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# ANALYSIS OF HEALTH CARE RESOURCES CONCENTRATION IN POLAND

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## Abstract:
*The aim of this study is to measure the concentration level of health care resources such as the doctors, nurses with midwives, outpatient entities and general hospital beds in Poland. It will also allow to identify inequities to access to these resources and thus also to health care services. The Herfindahl-Hirschman Index (HHI) was employed to measure the concentration level of the health care resources in Poland. The data for these health care resources spanning all Poland for the period of 2013-2017 were collected. The concentration of health care resources was measured in each of the 16 voivodeships in Poland based on the aggregated data at the powiat level. This approach arises from the limitation in the availability of data, which was collected from the public statistical system. The HHI indices support the assertion that in the period of analysis the entire general hospital beds, doctors and nurses with midwives sectors in Poland have been at average moderately concentrated and thus moderately competitive with the growing tendency to higher concentration and less competitive. The sector of outpatient's entities appeared to be mainly unconcentrated. Moreover, the concentration of all health care resources is diversified across the voivodeships of Poland and it is quite uneven, which can limit the access to health care services.*

**Keywords*: -*** *health care, resources, concentration, Herfindahl-Hirschman Index, Poland*

## I.INTRODUCTION

Health care is one out of four general factors which influences the state of health. Health care is defined as "an organized way of medical care concerned with the maintenance of the health of the whole body". Health care is delivered by the different types of health care providers or professionals, which operate in various fields. These include: physicians, pharmacy, nursing, medicine, dentistry, psychology etc. [1]. The importance of health care arises from the importance of health for people life. Health has been defined by the World

Health Organization in 1948 as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" [2]. What is important that health capital is one of the component of human capital and influences its quality? Healthy children have ability to better learn, which will also determine their ability to work or pursue an education and at general the range of opportunities and life plans [3]. Healthy adults are better able to contribute not only socially but also economically [4]. Thus good health has impact on the human capital quality, which then can positively influence the economic growth [5]. Everyone inherits a initial stock of health at the moment of birth but this capital depreciates with age and unfortunately at an increasing rate especially after some stage in the life cycle. However, it is possible to increase it by investment, among others also by the usage of health care [6].

However, health care services are very complex - in this sense that a variety of health care services are provided and also a variety of health resources are used when these health care services are provided. This complexity and differentiation of health care services arises not only from the complex definition of health but also because every individual could have different health problem thus presenting different health conditions which then would required different health care. Some could require normal care and some require extra special care. Therefore, based on the complexity of patient condition healthcare, can be divided into various types [1]. One of the main criteria is the length of time a patient must remain in the facility to have their procedure to be performed. Thus, the health care can be divided into outpatient health care and inpatient health care. In case of inpatient care, the overnight hospitalization is required, which means that patients must stay at the health care providers where their procedure was done for at least one night. During this time, they will be supervised by nurses or doctors [7]. Outpatient health care are to persons who don't require 24-hour or all-day treatment. The services guaranteed under outpatient specialist care are provided in specialist clinics in cases resulting from health condition (also at the patient's home) by a qualified physician or by another person who is authorized to provide specialist health services or general practitioners [8].

To provide the health care services, many different types of resources must be engaged. Thus the availability of health care services depends on the volume and structure of current resources such as medical doctors, nurses, hospital beds, outpatients facilities etc [9] and also on the access to them. The access to needed health services with the protection being pushed into poverty because of the health care cost is the crucial factor for maintaining and improving health [10].

However, health care systems face many challenges as demographic changes, aging society, new medical technology, which cause also the changes in health care services. Thus almost every country has been reforming their health care systems continuously also in the purpose to improve their equality, efficiency, quality as well as access to health care. However devising an effective, fair, accessible and cost-conscious healthcare system is difficult for any country [11]. As level and organization of healthcare is influenced by the social, economic conditions as well as by the health policies of the particular country, therefore it varies across different countries, individuals, groups etc. That's why, it is argument for analyzing each country in a separate way.

The Republic of Poland - which is a country with the location in central and eastern Europe (with both population of 38.1 million and area of 312 685 km2 in 2018) [12] and being the largest country among the new Member States admitted to the EU after 2004 – has been grappling with healthcare reform since 1989. However these attempts to modify and improve the health care system which were introduced over 1991-1998 failed to eliminate the negative phenomena of health care system. So, in the late nineties, the need to enforce new reforms was recognized as a priority by the Government of the Republic of Poland. And on 1 January 1999, a new general obligatory health insurance system entered into force and in fact a new insurance-budgetary model of health care funding was created. As a result of this reform the purchaser and provider functions were split. [13] It can be said that the decentralization of the system was placed. For many health care providers, this reform meant serious changes in the conditions of their activity. The function of purchaser was taken over by – 16 regional Health Insurance Organizations (the so-called Sickness Funds – one in each region) and one trade (nationwide) Health Insurance Organization [14]. The process of health care services purchase has been based on selective contracting between the payer/purchaser (initially the Sickness Funds) and health care providers [15].

