Regional Disparity in Physical Resources in the Health Sector in Iran: A Comparison of Two Time Periods

Ali AKBARI SARI [1], *Satar REZAEI [2], Enayatollah HOMAIE RAD [1], Nasim DEHGHANIAN [3], Yousef CHAVEHPOUR [1]

1. Dept. of Health Management and Economics, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran
2. Research Center for Environmental Determinants of Health, Kermanshah University of Medical Sciences, Kermanshah, Iran
3. Dept. of Healthcare Management, Marvdasht Branch, Islamic Azad University, Marvdasht, Iran

*Corresponding Author:** Tel: +98-8338262005 Email: satarrezaei@gmail.com

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Abstract

Background: One of the major health policy issues, in the both developed and developing countries, is the equality in the distribution of health resources. The aim of this study was to investigate the disparity in the distribution of health physical resources across the provinces of Iran in 2001 and 2011.

Methods: This was a cross-sectional retrospective study which investigated inequality in the distribution of health physical resources by three indexes of Gini Coefficient, Gaswirth index and Index of Dissimilarity. The data on provinces were obtained from the yearbook statistics and Ministry of Health, and Medical Education. The Excel software was used to calculated indexes.

Results: The finding showed the mean Gini Coefficient for all variables was 0.178 in 2001 and 0.158 in 2011. Besides, the mean Gaswirth index and index of dissimilarity were 11.5 and 1.5% in 2001 and 11 and 1.4% in 2011, respectively.

Conclusion: There was slightly inequality in distribution of physical health resources in Iran. According to the results of three indexes, this study showed when Tehran province excluding from total sample, the inequality was decreased.

Keywords: Regional disparity, Physical resources, Health sector, Iran

Introduction

Disparity in the distribution of health resources is considered as a major health policy issue in both developed and developing countries (1). The availability of health care resources is one of the main criteria to measure the efficiency and equality in the health system (2). There are significant correlation between higher health resources such as beds, medical supplier and lower mortality rate and higher life expectancy (3). Inequitable distribution of health care services is a major barrier for promotion health status and improving health system delivery in any country. Inequality in the dis-

tribution of health resources is high in both developed and developing countries. However this inequality is both between countries and within countries (4, 5).

The Iranian health care system is characterised by a public-private mix of health care provision. The public sector provides a considerable part of delivery health services; whereas the private sector accounts for only 10% of hospitals bed, 7.4% of health care centers and 27.5% of rehabilitation facilities (6). But it is important to note that there are a positive linkage between quantity of health

resources and their distribution and health status of people. So investigate the status of distribution health human resources (number of physician, dentist, nurses, pharmacist and others staff) and health physical resources (number of pharmacy, hospital beds, laboratory, rehabilitation centers and etc.) is very important. The previous studies conducted in Iran and others countries have focused on equality in distribution of health status, health care and health human resources (5, 7-12); while a few studies have focused on equality of distribution in health physical resources such as pharmacy, rehabilitation centers and laboratory (13, 14).

In the past decade, the quantity of health resources such as pharmacy, health house and beds hospitals has increased substantially in the public health sector in Iran. Based on data from the Statistical Center of Iran, the number of pharmacies has increased from 6022 in 2001 to 8644 in 2011 and the number of hospital beds has risen from 93762 in 2001 to 116987 in 2011 (15) in addition, how the resources are distributed is another important issue because the distribution of health care resources and their access is considered as one of the factors affecting on the health of people. There is a few information on the geographic distribution of physical resources in the health sector across provinces of Iran and this issue that how they are distributed less investigated in the previous studies. Also, at the time of this study, we could not find any study published in the literature related to the distribution of pharmacy, rehabilitation, laboratory and radiology centers in Iran and the main focus of previous studies conducted in Iran had been on hospital beds and health house (12, 16, 17).

The aim of this study was to investigate the inequality in geographic distribution of physical resources in the public health sector across the provinces in Iran in 2001 and 2011.

