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Trend of Inequality in the Distribution of Health Care Resources in Iran

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Abstract

Background: Equity of access to health care services is one of the main goals of health system. Equity in resource distribution in health section constitutes one of the main dimensions of the equity. The aim of the study is determining how doctors, paramedics and hospital beds are distributed in Iran.**Materials and Methods:** This analytical study was conducted in Iran. Data on 2006-2013 were collected from Statistics Center of Iran and Iran Ministry of Health and Medical Education. After determining the population of 31 provinces and number of physician, paramedics and hospital beds in them, the equal distribution of these facilities and personnel were analyzed using Lorenz curve and Gini coefficient. Stata 12 and DASP2.2 were used for analyzing Gini index. **Results:** The total number of physicians, paramedics and hospital beds were 37,000, 217,000 and 138,000, respectively in 2013. Tehran as the capital of Iran had the highest percentage of beds among all provinces. The number of physicians, paramedics and hospital beds per 10,000 population of the country were 5.6, 31.3 and 18.5, respectively for 2013. The calculated Gini coefficients for each of them were 0.47, 0.39 and 0.58, respectively. **Conclusion:** According to Gini coefficients, physicians, paramedics and hospital beds have an unequal distribution throughout the country. However, these distributions are different in different provinces. We recommend creating a comprehensive and continuous monitoring system for equitable allocation of health care resources.**[GMJ.2016;5(3):122-130]**

Keywords: Inequalities; Health Resources; Distribution; Health Services Accessibility

Introduction

There has been growth in the field of equity in recent years. Mostly policy makers, researchers and investigators employ this concept. Researchers and policy makers can make and use their own definition of equity according to different views expressed [1]. Health inequities come up from differences in access to health care among different individuals and groups. Equity health measuring sector involves concepts like health level, distribution of health care resources, costs, use and access. The definition of equity is intuitively and fundamentally appealing and when defined as equality of health; however,

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accurate measurement of health and distribution of health care resources is a problem in equalization of the levels. It is also possible in some cases to achieve this definition sometimes with efficiency and sometimes with inefficiency [2].

The right to health care, including the Universal Declaration of Human Rights, has emphasized its importance to the extent that the constitutions of many countries have noted it. Also, principle 29 of the Iranian constitution considers social security and health services and medical care as a universal right, indeed. The government has obligated the execution of it under the rules of Financial Services and support for each individual living in this country [3]. Health equity encompass the concerns and issues of permanent concern of researchers, economists, planners and policy makers in the field of health [4, 5].

Regardless of different concepts of equity, it is a service-oriented system. It should focus on a fair distribution of services among different social groups [3, 6]. Although responding to issues of equity in health may seem difficult, it is profoundly influential in policy, resource allocation and general legal principles of government and society [5, 7].

Attention to socially vulnerable groups when assessing the community needs and creating compensatory mechanisms to solve health problems of those who are in poor health status is important [3, 6]. An empirical estimation of equity can only proceed in case it is quite clear what it means by the term "equity". Equity in the health sector can be measured using the concepts of health status, distribution of resources, expenditures, utilization and access [8, 9].

Access to health care and its facilities is a fundamental right of all human beings. In this context, the inequality in the geographical distribution of health resources has made access to health services difficult [6, 7, 10]. In developing countries, due to the lack of information, skills and expertise in health care planning, there is often imbalanced allocation of resources. The distribution of hospital beds, physicians and paramedics as the most important healthcare resources can be used as an indicator of the distribution of services [11].

Nowadays, researchers and policymakers increasingly consider the equity issues in distribution of health resources [such as beds and physicians, equipment, etc.) as the indicators of general health [11, 12].

Hospital beds and number of physicians and paramedics working in the health sector are the most important and most valuable resources of a health system, and lack of equal and fair allocation among provinces of the country may lead to displacement of critically ill patients and consequently, irreparable problems. However, there are few studies done on density and equity in distribution of hospital beds and medical personnel in the country.

Therefore, the aims of the present study are measuring and visualizing the inequality in the geographical distribution of health facilities and personnel in Iran.

Materials and Methods

This retrospective study was conducted using data from 2006 to 2013 and research community encompassed all provinces in Iran.

Study Setting

Iran, a lower-middle-income country, is located in the Eastern Mediterranean Region. The country has 31 provinces (Figure-1), 402 districts, 999 cities with an estimated population of 80 million.

