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# Assessing the accessibility and degree of development in health care resources: evidence from the West of Iran

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A B S T R A C T

***Introduction:*** Health care is one of the most important sectors in the development of each country and disparities in their distribution will reduce the level of development. The aim of this study was to examine the access to healthcare and degree of development in health care resources in the west of Iran in 2011.

***Method:*** This was a cross-sectional and retrospective study. The study setting was 51 cities of five western provinces of Iran, including Kermanshah, Kurdistan, Ilam, Lorestan and Hamadan. For assessing these towns in terms of the degree of development in healthcare resources by the numerical taxonomy technique, 23 indicators of health resources were selected and obtained from the statistics yearbook. The data was analyzed by EXCEL software.

***Results:*** Our study showed that the highest and lowest access to health care based on numerical taxonomy belonged to cities of Kermanshah (0.61) and Salas Babajani (1.07). Also, most towns of Ilam, Lorestan and Kurdistan provinces are underdeveloped and developing, while the most towns of Kermanshah and Hamadan provinces were placed in the developed region.

***Conclusion:*** This study showed that there was a large gap between the cities of one province and also among the provinces in terms of the access to and degree of development in health care resources. Therefore, it is suggested that a higher priority in terms of health resource allocation should be placed on the developing and underdeveloped areas in order to reduce these disparities.

***Keywords:*** Disparity, Degree of development, Health care services, West of Iran

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## Introduction

Development is a multidimensional process that is affected by the socio-economic system of each country. Also, the main purpose of development is to improve people's overall living conditions (1, 2). One of the most important and effective sectors in the development of each country is the health care sector (3). In addition to considering the required standards of health and wellbeing, the role of health care sector in developed countries is paying attention to the public expectations such as: provision of employment opportunities, earning income and profitability as well as establishing a good social infrastructure, and contributing to growth and development. There is a mutual and reciprocal relationship between health and development and also inequality in the distribution of resources and access to health care facilities can reduce the socio-economic development of societies (4). Accessibility of health care services is a multidimensional concept that includes both physical and financial access. In this study, there is an emphasis on physical access. Usually, physical access is defined as the geographical distribution of health care services in a region and this type of access is usually an ongoing concern for health policy makers in each country (5, 6).

In Iran, health care is provided through public and private sectors. The public sector provides a significant part of delivery of health care services whereas the private sector accounts for only 10% of hospitals' bed, 7.4% of health care centers and 27.5% of rehabilitation facilities. Designing and implementing of health policies in the national level was done by the Ministry of Health and Medical Education in Iran. In each province, there is at least one university of medical sciences which is the delegate of the Ministry of Health and Medical Education to implement health policies to the medical universities (7). The health care network in Iran is presented in Figure 1.

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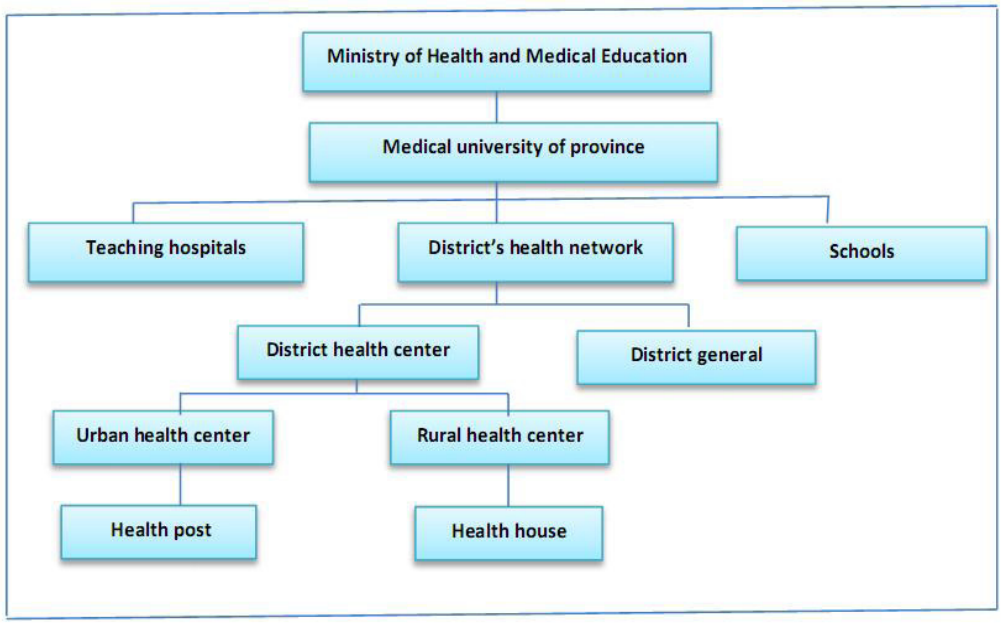
**Figure 1.** Health system network in Iran




