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ARAŞTIRMA / RESEARCH

Equality in distribution of pharmacist workforce in Iran

İran'da eczacı iş gücünün dağılımındaki eşitlik

Javad Ebrahimzadeh[1], Hadi Hayati[2], Samin Nobakht[3], Shahin Soltani[2], Hamid Salehiniya[4], Bahman Khosravi[2]

[1] Islamic Azad University, Mashad, Iran
[2] Tehran University of Medical Sciences, Tehran, Iran
[3] Islamic Azad University, Tehran, Iran
[4] Zabol University of Medical Sciences, Zabol, Iran

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Abstract

Purpose: To achieve health for everyone, health systems in all countries need training and proper distribution of human resources in the spatial and temporal places. This study aimed to evaluate the equality of the distribution of pharmacists affiliated to medical universities in the country.

Material and Methods: The data for this study were collected from the Statistical Center of Iran and Statistical Yearbook of 2014. After collecting data we started to analyze the distribution of pharmacists according to population. In entire Iran country, 31 provinces and in three types of universities of medical sciences those are responsible for distribution of health human resources in each province by Gini and Theil T indices.

Results: Results show that, 16 provinces have a positive gap and 15 provinces have a negative gap and there is no balance in the share of the population in compare of the pharmacist in any of the provinces. Overall Gini coefficient was 0.71 and Theil T showed that within inequality explained 47.2% and between inequality explained 52.8% overall inequality. The Gini index in Type 3 provinces was 0.5 and they have better distribution than type 1 and type 2 provinces with 0.6 and .64 Gini index.

Conclusion: Pharmacists play an important role in providing guidance and advice for the correct use of drugs. Appropriate distribution of pharmacists is one of the most important factors in improving access and health services throughout the society. But unfortunately there is an unbalanced geographical distribution in the country and there still is a significant deficit in the deprived areas.

Key words: Equity, human resource, pharmacist.

Öz

Amaç: Herkes için sağlık hizmeti sağlayabilmek amacıyla, tüm ülkelerdeki sağlık sistemleri insan kaynaklarının mekansal ve zamansal olarak eğitim ve uygun dağılımına ihtiyaç duyar. Bu çalışma, ülkedeki tıp üniversitelerine bağlı eczacıların dağılım eşitliğini değerlendirmeyi amaçlamıştır.

Gereç ve Yöntem: Bu çalışma için veriler İran İstatistik Merkezi ve 2014 İstatistik Yıllığı'ndan toplanmıştır. Verilerin toplanmasından sonra, eczacıların populasyona göre dağılımını incelemeye başladık. İran'ın tümünde 31 il ve üç tür tıp bilimi üniversitesi her ildeki insan sağlık kaynaklarının Gini ve Theil T endeksince dağılımından sorumludurlar. Theil T, İran illerindeki "iç" ve "ara" eşitsizlikleri açısından genel eşitsizliği gidermek ve sonuçları Excel ve STATA yazılımı ile gerçekleştirmek için kullanılmıştır.

Bulgular: 16 ilin olumlu bir boşluğa sahip olduğunu ve 15 ilin olumsuz bir boşluğa sahip olduğunu ve illerin herhangi birinde eczacının karşılaştırılmasında populasyon payında denge olmadığını göstermektedir. Genel Gini katsayısı 0.71 ve Theil T eşitsizlik içinde % 47.2 olduğu ve eşitsizlik arasında % 52.8 genel eşitsizlik olduğu açıklandı. Tip 3 illerindeki Gini indeksi 0.5 olup ve tip 3 illerindeki bu indeks tip 1 ve 2'ye göre 0.6 ve 0.64 Gini indeksli olup daha iyi dağılım göstermektedir.

