JCHR

Journal of Community Health Research 2022; 11(4): 262-276.

Assessing the Inequality of Health Distribution among the Provinces of Iran during the Fifth Development Plan (2011-2015)

Mansour Mahinizadeh [1]*, Mohammad Reza Pourghorban [2]

1. Department Economics, Faculty of Economics, Management and Accounting, Yazd University, Yazd, Iran
2. Department Economics, Payame Noor University of Babol, Babol, Iran

ARTICLE INFO

Original Article

Received: 20 December 2021

Accepted: 1 March 2022

OPEN ACCESS

Corresponding Author:
Mansour Mahinizadeh
mahinizadeh@yazd.ac.ir

ABSTRACT

Background: Health, both physically and mentally, raises the level of human capital. This study aims to challenge the performance of the Fifth Development Plan (2011-2015) regarding inequality in the distribution of health facilities among the provinces of the country.

Methods: This study is analytical cross sectional. In this research, using the TOPSIS method and using the Gini coefficient index and inequality ratios, was evaluated the distribution of health facilities among the provinces of the country. Also, to determine the degree of health development among the provinces of the country, from 13 indices including hospital per capita, hospital bed per capita, health house per capita, health center per capita, laboratory per capita, pharmacy per capita, general practitioner per capita, specialist physician per capita and other health care staff per capita were used. The software used in this research is SPSS 25.

Results: The results show that in 2011, the provinces of Tehran, Khorasan Razavi and Isfahan were at the highest level and the provinces of South Khorasan, Ilam and Kohgiluyeh and Boyer-Ahmad were at the lowest level in this regard. While, in 2015, the provinces of Tehran, Khorasan Razavi maintained their previous position and Fars province was in the third place. The province of Ilam, was still at the lowest level. The Gini coefficient of distribution of health facilities among the provinces of the country in 2011 was 0.49, and increased to 0.52 in 2015. The share ratio of the top 20% to the bottom 20% among the provinces in terms of enjoying health facilities in 2011 and 2015 was equal to 32 and 37, respectively.

Conclusion: The severity of inequality of health facilities among the provinces of the country has intensified during the Fifth Plan. The results show that the provinces have a significant difference in their position in access to health facilities and this indicates equal distribution of health facilities among the provinces of the country.

Keywords: Provinces of the Country, TOPSIS Method, Gini Coefficient, Inequality, Health Distribution, Development Plan.

How to cite this paper:

Mahinizadeh M, Pourghorban MR. Assessing the inequality of health distribution among the provinces of Iran during the Fifth Development Plan (2011-2015). J Community Health Research 2022; 11(4): 262-276.

Copyright: ©2022 The Author(s); Published by ShahidSadoughi University of Medical Sciences. This is an open-access article distributed under the terms of the Creative Commons Attribution License (https://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

[Downloaded from jhr.ssu.ac.ir on 2026-11-10]

[DOR: 20.1001.1.23225688.2022.11.4.7.9]

[DOI: 10.18502/jchr.v11i4.11643]

[Downloaded from jhr.ssu.ac.ir on 2026-11-10]

[DOR: 20.1001.1.23225688.2022.11.4.7.9]

[DOI: 10.18502/jchr.v11i4.11643]

Introduction

In recent decades, the human capital and its impact on the economic growth and development of countries has attracted the attention of economists. In this regard, health as one of the important dimensions of human capital along with education has been more prominent. Because health, both physically and mentally, raises the level of human capital (1).It should also be noted that economic growth does not necessarily improve human capital and health indicators. Because one of the most essential conditions for achieving such an important thing is that the distribution of benefits from growth is fair.

Increasing the quality of labor force is one of the most important factors in improving labor productivity. Continuous increase in production and its sustainability depends on improving labor productivity and technological change, and one of the ways to achieve this goal is to increase the quality of labor. One way to achieve this goal is to improve the quality of the workforce (2).

In fact, qualitative characteristics of human beings are a kind of capital because these characteristics can lead to productivity and production and generate more income and welfare. Improving the quality of the workforce can be achieved by raising the level of health and hygiene of the workforce. Proper health will increase people's health and potential and actual power of the labor force. A healthier labor force will have a greater share in increasing production and economic growth. Therefore, in many countries, investing in labor force and improving its quality has played the greatest role in increasing productivity and accelerating economic growth (2). However, with the decline in the health of the workforce, their productivity decreases and as a result, their unemployment period increases. So the weaker workforce is likely to face a longer period of unemployment. Accordingly, reducing the unemployment rate can be considered as one of the most obvious goals of economic planners and decision makers (3). According to the upstream and downstream documents and laws of the Islamic Republic of Iran, paying attention to the health of all members of the society is one of the main goals of the country's strategic plans. Among these, based on the 29th principle of the Constitution of the country, enjoying social security, including the need for health services and medical care in the form of insurance, etc., is a universal right for all people (4). Therefore, one of the manifestations of the management of health care services in the country is the provision of these services to different walks of life. The issue of health has always been the focus of attention in almost all development plans. Especially since the third plan, this issue has become more prominent. However, in recent years, with the introduction of the issue of resistance economy and the emphasis of the Supreme Leader on it, in accordance with the seventh article of its general policies, providing the treatment security has been considered necessary in the realization of resistance economy in the country(5). In this regard, the present study tries to evaluate the distribution of health facilities among the provinces of the country in the first and the last years of the Fifth Development Plan. Based on this approach, the contents of this article are organized in seven sections as follows. After the introduction, the theoretical foundations of the research will be stated and then a background of the studies will be presented in the third section. The fourth section describes the health criteria used and the research method. The fifth part is dedicated to the expression of research findings and analysis of its results. Summary, conclusion and proposed policies on the stated issues are presented in the final part of this study.

Theoretically and within the framework of human capital theory, the health of individuals is a capital stock that is depreciated with the natural aging. In one hand, investing in community health and improving the level of personal and social health not only increases the per capita health of each person on average and consequently reduces the average per capita disease of individuals in the community and compensates for the

depreciation of capital stock of this type, but also promotes labor productivity.

On the other hand, a person with health components is more efficient in the learning and training process and in the production process increases the production capabilities of all production factors and their productivity, especially the workforce.

This study aims to challenge the performance of the Fifth Development Plan regarding inequality in the distribution of health facilities among the provinces of the country.

