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Equity analysis of hospital beds distribution in Shiraz, Iran 2014

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Abstract

Background: One of the important aspects of equity in health is equality in the distribution of resources in this sector. The present study aimed to assess the distribution of hospital beds in Shiraz in 2014.

Methods: In this retrospective cross-sectional study, the population density index and fair distribution of beds were analyzed by Lorenz curve and Gini coefficient, respectively. Descriptive data were analyzed using Excel software. We used Distributive Analysis Stata Package (DASP) in STATA software, version 12, for computing Gini coefficient and drawing Lorenz curve.

Results: The Gini coefficient was 0.68 in the population. Besides, Gini coefficient of hospital beds' distribution based on population density was 0.70, which represented inequality in the distribution of hospital beds among the nine regions of Shiraz.

Conclusion: Although the total number of hospital beds was reasonable in Shiraz, distribution of these resources was not fair, and inequality was observed in their distribution among the nine regions of Shiraz.

Keywords: Equity, Hospital beds, Gini coefficient, Lorenz curve.

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Introduction

Equal access to healthcare services has always been of interest to researchers in different countries of the world (1). Access to health services, in orderto promote, protect, and ensure individuals' health, is one of the important cornerstones of any society. In fact, equitable access of all society members to health services improves the health level for social activities and produces growth and development facilities in the society. Thus, access to health services is the foreground of justice in the society, and the right to have healthcare will produce equal opportunities in the society (2).

Equality in distribution of health resources and its impact on the quantity and quality of the provide d services are one of the permanent concerns and worries of researchers, organizers, and policymakers in the health area (3,4). Justice, regardless of its different concepts, is the basis of service delivery systems, and focus should be provided on a fair distribution of services among different groups of the society (5). Although responding to issues of equity in health may seem difficult, it has deep effects on policy, resource allocation, and legal principles of the government and society generally (3,6).

In developing countries, due to the absence of information, skills, and expertise in the field of health planning, most of the

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resources will face unbalanced allocation. Among these resources, hospital beds can be named. Distribution of hospital beds, as a resource of the health system, can be assessed as an important indicator of the distribution of services (7). The increased application and use of hospital beds for treatment and care activities plays a vital role in treatment and recovery of patients, as one of the most important hospital resources. Nevertheless, incongruous and inappropriate allocation of precious resources throughout the world has led to the loss of resources (8). The increasing number of known treatable diseases, expensive equipment, technology, and new treatment methods as well as increasing levels of social expectations on one hand and limited resources on the other hand have made the need for precise decision making on the allocation of these resources undeniable (9).

Since hospital beds are one of the most important and most valuable resources of the healthcare system, lack of equal and fair allocation among the cities and provinces of the country may not only be a waste of resources but may also induce transport of critically ill patients and thus cause irreparable complications. According to the above explanations, the current study aims to assess the distribution of hospital beds, as a key resource indicator of the health sector, in Shiraz in 2014 using the Lorenz curve and the Gini coefficient.

Methods

This was a descriptive-analytical study with applicable results useful for organizers in the health sector. This study was conducted in Shiraz in 2014, and the research population included all the hospitals in Shiraz (34 Hospitals). The data of the urban population and the number of hospitals and beds (in 2013) were collected from the Strategic Department of Shiraz Municipality and Vice-Chancellery of Clinical Affairs of Shiraz University of Medical Sciences, respectively.

After determining the urban population in 9 regions (determined regions by the municipality, 1-9) and the number of hospital beds in the whole city and each region, fair distribution of beds was analyzed by the Lorenz curve and the Gini coefficient. Also, to investigate the geographic and population access to health facilities (hospital beds) simultaneously, population density index was used (The proportion of the population in area per hectare).

The study was approved by the Ethics Committee of Shiraz University of Medical Sciences.

The Gini coefficient can be calculated using several formulas. In the present study, we used the formula provided by M. Brown (10):

$$G = 1 - \sum_{i=0}^{k-1} (Y_{i+1} + Y_i)(X_{i+1} - X_i)$$

The numerical value of the Gini index is between zero and one, where zero represents perfect equality, and one indicates perfect inequality. If the value of the Gini index is less than 0.2, full equality in the distribution has been observed. If the value of the Gini index is between 0.2 and 0.3, equality in the distribution is largely observed. The values between 0.3 and 0.4 also show inequality of the distribution. Additionally, values between 0.4 and 0.6 indicate a high inequality in the distribution. Finally, those greater than 0.6 indicate a complete inequality in the distribution of resources (8). To use the Gini coefficient formula, the nine regions of Shiraz were ranked according to hospital beds per capita in descending order.

After all, Descriptive data were analyzed by Excel software, version 2013 and Gini index and Lorenz curve was computed using Distributive Analysis Stata Package (DASP) in STATA software, version 12.

