



## A Geographic Information System Analysis of Accessibility to Community Pharmacy in Shiraz, Iran

Khosro Keshavarz<sup>a</sup>, Amir Hashemi Meshkini<sup>a</sup>, Ramin Hayati<sup>b</sup>,  
Somayeh Dehghan<sup>c</sup>, Abbas Kebriaeezadeh<sup>a\*</sup>

<sup>a</sup>Department of Pharmacoeconomics and Pharmaceutical Administration, Faculty of Pharmacy, Tehran University of Medical Sciences, Tehran, Iran.

<sup>b</sup>Department of Public Health, Faculty of Paramedical, Hormozgan University of Medical Sciences, Bandar Abbas, Iran

<sup>c</sup>Department of Geographic Information System, Municipality of Shiraz, Shiraz, Iran

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### Abstract

Geographic proximity has been shown to be a significant factor in healthcare utilization and also one of the important dimensions in the concept of accessibility. In this study, we aimed to evaluate the geographic accessibility to pharmacies in city of Shiraz. A geographic information system approach was obtained to evaluate geographic accessibility to pharmacies. A stratified random sampling was conducted to choose adequate points as the representative of whole city to measure their distance in both pedestrian and driving condition to the pharmacies. To measure the pedestrian accessibility of selected blocks in Shiraz, different distances of 150, 300, 450, 600 and 750 meter, and to measure driving accessibility different network distances of 5, 10 and 15 min were considered as acceptable levels of geographic accessibility. In terms of pedestrian accessibility, the analysis showed that about 45% and 15% of sample blocks have accessibility to at least one pharmacy in their 750 meters in normal days and holidays, respectively, based on straight line distance. In terms of driving accessibility, our analysis indicated that in normal days and also in holidays about 98% of sample blocks in Shiraz have at least one pharmacy in their 15 min based on network analysis and considering traffic limitation. In spite of implemented policy by food and drug organization to distribute pharmacies equitably through the whole city, geographic accessibility to pharmacy doesn't seem to be desirable in Shiraz and some other policies may be needed to make the situation better.

*Keyword:* Accessibility; GIS; Iran; Pharmacy; Shiraz.

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### 1. Introduction

Equitable distribution of and accessibility to healthcare centers is a common goal for all

countries' policy makers. Geographic proximity has been shown to be a significant factor in healthcare utilization [1] and also one of the important dimensions in the concept of accessibility [2].

Community pharmacies are part of every healthcare system which play important role

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\*Corresponding author: Abbas Kebriaeezadeh, Dept of Pharmacoeconomics and Pharmaceutical Administration, Faculty of pharmacy, Tehran University of Medical Sciences, Tehran, Iran.  
Tel: (+98)2166482606; Fax:(+98)2166482606  
Email: Kebriaee@tums.ac.ir

in their both conventional and emerging responsibilities. As their conventional role they fill the prescription and provide some advices to patients regarding the appropriate use of medicines, potential interactions etc., and as their extended and emerging role, they are involved in some activities including smoking cessation [3], diabetes monitoring programs [4], etc. A previous study has indicated that people, who live in remote areas from pharmacy, are less likely to visit it [5] and receive pharmaceutical services. To assure the equitable accessibility to pharmacy for the population, some regulations have been implemented by ministry of health (MOH) and food and drug organization (FDO) including regulation about the least acceptable distance between different types of pharmacies which aims to avoid concentrated distribution of pharmacies [6].

Geographic Information system (GIS) as WHO has recommended, is a tool which enables healthcare policymakers to make more precise decisions by combining health resources and geographic data and doing

complex analysis [7]. In this study, we aimed to evaluate the geographic accessibility to pharmacies in city of Shiraz, Iran. It is the capital city of Fars province which is located in southwest of Iran, and is one of the tourist visiting cities of Iran which has many international visitors from all over the world every year.