Because of considerable differentiation of the number and quality of services in individual regions this system met with the criticism of new left - side government, which adopted of different solutions - instead of improving this system - it means the law on general insurance in the National Health Fund, was enforced on April 1, 2003. Under this law Health Insurance Organizations ceased to exist. They have been replaced by the National Health Fund with many branches – each in one region. It meant that the public funds for health care was again centralized. Shortly, the law on universal insurance in the National Health Fund met – this time - with the criticism of opposition. In January 2004 it was legally qualified as not standing in accordance with the Constitution. As a result of it, the Seym of the Republic of Poland passed on 30 July 2004 the law on health benefits financed from public means but the general idea of insurance in National Health Fund left [14]. The major task of the NHF is to finance health services provided to the entitled population, however it also manages the process of contracting health services with public and non-public service providers (setting their value, volume and structure), monitors the fulfillment of contractual terms and being in charge of contract accounting. It means that the quality and accessibility of health care services are to a certain extent influenced by the negotiated terms [16]. Thus the provision of health care services is determined by their providers resources on the one hand while also by the ability to finance the services by the NHF on the other hand [17].

Then some further fundamental changes in the Polish health care system took placed by implementing the 2011 Law on Therapeutic Activity, which introduced major changes to health care services provision. One of the most important was the introduction of a new legal term, such as 'therapeutic entity', which replaced the term health care unit, introduced by the 1991 Act on Health Care Units. It is also clearly specified that health care services can be provided by public and non-public health care units as well as by individual and group medical practices. Therapeutic activity comprises inpatient services (in hospitals and other institutions, such as hospices or nursing homes etc - article 8 of this Act) and outpatient services [18].

As a significant share of gross domestic product is consumed by the health care services, thus this topic seems to be also crucial from the point of view of society's welfare [19]. Thus measuring concentration of health care resources is increasingly important for analysis of health care markets as well as policies. Thus the aim of this study is to fill an important gap in the literature on health care resources concentration because such studies in this area and in the context of Poland are very limited. There is growing literature on concentration in the context of health care as for example in the context of the U.S.health care market [20] or Germany [21] etc. But still, there is surprisingly little research addressing these issues in case of Polish health care system and mainly from the different context. While, it can be assumed that high concentration of healthcare resources, in certain areas (in geographical sense), lower potential access to healthcare benefits, particularly when the amount of services, provided by an individual providers is limited [22]. Thus, the purpose of this study is to calculate concentration measures for the Polish health care resources and to find out the clear picture of how strong the concentration actually is. The higher the level of concentration thus the distribution of particular resource can be very uneven, which also limit the access to them. Moreover, these results are put within the context of the health reforms that have caused this development, which may be of interest to policy makers.

## II**Data and Method**

Data are collected from the public statistical system such as Local Data Bank database (Statistics Poland, 2013-2017) [23] for the period from 2013-2017. In this study, number of employed doctors in the main place of work, number of employed nurses and midwives in the main place of work, number of outpatient entities and number of general hospital beds were engaged and the number of population in Poland. These variables are chosen as they are very good indicator of market share of main health care resources, but also in some way the range of them are determined by their availability. Not only the range but also the period and level of analysis are mainly determined by the availability of data, but it is still sufficient to examine the dynamics of chosen geographic market in the aspect of degree of concentration. The number of employed doctors in the main place of work varies over the period of analysis but generally it shows the growing tendency as the number of them increased during the period of analysis by 16.24%. The number of employed nurses and midwives in the main place of work showed also the increasing tendency but during the period of analysis it increased only by 3.37%. Also total number of outpatients entities increased by the 10.94%, while in case of general hospital beds the decrease can be noted by the 1.33%.

**Table 1. Number of health care resources in the years from 2013 to 2017**

| year | 2013 | 2014 | 2015 | 2016 | 2017 | Change |
|---|---|---|---|---|---|---|
| Employed doctors in the main place of work | 187 663 | 201 472 | 205 941 | 214 236 | 218 145 | 16.24% |
| Employed nurses and midwives in the main place of work | 216 633 | 218 915 | 220 292 | 221 866 | 223 939 | 3.37% |
| Outpatient entities | 19 529 | 20 052 | 20 412 | 21 299 | 21 665 | 10.94% |
| General hospital beds | 187 763 | 188 116 | 186 994 | 186 607 | 185 263 | -1.33% |

*Source: Statistics Poland. Local Data Bank [23]*

In the empirical research, three different basic concepts can be distinguished and which are frequently applied in purpose to define the relevant geographic market to measure concentration. The first approach is geopolitical boundaries, the second is the fixed radius and the third approach is the patient flow technique [24]. In this empirical study the geopolitical boundaries' approach was chosen. Since the beginning of 1999, Poland is divided into three administrative level. First, all territory is divided into 16 voivodeships, which are further divided into powiats and these are divided into communities. Thus the concentration of each types of health care resources was measured in each of the 16 voivodeships in Poland but because of limited access to data at the level of individual providers (it means at micro level) thus the aggregated data at the level of powiats (counties) were employed in this study. However, in Poland there are two types of powiats (counties) in Poland such as rural and town with district rights, therefore these results will be also discussed in the context of different type of powiats (counties) as well.