Several studies have also shown that there is a large gap in terms of equal accessibility and distribution of health care resources in different geographical areas of a region, so some areas have the benefits of having greater access to these services (6, 8-10). Although this disparity exists in both developed and developing countries, it is more common and even greater in developing countries (11). There are many methods and techniques to evaluate and measure the degree of development and physical access such as taxonomy, topsis, and scalogram (6, 9, 12). Similar to previous studies, in this study we used the numerical taxonomy technique (6, 13, 14). This technique was introduced for the first time by United Nations Educational, Scientific and Cultural Organization (UNESCO) to categorize and determine the degree of development across countries or provinces (15). "This is an efficient method for the ranking, classifying, and comparing the countries and different areas based on their development and modernity degree that is also able to divide a certain set into relatively heterogeneous subsets and provide planners and decision makers with acceptable yardsticks for investigation and evaluation of the development of the areas" (14). Eliminating disparities between different regions, especially in the domain of accessibility of health care services has always been one of the main objectives of the policy makers in the health sector of Iran and one way of achieving this goal is the balanced distribution of health facilities and resources in different geographical areas based on the health needs and population requirements. The first step to prevent and reduce potential disparities is awareness about the situation of accessibility in the target areas (1, 2, 13). Therefore, the aim of this study was to investigate the status of accessibility and degree of development of health care resources in five western provinces in Iran, using the numerical taxonomy technique in 2011.

## Methods

The country of Iran 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 km2 (16)

This was a cross-sectional and retrospective study. The study setting consisted of five provinces and its counties in the west of Iran as follows: Kermanshah, Kurdistan, Ilam, Lorestan and Hamadan. The status of these towns (51 towns) was investigated using 23 indicators of health care sector in terms of the level of development and accessibility by numerical taxonomy technique in 2011. These indicators were selected based on the literature review (6, 12, 17, 18) and their availability and obtained from the Statistical Centre of Iran by self-made checklist. The site of the study is shown in map1.

*Numerical taxonomy Technique*

This procedure was conducted in several steps, as follows (4, 14, 15):

A: The formation of data matrix (health indicators in the columns and towns in the rows)

$$IN = \begin{bmatrix} IN_{11} & \dots & IN_{1m} \\ \dots & \dots & \dots \\ IN_{n1} & \dots & IN_{nm} \end{bmatrix} n \times m$$

