation (2014), and the Environmental Impact Assessment Regulation (2022). However, there are instances when the opposite occurs, as evidenced by the repeal of the Regulation on Non-sanitary Establishments, which entered into effect in 1995, by the regulation published in the Official Gazette in 2005 (Resmi Gazete, 1995; Resmi Gazete, 2014; Resmi Gazete, 2022; Resmi Gazete, 2005). This has resulted in challenges to accessing health institutions. In this context, the role of family physicians has been identified as a key factor in the effective provision of health services. Consequently, a number of efforts have been made with the aim of ensuring and facilitating access to health services.

The issue of accessibility, which plays a significant role in shaping healthcare expenditures and is supported by literature, forms the primary motivation for this study. In this regard, the aim of the study is to determine the accessibility of primary healthcare institutions in Erzurum in order to prevent direct and indirect expenditures on healthcare services. It is believed that identifying the accessibility of primary healthcare institutions (family health centers), which are becoming increasingly important in Türkiye's healthcare system, particularly in line with the "Healthy Türkiye Century" model, can provide policy and system designers with a strategic perspective. Furthermore, it is anticipated that identifying the role of accessibility to primary healthcare institutions in healthcare expenditures could bring a new perspective to location policies for healthcare institutions.

A review of the literature on access to primary health care services in Türkiye reveals a lack of studies that directly access building – or dwelling-based population data. In previous studies, the population residing in the neighborhood was aggregated to the buildings within that neighborhood when determining the size of the population experiencing difficulties in accessing the aforementioned issue (Güray and Kemeç, 2016; Yasak, 2019; Deniz et al., 2021). However, it should be noted that accessibility varies from one neighborhood to another. The study was designed and conducted in line with these objectives and importance.

THEORETICAL FRAMEWORK

The present study aims to determine the accessibility of primary health care institutions in Erzurum with a view to preventing direct and indirect expenditures on health services. There are similar studies in the literature on this subject (Rasoulynejad, 2004; Kılınç et al., 2012; Üstü et al., 2011; Alma-Ata, 1978; Grumbach et al., 1999). Nevertheless, the present study differs from the existing literature in terms of the segment it evaluates. Erzurum is a city in the Eastern Anatolia Region that experiences high demand for health services. Conversely, given that patients from surrounding provinces are referred to Erzurum for various reasons, secondary and tertiary health institutions get overcrowded. Consequently, primary health care institutions

assume particular importance for those in need of health services, which is crucial for evaluating access to health services in Erzurum. This significance is further illustrated by the demographic data on Erzurum's population structure (T.C. Sağlık Bakanlığı, 2022; T.C. Hazine ve Maliye Bakanlığı, 2023).

Health Statistics Yearbooks (T.C. Sağlık Bakanlığı, 2022) shows a notable increase in Erzurum's total population and the number of referrals to health institutions, comprising primary, secondary, and tertiary referrals. This situation illustrates the extent of patients who are referred to Erzurum from neighboring provinces. Indeed, it is hypothesized that the significant discrepancies between primary health care services and referrals to other steps may be a pivotal factor contributing to the observed surge in health expenditures. In this regard, the absence of an obligation for primary health care services in Türkiye's health system may be a significant factor contributing to the low number of applications to primary health care services. These issues underscore the imperative of ensuring access to primary health care services in Erzurum. In addition to the economic dimension, the challenge of accessing health services is compounded by the considerable number of individuals from Erzurum or other cities and villages who seek care at this city's hospitals without having received primary health care services.

In Türkiye, studies that employ geographic information system (GIS) methodologies to assess access to health services are already available in the academic literature (Deniz, 2018; Deniz et al., 2018a; Deniz et al., 2020; Deniz et al., 2021). Nevertheless, no study in the existing literature addresses this issue in the context of Erzurum. This situation highlights the fundamental focus of the present study. Furthermore, the study will determine the extent to which family health centers (FHCs) in Erzurum are able to provide appropriate primary health care services in terms of accessibility. In this way, the accessible and inaccessible areas of the city suitable for FHCs will also be revealed. The identification of these areas will also provide the necessary information for the planning processes of health managers, municipal services, and other decision makers. In line with this significance and uniqueness, this study aims to determine the accessibility of FHCs in line with the regulations in Türkiye and to evaluate the determination of accessibility in health expenditures from various perspectives.

Studies on access to health services are included in the literature under various headings. In this direction, studies on access to health services (Ricketts and Goldsmith, 2005; Delamater, 2013, Levesque et. al., 2013, Jordan et. al., 2004, Al-Taiar et. al., 2010, Gulliford et. al., 2002, O'Donnell, 2007, Toygar and Potas, 2021, Sharma et. al., 2007; Deniz, 2018, Deniz et. al., 2018a; Deniz et. al, 2020; Deniz et. al., 2021; Yasak, 2019; Gogorcena et. al., 1992; Sousa et. al., 2020), equity in access to health services (Goddard and Smith, 2001), access to rural health services (Murawski and Church, 2009; McGrail and Humphreys, 2009; McGrail and Humphreys, 2009a, Salber et. al, 1976), rural and urban differences in health service seeking (Haggerty et. al., 2014), models of access to health services (Arrivillaga and Borrero, 2016), problems of the elderly in accessing health services (Gaans and Dent, 2018), comparison of measurement methods in access to health services (Yang et. al., 2006), and factors affecting access to health services (Dassah et. al., 2018) are found in the literature. On the other hand, various practices are observed in the healthcare systems of different countries regarding access to healthcare services.

In order to develop a system that provides fair and accessible health services, Slovenia has organized its services into three steps, with a particular emphasis on primary health care institutions at the primary step (Slovenian Ministry of Health, 2024), while access to other steps is managed by family physicians (Koçak, 2014). Similarly, in Germany's health system, there is an obligation to utilize primary health care services. Patients who do not comply with the referral system are required to bear the financial responsibility for their health care costs (Mossialos et al., 2017). In New Zealand, individuals are required to comply with the referral system except for accidents and emergencies (French, 2001). Regulations on the provision and financing of primary health care services in Türkiye started in 1990. The reforms planned to be implemented in health services and included in the development plans aimed to improve the patient referral system between the steps for the coordination of health services. In this context, it was stated that a stepwise referral system was necessary to ensure efficiency in health expenditures (Devlet Planlama Teşkilatı, 1995; Devlet Planlama Teşkilatı, 2000; Devlet Planlama Teşkilatı, 2006).

The findings of studies in the existing literature on this topic also indicate that health expenditures can be allocated in an optimal manner through the provision of primary health care services.In the study conducted by Rasoulynejad (2004), it was

demonstrated that the active involvement of patients and their relatives in the referral process has the potential to prevent unnecessary health expenditures. Similarly, the study conducted by Kılınç et al. (2012) suggests that the referral system can play a role in preventing unnecessary health expenditures. Conversely, studies have shown that the treatment of health services that can be provided in primary care in secondary and tertiary care will result in increased costs (Üstü et al., 2011). Additionally, studies have demonstrated that 85% to 90% of health problems in treatment and 96% in simple laboratory examinations can be effectively addressed in primary health care services (Alma-Ata, 1978; Grumbach et al., 1999). In light of the aforementioned issues, primary health care services and the referral process are regarded as playing a pivotal role in determining health expenditures.