Method

This study is analytical cross sectional. The sample size includes data related to selected variables in the field of health between the years 2011 to 2015 in the provinces of the country. The software used was SPSS 25. In the inferential analysis section, the significance level of the hypotheses is 5%.

In the present study, in addition to determining the position of the provinces of the country in terms of health, the distribution of health facilities is also determined. In this regard, TOPSIS method and Gini coefficient index have been used. The results of Shannon entropy method and the degrees of importance obtained from it for the research criteria are used in the TOPSIS method. Remarkably, although the Gini coefficient is known as a tool for determining inequality in the distribution of health facilities, two different Lorenz curves may have the same Gini coefficient. In order to solve this problem, for each year, the ratio of provinces with the highest level of enjoyment (top 20%) to the provinces with the lowest level of distribution (bottom 20%) is calculated and then compared for the first year and the last year of the study period. This is also considered as the difference between the present study and previous studies.

Considering that the main purpose of this research is to determine the degree of development of the provinces of the country in terms of health criteria, in the first step, the desired criteria according to the available data are identified and defined as described in Table 1:

Table 1. Criteria used to determine the health status of the country's provinces

Row	Criterion(per 1000 people)	Row	Criterion(per 1000 people)
1	Hospital, per capita	8	Paramedic, per capita
2	Hospital bed, per capita	9	Dentist, per capita
3	Health house, per capita	10	Pharmacist, per capita
4	Health center, per capita	11	General Practitioner, per capita
5	Laboratory, per capita	12	Specialist Physician, per capita
6	Pharmacy, per capita	13	Other health care staff, per capita
7	Rehabilitation center, per capita		

To determine the degree of development of the provinces of the country in terms of health facilities, first the required data were taken from the statistical yearbook (10) of the country and then the TOPSIS method was used. This method was proposed by Hung and Yang in 1981 (11).This model is one of the most common multi-criteria decision making models (MCDM).Considering that in order to use this method, it is necessary to determine the importance of the desired criteria, Shannon entropy method has been used to weigh and determine their degree of importance. The main idea of Shannon's entropy method is based on the assumption that the higher the scatter in the values of one criterion, the more important that criterion is. According to the explanations given above, the degree of importance or weight of each of the criteria of this research for the years 2011 and 2015 has been calculated. In order to rank the provinces of the country and determine the degree of development of their health, the steps of TOPSIS method are described. In this method, m alternatives are evaluated and ranked according to n criteria. As mentioned before, in this study, m indicates the provinces of the country and n

[Downloaded from jhr.ssu.ac.ir on 2026-11-10]
[DOR: 20.1001.1.23225688.2022.11.4.7.9]
[DOI: 10.18502/jchr.v11i4.11643]

indicates the desired criteria. Problem solving by TOPSIS method consists of 6 steps as follows:

The first step: to convert the decision matrix to a standard matrix. This is done by the vector normalization method, Equation 1, as follows:

$$n_{ij} = \frac{a_{ij}}{\sqrt{\sum_{i=1}^{m} a_{ij}^2}} \quad , \quad j=1, 2, 3 \ldots n \qquad (1)$$

In this equation, i represents each alternative and j represents each criterion, a represents each member of the data matrix, andn_{ij} represents the standardized component of the decision matrix. The resulting matrix, Equation 2, is called the standardized matrix or ND and is represented as follows:

$$ND = \begin{vmatrix} n_{11} & n_{12} & \ldots & n_{1q} \\ n_{21} & n_{22} & \ldots & n_{2q} \\ \vdots & \vdots & \ldots & \vdots \\ n_{p1} & n_{p2} & \ldots & n_{pq} \end{vmatrix} \qquad (2)$$

The second step: to form a standard weighted matrix. Therefore, the weight of each specified criterion should be formed and a new matrix, Equation 3, should be formed according to the weight of the criteria as follows:

$$V = ND \times W_{n*n} = \begin{vmatrix} V_{11} & V_{12} & \ldots & V_{1q} \\ V_{21} & V_{22} & \ldots & V_{2q} \\ \vdots & \vdots & \ldots & \vdots \\ V_{p1} & V_{p2} & \ldots & V_{pq} \end{vmatrix} \qquad (3)$$

In this matrix, V is a standard weighted matrix and W_{n*n} is a diagonal matrix of the weights obtained for the criteria in the Shannon entropy method.

The third step: to determine the ideal positive and negative solution. Using Equation 2 and Equation 3, the positive and negative ideal alternatives are identified Equations 4, 5, 6 and 7. Considering that all the criteria introduced in Table 1 are directly related to the development of the health level of the provinces of the country, in these relations, the "best values" for these criteria are the largest values and the "worst values" for them are the smallest values.

$$A^+ = \{(maxV_{ij}I_j \quad J), (min\, V_{ij}I_j \quad J')\} \qquad (4)$$

$$A^- = \{(minV_{ij}\, I_j \quad J), (maxV_{ij}I_j \quad J')\} \qquad (5)$$

$$A^+ = \{V_1^+, V_2^+, \ldots, V_N^+\} \qquad (6)$$

$$A^- = \{V_1^-, V_2^-, \ldots, V_N^-\} \qquad (7)$$

The fourth step is to calculate the distance of the alternatives from the positive and negative ideal alternatives, which is done using Equations 8 and 9, respectively.

$$d_i^+ = (\sum_{j=1}^{q}(V_{ij} - V_j^+)^2)^{\frac{1}{2}} \qquad (8)$$

$$d_i^- = (\sum_{j=1}^{q}(V_{ij} - V_j^-)^2)^{\frac{1}{2}} \qquad (9)$$

The fifth step: to calculate the relative proximity, Equation 10.

$$Cl_i^+ = \frac{d_i^-}{d_i^+ + d_i^-} \qquad (10)$$

According to the statistical population of this study and data related to the beginning and end of the study period (2011 and 2015), the above relation was calculated for all provinces of the country.

The sixth step: related to the ranking of provinces in terms of health facilities. Accordingly, any province with a larger Cl_i is more developed. In other words, in the ranking of the provinces in question, a higher value of Cl_i will indicate a higher rank of the relevant province (20).