Iran is the most populous country in the region, and the 16th most populous country in the world.

According to the latest report of the Statistical Center of Iran (SCI) in 2013, there were 11175 healthcare institutions (hospitals, maternity and nursing homes) with more than 138000 fixed beds.

It is noteworthy that about 62% of these institutions are affiliated to the Ministry of Health and Medical Education (MHME).

In this year, 9625 pharmacies, 5303 Medical Laboratories, 2825 radiology centers and 5542 rehabilitation centers (physiotherapy, occupational therapy, speech therapy, eudiometry, optometry and orthotics) with 1635 pharmacists and 3332 dentists were active in the country. In addition, 217,000 paramedics worked in this year.

Figure 1. Map of Iran and its Provinces in 2013 and 2014

Data Sources and Variables

In the study, the population data of Iranian provinces based on population census in 2011 and 2006 conducted by SCI was used. The latest data on the number of physicians, paramedics and active beds collected from SCI was adapted from MHME data. The total number of physicians consisted of general practitioners, pharmacists and dentists in the public and private sectors.

The number of paramedics consisted of total personnel (nurses, staff, lab and imaging, health, etc.) in both public and private sectors. The divisions in 2011 and due to the lack of data in Alborz Province, the data for 2011 were excluded in accordance with the procedure prior to Tehran after it was added.

Inequity Indicators

Lorenz Curve and Gini Index:

Gini index and Lorenz curve are commonly used in analyzing the inequality in the distribution of health care resources [13-15].

Lorenz curve is used to compare the distribution of specific health variables with perfect equality (diagonal line).

This curve plots the cumulative share of population ranked by health variable, in an increasing order, against the cumulative share of health variable. The greater the distance from the diagonal line, the greater the degree of inequality.

The area between Lorenz curve and diagonal line presents a measure of inequality entitled Gini Index which is equal to twice the area between Lorenz curves and diagonal line.

The numerical value of Gini index is between zero and one, where zero represents perfect equality and one indicates perfect inequality. If the value of Gini index is less than 0.2, full equality in the distribution is observed; if it is between 0.2-0.3, equality in the distribution is largely observed. The values between 0.3-0.4 show inequalities of the distribution, those between 0.4-0.6 indicate high inequality in the distribution, and finally those greater than 0.6 indicate complete inequality in distribution of resources [16].

In the current study, the formula proposed by Brown [17] was used for calculating Gini index as follows:

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

G: Gini Index
Y_i: cumulative share of physicians, paramedics or hospital beds in the its province
X_i: cumulative share of the population in the its province
K: total number of provinces

Data Analysis

After determining the population by province, as well as the number of hospital beds,

Table 1. Number of Physicians, Paramedics and Hospital Beds Per 10000 People in Provinces of Iran, 2006 and 2013

Province	2006			2013		
	Physician	Paramedics	Hospital bed	Physician	Paramedics	Hospital bed
East Azerbaijan	2,789	21,685	15,962	4,958	29,099	19,894
West Azerbaijan	3,146	21,034	10,806	4,42	29,766	13,234
Ardebil	2,622	22,196	13,98	5,459	33,65	13,674
Esfahan	4,209	27,939	15,739	5,662	31,408	19,015
Ilam	2,419	30,213	9,582	8,057	41,332	18,888
Bushehr	4,4	24,643	9,399	5,608	33,892	12,838
Tehran	3,569	16,401	20,204	5,214	20,775	26,732
Chaharmahal	5,292	30,889	14,372	11,011	45,38	15,144
South khorasan	1,09	3,282	1,549	0,982	5,952	1,695
Razavi khorasan	31,866	185,239	144,48	36,152	234,994	139,942
North khorasan	0,468	3,261	1,407	0,703	4,564	1,563
Khuzestan	17,928	103,318	87,99	29,857	152,901	91,932
Zanjan	4,644	27,618	11,176	6,408	36,383	16,696
Semnan	7,613	35,914	18,534	8,918	43,439	30,599
Sistan & Baluchistan	2,486	20,002	8,804	4,764	31,112	9,796
Fars	3,486	22,02	14,54	7,354	35,533	24,534
Qazvin	3,411	19,148	11,258	4,64	19,147	17,497
Qom	2,771	14,913	10,614	4,754	21,982	16,831
Kurdistan	3,826	25,942	14,88	5,423	36,685	15,28
Kerman	3,289	16,974	13,939	5,584	33,353	14,689
Kermanshah	3,655	38,704	12,791	5,113	36,138	16,767
kohkiloye	3,327	29,655	10,027	6,818	50,144	11,644
Golestan	5,399	20,116	11,187	5,649	37,256	14,503
Gilan	4,582	25,648	12,562	6,899	34,847	19,079
Lorestan	3,268	21,316	9,741	4,856	34,077	14,347
Mazandaran	4,934	26,084	12,89	6,903	47,445	17,464
Markazi	3,463	20,84	13,817	4,402	31,518	13,283
Hormozgan	3,192	23,339	12,197	4,552	35,028	12,746
Hamadan	3,675	24,547	12,852	6,119	40,627	17,393
Yazd	5,601	30,601	25,393	7,358	37,918	25,925
Iran	3,718	22,061	14,989	5,588	31,299	18,534