Sonuç: Eczacılar ilaçların doğru kullanımı için rehberlik ve tavsiye sağlamada önemli bir rol oynamaktadır. Eczacıların uygun dağılımı erişim ve sağlık hizmetlerinin topluma yaygınlaştırılmasında en önemli faktörlerden biridir. Ancak maalesef ülkede dengesiz bir coğrafi dağılım vardır ve hala yoksul bölgelerde önemli bir açık bulunmaktadır

Anahtar kelimeler: Eşitlik, insan kaynağı, eczacı.

Yazışma Adresi/Address for Correspondence: Bahman Khosravi, Tehran Universityof Medical Sciences, Iran.
E-mail: bkhosravi67@gmail.com
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INTRODUCTION

World Health Organization, Considers health as the most basic human right for every individual, which must be equally available to all members of the society without any discrimination. Achieving this goal requires experts such as doctors, nurses, pharmacists and other healthcare staff who are main assets of health care organizations[1]. Nowadays, many countries face critical challenges in the field of human resource management, such as lack of healthy human resources, lack of harmony in combined skills, unbalanced geographical distribution, poor working conditions and lack of knowledge and skills in their staff[2]. While human resources are the most important input and the heart of the health system and proper exploitation of human resources is the main component of giving service. Most of the problems in the health system are due to lack of manpower or excessive manpower and its inappropriate distribution. A balanced and appropriate distribution of human resources could improve health indicators in a country. Health service depends not only on the number and frequency of human resources, but also it depends on the distribution of these resource in different regions of the country[3].

Justice and equality in the health system, is considered as one of the important criteria for distribution of resources and access to health care. Justice is a broad concept that includes effectiveness of management and also allocation of resources because when the effective utilization of resources is limited, it means that the unmet needs will increase[1]. to achieve health for everyone and social justice, health care system requires training and proper distribution of human resources in the spatial and temporal places[4].

One of the main concerns of health systems in the world, especially developing countries, is eliminating injustice and inequality in the health sector. Lack of financial and human resources on one hand, and the ever-increasing complexity of health on the other hand, have caused important challenges for supply, maintenance and promotion of health in different societies. The necessity for attention to this important issue is for everyone, especially policy makers and related executives[5]. In discussing manpower, there has always been the problem of imbalance and one of the most important inequalities of resources is the unequal distribution of human resources. Imbalance in human resources of health care is a complex and unpleasant phenomenon which can be in terms of quantity, quality or distribution (distributional imbalance such as: geographical and occupational, professional, institutional or even sexual)[6].

For most people, pharmacists (pharmacies) are one of the most accessible resources and Due to the large number, the extensive geographical distribution and long-time operation of the pharmacy, pharmacists are in the best position to monitor drug effects and avoid adverse drug reactions and to coordinate medications prescribed by health care providers. Thus, equitable distribution of pharmacists can help improve people's health[7] and fast and timely access to them reduces the burden of disease and causes social justice[8]. Therefore, this study aimed to evaluate the equality of the distribution of pharmacists under the supervision of medical universities in Iran.

MATERIAL AND METHODS

This study is an applied research and its method is descriptive-analytic, in terms of time is a retrospective review that took place in Iran in the year 2014.The subjects in this study are pharmacist under the supervision of Universities of Medical Sciences. The data for this study were collected from the Statistical Center of Iran and Statistical Yearbook of 2014 (This data is collected by medical universities in each province and is given to the statistics center). Since the information of all the population was available, there was no need for sampling. Also, because in the course of the study real data and existing documents were used, investigating the validity and reliability had no relevance.

Iran is a country with 31 provinces, among which Qom is the only province that has only one city and therefore it is not possible to calculate the distribution of inequality for it, however data for this province is considered at the national level. After examining inequality in the entire country and in the provinces and in order to understand the distribution inequality, we begin to investigate the distribution of pharmacists covered by universities of medical sciences at different type universities. In Iran universities of medical sciences are divided into three categories: type 1, type 2 and type 3.Universities of medical sciences of each province

are responsible for the distribution of the human resources for the health service in each province. In 2014, 7 provinces were under the supervision of type 1 medical universities, 16 provinces were under type 2 and 8 provinces were under the supervision of type 3 medical universities. After collecting data we started to analyze the distribution of pharmacists in terms of population and conducted the results by Excel and STATA 11 applications.