After calculating the degrees of health facilities in the provinces of the country, it is now possible to evaluate the degree of equality or inequality in the distribution of health facilities between them by using the degrees of development calculated for the provinces of the country. An issue that has been considered in few studies in the field of health in Iran. For this purpose, two methods have been used. In the first method, the distribution of degrees of health facilities is evaluated in terms of normalcy, so that using EVIEWS 9 software, the distribution of developmental degrees for the provinces is drawn and the Jarque-Bera test (normal distribution test), using the relevant statistics which asymptotically has a chi-square distribution, is calculated and normality of the distribution is statistically tested. In the second method, Lorenz curve and Gini coefficient have been used to determine the level of inequality in

[Downloaded from jhr.ssu.ac.ir on 2026-11-10]
[DOR: 20.1001.1.23225688.2022.11.4.7.9]
[DOI: 10.18502/jchr.v11i4.11643]

the distribution of health facilities in the provinces of the country. In this method, at first the cumulative values are calculated for the degrees of enjoyment and then the Lorenz curve is drawn for the studied years (2011 and 2015) and then the Gini coefficient is calculated. Although the Gini coefficient can be calculated in different ways, it is briefly discussed below. One of the methods for calculating the Gini coefficient is the method of using the absolute value criterion of the difference of relative means, Equation 11, in which the Gini coefficient value is calculated equal to half of the mentioned criterion.

$$G(S) = 1 - \frac{2}{n-1}\left(n - \frac{\sum_{i=1}^{n} i y_i}{\sum_{i=1}^{n} y_i}\right) \qquad (11)$$

Where G(S) represents the Gini coefficient for the sample under study, n is the number of provinces, y_i is the cumulative value of the degrees of health facilities. In the framework of theoretical foundations, it should be noted that Romer, Mankiw and Weil (6) and Mankiw (7), incorporated the human capital H_t, and labor-augmenting technical progress A_t, into the neoclassical growth model of Solow astwo other influential factors in the production process. Therefore, Equation 1 shows the neoclassical growth model in which labor force L_t, physical capital K_t, human capital H_t and the level of labor augmenting technology A_t, introduce a set of factors affecting production. In the literature of growth models, this neoclassical model falls into the category of endogenous growth models, Equation 12.

$$Y_t = TK_t^{\alpha} H_t^{\beta} (A_t L_t)^{1-\alpha-\beta}, \quad \alpha + \beta < 1 \quad , \quad \alpha, \beta > 0 \qquad (12)$$

Where Y_t total production, K_t physical capital, H_t human capital, L_t labor force and A_t the level of labor augmenting technology of and $A_t L_t$ effective labor force are effective and T is the coefficient of production (8).

Theoretically, the position of health and its role in the production process lies in the factor $A_t$as the level oflabor augmenting technology. Accordingly, the increase in the level of society's health facilities and the possibility of individuals'(especially the labor force) benefiting from it and its more fair distribution across all the regions of the country will increase the level of effective labor and consequently economic growth. In order to theoretically analyze this issue, it is assumed thatA_t is the level of health facilities that grows at the rate of x. dividing the production function by$A_t L_t$, the per capita product of each effective labor force is obtained, Equation 13:

$$\hat{y}_t = T\hat{k}_t^{\alpha}\hat{h}_t^{\beta} \qquad (13)$$

Following the Solow-Swan model, it is assumed that individuals consume a fixed share (1-s) of their gross income. Therefore, the accumulation flow is done as follows, Equation 14:

$$\dot{\hat{k}}_t + \dot{\hat{h}}_t = sT\hat{k}_t^{\alpha}\hat{h}_t^{\beta} - (\delta + n + x).(\hat{k}_t + \hat{h}_t) \qquad (14)$$

In which both capital goods are assumed to be depreciated at the same fixed rate. Here, in order to answer the key question of how much of the savings should be allocated to physical and human capital in total, it is assumed that households invest in capital goods in the hope of receiving higher profits. With this assumption, both rates of return on physical and human capital — and consequently both the final output of physical and human capital — must be equal, provided that the two types of investment are substitutes. The result is the following condition, Equation 15:

$$\alpha.\frac{\hat{y}}{\hat{k}} - \delta = \eta.\frac{\hat{y}}{\hat{h}} - \delta \qquad (15)$$

Equality of the marginal product of physical and human capital means the one-to-one relationship between human capital and physical capital, Equation 16.

$$\hat{h} = \frac{\eta}{\alpha}.\hat{k} \qquad (16)$$

In this way, Equation 5 can be used to remove the expression $\hat{h}_t$ from Equation 3. As a result we have Equation 17:

$$\dot{\hat{k}}_t = s\tilde{A}\hat{k}^{\alpha+\eta} - (\delta + n + x).\hat{k}_t \qquad (17)$$

Where $\tilde{A} \equiv (\frac{\eta^{\eta}\alpha^{(1-\eta)}}{\alpha+\eta})$and $\tilde{A}$ is constant. Note that

[Downloaded from jhr.ssu.ac.ir on 2026-11-10]
[DOR: 20.1001.1.23225688.2022.11.4.7.9]
[DOI: 10.18502/jchr.v11i4.11643]

the accumulation equation obtained is similar to the accumulation equation obtained in the Solow-Swan growth model, except that the powerof the variable per capita capital stock in equation 6 is equal to the sum of the share of human capital and physical capital $(\alpha + \eta)$ rather than α.Now by derivation we get the convergence coefficient in the steady state, Equation 18.

$$\beta^* = (1 - \alpha - \eta).(\delta + n + x) \quad (18)$$

The growth rate $\hat{y}_t$is also equal to the weighted average growth rates of the two production input, Equation 19, saying:

$$\frac{\dot{\hat{y}}}{\hat{y}} = \alpha.(\frac{\dot{\hat{k}}}{\hat{k}}) + \eta.(\frac{\dot{\hat{h}}}{\hat{h}}) \quad (19)$$

As observed, given the importance of the impact of human capital on economic growth and development and the position of this issue in growth models, most economic development theorists first focused on the impact of education as one of the aspects of human capital, but after that, health was considered as another dimension of human capital that can promote economic growth by affecting the productivity of human resources. Therefore, health as one of the dimensions of human capital has an important place in improving the physical and mental condition of individuals and provides the basis for increasing productivity and thus economic growth and development of each country. The introduction of health in the literature of economic growth and development, especially since the 1970s and the efforts of people like Gary Becker, is considered a turning point in the promotion of classical growth models. Accordingly, the present article, considering the position of health in the growth and development of different regions, has tried to evaluate the situation of the provinces of the country in terms of health facilities and degree of health development, and in addition to investigate that how the health facilities have been distributed among the provinces. For this purpose, the Lorenz curve and Gini coefficient can be used to measure the equality of health facilities between different regions of the country with respect to their degree of development. The value of Gini coefficient is between zero and one. The Gini coefficient can theoretically range from zero which shows complete quality, namely all people have an equal share of resources to one to show complete inequality. According to Hiroshi et al. (9), Gini index less than 0.2 represents perfect equality, between 0.2–0.3 relative equality, between 0.3–0.4 adequate equality, between 0.4–0.6 big inequality, and above 0.6 represents severe inequality. The position of the provinces of the country in terms of the availability of health facilities is examined. For this purpose, first, the degree of importance or weight of the criteria, has been evaluated using the Shannon entropy method for 2011, which coincides with the initial year of the Fifth Development Plan.