Results

The study results indicated that among the nine regions of Shiraz, regions 1 and 4 had the largest population and the highest

Table 1. Demographic data and hospital beds in each council region of Shiraz

City regions	Total population	Population density (person in hectare)	Number of hospitals	Number of active beds	Beds per capita (in 1000 people)
1	226952	74	14	2694	11.8
2	186209	110	7	762	4
3	194709	108	9	1204	6.2
4	229691	99	1	35	0.2
5	152166	91	1	35	0.2
6	165273	57	1	82	0.5
7	188695	128	0	0	0
8	45692	121	1	118	2.5
9	113889	45	0	0	0
Total	1503276	84	34	5420	3.6

population density was related to regions 7 and 8. Demographic data of the nine regions of Shiraz and the distribution of hospital beds among these regions is displayed in Table 1.

Distribution map of the hospitals in Shiraz has been shown in Figure 1. According to the map, distribution of the hospitals in the regions of Shiraz was mainly around the central parts of the city. Considering the geographical distribution of the hospitals in Shiraz, the highest concentration of the hospitals as well as the highest percentage of the hospital beds were within the central parts of the city, while other regions were either disadvantaged or small percentages were allocated to them.

The Gini coefficient was used to measure the amount of inequality and distribution of hospital beds. The Gini coefficient for the

