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A Study of the Application of Geographic Information Systems (GIS) in Children Access to Pharmacies: A Case Study of Kermanshah, West of Iran

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Abstract

Background

Adequate access to health services has tremendous effects on the usefulness and efficiency of health care. Therefore, this study aimed to investigate the access of girls under the age of 14 years old to pharmacies in Kermanshah, Iran.

Materials and Methods

In this cross-sectional study, the access of <14 years old girls to pharmacies in Kermanshah city, Iran, was investigated. The study population included 81,450 girls under the age of 14 years. The latest published population statistics on the Population Census in 2011 (Iran) were used as the basis for the analyses, and the information about the public and private pharmacies were collected from the Kermanshah University of Medical Sciences, Iran. Also, Geographic Information Systems (GIS) program was used for data analysis.

Results

In terms of access to 25 pharmacies through walking, the findings revealed that lacked access as much as 48.83%. In terms of access to daytime pharmacies through walking, 88.05% had improper access. Furthermore, in terms of access to 25 pharmacies through driving, the results were as follows: with five minutes of driving (24.75% no access), with 10 minutes of driving (9.07% no access), and with 15 minutes of driving (1.97% no access). As for access to daytime pharmacies through driving, the results were as follows: with five minutes of driving (5.42% no access), with 10 minutes of driving (2.15% no access).

Conclusion

The results of the present study demonstrated that the access for girls under the age of 14 years to pharmacies through walking was in poor condition. However, it was found out that access through driving was much better than access through walking.

Key Words: Children, Geographic Information System (GIS), Network Analysis, Pharmacy.

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1- INTRODUCTION

Iran, with an area of more than 1.6 million km2 (ranking the 17th largest country in the world in terms of area), lies in the South West of Asia and is part of the Middle East region. Iran contains 31 provinces, and Kermanshah province, with an area of about 10,000 hectares, is located in the West of Iran at latitude 34°, 190N, longitude 47°, 70E. Additionally, the population of Kermanshah City was 851,405 individuals (1). Each year, nearly 11 million children lose their lives in the world (2). This is while many of these deaths are not registered. The goal of the World Health Organization (WHO) has been to reduce two-third of deaths in the children population. These deaths have mainly occurred in low-income and middle-income countries (2). The results of studies indicate that access to health services is essential to cut down mortality (2, 3). The health of individuals and societies hinges upon the existence of centers that provide the necessities for their health. One of these centers, which directly affect the health of individuals and societies, is the establishment of health facilities and pharmacies (3).

Pharmacies are among the most important centers that cater for quick, timely and cost-effective access to services in cities towards achieving the basic goals of development, namely social justice and fair development. Pharmacies also have significant effects on determining the pattern of urban development and spatial distribution of demands for residency in cities. Hence, pharmacies can be employed as a tool for controlling and regulating the spatial distribution of population and facilities throughout cities as well as reducing the concentration of resources that have been the main cause of the growing loads of pollution, transportation, waste of time, and energy of the urban residents (4). Nowadays, Geographic Information System (GIS) has turned into a valuable tool for evaluating the extent of population access to health services (5, 6). In other studies, GIS has also been used as a tool to strengthen managerial decisions on removing inequalities in access to health services (5, 6). Access to health care systems is required for the diagnosis and treatment of acute and chronic pediatric diseases and injuries as well as the provision of preventive care for them (7, 8). Besides, adequate access to health services has tremendous effects on the usefulness and efficiency of health care. Therefore, measuring access to health care is a major function for assessing the quality of health systems in societies (9-11). Furthermore, research indicates that one of major causes that endanger the children's health is the lack of proper access to health services (12, 13).

On the other hand, the results of previous studies conducted in Kermanshah are indicative of the resident's lack of proper access to health centers, thereby triggering many health problems in this city (14, 15). In addition, the girls' group, as a population of paramount importance for the continuation of the next generation, led the authors of the present study to focus on this group, thereby making it a high research priority (15). Therefore, the present study aimed to investigate the access of Iranian children to pharmacies in Kermanshah city, Iran.