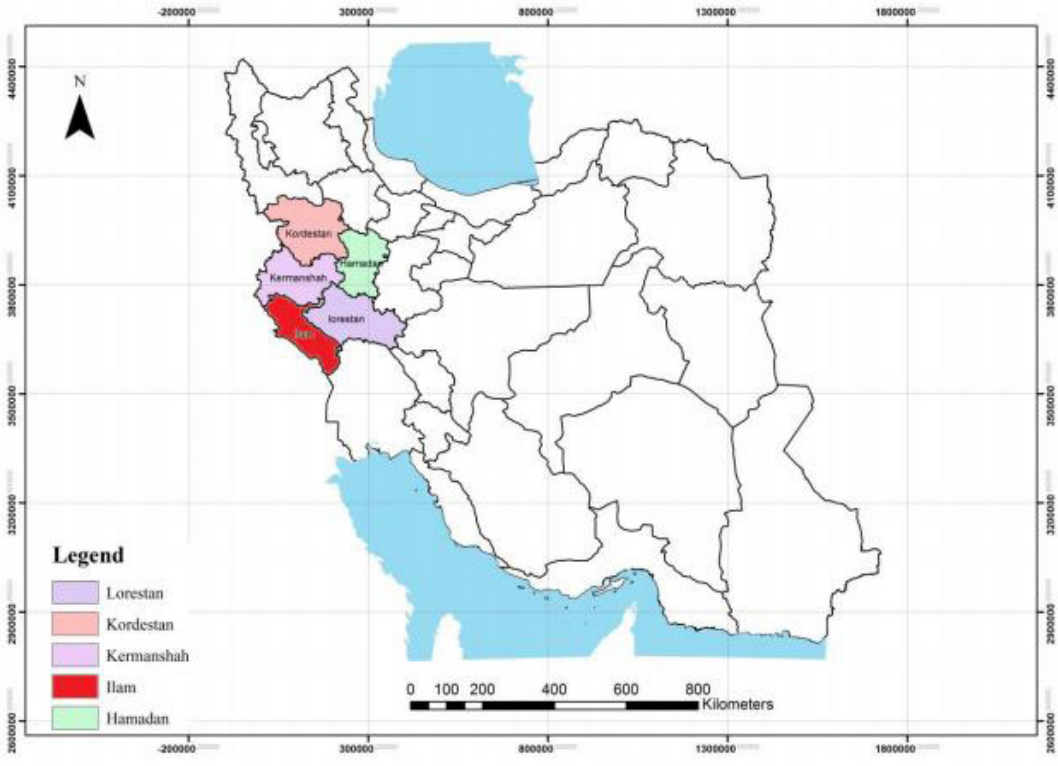
B: matrix standard form: for data standardization we used the following formula:

$$\overline{IN_j} = \frac{\sum_{i=1}^{n} IN_j}{n}, S_j = \sqrt{\sum (IN_{ij} - \overline{IN_j})^2 / n}, SIN = \frac{IN_{ij} - \overline{IN_j}}{S_j}$$

C: Calculation of distance matrix between towns using the following formula:

$$D_{ab} = \sqrt{\sum_{j=1}^{m} (SIN_{aj} - SIN_{bj})^2}$$

**Map 1.** Iran's map and its location of provinces under the study




The health indicators are shown in Table 1.

**Table 1.** Health care indicators for status assessment of accessibility of the studied areas

| |
|---|
| Number of general practitioners per 10,000 people |
| Number of specialists per 10,000 people |
| Number of dentists per 10,000 people |
| Number of pharmacist per 10,000 people |
| Number of nurses per 10,000 people |
| Number of technicians and experts in the field of control of diseases for 10,000 people |
| Number of environmental health technicians and specialists per 10,000 people |
| Number of professional health technicians and experts per 10,000 people |
| Number of anesthesiologist assistants per 10,000 people |
| Number of operating room assistants and technicians per 10,000 people |
| Number of midwives per 10,000 people |
| Number of licensed health workers per 10,000 people |
| Number of receptionists and medical records technicians per 10,000 people |
| Number of technicians and specialists in family health care per 10,000 people |
| Number of radiology technicians per 10,000 people |
| Number of laboratory technicians per 10,000 people |
| Number of active beds per 10,000 people |
| Number of health care centers per 10,000 people |
| Number of active health house for 10,000 people of rural population |
| Number of laboratories per 10,000 people |
| Number of radiology centers per 10,000 people |
| Number of rehabilitation centers per 10,000 people and |
| Number of pharmacies per 10,000 people |