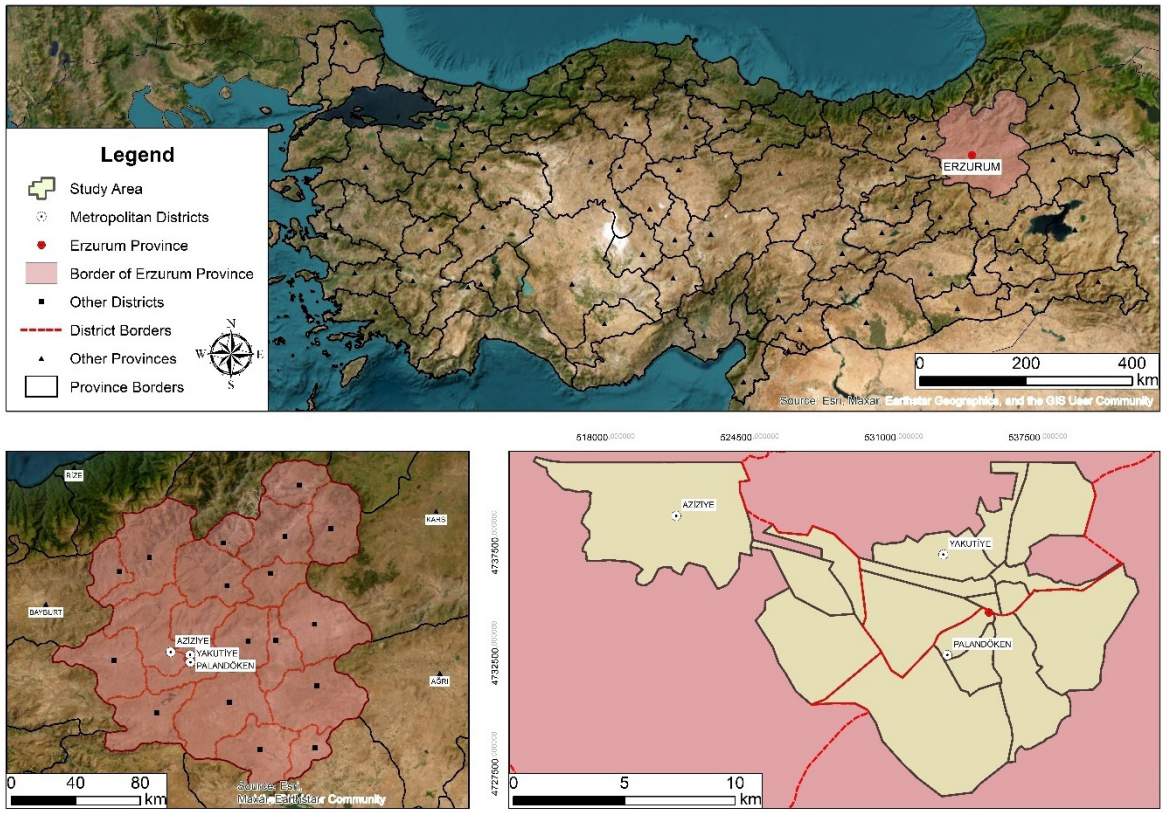
LOCATION AND MAIN CHARACTERISTICS OF THE STUDY AREA

The Erzurum province in the northeastern region of Türkiye, within the Eastern Anatolia Region it is situated between 39° and 55° north latitude and 41° 16° east. Erzurum is bordered by Artvin-Ardahan to the north, Bingöl-Muş to the south, Ağrı-Kars to the east, and Bayburt-Erzincan to the west. The study area was determined as the central metropolitan districts of Erzurum province, comprising 17 neighborhoods (Map 1). The study focused on three central districts of Erzurum: Yakutiye, Palandöken, and Aziziye.

The city is situated at an altitude of between 1750 and 2000 meters. The development of the city is largely constrained by natural factors. The elevation of the Palandöken Mountains, particularly in the southern region, has posed significant challenges to settlement, largely due to geomorphological and climatic considerations. The plain area in the northern region is not particularly conducive to settlement, due to both agricultural limitations and geological features, as well as the prevalence of swampy areas. The region is characterized by a harsh continental climate, with cold and snowy winters and relatively cool summers.

Erzurum has a long history of human habitation, with evidence of settlements dating back to 4000 BC (Kayserili, 2014). This history has been the subject of extensive research and archaeological excavations. The city, which has hosted many civilizations throughout history, has been ruled by a series of dynasties, including the Hurrians, Urartians, Sakas (Scythians), Medes, Persians, Parthians, and their successors, Romans, Byzantines, Sassanids, and Arabs (Four Caliphs, Umayyads, and Abbasids). The city has been ruled by a succession of empires and dynasties, including the Seljuk, Mongol, Ilkhanid, Kara Koyunlu, Timurid, Ak Koyunlu, Safavid, and Ottoman empires, up until the establishment of the Republic (Küçük, 2011, as cited in Zaman et al., 2018). Given the city's lengthy and complex history, the initial development of the urban center occurred in an unplanned and organic manner. During the Republican period, the city's development became more organized. This is due to the fact that Erzurum was among the first cities in the country to demonstrate a commitment to planned development during the Republican period, which followed the establishment of the modern Turkish state. The plan, prepared by the French city planner J. H. Lampert in 1938, was implemented in 1939 and was considered a successful plan by many researchers. In particular, the street systems recommended for the development and growth of the city and the population projection (based on 100 thousand people) were largely accurate (Doğanay, 1983; Doğanay, 1986). However, despite the inability to fully implement the plan due to various reasons, the main streets and street systems were developed in accordance with the plan. The functional sphere of influence of the city of Erzurum extends beyond the borders of Türkiye's Eastern Anatolia Region and includes neighboring countries (Doğanay, 1986), which made the implementation of such a plan a necessity. The plan also delineated a four-tiered road system, which remains in use today for facilitating access to health facilities. The initial level encompasses the historical center, while the final level incorporates the development zones, particularly during the Republican period (Dursun, 2020). Following the implementation of the Zeki Yapar Plan (1966-1972) and the Âlim Çopuroğlu Plan (1981), the city's zoning and transportation networks underwent significant development, with the latter becoming a crucial aspect of accessibility (Doğanay, 1986). The aforementioned plans sought to organize the city's zoning until 2000. Subsequent revisions were made based on these plans. Upon examination of these zoning plans, which played a pivotal role in the city's

development, and the criticisms levied against them, it becomes evident that while various issues pertaining to the city were highlighted, the situation of health institutions was not addressed.



Map 1. Location Map of Erzurum City

Source: It was created by the authors.

Erzurum has consistently retained its significance as a conduit between Anatolia and the Caucasus, and has persistently been selected as a settlement area despite the challenging climatic and topographical conditions. Erzurum, an important center in terms of urban centrality, had a population of approximately 30.800 (1927 census) during the Republican period. More recent censuses indicate that the population has exceeded 100.000, with the majority of the provincial population residing in Erzurum. Table 1 shows comprehensive data on Erzurum's provincial population and its evolution over time. Since population data is available up to 2008, the starting date has been set as 2008.

Table 1: Erzurum City Population and Its Ratio to Erzurum Provincial Population and Changes by Years

Years	Central Districts of Erzurum	Population of Erzurum Central District	Erzurum Population	Population Density of Erzurum
2008	Yakutiye	84.724	774.967	9.146
	Palandöken	73.763		10.506
	Aziziye	25.818		30.016
2009	Yakutiye	89.084	774.207	8.690
	Palandöken	75.106		10.308
	Aziziye	24.807		31.209
2010	Yakutiye	88.999	769.085	8.641
	Palandöken	77.152		9.968
	Aziziye	24.807		31.002

2011	Yakutiye	91.928	780.847	8.494
	Palandöken	79.546		9.816
	Aziziye	25.172		31.020
2012	Yakutiye	92.752	778.195	8.390
	Palandöken	80.543		9.661
	Aziziye	25.186		30.897
2013	Yakutiye	92.436	766.729	8.294
	Palandöken	80.508		9.523
	Aziziye	25.116		30.527
2014	Yakutiye	90.956	763.320	8.392
	Palandöken	81.969		9.312
	Aziziye	25.510		29.922
2015	Yakutiye	96.257	762.321	7.919
	Palandöken	83.878		9.088
	Aziziye	26.666		28.587
2016	Yakutiye	97.553	762.021	7.811
	Palandöken	84.690		8.997
	Aziziye	28.074		27.143
2017	Yakutiye	99.246	760.476	7.662
	Palandöken	85.370		8.908
	Aziziye	29.006		26.217
2018	Yakutiye	98.195	767.848	7.819
	Palandöken	85.601		8.970
	Aziziye	30.211		25.416
2019	Yakutiye	96.193	762.062	7.922
	Palandöken	87.856		8.673
	Aziziye	30.853		24.699
2020	Yakutiye	92.313	758.279	8.214
	Palandöken	88.310		8.586
	Aziziye	31.057		24.415
2021	Yakutiye	97.292	756.893	7.779
	Palandöken	89.455		8.461
	Aziziye	30.692		24.660
2022	Yakutiye	98.931	749.754	7.578
	Palandöken	90.541		8.280
	Aziziye	30.968		24.210
2023	Yakutiye	98.325	749.993	7.627
	Palandöken	90.703		8.268
	Aziziye	31.533		23.784
2024	Yakutiye	191.228	745.005	3.895
	Palandöken	179.286		4.155
	Aziziye	70.032		10.638

Source: TÜİK, 2024; Nüfus, 2024.