2- MATERIALS AND METHODS

2-1. Study Design and Population

In this cross-sectional study, the access of <14 year-old girls to pharmacies was investigated, and the statistical population consisted of 81,450 girl-children residing in Kermanshah city (Iran). The required data for this study were collected in two parts of spatial and non-spatial data using the following resources. The available numerical data on a scale of 1:2000 were collected from the statistical center of Iran in separate urban blocks containing data on

the population living in the residential blocks and the age range in each residential block. In this regard, the latest published population statistics on the Population and Housing Census in 2011 were considered the basis for the analyses (Due to the fact that the statistical blocks of Kermanshah in 2016 were not published, the statistical blocks of 2011 were used), and the information about the public and private pharmacies based in Kermanshah were collected from the Kermanshah University of Medical Sciences (1).

2-2. Methods

Given the spatial-temporal nature of the research, the GIS program was used for data analysis, and the data were entered into the Arc/GIS Software environment and were analyzed. Not to mention, the Network Analysis was utilized to evaluate the geographical access. In this study, the radius of pharmacy service was as follows:

1. Access to pharmacies through walking based on standard time was considered the basis for the analyses. Given that in the technical calculations of transportation, the speed of a pedestrian in normal mode is between 0.75 to 1.25 m/s (16), the speed of 1 m/s as regarded as the average speed of a person accompanying children. Given the standard radius of access for daytime pharmacies and the 150-meter access radius, a 2.30-minute walking time was considered. However, given the 1000-meter access radius for 25 pharmacies, a 16.66-minute walking time was considered (17).

2. Access to pharmacies was calculated according to the real time and real roads. The criteria for driving time were 5, 10 and 15 minutes. To calculate the speed of vehicles, the roads of Kermanshah were classified into three main types: main arteries with a maximum speed of 60 km, streets with a maximum speed of 50 km, and local routes with a maximum speed of 30 km. Then, the level of access to pharmacies was calculated using the driving time by vehicles across Kermanshah (5, 10 and 15 minutes).

2-3. Measuring tools

This section explains methods, instruments, detection methods that were used, accuracy assessment, statistical analyses that were applied. In this applied research, the research approach was descriptive-analytic using quantitative models in GIS.

2-4. Ethical consideration

The study was approved in the Research Council and Ethics Committee of Kermanshah University of Medical Sciences (ID- number: 96225).

2-5. Data Analyses

To evaluate the geographic access, all of the collected data and information were digitized using the network Analyze in GIS, and the location of the health services were identified on the statistical blocks.