Where:
D_ab: Distance matrix between towns, SIN_(aj ): Standardized value of jth health indicators in town a; SIN_(bj ): standardized value of jth health indicators in town b.
In this formula, a and b are representative of two towns that were under assessment in terms of their compound distance. The distance matrix among the cities is a symmetrical matrix and its main diameter is equal to zero.
D) Determination of homogeneous cities
The minimum amount for each town is identified in the distance matrix of the towns (excluding the number zero), and then in order to determine the convergence of these towns the upper and lower limits should be calculated; these limits can be obtained as follows:

$$d^{+} = \bar{d} + 2Sd,\ d^{-} = \bar{d} - 2Sd$$

Where:
¯d: Mean of minimum distance, Sd: Standard deviation of minimum distance, □ d□^+: Upper limit, □ d□^-:Lower limit
At this stage, the towns' whose least distances were between the lower and upper limit, were considered homogeneous towns. If the minimum distances of a town were outside these limits, the town was considered a heterogeneous and was removed from analysis. There was a lack of similarity between towns between and outside limits in terms of development, so they were placed outside the limits and were removed. In the current study, all of the studied cities were placed between the lower and upper limits and, therefore, all of them were included in analysis.

*E: Ranking the Homogeneous towns*
We selected the maximum value as the ideal point for each health indicator in the towns, and the distance of each town from the ideal point town was obtained from the following formula:

$$C_{io} = \sqrt{\sum_{j=1}^{m} (SIN_{ij} - SIN_{cj})^2}$$

Where:
C_iois the distance ith town from the ideal point(o),SIN_(cj )is the ideal point of jth health indicators and SIN_(ij ) is the value of jth health indicators in the ith towns in the standard matrix.
F) Calculating the degree of development in towns
The development degree (or underdevelopment) of the town was derived from the following formulae:

$$F_i = \frac{C_{io}}{C_o}$$

Where
□ F□_iis the degree of development ith town, C_iois the distance ith town from the ideal point(o), C_o is the average of C_io plus 2 times the standard deviation.
The numerical value of F was between zero and one and in rare cases it was more than one. If the F value gets closer to zero, it represents more development of the town and when it is closer to one, it indicates lack of development of the town (9, 10).
Also, C_io is the development model and less amounts of C_ioare indicative of the development of the county and, in turn, the more the C_io amount, the less the development of the county. Also, in the current study, the towns based on relative cumulative frequency ofC_ioare divided into three categories: developed (0-0.344), developing (0.344-0.637) and underdeveloped (0.637-1) (11).

## Results

The results showed that the degree of development varied from 0.61 to 1.07; the highest and lowest values belonged to Kermanshah and Salas Babajani, respectively. The highest values in terms of access to health care resources in provinces of Kermanshah, Kurdestan, Ilam, Lorestan and Hamadan belonged to Kermanshah (0.610), Sanandaj (0.770), Ilam (0.794), Khorramabad (0.821), and Hamadan (0.745), respectively. Also, the lowest value in terms of access to health care resources Kermanshah, Kurdestan, Ilam, Lorestan and Hamadan provinces belonged to Salas Babajani (1.07), Sarv Abad (0.998), Malekshahi (1.018), Doreh Chegeni (1.032) and Bahar (0.992), respectively. The results of the study in terms of the ranking order of the towns of western provinces of Iran (Kermanshah, Lorestan, Hamadan, Ilam and Kurdistan) are represented in Table 2.
Status of development of each town based on 5 provinces is shown in Table 3. Based on the results of this study, the majority of the towns of Kurdistan province (50% of the towns), Ilam (50% of towns) and Lorestan (40% of towns) are in the underdeveloped areas in terms of access to health resources, while a few towns of Kermanshah (17.5 %) and Hamadan (11%) provinces are located in the underdevelopment area.
The study area by the degree of development in health sector is shown in Table 4. The results showed 19 (37.3%), 15 (29.4%) and 17 (33.3%) of the towns were developed, developing and underdeveloped, respectively.
Status of the studied towns based on the development status of health care resources is demonstrated in Map 2.

## Discussion

Since there is a positive relationship between the level of accessibility to health care services and the health of individuals in a society, equality in the distribution of health care resources and facilities among the geographic areas of a country and even towns of a province are very essential. The first step in preventing and reducing inequality in the distribution of health care resources and facilities is having information and perception of the status of accessibility to health care services and facilities in the regions. The aim of this study was to investigate the distribution of health care resources and services in the towns of five western provinces of Iran (Kermanshah, Kurdistan, Lorestan, Ilam and Hamadan), using the numerical taxonomy technique.