Gini and Theil T index

In this study, the Gini coefficient and Theil T are used to calculate inequality in the distribution of pharmacist. The reason we use the Gini coefficient to measures inequality is that it's one of the most famous and the most common sources used in studies of the distribution of resources; It measures the aggregate level inequality and takes values between 0-1, also it measures deviation between observed distribution and perfectly equal distribution; but, unfortunately, is not decomposable; In order to solve this problem we have used Theil t index. In this study, the Gini index is calculated using the following formula.

$$\hat{I} = 1 - \frac{\hat{\xi}}{\hat{\mu}}$$

Where: $\hat{\xi} = \sum_{i=1}^{n} \left[\frac{(V_i)^2 - (V_{i+1})^2}{(V_1)^2}\right] y_i$

And $V_i = \sum_{h=i}^{n} w_h$ And $y_1 \geq y_2 \geq \cdots y_{n-1} \geq y_n$

That y_i is value of the variable of pharmacists for observation (county) i and $w_i = hw_i * hs_i$ that hw_i is sampling weight for observation i and hs_i is size of observation i and $\hat{\mu}$ is the mean of y.

And the Theil T index is estimated as

$$\frac{1}{\sum_{i=1}^{n} w_i} \sum_i \frac{w_i y_i}{\hat{\mu}} \log\left(\frac{y_i}{\hat{\mu}}\right)$$

The main advantage of the Theil T is that it can be decomposed in within and between subgroup or sub-national areas like provinces which allows accounting for different sources of inequality. The between-group inequality increases with the increase in number of group and considering that in this study, 31 groups (provinces) have been studied, the index is quite high.

One of the weaknesses of Theil index in the calculation of inequality is that groups and subgroups that have zero values are not considered; therefore we should replace small amounts with zero to not interfere in the calculations.

The calculated Gini index was transferred to the GIS software (Arc GIS 10.2), and mapping tools of GIS were then used for visualizing Gini index. The Gini index in complete equality is zero and in complete inequality is one. Usually if this index is between 0.2 and 0.35, it is a relatively balanced distribution and if it is between 0.35-0.5 it is a relatively unequal distribution and if the index is 0.5 - 0.7 it's a complete unequal distribution[9].

RESULTS

In this study, we calculate each provinces share from the country's population and the general pharmacists of the country and put them in table 1. The results show that Tehran, the capital of the country has 16.2 percent of the country's population, which is the highest share; while the share of pharmacists in this province is 13.67 percent of the country, this shows a negative gap of 2.53 percent which is the largest negative gap among the provinces. The result of this calculation is presented schematically in Graph 1.

Also Mazandaran province has 4.09 percent of the country`s population but 9.74 percent of the pharmacists of the country. This indicates a positive gap of 5.65 percent, which among the provinces has the largest positive gap. In general 16 provinces have a positive gap and 15 provinces have a negative gap and there is no balance in the share of the population in compare of the pharmacist in any of the provinces. That is why the inequality in the country and among the provinces is not improbable.