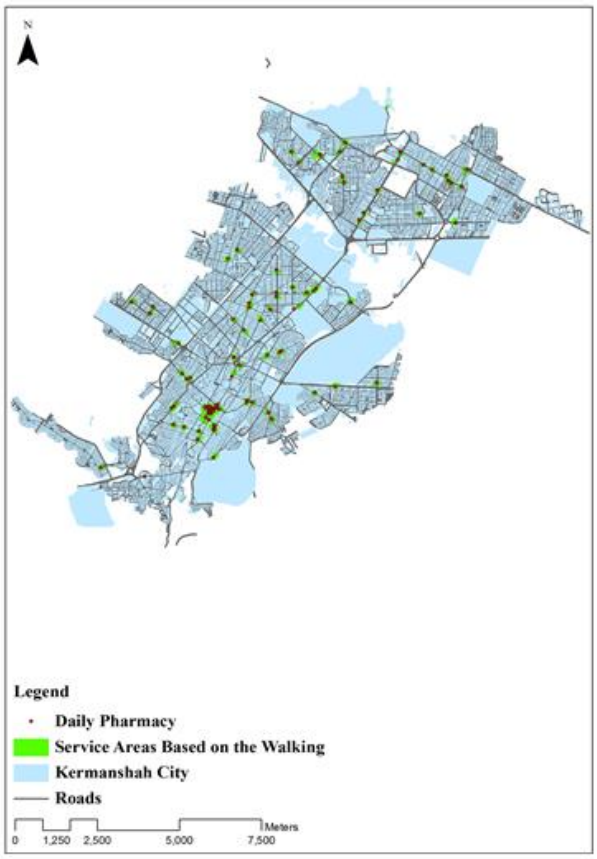
3- RESULTS

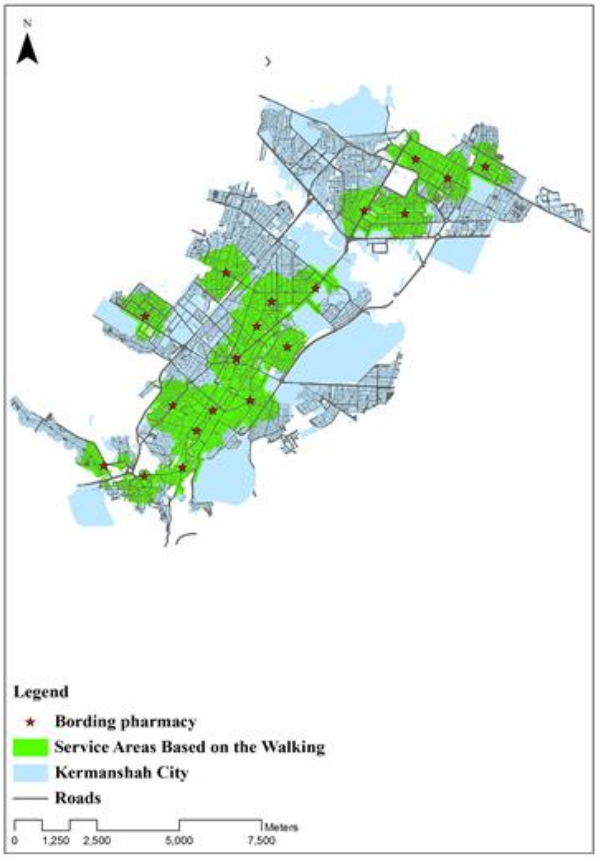
Kermanshah city has a population of 851,405, of which 81,450 (9.56%) are girl-children under the age 14 years. Moreover, there are 107 daily pharmacies and 19 full-time pharmacies across the Kermanshah, respectively. In terms of access to 25 pharmacies by walking, the findings of the present study revealed that the <14 year-old girls lacked access as much as 48.83% (39,775 people) as opposed to adequate access as much as 51.17% (41,675 people). In addition, in terms of access to daytime pharmacies by walking, 11.95% (9,735 people) had proper access; while 88.05% (71,715 people) had no access to the services in this regard (**Table.1 and Figure.1**). Furthermore, in terms of access to 25 pharmacies through driving, the results were as follows: with five minutes of driving (24.75% or 20,161 people with no access and 75.25% or 61,289 people with proper access), with 10 minutes of

driving (9.07% or 7,388 people with no access and 90.93% or 74,062 people with proper access), and with 15 minutes of driving (1.97% or 1,609 people with no access and 98.03% or 79,841 people with proper access). As for access to daytime pharmacies through driving, the results were as follows: with five minutes of driving (5.42% or 4,416 people with no access, and 94.58% or 77,034 people with proper access), with 10 minutes of driving (2.15% or 1,752 people with no access and 97.85% or 79,698 people with proper access); while the 0-14-year-old girls had proper access with 15 minutes of driving in this case (**Table.1 and Figure.2**).