Statistical analysis

In this research, to answer the basic question of whether the degree of development of the country's provinces in terms of health criteria follows a normal distribution or not, Jarque-bera test was used (Table 4). The significance level for the hypothesis test is considered equal to 5%. Based on the obtained results, the probability level of the Jarque-Bera statistic is lower than 5%, as a result, the null hypothesis that the distribution of the degree of health development is normal among the provinces of the country is rejected. Jarque-Bera test is defined as following equation 20:

$$JB = \frac{n}{6}\left(S^2 + \frac{1}{4}(E-3)^2\right) \quad (20)$$

In which JB, S and E are indicators of the Jarque-Bera statistic, skewness and Kurtosis of the distribution, respectively. These test is measure symmetry indices of the skewness and kurtosis of the normal distribution.

Results

With the TOPSIS method, the 31 provinces of the country are ranked in terms of having health facilities. The results of this method and the ranking of the provinces of the country are summarized in Table 3.

As can be seen in Table 2, the weights of health criteria were calculated based on Shannon entropy method. The research findings show that in 2011, among the studied criteria, per capita specialist

[Downloaded from jhr.ssu.ac.ir on 2026-11-10]
[DOR: 20.1001.1.23225688.2022.11.4.7.9]
[DOI: 10.18502/jchr.v11i4.11643]

physicians, per capita rehabilitation centers and per capita health centers with the figures of 0.171, 0.128 and 0.122 are of the highest importance weight, respectively. And per capita pharmacy, per capita paramedic and hospital per capita with the figures of 0.029, 0.037 and 0.044 are of the lowest importance weight, respectively.

Table 2. Estimation of the degree of importance of research criteria using Shannon entropy method

Row	Criterion per 1000 people	Weight of importance
1	Hospital per capita	0.044
2	Hospital bed per capita	0.056
3	Health house per capita	0.058
4	Health center per capita	0.122
5	Laboratory per capita	0.065
6	Pharmacy per capita	0.029
7	Rehabilitation center per capita	0.128
8	Paramedic per capita	0.037
9	Dentist per capita	0.087
10	Pharmacist per capita	0.09
11	General Practitioner, per capita	0.066
12	Specialist Physician, per capita	0.172
13	Other health care staff, per capita	0.047

Table 3. Development rank of the health sector of the provinces of the country using TOPSIS method

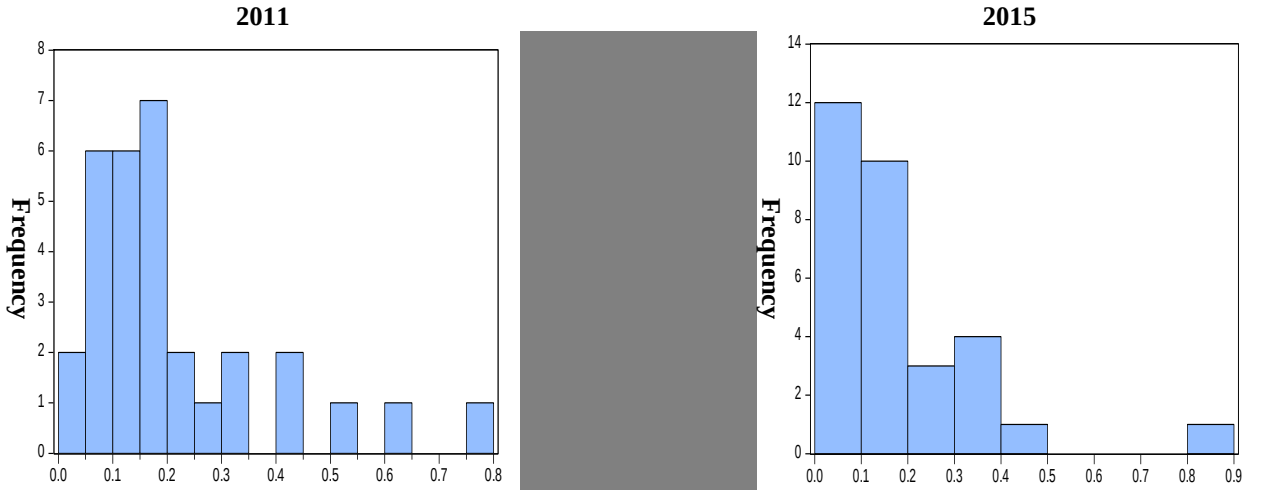
Province	2011		2015	
	Rank	CL_i^*	Rank	CL_i^*
Tehran	1	0.786	1	0.836
RazaviKhorasan	2	0.602	2	0.444
Fars	5	0.44	3	0.384
Isfahan	3	0.501	4	0.369
East Azerbaijan	7	0.307	5	0.313
Mazandaran	4	0.448	6	0.31
Gilan	8	0.293	7	0.248
Kerman	10	0.235	8	0.214
West Azerbaijan	9	0.242	9	0.212
Khuzestan	6	0.312	10	0.19
Sistan and Baluchestan	11	0.2	11	0.181
Golestan	15	0.16	12	0.143
Kermanshah	13	0.164	13	0.139
Hamadan	12	0.173	14	0.136
Lorestan	16	0.158	15	0.123
Markazi	18	0.129	16	0.122
Hormozgan	21	0.116	17	0.116
Alborz	14	0.161	18	0.112
Kurdistan	19	0.128	19	0.111
Zanjan	22	0.104	20	0.086
Ardabil	23	0.103	21	0.079
Yazd	17	0.154	22	0.077
Chaharmahal and Bakhtiari	24	0.096	23	0.069
North Khorasan	27	0.077	24	0.069
South Khorasan	29	0.069	25	0.062
Bushehr	28	0.073	26	0.061
Qazvin	25	0.086	27	0.052
Semnan	20	0.128	28	0.049
Qom	26	0.086	29	0.042
Ilam	30	0.036	30	0.031
Kohgiloyeh and Boyer-Ahmad	31	0.000	31	0.002

* $\mathbf{CL}_i$ is the relative proximity according to Equation 10.