Table 2. Inequality Indicators for Distribution of the Health Facility and Personnel in Iran

Year	Variable	Gini coefficient	STE	LB	UB
2006	Physician	0.49	0.03	0.43	0.56
	Paramedics	0.44	0.03	0.37	0.52
	Hospital beds	0.52	0.03	0.45	0.59
2007	Physician	0.49	0.03	0.43	0.56
	Paramedics	0.44	0.03	0.36	0.52
	Hospital beds	0.59	0.04	0.50	0.69
2008	Physician	0.50	0.03	0.43	0.57
	Paramedics	0.42	0.03	0.35	0.50
	Hospital beds	0.59	0.04	0.50	0.69
2009	Physician	0.48	0.03	0.40	0.55
	Paramedics	0.41	0.03	0.33	0.50
	Hospital beds	0.58	0.04	0.48	0.69
2010	Physician	0.47	0.04	0.39	0.55
	Paramedics	0.41	0.04	0.32	0.49
	Hospital beds	0.57	0.04	0.49	0.66
2011	Physician	0.47	0.04	0.39	0.56
	Paramedics	0.40	0.04	0.32	0.49
	Hospital beds	0.58	0.03	0.50	0.66
2012	Physician	0.48	0.03	0.40	0.55
	Paramedics	0.39	0.03	0.31	0.47
	Hospital beds	0.58	0.03	0.50	0.66
2013	Physician	0.46	0.03	0.39	0.54
	Paramedics	0.38	0.03	0.30	0.47
	Hospital beds	0.57	0.04	0.49	0.66

STE: Standard Error
LB: Lower Bounds
UB: Upper Bound

number of physicians and paramedics in the country for each province, fair distribution of variables was analyzed using Lorenz curve and Gini coefficient.

Descriptive data were analyzed with Excel 2013 software and the Gini index, and Lorenz curve was calculated using DASP2.2 STATA12 software.

Results

Iran's population was 70,485,635 in 2006 and increased to 74,740,116 in 2013. In 2006, there were 26,208 physicians, 155,498 paramedics and 105,654 hospital beds which increased to 41,768, 233,927 and 138,526 in 2013, respectively.According to the findings, in Iran there were 3.718 physicians, 22.061 paramedics and 14.989 hospital beds per 10,000 individuals in 2006 which increased to 5.558, 31.299 and 18.534 in 2013.

Table-1 illustrates the number of physicians, paramedics and hospital beds in 2006 and 2013 in Iran's provinces. According to this Table, Khorasan Razavi province had the highest number of physicians (36.152), paramedics (234.994) and hospital beds (139.942) and North Khorasan province had the least number of physicians (0.703), paramedics (4.564) and hospital beds (1.563) per 10,000 individuals in both studied periods (2006 and 2013).

The results of radar chart showed that the 10th and 12th provinces (Khorasan Razavi and Khuzestan) had the highest per capita and the 9th and 11th provinces (South and North Khorasan) have the lowest per capita.

Moreover, the findings of the study showed that there was an increasing trend in the num-

ber of physicians, paramedics and hospital beds from 2006 to 2013.

The number of physicians increased with a slow slope, whereas that of paramedics increased with a steeper slope.

Table-2 shows the Gini coefficient number of physicians, paramedics and hospital beds for the population from 2006 to 2013. According to Table-2, there was an irregular trend for the Gini coefficient for the number of physicians and hospital beds from 2006 to 2013, whereas there was a decreasing trend for the Gini coefficient for paramedics in the same period indicating more justice in the paramedic distribution in Iran. Figure-2 shows the Gini coefficient in the studied period. According to the Figure-2, there was a steeper decline for the Gini coefficient of paramedical staff during the studied years indicating more justice in the distribution of paramedics in the population.