PURPOSE AND SCOPE OF THE STUDY

The present study aims to determine the accessibility of primary health care services and to evaluate the impact of accessibility on health expenditures. In Türkiye, primary health care services are provided by family health centers, which have been established in accordance with the "Health Transformation Program" (Halk Sağlığı Genel Müdürlüğü, 2025). In this context,

the objective is to facilitate access to health services and ensure their availability. The concept of accessibility in health services has been a recurring topic of discussion from various perspectives throughout Türkiye's historical health system evolution. Consequently, Erzurum, which possesses the largest regional hospitals and health facilities in Eastern Anatolia, was selected as the study area.

The Regulation on the Construction of Spatial Plans (Resmi Gazete, 2014) states that pedestrian-accessible areas should be situated within a radius of 500 meters from family health centers. This regulation serves as the benchmark for measuring access to such facilities. Health institutions constructed in accordance with the relevant regulation play a significant role in individuals' healthcare service acquisitions and can also facilitate the optimal management of healthcare expenditures. In this context, it should be noted that the Turkish health system lacks a referral system. Consequently, individuals are able to submit their health service requests to any step of health institution, including state hospitals, research hospitals, city hospitals, and so forth. This situation gives rise to difficulties in making appointments and overcrowding in the relevant health institutions, which in turn leads to an increase in health expenditures due to the inability to meet the supply and demand for health services at the optimal level. It was therefore thought that expenditures could be managed and directed correctly by determining accessibility to primary health care institutions, and a study was carried out to investigate this. In addition, as mentioned previously, it is also aimed to contribute to the prevention of unnecessary overcrowding in higher-step health institutions.

METHOD

The purpose of the present study is to determine the accessibility of family health centers and to assess the factors influencing accessibility in relation to health expenditures from multiple perspectives. The study population comprises 27 FHCs situated within the city of Erzurum.

The address information of the FHCs analyzed in the study was obtained from the Erzurum Provincial Directorate of Health, while the point data on location were obtained from the Erzurum Metropolitan Municipality. The road data, which form the basis of the network analysis in this study, were obtained from the OpenStreetMap database (OpenStreetMap, 2024). In this context, the accessibility status of 27 family health centers was evaluated through the use of GIS analysis. Given the manageable size of the FHCs population, a full enumeration method was employed. Drawing of the necessary maps and analyses Network analyses and map design were made via Arcgis 10.2 software. Datasets were georeferenced WGS-1984 UTM Zones.

When assessing accessibility to family health centers, housing types were not taken into account, and all buildings were evaluated in the same category. The findings of the research were based on the statement in Article 12, subparagraph 2 of the Spatial Plans Construction Regulation: "*In zoning plans; playgrounds, open neighborhood sports areas, family health centers, nurseries, kindergartens and primary school functions can be planned in the service impact area that should be reached on foot by taking into account the distance of approximately 500 meters, secondary schools approximately 1.000 meters and high schools approximately 2.500 meters*" (Resmi Gazete, 2014). In accordance with the regulation, 500 meters was accepted as the optimum distance when determining the service area. However, in order to ensure the interpretation of the analysis was as accurate as possible, distances both closer and further away from this distance were also taken into consideration.

The implementation phase of the study commenced with the digitization of the data collected from the institutions into digital maps. In this regard, the initial step was to create a map of the location in question, which was then digitized to include the locations of family health centers. Topology was applied to the road data obtained from OpenStreetMap, and any erroneous data was corrected. The errors fixed generally involve incorrect overlaps in the road network within the dataset and the adjustment of roads that have been left incomplete or with gaps. These operations were performed during topology by selecting the "Must Not Overlap" and "Must Not Have Gaps" commands in the "Add Rules" tab. Subsequently, the completeness of the road data was verified. Subsequently, a network dataset was constructed from the road data following the application of topology. The dataset created was comprised of both locations of family health centers and other pertinent data. A network analysis was conducted using the ArcGIS software to identify service areas within specified distances. These distances ranged

from 100 to 1.000 meters, with increments of 250 meters, and included areas within a 100-meter, 250-meter, 500-meter, 750-meter, and 1.000-meter pedestrian walking distance. The number of dwellings within the specified walking distances was determined with the assistance of the selection function, and the number of dwellings within each distance range was subsequently calculated. Following the completion of the analysis, the current situation was explained with consideration of the appropriate walking distance as outlined in subparagraph 2 of Article 12 of the Spatial Plans Construction Regulation.

FINDINGS

Findings Based On Descriptive Statistics

The location of health institutions is important, and the place where they are constructed is determined in accordance with specific regulations. In this context, it is of great importance that family health centers are located in an accessible location for reasons such as the absence of co-payment in the health system, especially in primary health care institutions (SGK, 2024), and because they represent the first point of contact with the health care system. Table 2 shows the historical evolution of primary health care institutions in Türkiye and Erzurum.

Table 2: Changes in Primary Health Care Institutions in the Historical Process (2006-2022)

Years	Türkiye			Erzurum	
	Health Center	Family Health Center	Family Medicine Unit	Family Medicine Unit	Population per Family Medicine Unit
2006	5.250	-	-	-	-
2007	4.944	943	-	-	-
2008	4.297	1.765	-	-	-
2009	3.842	2.086	6.546	-	-
2010	-	6.367	20.185	-	-
2011	-	6.520	20.216	-	-
2012	-	6.660	20.811	-	-
2013	-	6.756	21.175	239	3.208
2014	-	6.829	21.384	239	3.194
2015	-	6.902	21.696	240	3.176
2016	-	7.636	24.428	271	2.812
2017	-	7.774	25.198	273	2.786
2018	-	7.979	26.252	275	2.792
2019	-	7.997	26.476	274	2.781
2020	-	8.015	26.594	272	2.788
2021	-	8.057	26.928	272	2.783
2022	-	8.172	27.762	275	2.726

Source: T.C. Sağlık Bakanlığı (2008-2022).

Table 2 shows the evolution of primary health care services provided in health centers to family health centers and the population distribution in this regard. Although Erzurum admits patients to existing health institutions due to referrals or preferences, it is assumed that primary health care institutions are managed by family physicians and that each individual has a family physician, thus providing services to individuals residing in the city in general. In this context, it is proposed that a strategic perspective on the referral system and health expenditures can be gained by conducting an analysis of the accessibility issue specific to primary health care institutions.

It was hypothesized that reducing co-payments in primary health care institutions, increasing the accessibility of family health centers, and limiting the provision of services with sophisticated equipment for minor ailments could potentially reduce health

expenditures. To test this hypothesis, a study was conducted. Table 3 presents a detailed account of the health expenditures in Erzurum during the study period.

Table 3: Erzurum Province Health Expenditures (2022)

Year	Month	Health Expenditure Thousand (TRY)
2022	January	108.924
2022	February	240.298
2022	March	346.858
2022	April	470.675
2022	May	641.452
2022	June	749.406
2022	July	938.579
2022	August	1.130.466
2022	September	1.327.588
2022	October	1.536.796
2022	November	1.744.244
2022	December	1.943.168

Source: T.C. Hazine ve Maliye Bakanlığı, 2022.

As illustrated in Table 3, the highest health expenditures in Erzurum were made during the months of October, November, and December. In primary health care institutions, a number of specific conditions are monitored, including cardiovascular disease, diabetes, hypertension, and obesity. Additionally, pregnancy and childbirth are also followed up on. Routine screenings for specific cancerous diseases, including colon cancer, cervical cancer, and breast cancer, are conducted. Individuals aged 65 and above are also monitored by primary health care institutions. It is thought that by designating primary health care institutions as the primary choice for healthcare services, positive health outcomes can be achieved while simultaneously reducing healthcare expenditures. In this regard, a number of initiatives are being implemented to enhance primary health care services.