[Downloaded from jhr.ssu.ac.ir on 2026-11-10]
[DOR: 20.1001.1.23225688.2022.11.4.7.9]
[DOI: 10.18502/jchr.v11i4.11643]

The test of normality of the developmental distribution of the provinces of the country in terms of health criteria is given in Table 4. The results of this study for 2011 show that the amount of skewness and Kurtosis of this distribution is equal to 1.6 and 5.18, respectively, which in comparison with its standard values for normal distribution indicates the difference between the developmental distribution of the provinces and the normal distribution. Based on the Jarque-Bera statistic and the computational probability level, the probability level of the Jarque-Bera statistic is lower than 5% significance level, and as a result, the null hypothesis that the distribution is normal, is rejected.

Studies have shown that the distribution situation in 2015 is not normal as in 2011.Therefore, it is clear that the non-normal distribution of health facilities among the provinces of the country indicates the continuation of the previous trend and no change in the distribution of health facilities among the provinces and the lack of coherent planning to achieve the policies of the Fifth Development Plan to reduce inequality in distribution of health facilities among the provinces of the country. Then, using the results obtained from Table 4 and standardizing the development index of the provinces of the country listed in Table 3, the provinces of the country in the years2011 and 2015 are classified into five groups: fully developed, higher developed, semi-developed, less developed and undeveloped. These rankings are based on the dispersion of the development index of the provinces from the average, which is well illustrated by Table 5. In addition, the results of provincial development ranking are listed in Table 6.As can be seen from Table 6, in 2011 the provinces of Tehran, KhorasanRazavi and Isfahan in terms of the index of health facilities are fully developed and the provinces of South Khorasan, Ilam and Kohgiluyeh and Boyer-Ahmad are undeveloped. Similarly, in 2015, the provinces of Tehran, KhorasanRazavi and Fars in terms of health facilities lie in the group of fully developed provinces and the Provinces of Ilam, Kohgiluyeh and Boyer-Ahmadlie in the group of undeveloped provinces.



Developmental Degrees and Descriptive Parameters of Health Criteria		Developmental Degrees and Descriptive Parameters of Health Criteria
0.212	Mean (μ)	0.174
0.178	Standard Deviation (σ)	0.166
1.6	Skewness	2.28
5.18	Kurtosis	9.17
19.462	Jarque-Bera Statistic	76.000
0.000	P-value	0.000

Figure1. Distribution of developmental degrees and descriptive parameters of health criteria of the provinces of the country

[Downloaded from jhr.ssu.ac.ir on 2026-11-10]
[DOR: 20.1001.1.23225688.2022.11.4.7.9]
[DOI: 10.18502/jchr.v11i4.11643]

Comparing the results of ranking the provinces of the country in terms of health facilities index, it can be stated that in 2015 compared to 2011, the situation of Khuzestan, Yazd and Alborz provinces worsened and the situation of West Azerbaijan, Kerman and Markazi provinces improved. The situation in other provinces has not changed significantly.

So far, the analysis performed in this study was based on the distribution of health facilities among the provinces of the country. However, to determine the level of welfare of all the country's provinces in terms of health facilities in 2011 and 2015, Gini coefficient and calculations based on equation19 has been used. Figure 1 shows the distribution of standardized development index in terms of health facilities in the provinces. The two distributions in figure 1 have apparent differences; however, to say that there was a significant difference between the years 2011 and 2015, it is not enough, just as the Lorenz curves in figure 2 are not enough. As can be seen in figure 2from the Lorenz curve and Gini coefficient calculated for 2011 and 2015, there has not been much change in the welfare of the provinces in terms of health facilities. So that the Gini coefficient in 2011 was equal to 0.49 and in 2015 has increased to 0.52. Needless to say, both the Lorenz curve (Figure 3) and the Gini coefficient have disadvantages in measuring inequality. Since the Lorenz curve is a geometric shape, it does not give an accurate measure, and the disadvantage of the Gini coefficient is that it shows only the average inequality, and most importantly, it is possible for two Lorenz curves and two different distributions for two different statistical populations it may be calculated the same Gini coefficient. Also, with the Gini coefficient, it is not possible to determine in which of the deciles the distribution is more unequal. Therefore, to overcome these weaknesses, another criterion called the ratio of provinces with the highest level of enjoyment (top 20%) to the provinces with the lowest level of enjoyment (bottom 20%) is calculated for each year and then the first Year and the last year of the study period is compared with each other. So, all the provinces of the country were categorized into 5 equal groups of 20%in ascending order in terms of priority in access to health facilities. Then the ratio of the top 20% share to the bottom 20% share for the first year (2011) and the last year (2015) of the Fifth Development Plan was calculated and compared with each other. Based on the calculations, this ratio was equal to 32 for 2011, which shows that the provinces that are in the top 20% group have 32 times more health facilities than the provinces that are in the bottom 20% group. This situation at the beginning of the Fifth Development Plan indicates a huge gap between the provinces of the country in terms of health facilities. This is while the same ratio in 2015 was equal to 37 and indicates that the severity of inequality during the 5 years of the Fifth Development Plan, has increased by about 15 percent. In other words, on average, the intensity of inequality of health facilities among the provinces of the country has increased by 3% annually. A comparison of this ratio for these two years shows that during the years of the Fifth Development Plan, not only has the severity of inequality among the provinces of the country not improved, but it has even increased..