**Table 2.** Development status of western provinces and their towns in terms of access to health care resources, based on numerical taxonomy technique

| City | F | Cio | A* | B* | City | F | Cio | A* | B* |
|---|---|---|---|---|---|---|---|---|---|
| **Kermanshah** | 0.610 | 9.47 | 0.013 | 1 | **Sahneh** | 0.923 | 14.46 | 0.475 | 27 |
| **Hamadan** | 0.745 | 11.58 | 0.029 | 2 | **Ivan** | 0.925 | 14.5 | 0.494 | 28 |
| **Sanandaj** | 0.770 | 11,96 | 0.045 | 3 | **Saqez** | 0.931 | 14.51 | 0.514 | 29 |
| **Paveh** | 0.775 | 12.04 | 0.062 | 4 | **Borujerd** | 0.933 | 14.53 | 0.534 | 30 |
| **Qasreshirin** | 0.788 | 12.25 | 0.079 | 5 | **Islamabad e Gharb** | 0.934 | 14.58 | 0.555 | 31 |
| **Ilam** | 0.794 | 12.33 | 0.096 | 6 | **Marivan** | 0.935 | 14.59 | 0.575 | 32 |
| **Khorramabad** | 0.821 | 12.76 | 0.113 | 7 | **Sarpol e Zahab** | 0.939 | 14.72 | 0.595 | 33 |
| **Famenin** | 0.832 | 12.93 | 0.131 | 8 | **Selseleh** | 0.939 | 14.8 | 0.615 | 34 |
| **Kangavar** | 0.835 | 12.96 | 0.149 | 9 | **Dorud** | 0.948 | 14.92 | 0.635 | 35 |
| **Tuyserkan** | 0.841 | 13.06 | 0.167 | 10 | **Diwandareh** | 0.953 | 14.93 | 0.656 | 36 |
| **Harsin** | 0.845 | 13.12 | 0.186 | 11 | **Dehloran** | 0.960 | 15.03 | 0.676 | 37 |
| **Razan** | 0.852 | 13.23 | 0.204 | 12 | **Shirvan&Chradavl** | 0.961 | 15.14 | 0.697 | 38 |
| **Javanrood** | 0.865 | 13.44 | 0.222 | 13 | **Dalaho** | 0.968 | 15.16 | 0.718 | 39 |
| **Gilangharb** | 0.870 | 13.51 | 0.241 | 14 | **DarehShahr** | 0.974 | 15.22 | 0.739 | 40 |
| **Azna** | 0.877 | 13.63 | 0.260 | 15 | **Delfan** | 0.976 | 15.23 | 0.760 | 41 |
| **Asad Abad** | 0.885 | 13.75 | 0.279 | 16 | **Bane** | 0.980 | 15.25 | 0.781 | 42 |
| **Nahavand** | 0.890 | 13.83 | 0.298 | 17 | **Ravansar** | 0.980 | 15.28 | 0.802 | 43 |
| **Poldokhtar** | 0.905 | 14.06 | 0.318 | 18 | **Kuohdasht** | 0.982 | 15.4 | 0.823 | 44 |
| **Mehran** | 0.906 | 14.1 | 0.337 | 19 | **Kamyaran** | 0.984 | 15.5 | 0.844 | 45 |
| **Aligoodarz** | 0.908 | 14.13 | 0.356 | 20 | **Bahar** | 0.992 | 15.68 | 0.865 | 46 |
| **Qorveh** | 0.910 | 14.17 | 0.376 | 21 | **Sarv Abad** | 0.998 | 15.82 | 0.887 | 47 |
| **Abdanan** | 0.912 | 14.23 | 0.396 | 22 | **Dehgalan** | 1.009 | 16.03 | 0.909 | 48 |
| **Malayer** | 0.916 | 14.25 | 0.415 | 23 | **Malekshahi** | 1.018 | 16.7 | 0.930 | 49 |
| **Songhor** | 0.917 | 14.28 | 0.435 | 24 | **DorehChegeni** | 1.032 | 17.26 | 0.953 | 50 |
| **Kabudaraa-hang** | 0.919 | 14.34 | 0.455 | 25 | **Salas Babajani** | 1.075 | 17.4 | 0.976 | 51 |
| **Bijar** | 0.923 | 14.36 | 0.475 | 26 | | | | | |