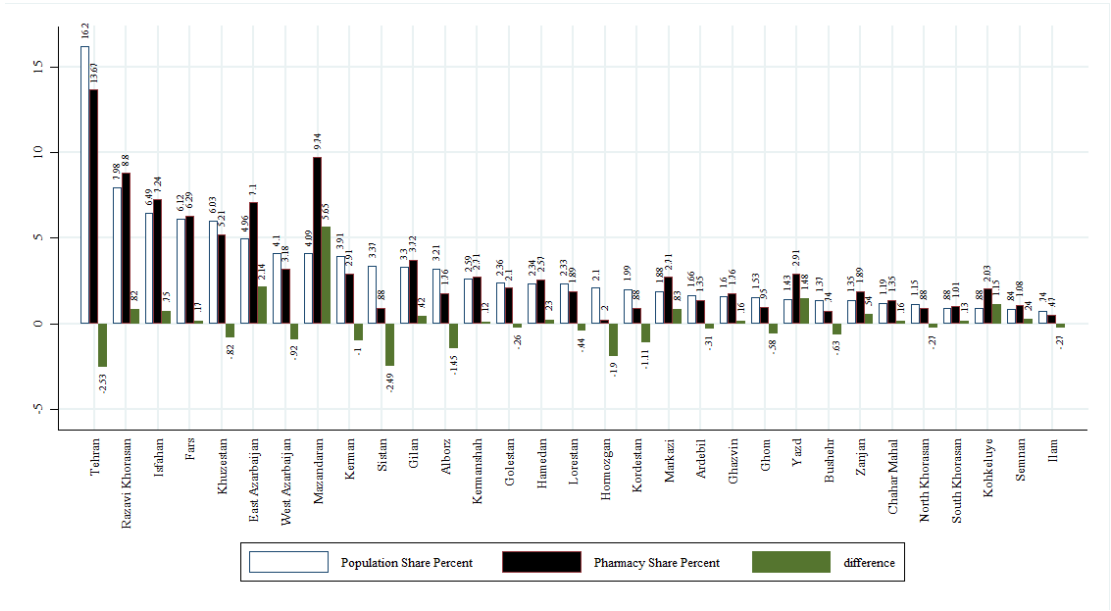

Figure 1. Population share percent, pharmacist share percent and difference between them in Iran

For a closer look at the inequality of the countries pharmacists, we considered the regions of the country as subgroups, so in addition to calculating the inequality in the country, identify the source of the overall inequalities. The results of the inefficiency calculation that is the Gini coefficient and Theil T index are shown in Table 1.

Table1. Population share, Pharmacist share, Gini index and Theil index of pharmacist distribution in Iran

ID	Provinces	Density Per 100000 Population	Population Share (Percent)	Pharmacist Share (Percent)	Gini Index	Theil Index
1	Markazi	2.83	1.88	2.71	0.377	0.3
2	Gilan	2.22	3.3	3.72	0.543	0.616
3	Mazandaran	4.68	4.09	9.74	0.663	0.86
4	East Azarbaijan	2.82	4.96	7.1	0.523	0.674
5	West Azarbaijan	1.53	4.1	3.18	0.52	0.532
6	Kermanshah	2.06	2.59	2.71	0.434	0.473
7	Khuzestan	1.7	6.03	5.21	0.632	0.845
8	Fars	2.02	6.12	6.29	0.542	0.636
9	Kerman	1.46	3.91	2.91	0.659	0.89
10	RazaviKhorasan	2.17	7.98	8.8	0.455	0.51
11	Isfahan	2.19	6.49	7.24	0.517	0.62
12	Sistan&Baluchestan	0.51	3.37	0.88	0.643	0.844
13	Kordestan	0.87	1.99	0.88	0.547	0.593
14	Hamedan	2.16	2.34	2.57	0.506	0.51
15	ChaharMahal&Bakhtiari	2.23	1.19	1.35	0.563	0.696
16	Lorestan	1.6	2.33	1.89	0.453	0.365
17	Ilam	1.26	0.74	0.47	0.617	0.957
18	Kohkeluye& Buyer Ahmand	4.55	0.88	2.03	0.381	0.3
19	Bushehr	1.06	1.37	0.74	0.605	0.728
20	Zanjan	2.76	1.35	1.89	0.477	0.538

21	Semnan	2.53	0.84	1.08	0.231	0.175
22	Yazd	4	1.43	2.91	0.432	0.49
23	Hormozgan	0.19	2.1	0.2	0.765	1.4
24	Tehran	1.66	16.2	13.67	0.31	0.336
25	Ardebil	1.6	1.66	1.35	0.48	0.527
26	Ghom	1.22	1.53	0.95	-	-
27	Ghazvin	2.16	1.6	1.76	0.49	0.58
28	Golestan	1.74	2.36	2.1	0.599	0.7
29	North Khorasan	1.5	1.15	0.88	0.495	0.541
30	South Khorasan	2.26	0.88	1.01	0.55	0.67
31	Alborz	1.08	3.21	1.76	0.137	0.1
Total	Iran	1.97	1	1	0.71	0.95

* Index of inequality for the province Qom is incalculable because it only has one city.