[Downloaded from jhr.ssu.ac.ir on 2026-11-10]
[DOR: 20.1001.1.23225688.2022.11.4.7.9]
[DOI: 10.18502/jchr.v11i4.11643]

Table 4. Level of development based on health facilities of the provinces of the country (2011 and 2015)

Development Level	2011 Province	Z_i^*	2015 Province	Z_i^*
Fully Developed	Tehran	3.231	Tehran	3.978
	RazaviKhorasan	2.193	RazaviKhorasan	1.623
	Isfahan	1.627	Fars	1.262
	Mazandaran	1.329	Isfahan	1.175
	Fars	1.283	East Azerbaijan	0.838
	Khozestan	0.565	Mazandaran	0.822
	East Azerbaijan	0.533	Gilan	0.445
	Gilan	0.458		
Higher Developed	----------	——	Kerman	0.242
			West Azerbaijan	0.231
Semi-developed	West Azerbaijan	0.167	Khuzestan	0.097
	Kerman	0.130	Sistan and Baluchestan	0.043
	Sistan and Baluchestan	-0.069		
Less Developed	Hamadan	-0.221	Golestan	-0.185
	Kermanshah	-0.270	Kermanshah	-0.206
	Alborz	-0.285	Hamadan	-0.223
	Golestan	-0.294	Lorestan	-0.304
	Lorestan	-0.303	Markazi	-0.311
	Yazd	-0.324		
Undeveloped	Markazi	-0.465	Hormozgan	-0.349
	Kurdistan	-0.470	Alborz	-0.370
	Semnan	-0.471	Kurdistan	-0.374
	Hormozgan	-0.542	Zanjan	-0.52806
	Zanjan	-0.605	Ardabil	-0.570
	Ardabil	-0.613	Yazd	-0.582
	ChaharmahalandBakhtiari	-0.654	ChaharmahalandBakhtiari	-0.626
	Qazvin	-0.707	NorthKhorasn	-0.629
	Gom	-0.707	SouthKhorasn	-0.669
	North Khorasan	-0.757	Bushehr	-0.674
	Bushehr	-0.779	Qazvin	-0.728
	South Khorasan	-0.802	Semnan	-0.748
	Ilam	-0.987	Gom	-0.789
	Kohgiloyeh and Boyer-Ahmad	-1.192	Ilam	-0.854
			Kohgiloyeh and Boyer-Ahmad	-1.043

$*Z_I = \frac{CL_i - \mu}{\sigma}$

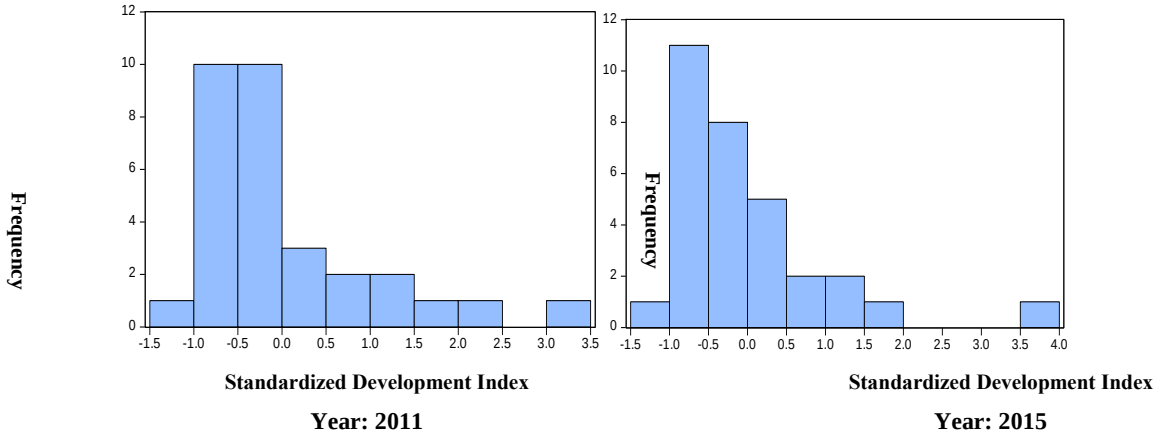


Figure 2. Distribution of Standardized Development Index in Terms of EnjoyingtheHealth Facilities of the Provinces

[Downloaded from jhr.ssu.ac.ir on 2026-11-10]
[DOR: 20.1001.1.23225688.2022.11.4.7.9]
[DOI: 10.18502/jchr.v11i4.11643]

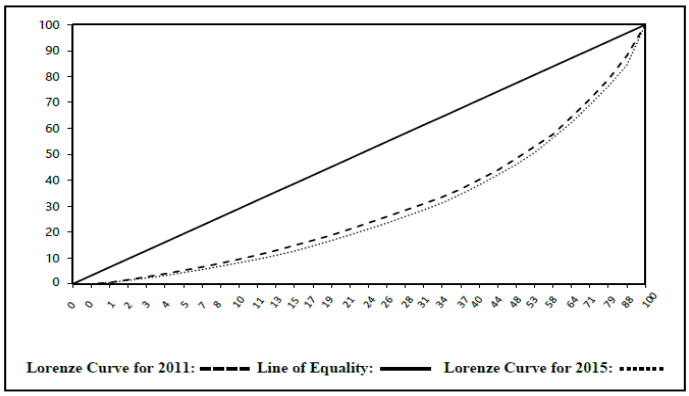


Figure3. Comparison of Lorenz curve for health facilities index (2011 and 2015)

Discussion

Issues related to inequality in the distribution of health facilities are among the constant concerns of researchers, planners and policy makers in the field of health. Access to health care and treatment is a fundamental human right. In this regard, inequality in the geographical distribution of health and treatment resources in each country can make it difficult for people to access health services. Accordingly, the present study has tried to evaluate the position of the provinces of the country in terms of health facilities by using the indicators of health facilities by TOPSIS method. Although in almost all studies in the field of management in determining the position of different regions, it is often enough to calculate CL_i and rank regions based on this criterion, in this study, in addition, these results have been used to determine the distribution of health facilities. Gini coefficient index was used to determine the distribution of health facilities. A subject that has been less used methodologically in research studies in this field. It is noteworthy that although the Gini coefficient is known as a tool to determine inequality in the distribution of health facilities and is considered as a strength of this study compared to previous studies, however, the present study probably has some weaknesses. Therefore, although this index has been used according to its potentials, it is possible that two different distributions have the same Gini coefficient. Therefore, to solve this problem, for each year, the ratio of provinces with the highest level of enjoyment (top 20%) to the provinces with the lowest level of enjoyment (bottom 20%)is calculated and then compared for the first year and the last year of the study period. The results show that the severity of inequality of health facilities among the provinces of the country has intensified during the Fifth Development Plan, and the following strategic proposals are presented

Now, we review a number of studies that have examined the health situation in different regions of Iran, and some similar foreign studies in other countries:

Meshkini et al. (12) have analyzed the development indicators in the border provinces of the country. For this purpose, multi-criteria decision making methods have been used. In this research, indices such as the percentage of specialist physicians, the percentage of dentists and the percentage of pharmacists in each province to the whole country, etc. have been used. The results of this study show that in total, the two border provinces of North Khorasan and Mazandaran are in the optimal range. Also, out of 16 border provinces studied, seven other provinces, including Khuzestan, East Azerbaijan, Kermanshah, West Azerbaijan, Hormozgan, Golestan and Gilan, are in the semi- optimal range. Finally, the remaining seven provinces, which include the provinces of Sistan and Baluchestan, Bushehr, Kurdistan, South Khorasan, Ilam, Ardabil and North Khorasan, are in the non-optimalrange.