According to Article 8 (12, iii) of the "Regulation Amending the Regulation on Family Medicine Contract and Payment" published in the Official Gazette in 2024, "*persons registered to the family medicine unit during the year are subject to the public health obligation, If the number of visits per capita to private and university hospitals is equal to or lower than the number of visits per capita in the same period of the previous year, or if the number of visits per capita to all health institutions and organizations by registered persons in the previous 12-month period is less than 7, an incentive payment of 2.5% of the ceiling fee is made*" (Resmi Gazete, 2024), family physicians are expected to guide their patients in the use of primary healthcare institutions. In Türkiye's health system, where there is no obligation regarding the referral system, it is thought that individuals' health demands can be directed and health expenditures can be reduced through the relevant regulation. As a matter of fact, the recently published regulation supports this idea.

It can be said that the elevated levels of health expenditure observed in Erzurum during the months of October, November, and December when climatic conditions are difficult may be attributed to a tendency among residents to utilize secondary and tertiary health institutions. The present study focuses on the issue of pedestrian access to health institutions. Those who are likely to encounter difficulties in accessing health facilities are the elderly and children. It is therefore important to observe the age distribution of the population living in the city. Table 4 shows a statistical overview of the age distribution of the population residing in the metropolitan central districts of Erzurum, specifically the neighborhoods of Aziziye, Palandöken, and Yakutiye.

Table 4: Age Statistics for Erzurum Neighborhoods (2024)

Neighborhood Name	Age Groups				
	0-9	65+	Total Population	0-9 and 65+ Total	%
Abdurrahman Gazi	4877	1632	24940	6509	26,1
Adnan Menderes	4319	2709	29385	7028	23,9
Hüseyin Avni Ulaş	9226	2847	51414	12073	23,5
Ilıca	1287	663	8002	1950	24,4
Kazım Karabekir Paşa	1323	855	8854	2178	24,6
Kurtuluş	6901	1983	34839	8884	25,5
Lalapaşa	2547	2000	20391	4547	22,3
Muratpaşa	1390	982	10758	2372	22,0
Müftü Solakzade	3540	2542	24362	6082	25,0
Rabia Ana	2700	1372	17379	4072	23,4
Ömer Nasuhi Bilmen	4731	1734	29254	6465	22,1
Saltuklu	4463	1516	27449	5979	21,8
Selçuklu	2661	1366	17795	4027	22,6
Şükrüpaşa	6255	2335	35575	8590	24,1
Üniversite	658	101	13162	759	5,8
Yarımca	452	122	2614	574	22,0
Yunusemre	6607	3302	41608	9909	23,8
Total	**63937**	**28061**	**397781**	**91998**	**23,1**

Source: TÜİK.

Table 4 presents the distribution of the 0-9 age group and the 65+ age group, which are particularly vulnerable in the event of non-compliance with the established limits, at the neighborhood scale ("*In zoning plans; playgrounds, open neighborhood sports areas, family health centers, nurseries, kindergartens and primary school functions can be planned in the service impact area that should be reached on foot by taking into account the distance of approximately 500 meters, secondary schools approximately 1.000 meters and high schools approximately 2.500 meters*" (Resmi Gazete, 2014)). The data indicate that these age groups comprise approximately 23% of the total population. At the neighborhood level, these rates exhibit considerable variation, ranging from 21.8% to 26.1%. The relatively low values observed in the University neighborhood, which deviates from the overall distribution, can be attributed to the presence of university accommodations in this area. The absence of retired education personnel residing in these residences, coupled with the dominance of university students in the population, has led to a notable divergence in this part of the city compared to the rest of the city.

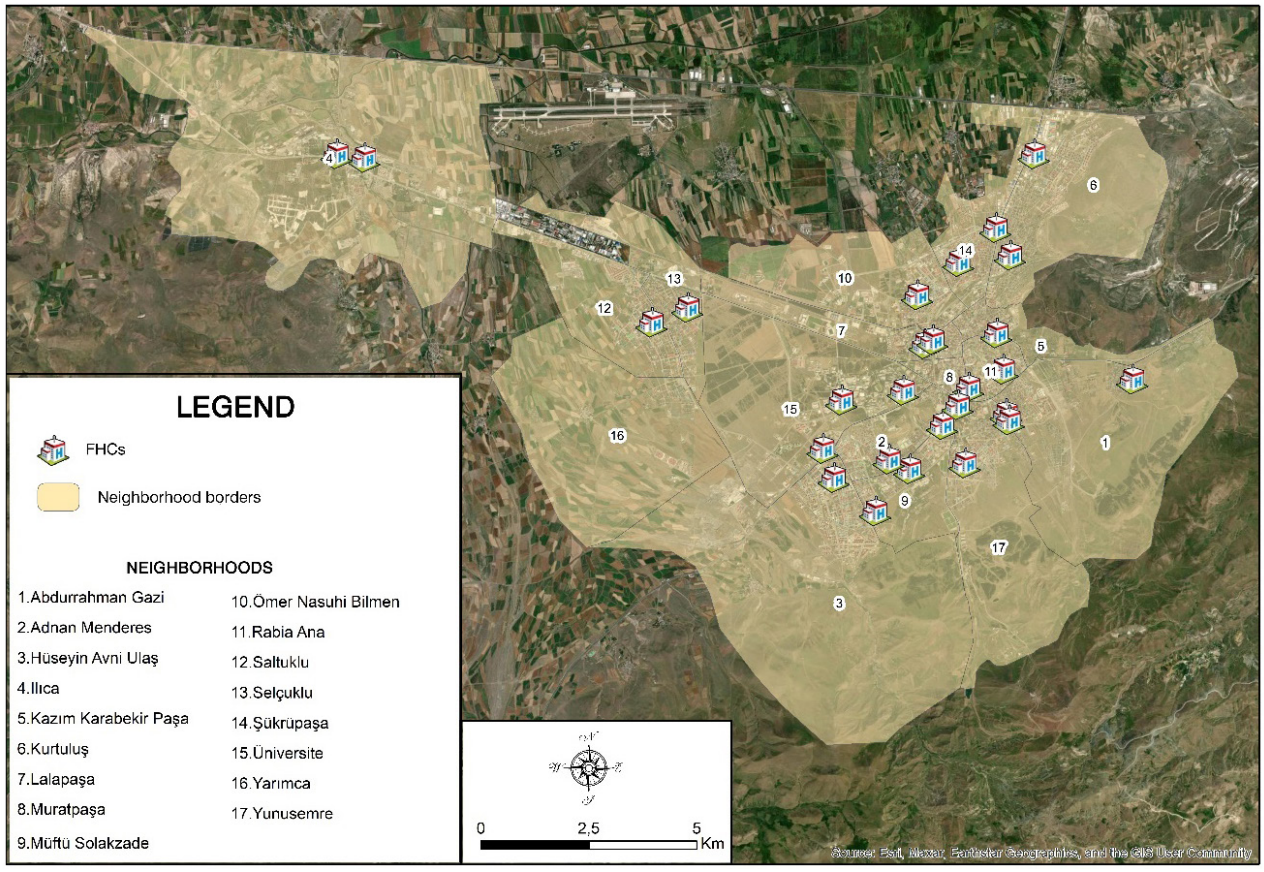
FINDINGS BASED ON SPATIAL ANALYSIS

The distribution of primary health care facilities in the study area demonstrates that a family health center is situated within the boundaries of nearly every neighborhood. While not distributed in a uniform manner throughout the city, there are 27 family health centers located within the city limits. However, it is also evident that the distribution of family health centers is not proportional to the population density. For instance, while the Hüseyin Avni Ulaş neighborhood has the largest population in the city, it is served by only one family health center. Despite the relatively low population density of the University neighborhood, the number of family health centers is higher than in other neighborhoods due to the presence of students in the area. A review of the spatial distribution of family health centers reveals a concentration towards the center of the city, with a subsequent decrease in the number of centers in the peripheries (Map 2). Of the 17 neighborhoods that comprise the city, no family health center provides services in Yarımca and Muratpaşa. The population residing in these neighborhoods receives primary health care services from family health centers in the surrounding area. Therefore, it cannot be concluded that there

is an equal or nearly equal distribution of family health centers. Table 5 shows the distribution of family health centers by neighborhood.