These values help us to have a more logical view on the distribution of government pharmacist in each province and the whole country. The result of the Gini coefficient shows that the inequality in the distribution of government employed pharmacist in the country is 0.71. The Gini index is a relative index and has values between zero and one, the index value zero represents an equal distribution of resources and the value one represents a highly unequal distribution of resources among the population. The Gini index of 0.71 indicates that governmental pharmacist in Iran is unevenly distributed.

Among the provinces, Alborz has the lowest Gini coefficient (0.137) and the pharmacist distribution is highly even. Hormozgan province has the most value Gini coefficient (0.765) and so the pharmacists in this province are largely unequal. The minimum and maximum Gini coefficient among the provinces and the country's Gini coefficient are shown in the Lorenz diagram and in Figure 2.Lorenz diagram is a graphical representation of the distribution of a variable among a population. The Lorenz diagram shows that the further we are from the line of equality (45 degrees line) and the closer we are to the x-axis, inequality increases.

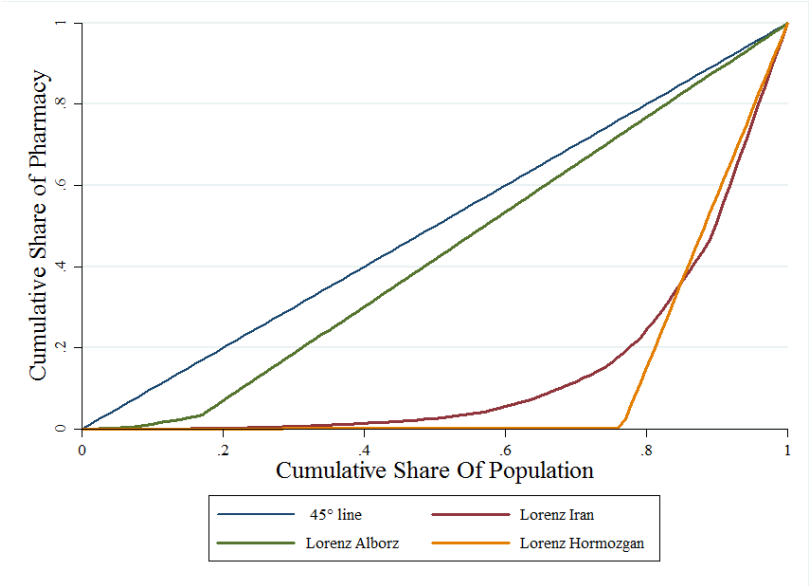

Figure2. Gini index of pharmacists distribution of different provinces in Iran

The results of comparing the Gini coefficient and Theil T index is largely synchronized with each other. We use Theil T index in order to analyze and identify the inequality and the source of inequality. The results of the Theil T index analysis are shown in Table 2.

Table2. Decomposition of Theil T index to within and between inequalities

	Absolute	Relative (Percent)
Within	0.45	47.2
Between	0.502	52.8
Population	0.952	1