Rezaei and Nouri(13) have evaluated the situation and trend of inequality in the distribution of resources in the health sector in the cities of

[Downloaded from jhr.ssu.ac.ir on 2026-11-10]
[DOR: 20.1001.1.23225688.2022.11.4.7.9]
[DOI: 10.18502/jchr.v11i4.11643]

Kurdistan province in the period of 8 years (2006-2017) using Gini coefficient and Lorenz curve. The method of this research is descriptive-analytical and criteria such as general practitioner, specialist physician, dentist, etc. have been used. Based on the findings of this study, the level of inequality in the distribution of health sector resources in 2013 has decreased compared to 2006, but there is still inequality.

Kazemi et al. (14) have examined the level of development of the provinces in terms of access to health services. The statistical population of this study includes all provinces of the country in 2012 and criteria such as the number of pharmacies, general practitioners, dentists, etc. have been used. In this study, at first the desired indices have been determined using Shannon Entropy method and then the developmental degrees of the provinces of the country have been evaluated using taxonomic method. The results of this study show that out of 31 studied provinces, 12 are developed, 9 are semi-developed and 10 are underdeveloped.

Omrani-kho et al. (15) study the level of equality in the distribution of dialysis beds and nephrologists in Iran in 2010. This applied study has been done by descriptive method. The study data included the number of dialysis beds, number of patients and number of nephrologists in each province and data analysis was performed using Lorenz curve and Gini coefficient index. The findings of this study show that despite the equal distribution of dialysis beds according to the need criterion, the distribution of nephrologists is unequal. Therefore, due to the fact that human resources and equipment are complementary in providing services, a more equal distribution of nephrologists can lead to better resource efficiency.

GhaedRahmati et al. (16) have identified and determined the degree of development of the cities of Sistan and Baluchestan province using the latest data and information related to the year 2006.In this study, 10 cities of the province have been evaluated based on 29 welfare indices, including health sector indices such as pharmacies, physicians, etc. The results of this research using taxonomic method indicate the lack of coordinated distribution of facilities and services in the cities of this province. As out of the ten cities studied, Zahedan and Zabol cities in respect of the allocation of resources and facilities and services in the first place and Iranshahr, Saravan, Chabahar, Khash and Nikshahr cities in the second place and Sarbaz, Konarak and Zahak cities in the last place.

Tofighi et al. (17) have studied the level of equality in the distribution of CCU1, ICU2, POST CCU3, POST ICU4, NICU5 beds among the provinces of the country. This is an applied study with the descriptive-analytical method. According to the results of this study, although the geographical maps of intensive care beds show different densities in the provinces of the country, but this difference is negligible in terms of Gini coefficient. Finally, it can be concluded that there is almost complete equality in the distribution of intensive care beds, except for NICU beds, among the provinces of our country.

Agbenyo et al. (18) examined the access of people to health services in a village in Ghana. This article uses a combined access approach to services and health care in the West Wa region. The method used in this research is GIS. The results of this study show that only a small number of people have physical access to the hospital. Poor road conditions are a major barrier to access to hospitals in the area, and the findings emphasize the need for an integrated approach to improving access to health services.

Darlington-Pollack and Norman (19) examine the relationship between health and ethnic inequalities in the UK. This paper examines ethnic inequalities in terms of health using cross-sectional data from 1991, 2001 and 2011. The method used in this study is descriptive, which was obtained through sampling of households aged 16 to 74 years. The findings show that the relationship between health and ethnic inequalities in the UK is positive.

Zheng et al. (20) examine the impact of China's economic reforms on population health and mortality in the region between 1980 and 2000.The method used in this study is descriptive. The

[Downloaded from jhr.ssu.ac.ir on 2026-11-10]
[DOR: 20.1001.1.23225688.2022.11.4.7.9]
[DOI: 10.18502/jchr.v11i4.11643]

results of this study show that during the study period, life expectancy in China has increased, but the level of inequality has increased in different cities of China, so that life expectancy for people living in the eastern provinces of China is much larger than the coastal areas of western China. Differences in life expectancy will lead to differences in regional economic development and increase in health inequalities in the region. Therefore, health policies and the public health system need to be improved in less developed areas.

Sun et al. (21) examined regional differences in health situation in China, using the EQ-5D instrument. The data used in this study were obtained through interviews. The results of this study show that the health situation in rural areas is worse than urban areas, which with the development of the country's economic level, the health situation in rural areas has improved.

Theodorakis and Mantzavinis(22) have examined and compared the level of inequality in the services provided by the primary care physicians in Ioannina city in Greece and Griocaster city in Albania in 2001 and have used criteria such as general practitioners, internal medicine specialists and so on. Using the Lorenz curve and Gini coefficient, they found that primary care physicians were unequally distributed in both regions, and that the inequality in physician distribution in rural Greece was significantly higher than in rural Albania.

Wallace and Gutierrez (23) in a study determined the share of access to health care for the elderly in the four largest cities in Latin America. The statistical population was over 60-year- old people in Sao Paulo, Brazil (143 people), Santiago, Chile (301 people), Mexico City, Mexico (247 people) and Montevideo, Uruguay (450 people).In this study, real health services (visiting a doctor in the last 12 months), wealth quintile, type of health insurance, education, health and demographic characteristics were examined. All countries have different levels of access to services, and this access depends on per capita national wealth.

Hiroshi et al. (9) analyzed the regional characteristics and geographic distribution of the medical staffs (physicians and nurses) and the patient beds in relation to the population and average death rates in each of the provinces in Thailand, using the Lorenz curve and Gini coefficients. Those data were obtained from surveys conducted by the Ministry of Public Health and the Office of the National Education Commission. It was demonstrated that there are certain clear uneven distributions in medical personnel, especially physicians (Gini index = 0.433), by province. For physicians, nurses, and patient beds, approximately 39.6%, 25.8% and 20.6% are concentrated in the Bangkok Metropolis. Specific ideas to solve those problems are discussed in order to overcome this health care crisis by the year 2025.