Figure-3 illustrates the Lorenz curve of distribution of health facilities (physicians, paramedics, hospital beds). The greatest inequality in the distribution of health facilities was related to the hospital beds in both 2006 and 2013 in Iran.

Discussion

Balanced and proportionate distribution of health resources, particularly specialist human resources and hospital beds are the factors that improve health indicators and as a result increase equity and social justice. In developing countries, often due to the lack of information, skills and expertise in health planning, resources are often allocated unevenly [18];

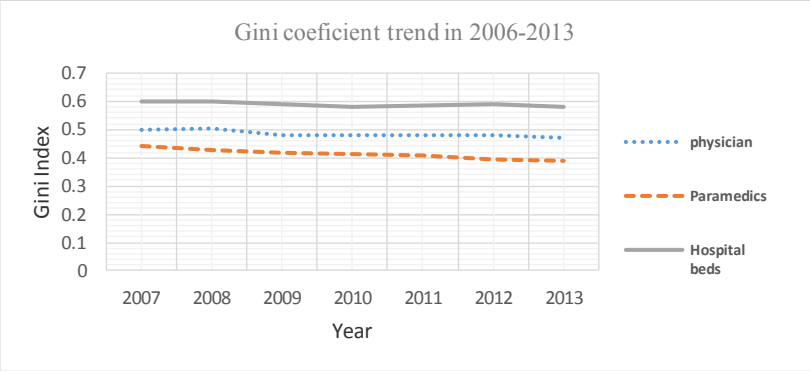

Figure 2. Trend of Gini Coefficient in Distribution of Health Care Resources in Iran, 2006-2013

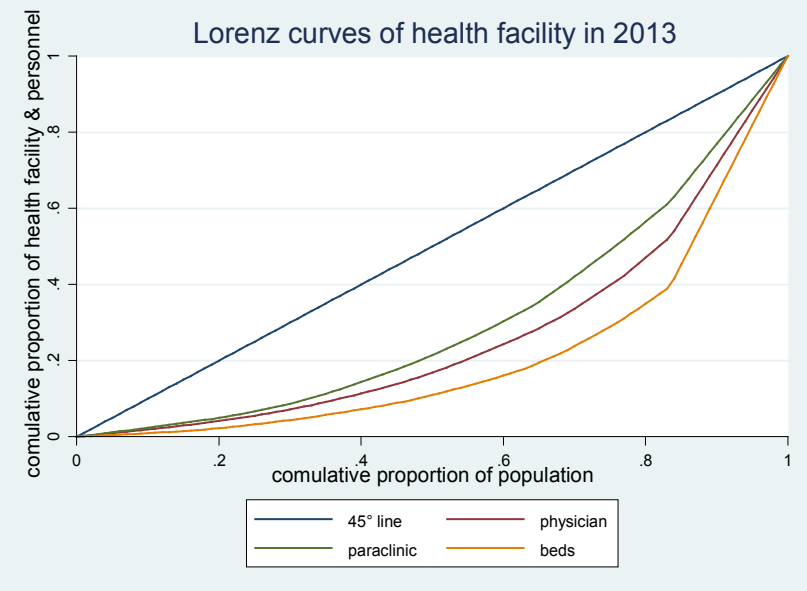

Figure 3. Lorenz Curves for the Distribution of Physicians, Paramedics & Hospital Beds Among Provinces in Iran, 2013

however, in Iran, health promotion with equitable distribution of health facilities is taken into consideration and policy-makers have always sought to achieve this goal in socio-economic development programs [19]. Accordingly, the present study aimed to evaluate justice in the distribution of health resources in Iran.

The results considering the number of physicians, paramedics and hospital beds per 10,000 individuals revealed that there was an increase in the number of physicians, paramedics and hospital beds from 2006 to 2013; however, due to unequal distribution of resources in such provinces, the ratio is quite different.