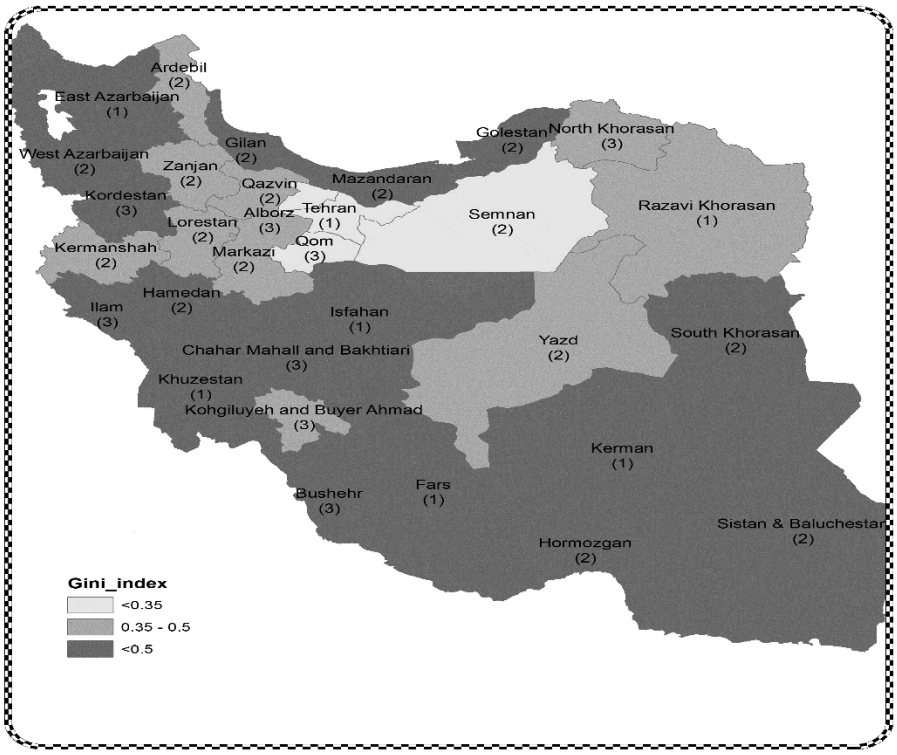

Figure 3. Distribution of pharmacists in the provinces of Iran

From Table 2, the Theil T index is 0.952. The contribution of within-group is 47.2 percent and between groups is 52.8 percent.

As it can be seen between provincial inequality is greater than inter-provincial inequality. High inequality between the provinces is not surprising because in graph 1 we see that among all the provinces there is positive or negative gaps. Also measures taken by the Theil index show that 13.2 percent of the overall inequality in the distribution of state pharmacists is because of the cities that do not have any governmental employed pharmacist.

As noted, one of the objectives of the study is analyzing inequality in the regions covered by different grades of universities. Results of table 1 schematically shown in figure 1, show that the Gini index of three provinces is between 0.2 and 0.35, that represents a relatively balanced distribution of

pharmacists in these province; the provinces are Tehran, Semnan and Alborz which respectively have grade 1, 2 and 3 universities. The Gini coefficient of 10 provinces is between 0.36 and 0.5 which shows a relatively unbalanced distribution of governmental pharmacists in these provinces. Among these provinces only one is covered by a 1st Brigade University, seven have 2nd brigade and 2 have 3rd brigade. Also the Gini coefficient of 17 provinces is more than 0.5 which represents an unequal distribution of governmental pharmacists in the cities of these provinces. As it can be seen almost 57 percent of the provinces nationwide are in third level distribution which means a highly unequal distribution of governmental pharmacists in the provinces. Of these 5 provinces are covered by 1st brigade, 8 provinces are 2nd brigade and 4 provinces are covered by 3rd brigade universities. In other words 14% of the regions covered by the Universities of 1st Brigade have a relatively balanced distribution of pharmacist, 14% of the provinces are relatively unequal distributed and 71% are distributed very unequally. In the regions covered by the 2nd brigade Universities 6% had a relatively balanced distribution and for 44% the distribution is relatively unequal and the remaining 50% had a highly unequal distribution. The regions covered by 3rd brigade universities also had 14% of relatively balanced distribution and 28% of the distribution is relatively unequal and 58% of the pharmacists are distributed highly unequally.