Materials and methods

Context and geographical units of Analysis
The Iran country consists of 31 provinces, based on the census 2011, with a population of around 75149669 of people, which is located in the Eastern Mediterranean Region with an area of 1,648,000 km^2.

Inequality measures
Similar to other studies (5, 13, 14, 17-19), the inequality measures (the Gini Coefficient (GC), Index of Dissimilarity (ID) and Gaswirth Index of Disparity (GID)) were used to examine the disparity in the distribution of health physical resources in Iran.

Gini Coefficient (GC)
The GC is used commonly for measuring inequality in the distribution of health care resources. It is varies between 1 (perfect inequality) and 0 (perfect equality).

As similar to the other studies (12, 20) in this study we used the following formula (21).

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

Where:
G: Gini index, Yi: cumulative percentage of health variable in the ith province, Xi: cumulative percentage of the population (ranked by variables) in the ith province, K: total number of provinces.

Index of Dissimilarity (ID)
The index of dissimilarity represents the percentage of total health variables which would need to be redistributed across provinces to achieve a situation of perfect equality (22). The value of ID is between 0 and 100. In the current study, the index of dissimilarity is calculated with following formula:

$$ID = \frac{1}{2} \sum_{i=1}^{n} |X_{ip} - X_{ih}|$$

Where:
ID: index of dissimilarity, Xip: ith province's population share, Xih: ith province's health variable share, n: total number of provinces.

Gaswirth Index of Disparity (GID)
This index estimates how many new health variable should be added to the entire population to

reach to the level received by referenced group (23). The best group generally was considered as the reference group. This index is calculated in two steps: first, the fraction of the entire population which is underserved relative to the reference groups is calculated as follow:

$$U = \sum_{i=1}^{k-1} \gamma_i(P_{ref} - P_i)$$

Where:

γ_i : ith province's population share; P_{ref} : the maximum number of health variables in the province of reference group; P_i: number of health variables in the province.

Then, the GID is calculated by $GID = \frac{U}{\bar{P}}$; where $\bar{P}$: the average of health variable in entire population (provinces of Iran).

Data analysis

In the study, each province was considered as a unit analysis and the 30 provinces included in the study (Data for Alborz province are not available and, then, exclude from the analysis). Data on number of health house (HH), hospital's beds, pharmacy, laboratory, rehabilitation centers and radiology centers were obtained from the Statistical Centre of Iran and ministry of health and medical education for years 2001 and 2011 (15).

Furthermore, in another sensitivity analysis, Tehran province was excluded from the analysis to examine inequality in the distribution of physical health resources across the remaining provinces. The reason for this was that Tehran has special situation as the capital of the country and the

more resources are concentrated in Tehran. It is similar to the study conducted by Kiadaliri et al. on distribution of dentists in Iran (20).

Results

The average of beds has increased from 14.3 per 10,000 populations in 2001 to 16 in 2011 and the average of Radiology centers has increased from 0.27 in 2001 to 0.36 in 2011. The average of physical resources per 10,000 populations in public health sector in Iran for the years 2001 and 2011 is shown in Table 1.

Table 1: Average health physical resources per 10,000 populations in the Iran in 2001and 2011

Variable	2001	2011
Beds	9.4	16.2
Pharmacy	0.92	1.2
Laboratory centers	0.6	0.67
Rehabilitation centers	0.26	0.59
Radiology centers	0.27	0.36
Health House	8.3	8.37

The GC for beds was 0.158 in 2001 and 0.13 in 2011. Also, the GC for Radiology centers was 0.19 in 2001 and 0.16 in 2011. The study showed the mean GC for all health physical resources in 2001 with and without Tehran was 0.178 and 0.158, respectively. Also, the mean GC for all health physical resources in 2011 with and without Tehran was 0.163 and 0.155, respectively. The GC of health resources across the provinces in Iran 2001 and 2011 is shown in Table 2.