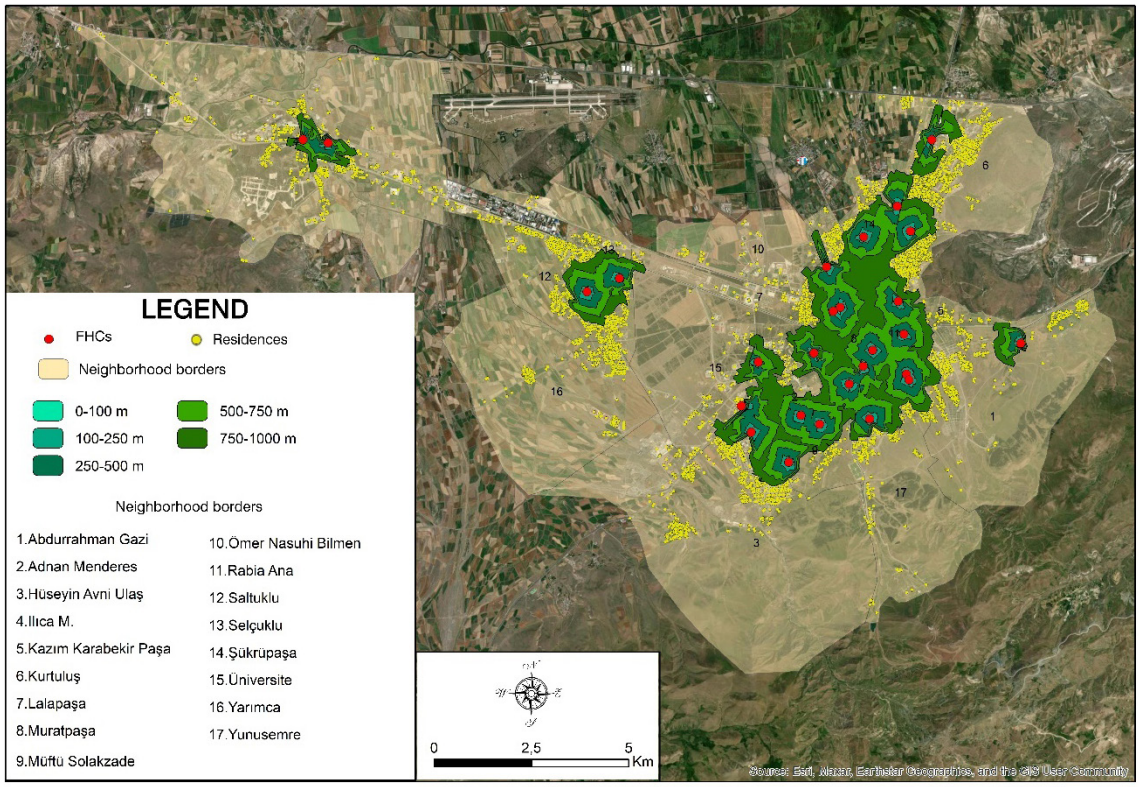
Table 5: Distribution of Family Health Centers in Neighborhoods

Neighborhood Name	Number of Family Health Centers	Neighborhood Name	Number of Family Health Centers
Abdurrahman Gazi	3	Rabia Ana	2
Adnan Menderes	1	Ömer Nasuhi Bilmen	1
Hüseyin Avni Ulaş	1	Saltuklu	1
Ilıca	2	Selçuklu	1
Kazım Karabekir Paşa	1	Şükrüpaşa	2
Kurtuluş	2	Üniversite	3
Lalapaşa	2	Yarımca	-
Muratpaşa	-	Yunusemre	2
Müftü Solakzade	3	**Total**	**27**



Map 2. Distribution of Family Practices in Erzurum by Neighborhoods

In the course of the study, network analysis was applied separately to identify accessible areas, accessible dwellings, and the residents of these dwellings within the city. Map 3 and Table 6 illustrate the extent of accessible areas within the city. Upon examination of Map 3, it is seen that family health centers and areas within the appropriate walking distance are concentrated in the historical center of the city. Apart from this area, areas with extensive suitable walking distances are interrupted along the D-100 (E-80) highway and exhibit increased density in the Dadaşkent and Ilıca neighborhoods in the northwest.



Map 3. Accessibility to Family Practices in Erzurum

In accordance with the specifications set forth in the Spatial Plans Making Regulation regarding the appropriate accessible distance (0-500 m), it can be seen that 753.8 (ha) of the total area of 18149.2 (ha) is accessible. Furthermore, an additional area of 1903.5 ha is accessible between 500 and 1000 m, resulting in a total accessible area of 2657 ha (Table 6). By focusing on the ratio of accessible areas within urban areas rather than their absolute size, the extent of the problem becomes more evident. When the city is considered as a whole, it is notable that only 4% of the total area of the Aziziye, Palandöken, and Yakutiye metropolitan districts is properly accessible. Upon doubling the distance, it is found that the areas that are properly accessible and accessible at acceptable distances reach only 14.6% of the total area (2657 ha).

Table 6: Accessibility of the Research Area

0-100 (ha)	100-250 (ha)	250-500 (ha)	0-500 m (ha)	0-500 m Accessible Space (%)	500-750 (ha)	750-1000 (ha)	500-1000 m (ha)	Total Accessible space (ha)	Accessible Area Ratio (%)	Total area (ha)
28,7	154,0	571,2	753,8	4,2	849,3	1054,3	1903,5	2657,3	14,6	18149,2

As indicated in Table 6, the aggregate area of Erzurum's metropolitan central districts (Aziziye, Palandöken, Yakutiye) is 18149.2 hectares. Of the 17 neighborhoods evaluated, those with the largest areas within walking distance of FHCs are Müftü Solakzade (89 ha), Yunusemre (74 ha), and Şükrüpaşa (70 ha). The proportional distribution of accessible land in these neighborhoods is 21.6%, 6.6%, and 15.3%, respectively. The neighborhoods with high proportions of accessible areas within walking distance are predominantly those with relatively small surface areas, such as Rabia Ana and Muratpaşa. Conversely, the neighborhoods with low rates are those with larger surface areas. Further detailed information on the accessibility status of the 17 neighborhoods in the area evaluated in the study can be found in Table 7.

Table 7: Total and Accessible Area of Neighborhoods in the Study Area

Neighborhood Name	Total Area (ha)	Accessible Space (ha)	%
Abdurrahman Gazi	1827,5	48	2,63
Adnan Menderes	309,4	59	19,07
Hüseyin Avni Ulaş	3087,1	48	1,55
Ilıca	3717,8	28	0,75
Kazım Karabekir Paşa	268,5	20	7,45
Kurtuluş	1199,7	46	3,83
Lalapaşa	388,7	36	9,26
Muratpaşa	84,9	23	27,09
Müftü Solakzade	411,7	89	21,62
Rabia Ana	164,8	68	41,26
Ömer Nasuhi Bilmen	843,3	29	3,44
Saltuklu	649,3	38	5,85
Selçuklu	493,9	32	6,48
Şükrüpaşa	465,7	70	15,03
Üniversite	1384,9	36	2,60
Yarımca	1630,2	0	0,00
Yunusemre	1221,8	74	6,06

The results of the network analysis indicate that the most accessible areas in Erzurum are located in the Müftü Solakzade (89 ha), Yunusemre (79 ha), and Şükrüpaşa (70 ha) neighborhoods. The neighborhoods with the lowest accessibility rates are Ilıca (28 ha), Muratpaşa (23 ha), and Kazım Karabekir Paşa (20 ha). Additionally, the 1630.2 ha area in Yarımca is inaccessible.

In urban or suburban contexts, the number and density of buildings within a pedestrian's walking distance are as significant as the number of areas with convenient access. For this reason, the distances traversed on foot from family health centers to dwellings were also analyzed. The results of the network analysis indicate that 24.3% of dwellings in Erzurum are situated within the appropriate walking distance as defined in the Spatial Plans Construction Regulation. A total of 27492 buildings are located within the three metropolitan central districts of Erzurum. Of these, 6.668 are situated within the designated pedestrian walking distance. Upon doubling this distance, the number of buildings within the appropriate pedestrian walking distance limits specified in the regulation is 13.483, representing only 48% of the total number of buildings (Table 8).