Figure 4 shows the relationship between levels of inequality and congestion of the pharmacist in every province and in different grade universities. The horizontal line represents the overall Gini coefficient of the country and the vertical line represents the average congestion of pharmacists in the country

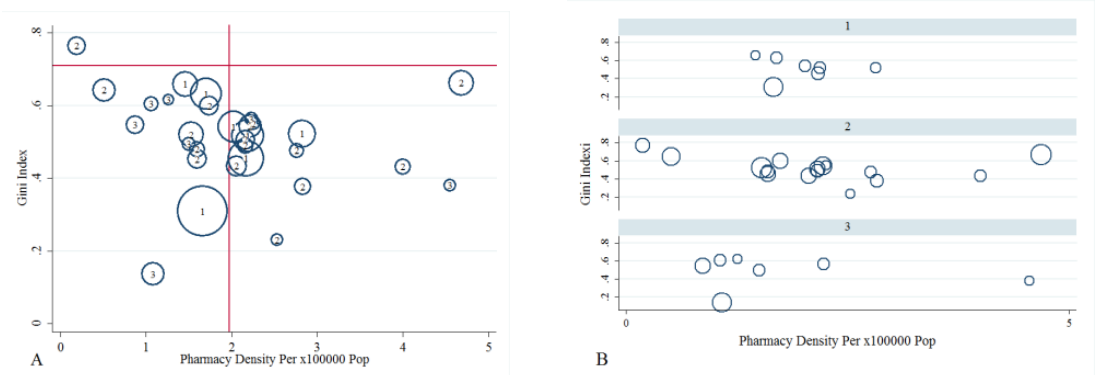

Figure 4. Relationship between the level of inequality and the density of pharmacists per 100000 pop

As seen in Figure 4, Part A, the congestion of pharmacists in 16 provinces is more than the countries average and the congestion of 14 provinces is lower than that average. The provinces on the lower right of the chart have a better status because they have a good congestion of pharmacists with a good distribution. The situation of the provinces on the upper left part of the chart is very bad because they not only have a low congestion of pharmacists compared to their population but also the pharmacists are distributed poorly. Hormozgan is the only province with a lower congestion of pharmacists compared to the countries average and the inequality is higher than the national average so it has the worst situation among the provinces in terms of pharmacists covered by the Universities of Medical Sciences. An interesting thing that can be seen in Figure 4 is that the Gini coefficient of all the provinces except one is lower than the countries Gini coefficient the reason for this too is the inequality of distribution that exists between the provinces. According to the results presented in Table 3, the inequality between the provinces is more than the inter-provincial inequality of pharmacists (shown in part A of Eigure 4. In part B of Figure 4, the congestion of pharmacists and the level of inequalities are differentiated by the grade of universities. In the first grade universities, the congestion of the provinces pharmacists is close together while in the second and third grade

universities the congestion is spread out more. Also pharmacist congestion is lower in the second group than the other two groups. To understand the inequalities within the areas covered by various types of universities, inequality for each type was separately calculated and presented in Table 3.

Table 3. Inequality in distribution of pharmacists in different types of provinces

	Gini Index	Theil T Index	Within Group Inequality	Between Group Inequality
Type 1	0.6	0.69	0.44 (64 %)	0.25 (36 %)
Type 2	0.64	0.78	0.6 (77 %)	0.18 (23 %)
Type 3	0.5	0.47	0.21 (45 %)	0.26 (55 %)

As it can be seen in Table 3, according to the Gini coefficient and Theil T index the inequality of pharmacist's congestion is different in different grade universities. So that grade 3 universities have the lowest inequality of distribution and the 2nd grade have the most. The Gini coefficient in the three grades was more than 0.5; this represents a completely unequal distribution of pharmacists within the cities and provinces. Theil t index's analysis shows that in grade 1 and 2, the largest share of inequality is within the group (within the region),whereas in grade 3, the most unequal share is related to inequality between the groups. The highest intergroup inequality is related to grade 2 and the lowest is grade 3. While the highest inequality between the groups related to type 3 and type 2 is the lowest.