## 2. Materials and methods

A geographic information System approach was obtained to evaluate geographic accessibility to pharmacies in Shiraz city. Arc GIS 9.3 software was used for measuring geographic accessibility. The list of pharmacies was acquired from the food and drug affairs in Shiraz University of Medical Sciences, and was located in the map by the GIS experts. A stratified random sampling was conducted to choose adequate points as the representative of whole city to measure their distance in both pedestrian and driving condition to the pharmacies. The number of these points was calculated to be 1147 ( $P=0.63$ ,  $d=0.05$ ,  $\alpha=0.01$ ).

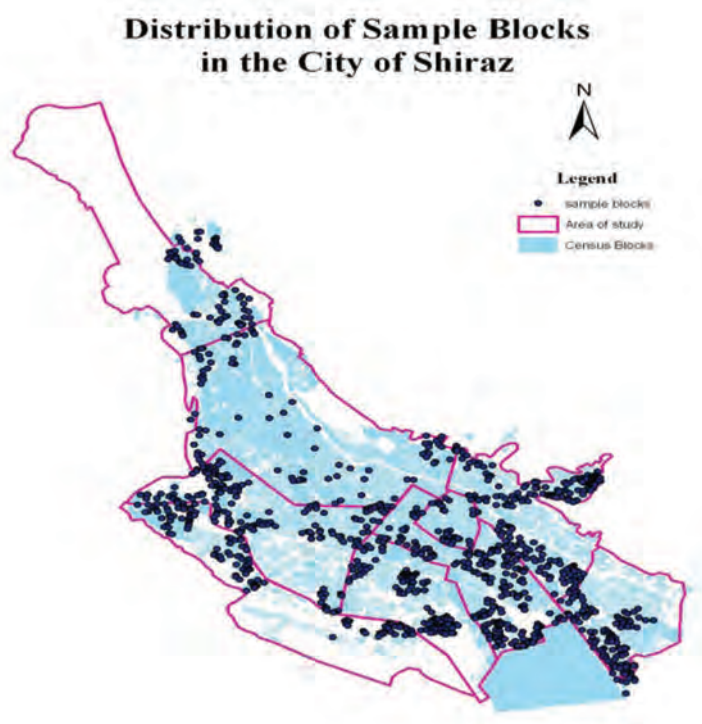


Figure 1. Distribution of sample blocks in the city of Shiraz.

**Table 1.** Pedestrian geographic accessibility in normal days/ holidays, weekends and at night.

Situation	Accessibility in normal days					Accessibility during holidays, weekends and at night				
	150	300	450	600	750	150	300	450	600	750
Acceptable distances	150	300	450	600	750	150	300	450	600	750
Number of sample blocks	35	137	271	414	519	5	21	60	117	175
Percentage of sample blocks	3.5	11.8	23.6	36.09	45.24	0.43	1.83	5.23	10.20	15.25

The municipal regions were considered as clusters and the points were randomly assigned to the blocks' center of these regions based on their number of blocks. Finally about 1147 block centers were selected as the sample which their distribution of them are shown in Figure 1 and then pedestrian and driving accessibility were measured for each of them.

*2.1. Pedestrian geographic accessibility*

To measure the pedestrian accessibility of selected blocks in Shiraz, a straight line

distance measurement was used. Different distances of 150 meter, 300 meter, 450 meter, 600 meter and 750 meter were considered as acceptable levels of geographic accessibility and percentage of the samples (blocks and population) which were within these distances were calculated. To measure pedestrian geographic accessibility during the weekends, on holidays and at nights which in day-opened pharmacies are closed, we omitted day-opened pharmacies and only 24-hour, 7-days pharmacies were considered in the analysis but for measuring geographic accessibility



**Figure 2.** Distribution of pharmacies in the city of Shiraz.

**Table 2.** Driving geographic accessibility in normal days/ holidays, weekends and at night.

Situation	Accessibility in normal days			Accessibility during holidays, weekends and at night		
	5 min	10 min	15 min	5 min	10 min	15 min
Acceptable distances						
Number of sample blocks	1099	1125	1145	827	1125	1145
Percentage of sample blocks	95.8	98.08	98.13	72.10	98.08	98.13

both type of pharmacies were taken into account.