*A:relative Cumulative frequency, B: ranking of development

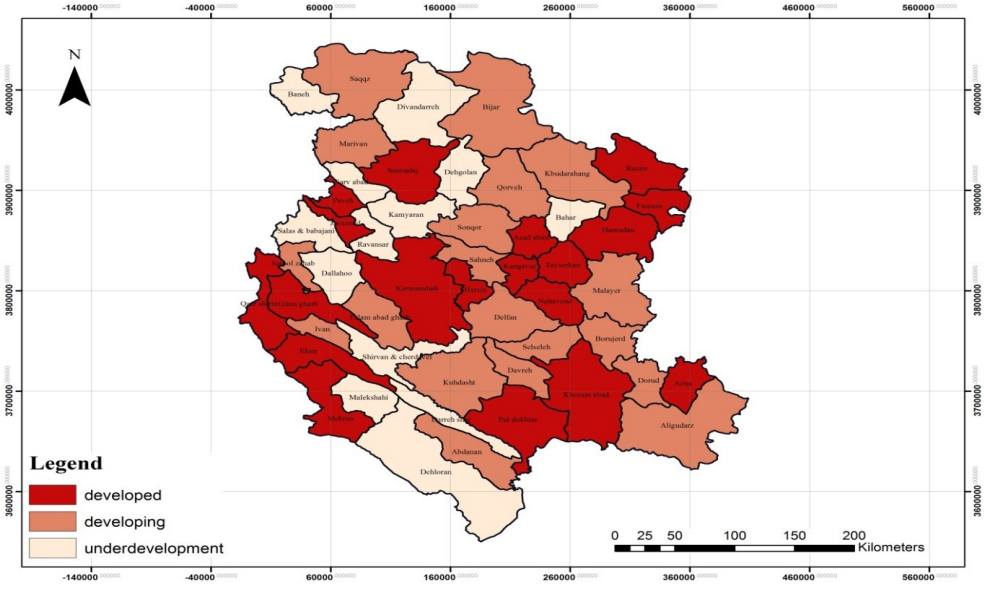
**Table 3.** Development status of access to health care resources among the towns of provinces based on the numerical taxonomy technique

| province | Status of develop-ment | Cities | Number | % |
|---|---|---|---|---|
| **Kermanshah** | developed | Kermanshah - QasreShirin - Paveh- Kangavar – Javanrood - Gilangharb - Harsin | 7 | 50 |
| | developing | Sarpol e Zahab – Islamabad e Gharb - Sahneh- Songhor | 4 | 28.6 |
| | developed | Salas - BabajaniRavansar - Dalaho | 3 | 21.4 |
| **Kurdistan** | underdeveloped | Sanandaj | 1 | 10 |
| | developing | Qorveh-Bijar-Saqez- Marivan | 4 | 40 |
| | underdeveloped | Diwandareh- Bane- Kamyaran - Sarv Abad - Dehgalan | 5 | 50 |
| **Ilam** | developed | Ilam- Mehran | 2 | 25 |
| | developing | Ivan- Abdanan | 2 | 25 |
| | underdeveloped | Malekshahi-DarehShahr- Dehloran-Shirvan&Chradavl | 4 | 50 |
| **Lorestan** | developed | Khorramabad - Poldokhtar - Azna | 3 | 30 |
| | developing | Borujerd–Aligoodarz- Selseleh | 3 | 30 |
| | underdeveloped | Dorud-Delfan–DorehChegeni- Kuohdasht | 4 | 40 |
| **Hamadan** | developed | Hamadan-Famenin- Tuyserkan -Razan–Asadabad - Nahavand | 6 | 66.7 |
| | developing | Kabudaraahang - Malayer | 2 | 22.2 |
| | underdeveloped | Bahar | 1 | 11.1 |