DISCUSSION

Justice in the distribution of resources, especially human resources in the health sector has been one of the major issues of policy-makers and health custodians, So that many studies have been conducted in this regard, and due to the unequal distribution of resources, especially human resources there have been complaints of the health system[3, 10-12]. Five types of inequality in the distribution of human resources in the health system is known that are disparities in expertise, geographic distribution, gender, public or private organization forces[13]. The aim of this study is to assess the equity in the geographical distribution of pharmacists in the city and provinces of the country. Inequality indicators in most provinces, represents a relatively unequal distribution or highly unequal distribution of state pharmacists in Iran. In this respect, studies showed that the Gini coefficient of public pharmacies in the province of Shiraz in 2011was equal to 0.5 and this index has increased over time8 and in Ardabil province's there was unequal distribution of pharmacists[14].

In the present study, in most of the bordering provinces of Iran, there is a highly unequal distribution of pharmacists, while in the provinces located in the center of the country; the distribution of pharmacists is relatively balanced or fairly unequal. In this context, studies show that the country's central provinces have better medical professional subgroups, but the other provinces required to provide experts in various medical groups[15].

Also the results showed that the inequality between the provinces has a greater share in the distribution of pharmacist in the country. But with the separation of the country into three regions based on the types of universities, we find that inequality between provinces covered by type 1 and 2 universities is less than the inter-provincial inequality but in the areas covered by type 3 universities the disparity between the provinces is more than within province inequality. For this reason, it is recommended that in order to reduce the inequality of governmental pharmacists between the provinces of the country, more attention should be paid to provinces covered by type 3 universities. Also according to the share of 13.2 percent for the cities that do not have governmental pharmacists that effect the countries uneven distribution, it is recommended that human resources of pharmacist be redistributed to these cities.

The unequal distribution of high level professional human resources such as doctors and pharmacists has always had a special importance. Besides Iran, other countries also have considered the unequal distribution of human resources in the health section. So that the countries like America[16], Japan[17], Brazil[18], China[10,12], Thailand[19], Turkey[20], Portugal[21], England[22] and South Africa[23] also face this problem in different ways. For example, studies show that while the number of physicians has increased in

Japan but the inequality index has also increased every year[24]. In addition, nearly 50 percent of the health care providers in Nicaragua are concentrated in the capital, which has only one-sixth of the country's population[25]. The unfair distribution of health care workers in Indonesia has been reported in the big cities[26]. These inequalities have also been reported as one of the main problems in the OECD countries[27]. The limitation of this study was research using archival data to show how pharmacies in Iranian context are scattered, thus, some provinces data was not available.

As a conclusion, Pharmacists are trained to provide medical information to meet the needs of patients and the society. Therefore, pharmacists play an important role in providing guidance and advice for the correct use of drugs. Appropriate distribution of pharmacists is one of the most important factors in improving access to health services throughout the society. But unfortunately there is an unbalanced geographical distribution in the country and there is still a significant deficit in the deprived areas. Justice and equality are fundamental principles of ethics in the healthcare system and the formulation of appropriate policies at macro levels in the society depends on the policy makers in each country.

The study showed that inequality in the distribution of government pharmacist in the border provinces is higher than the central provinces; Also, in despite of the allocation of much budget and manpower to the type 1 universities, pharmacists distribution is not equitable in these universities and since the differences between the provinces in the geographical distribution and utilization of the medical professionals, especially pharmacists is important, It is recommended that in addition to considering the congestion of human resources in the central and border provinces and different provinces and different types of universities, but to especially pay attention to the distribution of pharmacists in the cities and provinces. Also, in addition to proper and equitable geographical distribution, other factors led to less access to health resources and health care such as financial barriers, cultural barriers (such as low literacy level) and administrative obstacles should be paid attention too and consider them in the policy. It is worth mentioning that this study focused only on pharmacists of the public sector and the limitations of this study include lack of access to private pharmacist's information which can be done in future studies.

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