Table 8: Accessibility Status of Buildings in the Research Area

Neighborhood Name	100	250	500	Total (0-500)	Ratio % (0-500)	750	1000	Total (500-1000)	Ratio % (500-1000)	Total Structure	Total Accessible Structure
Abdurrahman Gazi	48	179	485	712	30,1	745	359	1.104	46,7	2.364	1.816
Adnan Menderes	5	43	160	208	17,0	345	557	902	73,6	1.225	1.110
Hüseyin Avni Ulaş	7	49	156	212	18,1	162	147	309	26,3	1.173	521
Ilıca	3	61	266	330	26,0	163	129	292	23,0	1.268	622
Kazım Karabekir Paşa	30	171	332	533	21,3	708	1.144	1.852	74,1	2.499	2.385
Kurtuluş	17	88	574	679	12,7	807	1.034	1.841	34,4	5.353	2.520
Lalapaşa	8	46	215	269	24,2	342	314	656	58,9	1.113	925
Muratpaşa	6	125	188	319	33,8	341	283	624	66,2	943	943
Müftü Solakzade	26	92	190	308	42,8	249	90	339	47,1	720	647
Rabia Ana	47	143	909	1.099	43,8	951	458	1.409	56,2	2.508	2.508
Ömer Nasuhi Bilmen	0	9	230	239	22,8	352	255	607	58,0	1.047	846

Saltuklu	3	50	164	217	18,1	210	167	377	31,5	1.197	594
Selçuklu	4	22	164	190	18,2	328	267	595	56,9	1.045	785
Şükrüpaşa	18	96	542	656	31,4	816	465	1.281	61,3	2.089	1.937
Üniversite	0	9	26	35	10,4	63	100	163	48,7	335	198
Yarımca	0	0	0	0	0,0	0	0	0	0,0	408	0
Yunusemre	15	115	532	662	30,0	660	472	1.132	51,3	2.205	1.794
Total	**237**	**1.298**	**5.133**	**6.668**	**24,3**	**7.242**	**6.241**	**13.483**	**48,5**	**27.492**	**20.151**

Table 8 shows that there are no accessible buildings within 100 m in three neighborhoods. Furthermore, 408 buildings in the Yarımca Neighborhood have no access to family health centers whatsoever. When the 17 neighborhoods in the study area are evaluated separately, it becomes evident that the accessibility status of the neighborhoods differs from one another.

An examination of the accessibility status of the Yarımca neighborhood reveals that none of the 408 buildings are located in an accessible location, thereby creating an access problem with regard to health services. Upon evaluation of the accessibility status of the university neighborhood, it was determined that 35 out of 335 buildings are accessible, while 163 buildings are accessible within a distance of 500-1000 meters. Conversely, it was also established that there is no accessible building in the university neighborhood at a distance of 100 meters. The accessibility status of the Selçuklu neighborhood was evaluated, and it was determined that 190 buildings are located at a distance of 0-500 m, and 595 buildings are accessible at a distance of up to 1.000 m. These three neighborhoods have the lowest accessibility in the city according to the regulation.

Subsequently, the neighborhoods of Saltuklu, Hüseyin Avni Ulaş, Lalapaşa, Ömer Nasuhi Bilmen, Adnan Menderes, Kurtuluş, and Kazım Karabekir Paşa exhibit similar deficiencies. In these neighborhoods, the number of accessible buildings within a radius of 500 meters is below the city average of 24 percent. In the Hüseyin Avni Ulaş neighborhood, 212 of the 1.173 buildings are accessible, with a total of 309 accessible buildings. Despite the differing total building structures of the Saltuklu and Selçuklu neighborhoods, 164 buildings are accessible in both neighborhoods within a 500 m radius. An examination of the accessibility status of the Saltuklu neighborhood reveals that 217 out of 1.197 buildings are accessible. Furthermore, when the 500-1.000 m scale is taken into consideration, it is observed that 377 neighborhoods are accessible. 18% of the buildings in the neighborhood are in compliance with the applicable regulations. Upon examination of the accessibility status of the Lalapaşa neighborhood, it was determined that 269 of the total 1.113 buildings are accessible. At the 500-1.000 m distance, a total of 656 accessible buildings are observed. The Kurtuluş neighborhood exhibits a higher accessibility rate, with 679 of its 5.353 buildings accessible. At the 500-1.000 m distance, a total of 1.841 buildings are accessible.

The Ömer Nasuhi Bilmen neighborhood exhibits a relatively high degree of accessibility, with 239 of its 1.047 buildings offering accessible entryways. At a distance of 500-1.000 meters, an additional 607 buildings are accessible. However, it is noteworthy that there are no accessible buildings within a 100-meter radius. An examination of the accessibility status of the Kazım Karabekir Paşa neighborhood revealed that there are a total of 2.499 buildings, with 533 of these buildings being accessible. When the 500-1.000 m scale was considered, it was determined that 1.852 buildings were accessible. When the accessibility status of Adnan Menderes neighborhood is evaluated, it is seen that 208 out of 1.225 buildings are accessible. In the 500-1000 m scale, 902 buildings are accessible.

Seven of the neighborhoods included in the study exhibit relatively high levels of accessibility, exceeding the average rate. An evaluation of the accessibility status of the Ilıca neighborhood reveals that 330 of the 1.268 buildings are accessible within a distance of 500 meters. In the 500-1.000 m range, the number of accessible buildings decreases, with the conclusion that 292 buildings are accessible. Upon examination of the accessibility status of the Şükrüpaşa neighborhood, it was determined that 656 of the total 2.089 buildings are accessible. Furthermore, when the 500-1.000 m scale is considered, a total of 1.281 buildings are found to be accessible. Upon examination of the accessibility status of the Muratpaşa neighborhood, it was determined that 319 buildings out of 943 buildings were accessible in accordance with the established regulations. Additionally, 624 buildings were found to be accessible when the 500-1.000 meter measurement was taken into consideration. Upon evaluation of the

accessibility status of the Rabia Ana neighborhood, it was determined that 1.099 of the 2.508 buildings are accessible. When the 500-1.000 m scale is employed, 1.409 buildings are determined to be accessible. Upon evaluation of the accessibility status of the Abdurrahman Gazi neighborhood, it was determined that 712 of the total 2.364 buildings are accessible. Additionally, it was established that 1.104 buildings are accessible within a radius of 500-1.000 meters, with the Abdurrahman Gazi neighborhood exhibiting the highest level of accessibility among the neighborhoods evaluated, with 48 buildings accessible within a 100-meter radius.

Upon examination of the accessibility status of the Müftü Solakzade neighborhood, it is observed that nearly half of the total 720 buildings (42.8%) are accessible. In terms of the accessibility status of the Yunusemre neighborhood, it is determined that 662 out of 2.205 buildings are accessible. When the 500-1.000 m scale is taken into consideration, the number of accessible buildings rises to 1.132.

A general framework regarding the accessibility of the 17 neighborhoods evaluated in the study area reveals that two neighborhoods (Rabia Ana and Mufti Solakzade) exceed the 40% accessibility threshold in the 0-500 m scale. In the 500-1.000 m scale, nine neighborhoods (Selçuklu, Lalapaşa, Ömer Nasuhi Bilmen, Şükrüpaşa, Muratpaşa, Rabia Ana, Kazım Karabekir Paşa, Adnan Menderes, and Yunusemre) are found to be 50% or more accessible. Additionally, it was determined that the Rabia Ana neighborhood exhibited the highest accessibility within a 500-meter radius, while the Kazım Karabekir Paşa and Abdurrahman Gazi neighborhoods demonstrated the highest accessibility within a 250-meter radius. The highest accessibility is observed within a 100-meter radius. Conversely, the findings indicate that the buildings in the Yarımca neighborhood are unable to access any family health center, and there are no accessible buildings in the Ömer Nasuhi Bilmen and University neighborhoods within a 100-meter radius.

Similarly, the population was incorporated into the analysis, whereas spatial areas and buildings within walking distance were excluded. From this perspective, 96.725 of the 397.831 individuals in the study area reside within the distances prescribed by the regulation. A distance of 1.000 meters, deemed an appropriate radius in the existing literature, encompasses 290.457 individuals. This figure represents approximately 27% of the population, or 107.347 individuals, who are adversely affected by this situation. Table 9 shows comprehensive data on the accessibility of the population residing in the study area to family health centers.