### 2.2. Driving geographic accessibility

To evaluate geographic accessibility in driving condition, we used a network analysis approach. The different network distances of 5, 10 and 15 min were considered as acceptable levels of geographic driving accessibility and percentage of the sample (blocks and population) which were within these distances were calculated. To evaluate driving accessibility to pharmacies on weekend, holidays and at nights we omitted day-opened pharmacies and only considered 24-hour, 7-days pharmacies in our analysis.

## 3. Results

There are 276 pharmacies in Shiraz providing pharmaceutical services to peoples which from those, 59 pharmacies are 24-hour, 7-days open and the others are day-opened pharmacies which are closed on holidays, weekends and at nights. The distribution of pharmacies in Shiraz is shown in Figure 2. The geographic accessibility to pharmacies are presented below separately for pedestrian and driving situation as percentage of selected points (block centers) which are within acceptable distances (meter and minute) from at least one pharmacy.

### 3.1. Pedestrian geographic accessibility

As it is indicated in Table 1, our analysis showed that in normal days about 45% of sample blocks have accessibility to at least one pharmacy in their 750 meters based on straight line distance. Also about geographic

accessibility to pharmacy our analysis showed that only 15% of our sample blocks are within 750 meters distance of at least one 24-hour, 7-days pharmacy.

### 3.2. Driving geographic accessibility

Our analysis indicated that in normal days, about 98% of sample blocks in Shiraz have at least one pharmacy in their 15 min by driving based on network analysis and considering traffic limitation. As indicated in Table 2, about 95% of those blocks have at least one pharmacy within their 5 min distance. About measuring geographic driving accessibility to pharmacy during holidays, weekends and at nights, our analysis showed that about 98% of sample blocks are within 15 min of at least one 24-hour, 7-days pharmacy while about 72% of those sample blocks have one 24-hour, 7-days pharmacy within their 5 min distance by driving.

## 4. Discussion

According to the results, the geographic accessibility to pharmacies by pedestrians and without transportation system is not desirable and this accessibility was shown to be worst in holiday, weekends and at nights. Although geographic accessibility to pharmacies in driving situation was good, but considering the increased costs of using personal vehicle or transportation system and their related difficulties makes attention to pedestrian accessibility more necessary. This issue is even more important for aged people who need more medical and pharmaceutical services [8] and because of their limited physical abilities are faced with more

problems in term of accessibility.

GIS has been used before in other section of healthcare system in Iran [9, 10], however, there are still many limitations regarding the applicability of this tool [11]. Unfortunately, much less studies have been performed around the subject of pharmaceutical policy making and this study is one of the first utilization of GIS as a policy making tool in Iran's pharmaceutical system. Using available tools and techniques as a decision making support system by conducting such studies would help pharmaceutical policy makers to reach their goals in national drug policy (NDP).

Although this study could be considered as one of the pioneer in utilization of GIS in pharmaceutical policy making and analysis and could be as a model for such studies in other provinces and cities of Iran, there are some limitations which could be attended in next study development. In this study, a simple assumption was taken about selecting a pharmacy by people. It was considered that all pharmacies are similar to each other from peoples' points of view and the only criteria for selecting a pharmacy is proximity. But it is clear that it not the case in the real world and people choose to visit a pharmacy based on its comparative advantages in providing better services. This issue could affect the accessibility to pharmacy negatively because people may not choose the nearest pharmacy for many reasons, including quality, socioeconomic reasons, etc. [12, 13]. Also, parts of the population are covered through small insurance funds that are not under contract with all the pharmacies, so this part of population are faced with some limited choices and their geographic accessibility to pharmacies are affected negatively. These limitations related to the pattern of selecting a pharmacy to visit by patients and some other ones including the adequacy of pharmacy supply, influence the accuracy of analysis has to be addressed in next studies.

This study indicated that in spite of current

implemented policy by food and drug organization to distribute pharmacies equitably through the whole city, geographic accessibility to pharmacy doesn't seem to be desirable in Shiraz and some other policies may be needed to make the situation better.

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