Table-1: The Girls <14 years with and without Access to Pharmacies in Kermanshah, Iran (1)**.**

Variables			Boarding pharmacy			Daily pharmacy		
			Population without Access	Population with Access	Total	Population without Access	Population with Access	Total
The walking time	Number		39775	41675	81450	71715	9735	81450
	Percent		48.83	51.17	100	88.05	11.95	100
The driving time	5mins	Number	20161	61289	81450	4416	77.37	81450
		Percent	24.75	75.25	100	5.42	94.58	100
	10mins	Number	7388	74062	81450	1752	79698	81450
		Percent	9.07	90.93	100	2.15	97.85	100
	15mins	Number	1609	79841	81450	0	81450	81450
		Percent	1.97	98.03	100	0	100	100





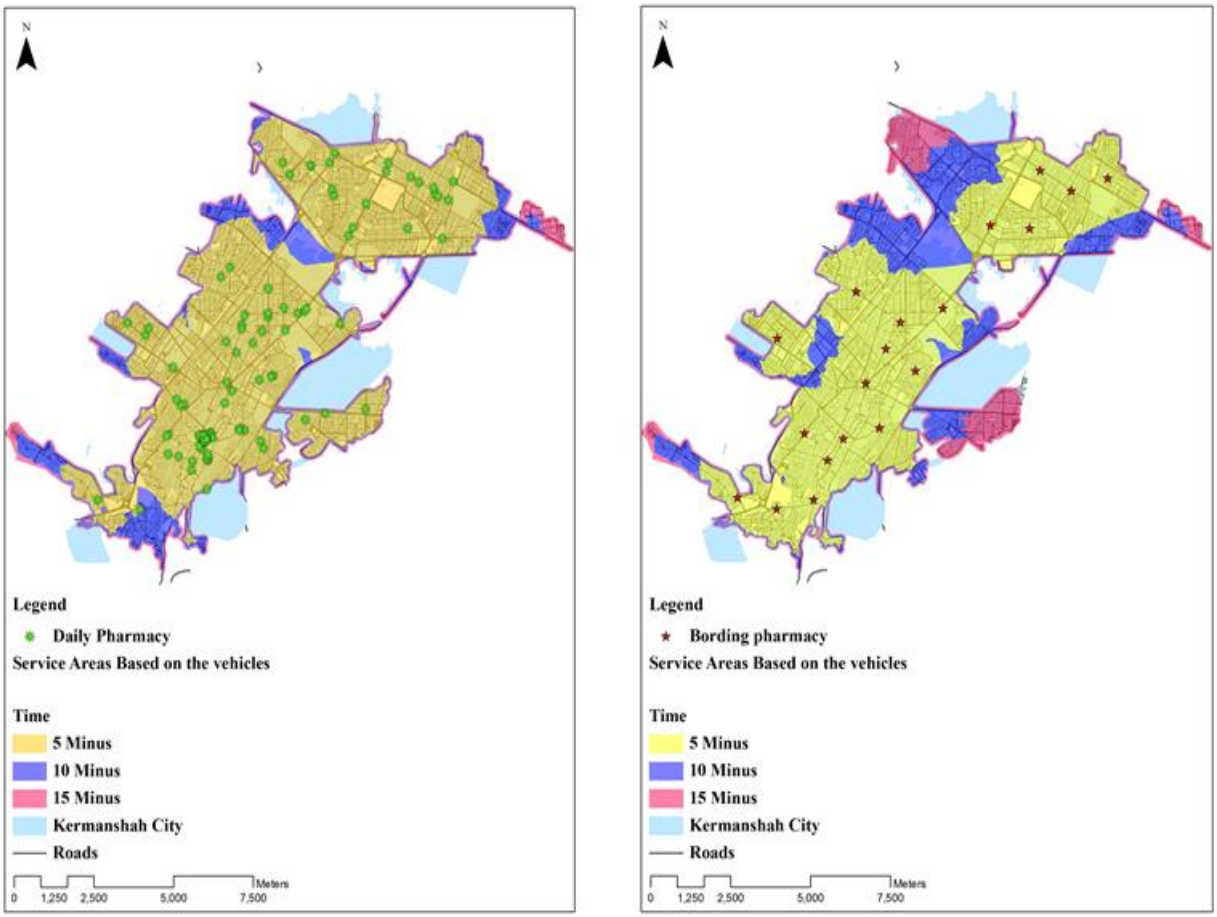


Fig.2: The Range Covered by Pharmacies Based on Driving, Kermanshah, Iran.