Table 2: Gini coefficient for physical resources in the health public sector in Iran in 2001 and 2011

Variable	2001		2011	
	Total sample	Sample excluding Tehran	Total sample	Sample excluding Tehran
Beds	0.158	0.15	0.13	0.12
Pharmacy	0.13	0.12	0.14	0.13
Laboratory centers	0.2	0.18	0.21	0.19
Rehabilitation centers	0.25	0.22	0.24	0.23
Radiology centers	0.19	0.12	0.16	0.14
Health House	0.14	0.16	0.11	0.12
Mean	0.178	0.158	0.163	0.155

The ID and GID for physical resources across the provinces of Iran are shown in Tables 3 and 4, respectively. The highest and lowest value of ID in 2001 and 2011 were belonged to the Rehabilitation centers (18%) and Health Houses (8%), respectively. The mean ID for all physical health resources in 2001(2011) with and without Tehran was 13 % (13 %) and 12 % (11 %), respectively.

Also, the number of beds and pharmacy which should be added to current beds and pharmacy in 2001 was 23440 and 7226 and in 2011 was 23397 and 7797, respectively. Furthermore, the mean GID for all physical health resources in 2001(2011) with and without Tehran was 1.5 (1.2) and 1.4 (0.98), respectively.

Table 3: Index of dissimilarity for physical health resources across the provinces in Iran in 2001 and 2011

Variable	2001				2011			
	A*		B**		A*		B**	
	X***	Y****	X***	Y****	X***	Y****	X***	Y****
Beds	10	+9376	6	+4242	9	+10582	5	+4369
Pharmacy	8.2	+481	7.5	+356	9	+779	8	+532
Laboratory centers	12	+477	11	+357	12	+584	10	+ 397
Rehabilitation centers	18	+311	10	+139	16	+689	7.5	+2712
Radiology centers	13	+237	12	+156	13	+347	11	+212
Health House	8	+1178	7	+1010	7	+1107	7	+1090
Mean	11.5	2010	8.5	1043	11	2348	8	1552

*A: Total sample, **B: Sample excluding Tehran; ***x: the value of index of dissimilarity; ****Y: redistributed based on index of dissimilarity

Table 4: Gaswirth Index of Disparity for physical health resources across the provinces in Iran in 2001 and 2011

Variable	2001				2011			
	A*		B**		A*		B**	
	X***	Y****	X***	Y****	X***	Y****	X***	Y****
Beds	0.25	+ 23440	0.12	+ 8484	0.2	+ 23397	0.13	+ 11359
Pharmacy	1.2	+ 7226	0.9	+ 4275	0.9	+7797	0.6	+ 3992
Laboratory centers	2	+ 7952	1.8	+5850	2.5	+ 12172	1.6	+ 6355
Rehabilitation centers	3	+ 5187	1.9	+ 2648	2.8	+ 12059	2	+ 7234
Radiology centers	2.6	+ 4745	2.3	+ 3006	2	+ 5340	1.5	+ 2902
Health House	0.09	+ 1325	0.07	+ 1010	0.09	1423	0.08	+ 1246
Mean	1.5	+ 8312	1.2	4212	1.4	10364	0.98	5514

*A: Total sample, **B: Sample excluding Tehran; ***x: the value of Gaswirth Index of Disparity; ****Y: increased based on Gaswirth Index of Disparity.

Discussion

Inequality in the distribution of health care resources is one of the main barriers for access to healthcare and improving health status of population throughout the world. In addition, both the quantity of health resources and their distribution is affecting on overall level of health of a population. In this study, we evaluate inequality in the distribution of physical health resources in the public sector by three practical indexes of Gini Coefficient, index of dissimilarity and Gaswirth index of disparity. The results showed although the number of health resources in 2001 had increased in comparison with 2011, but inequality in their distributions was increased.