According to the results, in 2013 in Iran, there was an average one physician per 1,789 people, a paramedic per 319 people and one hospital bed per 540 people. The ratio is very different in other provinces, so that per capita physician varies from 36.152 in North Khorasan province to 0.703 in Khorasan Razavi province; the number of paramedical staff varies from 234.99 in Khorasan Razavi province to 4.564 in North Khorasan province and the number of hospital beds varies from 139.94 in Razavi Khorasan to 1.695 in South Khorasan province per 10,000 people in 2013. Therefore, it can be said that the distribution of the resources in Iran was not equal and fair and the Ministry of Health has performed poorly in the distribution of health resources to the provinces and many parts are facing shortage of resources.

Jin *et al*.'s study in China showed similar results; based on the results, the distribution of beds in different health care institutions in China varied from 1.1 to 48.97 beds per 10,000 individuals [20]. A study in Japan showed that in Japan, the number of physicians as to the population from 1996 to 2006 was always increasing (an increase of 3.1 percent each year) [1].

The average number of physicians and hospital beds from 2006 and 2013, per 10,000 people in Iran were calculated 6, 38 and 20.53, respectively. According to World Health Statistics (2014), during 2013-2006 in the Eastern Mediterranean region (including Iran), there were 11.4 and 8 physicians and hospital beds per 10,000, respectively and also 14.1 and 27, respectively worldwide. These values indicate that the average number of hospital beds in Iran was higher than the average of Eastern Mediterranean region, but the number of physicians and paramedics were much smaller than the average for the region and worldwide [21].

Gini index of medical personnel indicates that there was no increase in Gini coefficient for physicians' distribution between 2006 and 2013 in Iran, so it reached from 0.49 in 2013 to 0.46 in 2006. In fact, in Iran, the Gini coefficient of the distribution of physicians has changed, so that the maximum number (0.505) was reported in 2008 and the lowest number (0.478) in 2010. These values indicate that there was an unfair distribution of physicians to the population in Iran.

Huang's study in Taiwan has shown similar results; there was no increase in geographical distribution for all physicians in Taiwan from 1984 to 1998, according to the Gini coefficient, increasing the medical personnel can improve the geographical distribution of physicians [22].

Erdinç Ünalin in Turkey found that Gini coefficient for the distribution of physicians between 1965 and 2000 due to government intervention dropped from 0.47 to 0.20 [23]. Moreover, that of distribution of physicians in 2010 was estimated 0.14 by Yardım and Üner, indicating an improvement in equitable distribution of physicians in Turkey [24]. Horeve in America concluded that the Gini coefficient of distribution of physicians varied from 0.089 to 0.399 in different states [25]. The results of another study in Thailand showed that the Gini coefficient of distribution of physicians was 0.433, indicating poor distribution of physicians in Thailand [26]. Tandi in Cameron showed that the Gini coefficient of distribution of physicians was 0.527, partly indicating similar levels of inequality in the distribution of physicians in Iran [27].

The Gini coefficient of distribution of paramedic showed that it declined from 0.449 in 2006 to and 0.389 in 2013. Although these values partly reflect the inequality in the distribution of resources, distribution of paramedic personnel in Iran is partly fairer than

that of physicians and hospital beds. Tandi in Cameron concluded that distribution of paramedic personnel is more equitable to that of physicians. In this study, the Gini coefficient for distribution of paramedics is estimated 0.366 [27]. Additionally, the Gini coefficient for hospital beds indicate that this amount varied from 2006 to 2013, the lowest amounts (0.523) in 2006 and the highest amounts (0.598) in 2007. It indicates that hospital beds are not distributed fairly in Iran. In fact, although the number of hospital beds in Iran was appropriate, higher than the average of neighbor countries, it is not distributed well. Therefore, we can see inequality in the distribution of hospital beds in Iran. Horev reported the lowest and highest Gini coefficient of hospital beds in the American states about 0.057 and 0.43, respectively. Although it is much lower than our results, it indicates the inequality in the distribution of hospital beds in America [25]. Also, Jin *et al*. [20] reported 0.639 for Gini coefficient of distribution of health care institutions in China, representing a high level of inequality in the geographical distribution of health care beds in China, which is partly consistent with the results obtained in this study.

Conclusions

Hospital beds, physicians and paramedics are not fairly distributed in Iran. Although the number and distribution of health resources in Iran are different from those of other countries, it should be noted that the comparison of inequality in the distribution of health care resources and human resources among different countries reveals that the most important indicators of these differences are differences in the health systems, health care presentation as well as differences in geographical areas. It is necessary for the authorities and health policy-makers to consider scientific principles and essential standards in the distribution and allocation of resources.

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Conflict of Interest

The authors declared no conflict of interest.

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