Table 9: Accessibility Status of the Population in the Research Area

Neighborhood Name	Population	Accessibility % (0-500 m)	Accessible Population (0-500 m)	Accessibility % (500-1000 m)	Accessible Population (500-1000 m)	Total Accessible Population
Abdurrahman Gazi	24940	30,1	7512	46,7	11647	19205
Adnan Menderes	29385	17,0	4989	73,6	21637	26700
Hüseyin Avni Ulaş	51414	18,1	9292	26,3	13544	22862
Ilıca	8002	26,0	2083	23,0	1843	3948
Kazım Karabekir Paşa	8854	21,3	1888	74,1	6562	8524
Kurtuluş	34839	12,7	4419	34,4	11982	16435
Lalapaşa	20391	24,2	4928	58,9	12018	17006
Muratpaşa	10758	33,8	3639	66,2	7119	10824
Müftü Solakzade	24362	42,8	10422	47,1	11470	21939
Rabia Ana	17379	43,8	7615	56,2	9764	17435
Ömer Nasuhi Bilmen	29254	22,8	6678	58,0	16960	23696
Saltuklu	27499	18,1	4985	31,5	8661	13678
Selçuklu	17795	18,2	3235	56,9	10132	13424
Şükrüpaşa	35575	31,4	11171	61,3	21815	33048
Üniversite	13162	10,4	1375	48,7	6404	7828
Yarımca	2614	0,0	0	0,0	0	0
Yunusemre	41608	30,0	12492	51,3	21361	33904
Total	**397831**	**24,3**	**96725**	**48,5**	**192918**	**290457**

According to Table 9, Rabia Ana (53.8%) and Müftü Solakzade (42.8%) are the neighborhoods with the highest accessibility (0-1000 m) to the family health center in accordance with the regulation. When the 1000 m measure of accessibility is taken into consideration, significant increases are observed in the relevant neighborhoods [Rabia Ana (56.2%), Müftü Solakzade (47.1%)]. Moreover, although they do not have high accessibility in accordance with the regulation, it was concluded that University (48.7%), Selçuklu (56.9%), Ömer Nasuhi Bilmen (58.0%), Lalapaşa (58.9%), Şükrüpaşa (61.3%), Muratpaşa (66.2%), Adnan Menderes (73.6%), and Kazım Karabekir Paşa (74.1%) neighborhoods have high accessibility within 1000 m.

The neighborhoods of Hüseyin Avni Ulaş (51.414 residents), Yunusemre (41.608), Şükrüpaşa (35.575), and Kurtuluş (34.839) have the largest populations among those evaluated in the study. Notwithstanding the fact that these neighborhoods have the highest population, they have low accessibility when the distance determined in the regulation is taken into consideration (Hüseyin Avni Ulaş 18.1%, Yunusemre 30%, Şükrüpaşa 31.4%, Kurtuluş 12.7%). Furthermore, the Hüseyin Avni Ulaş neighborhood, which has the largest population, exhibits a markedly low accessibility rate in comparison to other neighborhoods.

When the population is taken into account, it becomes evident that the neighborhoods where access problems to the family health center are experienced are similar. It is notable that no individual in the Yarımca neighborhood has access to a family health center. Furthermore, even when the distance of 1000 m is taken into consideration, the Ilıca (23%) and Hüseyin Avni Ulaş (26.3%) neighborhoods have access problems.

DISCUSSION, CONCLUSION AND SUGGESTIONS

The concept of accessibility in health services is multidimensional, encompassing a range of elements. In this regard, the historical process of the health system has undergone significant changes and transformations with the objective of ensuring accessibility to health services. Indeed, the provision of various facilities with the "Green Card" in the past and the "General Health Insurance" in the present for individuals who are financially unable to pay serves as an indicator of financial accessibility. Conversely, the Health Transformation Program in Türkiye has proposed the implementation of a referral system through the creation of common databases within health information systems. However, the referral system was initially introduced as a pilot application in Aydın and Denizli, where it encountered numerous challenges and was ultimately terminated (T.C. Sağlık Bakanlığı, 2003). The overarching objective of these initiatives is to enhance accessibility by reducing the time and cost associated with accessing health services. However, the decision regarding the location of health institutions and their subsequent placement is a primary factor influencing accessibility and plays a significant role in determining costs.

Family health centers play the biggest role in the location and accessibility of health institutions with regard to health expenditures. In this context, the study evaluated the accessibility of family health centers in the central districts of Erzurum. The role of primary health care institutions in expenditures was analyzed by examining the health expenditures made during the evaluated period.

The evolution of primary health care services has been marked by a series of changes and transformations, spanning from the historical past to the present. The overarching objective of these initiatives is to achieve enhanced health outcomes through the reduction of expenditure. In this regard, the maximum population per family physician was previously set at 4.000, but this has now been reduced to 3.500 in line with the recently published regulation (Resmi Gazete, 2024). With regard to the ratio of population to family physician, Erzurum is in a favorable position in comparison to the national average for (Türkiye 3.259:1; Erzurum: 3.009-3.120) (T.C. Sağlık Bakanlığı, 2022). In consideration of the aforementioned regulation (0-500 m), the neighborhoods of Rabia Ana, Kazım Karabekir Paşa, Abdurrahman Gazi, and Müftü Solakzade are situated within an accessible radius of 500 meters to family health centers. Similarly, the neighborhoods of University, Selçuklu, Ömer Nasuhi Bilmen, Lalapaşa, Şükrüpaşa, Muratpaşa, and Adnan Menderes are located within a 1.000-meter radius of family health centers. Furthermore, the Yunusemre, Ilıca, and Saltuklu neighborhoods exhibit moderate accessibility to family health centers. The results of the study indicate that the health demands of the relevant neighborhoods are met by primary health care services,

which play a significant role in reducing health expenditures. It is predicted that the desired health outcomes and time and cost savings, which are among the goals of the Health Transformation Program, can be achieved in the aforementioned neighborhoods with the accessible location of family health centers and the reduction of the population per family physician in the near future. The findings of the study align with the results of previous studies in the literature (Forrest and Starfield, 1998; Franks et al., 1992; Etter and Perneger, 1998; Holdsworth et al., 2006).

The findings of the study indicate that residents of the buildings in the Yarımca neighborhood encounter difficulties in accessing family health centers. It is hypothesized that the observed result may be associated with the sociodemographic characteristics of the residents of the neighborhood and the number of family health centers. In light of these observations, it can be said that individuals may seek care at secondary or tertiary health institutions, such as public or private hospitals, research hospitals, or city hospitals, due to the lack of a family health center in the neighborhood. Conversely, it has been determined that accessibility within 500 meters is exceedingly limited in the Hüseyin Avni Ulaş and Kurtuluş neighborhoods, which are among the most densely populated in the city. In light of these considerations, it is thought that even in the case of a relatively straightforward health issue, individuals may resort to higher-step health institutions, which could potentially result in a notable increase in health expenditures. Despite the availability of a family physician in the relevant neighborhood, the absence of a referral system and an accessible family health center may prompt individuals to seek care at other health institutions, potentially leading to avoidable health expenditures. This finding aligns with the conclusions of previous studies (Kılınç et al., 2012; Üstü et al., 2011).

In a similar study conducted in Rize city in Türkiye, it was revealed that 19.6% of the demographic most susceptible to the pedestrian walking distance in the urban area is a significant concern (Deniz et al., 2020). In Erzurum, the research area, this rate is 23%, with occasional peaks reaching 26%. It can be reasonably deduced that the issue is more pronounced in Erzurum.

Previous studies show that the zoning plans currently in place in Erzurum are problematic. Researchers have classified these problems as belonging to the following categories: transportation, municipal services, and so forth. (Doğanay, 1983, 1986; Dursun, 2020). With regard to both urban land use and transportation, the issue under discussion has not been the subject of any significant attention. One of the transportation-related issues, including traffic congestion and noise pollution, is the lack of consideration for pedestrian access to health institutions in certain parts of the city due to inadequate urban planning. Furthermore, these distances are not reflected in the land use maps within the designated zoning areas.

In two neighborhoods in the study area (Yarımca, Muratpaşa), there is no family health center within walking distance. This situation is also found in other cities in Türkiye (Duman and İrcan, 2020; İrcan and Duman, 2021; Yasak, 2021). Nevertheless, while there may be FHCs in densely populated areas, particularly in the peripheries of the city, as is the case in other cities today, zoning plans for the parts of the city that are adjacent to the countryside should be organized with this in mind.