The numbers of laboratories (11%), rehabilitations (30%) and pharmacies (126%) in 2011 have in-

creased in comparison with 2001, while inequality in the distribution of these resources had increased according to the Gini Coefficient although it is slightly. The Gini Coefficient for laboratories and pharmacies was 0.2 and 0.13 in 2001, while in 2011 it was 0.21 and 0.14 respectively. Similar to our study, Ameryoun et al (16) founded the Gini coefficient for ICU and Post ICU were 0.17 and 0.15. Also, a study (14) found that the GC for beds of hospital was 0.2 and it was higher in compared to our findings. The main reason for this differences is that in our study only public sector data is used while in Nishiura study, both beds in public and private sector were considered. The Gini Coefficient for radiology centers in our study was 0.19 in 2001 and 0.16 in 2011. On the other hand, the distribution of radiology centers seems somewhat more equitable. Da He et al. revealed that the Gini Coefficient for CTs was 0.14 and 0.15 in 2006 and 2009 in china, respectively (24).

The current study showed when excluding the Tehran province from total sample, the value of Gini Coefficient was reduced and the equity in distribution of health resources was increased. This indicates that the physical health resources per 10,000 populations in Tehran province is more than the others provinces. For example, the number of beds per 10,000 populations was 2 times more in Tehran (with the highest per capita beds) compared to Ilam (with the lowest per capita beds) which is consisted with others studies conducted in Iran (16, 20). Results of a study conducted by Kiadaliri et al showed that the number of dentist per 100,000 populations in Tehran (the highest density) was 11 time higher in compared to Khorasan Razavi (the lowest density) in 2009 (20). Besides, based on the GC results, our finding indicated that the distribution of HH in 2011 has decreased in compared to 2001. It was shown by another study in Iran (17).

Based on the ID results, if government wants to increase equity in the distribution of physical health resources in the country, near 1 out of 10 beds, 0.9 out of 10 pharmacy, 1.2 out of 10 Laboratory centers, 1.8 out of 10 Rehabilitation centers, 1.3 out of 10 Radiology centers and 0.8 out of 10 HH should be redistributed. Also, according to the ID results, the main redistribution should be happen from Tehran, Esfahan and Fars provinces to other provinces specially Ilam, Kurdestan and Khorasan Razavi. Kiadaliri et al. demonstrated that 3 out of 10 dentist should be redistributed from the over served provinces to the under-served provinces. In addition, they concluded that 31583 dentists in Iran are needed to reach the entire population to the level received by best groups (Tehran Province) (20). The result also showed that if the government wants to reach the level of all the provinces to the level of Tehran (reference group), about 0.2 per 10 beds current, 0.9 per 10 pharmacy, 2.5 per 10 laboratory centers, 2.5 per 10 Rehabilitation centers, 2 per 10 Radiology centers and 0.09 per 10 HH should be added to current physical resources.

The current study showed that when Tehran province is excluded from the sample, the inequality in distribution of physical health resources has decreased. Our results can help to managers and planners in health system in Iran for planning in order to decreasing inequality in distribution of health physical resources. In addition, the current study provided a holistic view about situation of equality in the distribution of physical health resources especially in pharmacies, laboratories and rehabilitation centers, for health policy makers. Finally, we hope the results of the current study could help health policy-makers for improving the delivery of health care and promotion of health status because one of the main factors which affect the health status of people is physical accessibility to health care resource.

This study has several limitations. First, the data used in this study was obtained from the Iran Statistical Yearbooks, so potential measurement error in the data registry is possible. Second, the inequality measurement may be underestimated because we considered only public health sector.

Conclusion

This study is the first national study which assessed inequality in the distribution of physical resources such as pharmacy, laboratory and radiol-

ogy centers. This study showed that inequality in the distribution of physical resources across the provinces in Iran is slight and the mean value of GC for all of physical health resources is less than 0.2. Also, it is recommended that the results of this study to be considered in decision making on the distribution of physical resources across the provinces in Iran.

Ethical considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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