4- DISCUSSION

The health of individuals and societies relies on the existence of centers that provide the necessities of health. One of these centers, which directly affect the health of individuals and societies, is the establishment of health facilities and pharmacies. Therefore, the present study aimed to investigate the access of girls under the age of 14 years old to pharmacies in Kermanshah, Iran. The results of the present study showed that more than half of the girls had good access to 25 pharmacies through walking. This finding was consistent with the results of a study conducted by Yaghfuri et al. (2013), in which it was reported that the standard distance between the 24.7 pharmacies was observed (17). However, access to daily-time pharmacies within the range under study in the present research was in an unfavorable condition (Table.1 and Figure.2). This finding was concurrent with the results of a study done by Jabbedari et al. (2016) (18). As the results of the present study revealed, the distance between pharmacies with respect to concentration in the central part of the city was not observed, and the daytime pharmacies overlapped with each other with a function radius of 150 meters. Even several pharmacies were located within the function radius of one pharmacy. The number of pharmacies in the marginal parts of the city was much lower than that in the central parts of the city, and no pharmacy was observed in most areas of the city, especially in remote areas (Figure.1). As stated in other studies, this is likely to be due to their private nature

and economic unprofitability in other parts of the city (4, 17, 19). According to field observations, there was a relationship between the density of pharmacies and the distance from the doctors' clinics and hospitals. In other words, as the distance between the pharmacies and physician' clinics and hospitals increase, the number of pharmacies decrease, and vice versa. On the other hand, pharmacies seek to attract more customers, and the central areas are the best spots where these centers can be established because of the concentration of other services and daily commute of people to this part of the city. Further, quick, timely and cheap access to pharmacies in any society can improve the well-being of residents and their health (3), and it is of importance in terms of service provision and imposing costs on users (19). It is very important to provide, maintain and improve the health of infants and children as vulnerable groups in the health sector.

Further, given their special physical conditions and the evolution of various systems in their bodies, children are more vulnerable to diseases and environmental factors. Hence, their inadequate access to health services threatens their physical, mental and social health in the future. The results of the present study demonstrated that the <14 years girls' access to pharmacies through driving was in good condition (Table.1 and Figure.2). Pharmacies are licensed by the Ministry of Health to supply, manufacture drugs and provide the clients with consultation, thereby catering for quick, timely and cost-effective access to services in cities towards achieving the basic goals of development, namely social justice and fair development (17). In other studies, access to health services has been reported as one of the key criteria of healthy societies (5, 10). One of the limitations of the present study was the lack of access to the statistical blocks of 2016, thereby leading the authors of the present study to use the statistical blocks of 2011. If the statistical blocks of 2016 are used, the results will probably change. One of the strengths of the present study was the use of GIS for optimal health care management.

5- CONCLUSION

The results of the present study demonstrated that the <14 years old girls' access to pharmacies through walking was in poor condition, and access to daytime pharmacies was inadequate. As shown in the findings, this situation was influenced by the current distribution of pharmacies in the region, so that most pharmacies are concentrated in the central parts of the city. It should be noted that the access status based on using vehicles was much better than access by walking. Besides, in terms of using vehicles, the <14 years girls lacked adequate access to 25 pharmacies within 5, 10 and 15 minutes as much as 23.32%, 7.96%, and 2.12%, respectively. In the case of daytime pharmacies, nearly 5.34%, and 2.05% of the population were covered within 5 and 10 minutes, respectively. However, the total population was covered within 15 minutes. Therefore, it is suggested that health policy makers in Kermanshah use GIS as a tool to strengthen managerial decisions regarding access to pharmacies.

6- CONFLICT OF INTEREST: None.

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