It is notable that the issue of spatial sprawl is not taken into account when constructing public buildings in Turkish cities where accessibility analyses have been conducted (Güray and Kemeç, 2016; Sezer et al., 2018, 2019; İrcan and Duman, 2021). In all studies, the issue of spatial dispersion is problematic. In such cases, the affected population includes family health centers in the surrounding area. In some cases, city dwellers utilize higher-level health institutions, which increases the density and health expenditures in hospitals. From this perspective, when determining the location of family health centers, an equal or close to equal distribution should be tried to be ensured.

The changes and transitions that have occurred in Türkiye's health system from its historical roots to the present day, in addition to facilitating a range of enhancements in health services, are primarily focused on enhancing accessibility. In this regard, accessibility in terms of financial, physical, and disadvantaged groups (disabled, elderly, children, etc.) represents a significant challenge that is addressed by numerous health policies. As a consequence of alterations and modifications to the system and incorporation of evolving technology, the primary objective is to attain a favorable position in global health status indicators. In this regard, the General Health Insurance scheme was introduced in 2012 with the objective of ensuring financial

accessibility within the Turkish health system. In order to enhance the availability of beds and health facilities for individuals with physical disabilities, city hospitals were established in 2016 in alignment with the Health Transformation Program. Furthermore, health institutions are integrated into quality indicators and various versions determined by the Ministry of Health to eliminate access barriers. Despite the implementation of the aforementioned practices to enhance access, there may be a challenge in achieving the targeted health outcomes due to the fact that the demand for health services is shaped in line with the preferences of individuals (health literacy). As a matter of fact, the "Health Literacy Survey" recently launched by the Ministry of Health (Çalık Göçümlü, 2023) supports this issue.

The inability of the referral system in the health system to be implemented for various reasons in the past, coupled with the option for individuals to request health services from the health institution of their choice, has resulted in overcrowding in relevant health institutions and a range of appointment-related issues. The "Approved Appointment System" has recently been implemented as a means of addressing this issue (Türkay, 2024). In light of these considerations, it was hypothesized that by determining the physical accessibility of family health centers, densities and, consequently, expenditures in health institutions could be reduced. To test this hypothesis, a study was conducted to assess the accessibility of 17 neighborhoods in the central districts of Erzurum province (Aziziye, Palandöken, Yakutiye) to 27 family health centers. This assessment was performed using GIS.

The findings of the study indicate that four neighborhoods in Erzurum (Rabia Ana, Kazım Karabekir Paşa, Abdurrahman Gazi, Muftü Solakzade) are in compliance with the Spatial Plans Construction Regulation, as they have access to family health centers. It should be noted that patients addressed by family physicians may reside in a different neighborhood than the one where the family health center is located. At the inception of the family medicine system, the ministry designated family physicians based on the location of their residence. Subsequently, however, individuals were afforded the right to choose and change their family physicians (Halk Sağlığı Genel Müdürlüğü, 2024), which proved to be a pivotal factor in terms of accessibility. This issue is expected to play a significant role in the growth of health expenditures. Additionally, the existing literature indicates that health expenditures can be reduced by establishing family health centers as the primary point of access to health services through an integrated accessibility and referral system (Etter and Perneger, 1998; Holdsworth et al., 2006). Consequently, this highlights one of the underlying causes of the challenges observed in the secondary and tertiary health services in Erzurum.

As stated in the 2014 Spatial Plans Construction Regulation, "*In zoning plans, family health center functions can be planned in the service impact area that needs to be reached on foot, taking into account a distance of approximately 500 meters*" (Resmi Gazete, 2014), it is seen that none of the 17 neighborhoods evaluated in the study has a configuration in accordance with the regulation. It is notable that no neighborhood has 100% access to a FHC, whether within its own neighborhood or in nearby neighborhoods. The highest rate of access to Erzurum on a neighborhood basis is 43.8%. Two neighborhoods (Yarımca and Muratpaşa) are devoid of any family health centers. It is anticipated that the implementation of health strategies tailored to the provision of primary health care services in Erzurum's Yarımca, Hüseyin Avni Ulaş, and Kurtuluş neighborhoods has the potential to reduce health expenditure. Furthermore, it is hypothesized that the undertaking of initiatives to enhance the quality of primary health care services in Yunusemre, Ilıca, and Saltuklu neighborhoods could yield positive outcomes.

It is observed that the Spatial Plans Building Regulation, which is the subject of the distances used as a measure in the method, is not applied consistently throughout Türkiye. This situation has also been demonstrated by previous studies (Deniz, 2018; Deniz et al., 2018a; Deniz et al., 2020; Deniz et al., 2021). In a city or settlement, the number and density of buildings within the pedestrian walking distance are as significant as the number of areas where appropriate access can be made. Therefore, it is essential to determine whether the relevant regulation is taken into account in newly constructed family health centers and in areas opened to new settlements. In the event of non-compliance, appropriate sanctions should be applied.

The location of health institutions is of significant importance, with the specific site of construction determined in accordance with established regulations. In this context, the absence of co-payment within the health system, particularly in primary care facilities (SGK, 2024), may prove economically attractive for patients.

The city's current zoning plan was designed with the processes until 2000 in mind; however, no radical innovations were introduced after this date. Following this date, amendments were made in accordance with these plans. Upon examination of these zoning plans, which played an instrumental role in the city's development, and the criticisms levied against them, it becomes evident that while various issues pertaining to the city have been highlighted, the situation of health institutions has not been duly considered. In this regard, it is imperative that the units affiliated with the municipality and the Ministry of Health collaborate to conduct a comprehensive needs assessment and implement the requisite measures.

While the majority of family health centers are situated within the historical center of the city, thereby reducing the issue of limited accessibility in these regions, the relatively low number of such centers in the peripheries of the city results in significant challenges for residents in these areas. Outside the city center, family health centers are experiencing a resurgence in Dadaşkent and Ilıca neighborhoods in the northwest. However, in neighborhoods such as Hüseyin Avni Ulaş, Kurtuluş, Adnan Menderes, where mass housing developments are imminent, the lack of facilities will result in a reduction in the number of accessible buildings.

The study's overall findings reinforce the significance of an effective referral system. Conversely, the necessity for certain improvements to be made in order for primary health care institutions (PHCs) to operate in accordance with their purpose is emphasized. Even if the patient has a high level of health literacy and will first apply to family health centers, they may face an access problem. This situation causes the patient to turn to other health institutions, leading to appointment problems as well as increased expenditures.

In light of the findings of the study, the following suggestions can be made for the health system:

Health expenditures can be shaped in the desired direction by revisiting and evaluating the applicability of the referral system.

The family health centers of Rabia Ana, Kazım Karabekir, Abdurrahman Gazi and Müftü Solakzade neighborhoods, which are located in accessible locations, can be taken into consideration in the improvements to be made for primary health care institutions and in the process of building new FHCs, and new buildings can be built in areas where they are needed.

The Yarımca, Muratpaşa, Hüseyin Avni Ulaş and Kurtuluş neighborhoods could be prioritized for family health centers.

In family health centers where multiple family physicians work together, physicians can be moved to areas where they are needed.

As the study was nearing completion and the recommendations for expenditure management within the health system were being finalized, it was announced that there would be a change in Türkiye's health system. This situation is particularly relevant to family health centers, as it provides an opportunity to reduce expenditures. In alignment with the impending transformation, it has been reported that if the proposed legislation is enacted, a new referral system will be established, and the initial application fee will be allocated directly to secondary and tertiary health institutions (Aile Hekimlikleri, 2024). The study's emphasis on the importance of family health centers in reducing expenditures on the health system during the preparation phase, along with the results it reached, serve as an indication of the veracity of the results that will be reached in the study with the announcement of the upcoming change.

LIMITATIONS

This study analyzed accessibility to family health centers in the central metropolitan districts of Erzurum province using geographic information systems. One limitation of the study is that it only addresses accessibility to family health centers

located in Erzurum. In Türkiye's healthcare system, individuals are encouraged to choose primary healthcare institutions as their first point of contact, particularly in line with the "Healthy Türkiye Century" program. Based on the results obtained in the study, it is anticipated that large-scale analyses of accessibility for Türkiye's healthcare institutions in the future will lead to an increase in positive health outcomes. Additionally, a study could be conducted in Türkiye to investigate the local population's views on the quality and accessibility of FHCs.

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