The results of the present study confirm that the distribution of health facilities in the provinces of the country has been unequal and this inequality has intensified. These results were consistent with the results of side studies.

Conclusion

The results show that the severity of inequality of health facilities among the provinces of the country has intensified during the Fifth Development Plan, and the following strategic proposals are presented. According to the results of the present study, considering that the provinces of the country have a significant difference in terms of their position in access to health facilities and this indicates a lack of equal distribution of health facilities among the provinces of the country, therefore, it is recommended that the necessary measures be considered in this regard. The results of the present study show the severity of inequality in health facilities in favor of more enjoying groups. Therefore, designing an efficient system for optimal, equal and systematic allocation of health facilities seems inevitable.

Acknowledgements

This study is based on independent academic studies approved by Yazd University with ethics ID: IR.YAZD.REC.1400.014. Thereby, the authors

[Downloaded from jhr.ssu.ac.ir on 2026-11-10]

[DOR: 20.1001.1.23225688.2022.11.4.7.9]

[DOI: 10.18502/jchr.v11i4.11643]

would like to thank and appreciate the vice chancellor for research of Yazd University, who have supported us in conducting this study by issuing a code of ethics.

Conflict of Interest

The authors declare that there is no conflict of interest.

Authors' contribution

MR.P. and M.M. Contributed to the design and implementation of the research, to the analysis of the results and to the writing of the manuscript.

References

1. Emadzadeh M. Economics of Education. Tehran: Payam Noor University Press; 2004. [Persian]
2. Amini A, Hejazi Azad Z. An Analysis and Assessment of Health Contribution to Increasing Labor Productivity: A Case Study of Iran. Iranian Economic Research. 2007; 9: 137-163. [Persian]
3. Shahabadi A, Khany Z. Investigating the Causal Relationship between Total Factor Productivity Growth and Unemployment Rate of Iran. Economic Growth and Development Research. 2012; 2(7): 21-32. [Persian]
4. Constitution of the Islamic Republic of Iran [Persian]
5. Announcement of the general policies of Iran's resistance economy. Available at URL: http://www.leader.ir/fa/content/11480. [Persian]
6. Mankiw NG, Romer D, Weil DN. A Contribution to the Empirics of Economic Growth. Quarterly Journal of Economics. 1992; 107: 407-437.
7. Mankiw NG. The Growth of Nations. Brookings Papers on Economic Activity. 1995; 1: 275-326.
8. Barro RJ, Sala-i martin X. Economic Growth. London: Massachusetts Institute of Technology (MIT); 2004.
9. Hiroshi N, Sujan B, Saranath L. Health Inequalities in Thailand: Geographic Distribution of Medical Supplies in the Provinces Southeast. Asian Journal Trop Med Public Health. 2004; 3: 735-740.
10. Iran Statistical Yearbook 2016-2017. Available at URL: https://www.amar.org.ir/Portals/0/Files/fulltext/1395/n_Salname_95-V3.pdf. [Persian]
11. Hwang CL, Yoon K. Multiple Attribute Decision Making Methods and Applications. New York: Springer-Verlag; 1981.
12. Meshkini A, MohamadiHamidi S, Waysian M. Investigating the Development of Frontier Provinces for Sustainable Security Using the Wickler Model. Border science and technology. 2017; 8(2): 147-169. [Persian]
13. Rezaei S, Noori B. Evaluation of Inequalities in the Distribution of Health Resources by Gini Coefficient and Lorenz Curve: A Case Study in Kurdistan Province from 2006 to 2013. Scientific Journal of Kurdistan University. 2015; 20(6): 1-11. [Persian].
14. Kazemi A, Rezapoor A, Bagherifaradonbeh S, et al. Study the Development Level of Provinces in Iran: A Focus on Health Indicators. Journal of Health Administration. 2015; 18(59): 29-42. [Persian]
15. OmraniKhou H, Shafiee M, Safari H, et al. Equity in Geographical Distribution of Dialysis Beds and Nephrologists Based on the Lorenz Curve and Gini Coefficient Need Indices: Case of Iran. Hakim Research Journal. 2013; 16(1): 20-27. [Persian]
16. GhaedRahati S, Khadealhoseini A, Mohammadifard A. Analyzing of development Degree of Sistan&Balouchestan provinces. Quarterly Journal of Environmental Based Territorial Planning. 2010; 3(9): 97-113. [Persian]
17. Tofighi S, MeskarpourAmiri M, Ameriuon A, et al. Equity in Distribution of Intensive Care Beds in Iran with Gini Coefficient and Lorenz Curve Approach. Yafte. 2011; 12(244): 75-83. [Persian].
18. Agbenyo F, Marshall Nungua A, Dongzagla A. Accessibility Mapping of Health Facilities in Rural Ghana. Journal of Transport & Health. 2018; 6: 73-83.
19. Darlington-pollock F, Norman P. Examining Ethnic Inequalities in Health and Tenure in England: A Repeated Cross-Section Analysis. Health & Place. 2017; 46: 82-90.
20. Zheng XY, Song XM, Chen G, et al. Health Inequalities during 20 Years of Rapid Economic Development in China (1980-2000): A Mortality Analysis. Biomed Environ Sci. 2011; 24(4): 329-334.
21. Sun S, JiayingCh, Magnus J, et al. Regional Differences in Health Status in China: Population Health-Related Quality of Life Results from the National Health Services Survey 2008. Health &Place. 2011; 17(2): 671-680.

[Downloaded from jhr.ssu.ac.ir on 2026-11-10]
[DOR: 20.1001.1.23225688.2022.11.4.7.9]
[DOI: 10.18502/jchr.v11i4.11643]

22. Theodorakis PN, Mantzavinis GD. Inequalities in the Distribution of Rural Primary Care Physicians in Two Remote Neighboring Prefectures of Greece and Albania. Rural and Remote Health. 2005; 5(3): 457.
23. Wallace SP, Gutierrez VF. Equity of Access to Health Care for Older Adults in Four Major Latin American Cities. Rev PanamSaludPublica. 2005; 17: 394-409.

[Downloaded from jhr.ssu.ac.ir on 2026-11-10]

[DOR: 20.1001.1.23225688.2022.11.4.7.9]
[DOI: 10.18502/jchr.v11i4.11643]