**Table 4.** Status of the studied cities in terms of access to healthcare resources based on the degree of development in 2011

| Degrees of development | Coefficient ranges | Cities | Number | % |
|---|---|---|---|---|
| **Developed** | 0 – 0.344 | Kermanshah - QasreShirin - Paveh- Kangavar - Javan-rood- Gilangharb – Harsin - Sanandaj- Ilam - Mehran - Khorramabad - Poldokhtar - Azna - Hamadan - Famenin - Tuyserkan - Razan - Asad Abad- Nahavand | 19 | 37.3 |
| **Developing** | 0.344 -0.637 | Sarpol e Zahab-Islamabad e Gharb-Sahneh- Songhor-Qorveh-Bijar-Saqez–Marivan-Ivan -Abdanan-Dorud-Borujerd-Abdanan- KabudarAhang - Malayer | 15 | 29.4 |
| **Underdeveloped** | 0.63 – 1 | Bahar-Dorud-Delfan-DorehChegeni-Kuohdasht-malekshahi-DarehShahr-Dehloran- Shirvan&Chradavl - Diwandareh - Bane - Kamyaran – Sarvabad - Dehgalan - Salas - Ravansar - Dalaho | 17 | 33.3 |

**Map 2.** The geographical map of the studied towns based on the development status in terms of access to health care resources




The results of the study showed that there are significant gaps between the towns of the each of the provinces and also among provinces in terms of the level of accessibility to health care services and health care resources are unfairly distributed in these areas. As to the development of the health care sector and degree of accessibility of these services, about 37% of the towns had accessibility to the services and 33% were in the underdeveloped area. The Kermanshah and Salas Babajani towns were respectively the most privileged and the most deprived towns in terms of the level of development of the health indicators. The comparison of the towns in the five provinces under the study indicated that Ilam, Lorestan and Kurdistan towns had the worst situation in comparison with Hamadan and Kermanshah towns and there was a large gap in the distribution of health facilities and resources among the towns of the five provinces.

The results also demonstrated that only Sanandaj town in Kurdistan province, Ilam and Mehran towns in Ilam province, and only Khorramabad, Poldokhtar and Azna towns in Lorestan province were placed in the developed status and the rest of the towns of these three provinces had the developing or underdeveloped status. However, only Bahar town in the Hamadan province and Ravansar , Salas Babajani and Dalaho towns in Kermanshah province were in the underdeveloped status. The rest of the towns were considered as developed or developing. Inequality and unfairness in the distribution of health resources is not only limited to the western provinces of Iran and these disparities also exist among other towns and other provinces of the country (8, 16). The study conducted by Taghvaiee and Shahivand on the distribution of health care services in the towns of Iran represented that 90 percent of the towns of the country were deprived and only 10 percent of them was in a desirable condition (17). This study showed that from 51 towns of the studied areas, 19 were developed, 15 developing and 17 underdeveloped. The study of Taheri Mehrjerdi et al. indicated that from 30 provinces of the country, 12 were developed, 9 developing and the other 9 provinces underdeveloped (10). Bahadori et al. indicated that from 11 towns in Golestan Province in 2010 with Scalogram model, 3 towns, 6 towns and 2 towns were developed, developing and underdeveloped, respectively (9).

Given the importance of equality in the distribution of health care resources and facilities, it is also recommended that policy makers and planners should prioritize the allocation of resources to the less developed and

undeveloped towns and areas. Therefore, according to the results of this study, Ilam, Lorestan and Kurdistan provinces should be given priority. The results also demonstrated that all provincial capitals were privileged in terms of accessibility to health care services and the level of development of health resources and facilities and they are considered as developed areas.

## Conclusions

This study indicated that there is a significant gap between the towns under the study in terms of accessibility of health care resources and facilities. Therefore, it is recommended that the health care planners and officials should prioritize the less developed and undeveloped regions in the regional planning and resource allocation in order to eliminate or reduce these disparities among towns. Also, by considering the fact that all provincial capitals are placed in the developed and privileged regions, so as a solution, it can be recommended that the decentralization of the resource allocation from the provincial capitals to other areas could be effective and impressive in reducing disparities.

## Competing Interest

There is no conflict of interest to be declared.

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