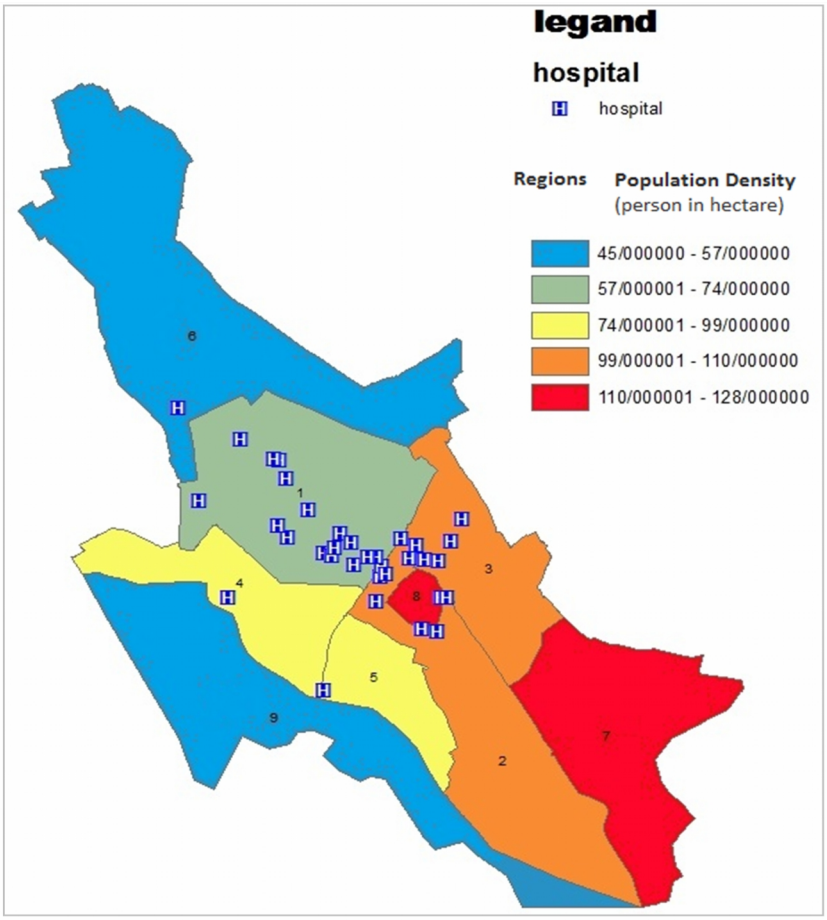

Fig. 1. Map of distribution of hospital beds in Shiraz

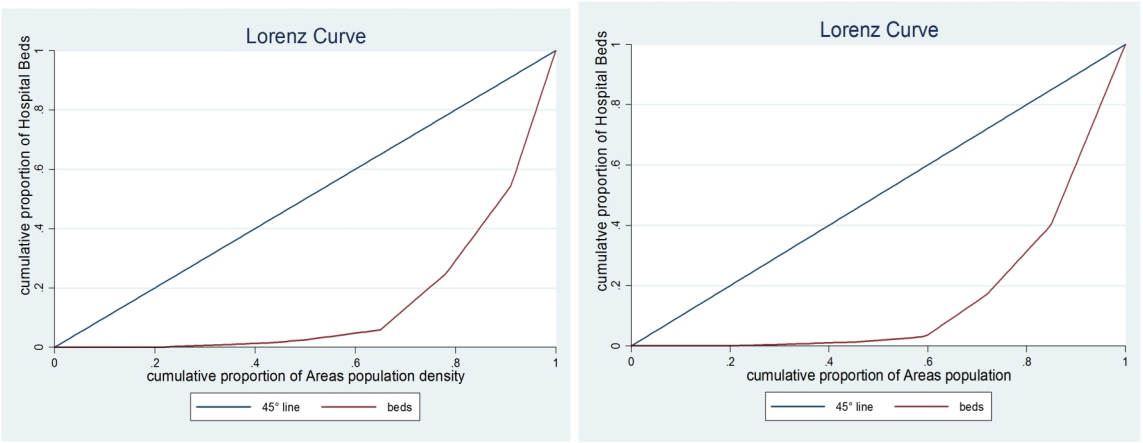

Fig. 2. Lorenz curve of distribution of hospital beds based on population and population density in the 9 regions of Shiraz

distribution of hospital beds based on population in the nine regions of Shiraz was 0.68, significant in the range of 0.39-0.96. This indicated an inequality in the distribution of hospital beds among the nine regions of Shiraz. The Gini coefficients on the Lorenz curve have been given in Figure 2. In addition, the Gini index for the distribution of the number of active beds based on population density in each region was 0.70, significant in the range of 0.44-0.96.

Lorenz curve for the number of active beds and population has been presented in Figure 2. According to the figure, Lorenz curve has a large distance from the optimal limit (Justice line, 45 degrees). This increases the distance between the curve and the justice line, which indicates a lack of proper distribution of hospital beds in the research community.

Discussion

The results of this research on the distribution of hospital beds according to urban regions in Shiraz suggested that one hospital exists for every 44,214 people, and one bed exists for approximately every 278 people (almost 3.6 hospital beds and 0.22 hospitals per 1,000 population). This implies that Shiraz has enough number of hospital beds, which is not far from the desirable global standards. However, according to 2014 World Health Statistics, 0.9 hospitals existed per 10,000 people in the Eastern Mediterranean Region, to which Iran belongs, during 2006-2012. Besides, this figure was 0.8 in low-income countries. According to this report, averagely 27 beds per 10,000 people existed in the world. This value was reported to be 8 in the Eastern Mediterranean Region (11).

Regarding the distribution of hospital beds based on the urban population, the study results revealed uneven distribution of the beds in the population. This was also confirmed by the Gini coefficient (0.68). In fact, although the number of hospital beds was desirable in Shiraz, distribution of the resources was undesirable, and we witnessed inequality in the distribution of hospital beds in the nine regions of Shiraz. The findings of this study indicated that most hospitals were concentrated in the city center, while regions 7 and 9, with 20% of Shiraz population, lacked any hospitals.

The results of national and international studies (12-16) were not in line with those of the present study regarding the Gini coefficient of distribution of hospital beds. In fact, the Gini coefficient of distribution of hospital beds in Shiraz (0.68) was higher than that of other similar studies. This shows the disproportionate and unfair distribution of these resources.

The results of the study performed by Harrow in the U.S. (2004) indicated that the Gini coefficient for the distribution of hospital beds in different states of the country varied significantly from 0.068 to 0.417 in a period of 30 years (16). In China also,

the Gini coefficient of the beds of the community's healthcare centers was calculated as 0.32 in 2007 (17).

The high Gini coefficient (inequality) of distribution of hospital beds in Shiraz can be due to urban development, population growth in rural areas, archaism of most of the hospitals, and lack of construction and establishment of new hospitals in the suburbs. Moreover, according to the results of our study and in comparison to other studies (13-17), a tremendous difference was observed in the distribution of hospital beds, which can be misleading at the first glance regardless of the location and the target population. Certainly, an overview of the beds distribution in different provinces or cities in a province would result in different statistics compared to the distribution of facilities in regions of a city that requires further examination and determination of certain standards in this zone by professionals.

Conclusion

Shiraz has an appropriate number of hospitals and hospital beds, but the main problem is related to the distribution of hospital beds (Gini coefficient: 0.68). According to the study results considering the geographical distribution of the hospitals in Shiraz, the highest concentration of hospitals as well as the highest percentage of hospital beds existed within the central parts of the city, while other areas lacked these facilities or had few hospitals. Also, fair distribution of hospital beds was not met in the nine regions of Shiraz. Since the most important measure needed to calculate other sources, including doctors, nurses, and equipment, is hospital beds, equity in the distribution of these resources can provide justice in the distribution of other factors. Therefore, to achieve greater equity in access to services, a system is suggested to be organized for comprehensive and continuous monitoring of equitable allocation of health resources, including hospital beds.

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