In addition to it, some regions of in Poland can be differentiated according to their similarities in terms of economic, landscape, ethnographic features. Such division of voivodeships by region was employed in this research and the specification of these regions is provided by the Central Statistical Office (Table 2).

**Table 2: The division of voivodeships by region in Poland in the years from 2013-2017**

| Region of Poland | voivodeship | |
|---|---|---|
| Central region | ○ łódzkie; | ○ mazowieckie; |
| Southern region | ○ małopolskie; | ○ śląskie; |
| Eastern region | ○ lubelskie;<br>○ podlaskie; | ○ podkarpackie;<br>○ świętokrzyskie; |
| North – western region | ○ lubuskie;<br>○ zachodniopomorskie; | ○ wielkopolskie; |
| South – western region | ○ dolnośląskie; | ○ opolskie; |
| Northern region | ○ kujawsko-pomorskie; | ○ pomorskie; |
| | ○ warmińsko- mazurskie; | |

Source: Statistics Poland [12].

To measure the intensity (degree) of competition the Herfindahl-Hirschman Index (HHI) is employed. It is the common and undoubtedly popular indicator for market structure, I.e. market concentration which is used in most studies. The market concentration is an important aspect of industrial structure. HHI is used to represent the dispersion of providers of services within one industry /sector and thus it is the most commonly employed variable to indicate the degree of competition [25]. The Herfindahl-Hirschman health concentration index was worked out at the same time by A.O. Hirschman (1945) [26] and O.C. Herfindahl (1950) [27] and became a universally known index of market concentration, which was used in purpose to determine the degree of competitiveness of a company [28]. It is a simple statistical measure which is more and more often borrowed in the context of health care sector as for example to calculate concentration of financial and non-financial resources in health protection [29, 28].

Because of the importance attached to market concentration as an indicator of competition and the relative ease of calculating the HHI, this index serves as an efficient screening device for regulators and also as a planning tool [30].

The HHI can be defined as the sum of squared market (area) shares of health care resources participating in the all area (market). And it is expressed by the following formula [31]:

$$HHI = \sum_{i=1}^{n} (MSi)\,2 \qquad (1)$$

where: $MS_i$ - represents the area (market) share of health care resource as well as it stands for market concentration n – number of health care resource in the area (market).

This index is the sum of the squared market share of each types of health care resources and then for example, a market with only one particular provider would have a squared market share equal to 1. Conversely, a market with a large number of small amount of health care resources would have a small sum of squared market shares, and thus an HHI near 0. If markets have the HHI greater than 0.25, then these markets are considered to be highly concentrated. If they have an HHI between 0.15 and 0.25 then they are moderately concentrated and they are unconcentrated if they have an HHI between 0.01 and 0.15. In case of having HHI below 0.01, the markets are treated as highly competitive. So, higher HHI values are consistent with less competitive markets and also lower equity, while a perfectly competitive market would have the lowest level of concentration and would be also treated as more equitable in the access to particular resources [31]. Thus the results of empirical analysis of health care resources concentration in Poland are presented in the next sections.

## III. **Results and Discussion**

This section gives a detailed account of research results. The descriptive statistics reported in Table 3 suggest that the average number of employed doctors in the main place of work per 10 thousand population increased during the period of analysis from 46 doctors per 10 thousand population in 2013 to 53 doctors per 10 thousand population in 2017. The median was at the level of 46 in 2013 and 52 in 2017, which means that in 2013, at least 50% of voivodeships had number of employed doctors in the main place of work per 10 thousand population above 46, which also means - at the level of average and above while the median of 52 in 2017 shows, that at least 50% of voivodeships had number of employed doctors per 10 thousand population above 52, so almost at the level of average and above. As the standard deviation was at the level from 9 in 2013 to 11 in 2017, so it shows that the number of employed doctors in the main place of work per 10 thousand population is moderately varied among voivodeships in Poland. Moreover, the minimum number of employed doctors in the voivodeship was 31 in 2013 while the maximum was at the level of 61 in 2013. And in the year of 2017, the minimum was at the level of 38 and maximum at the level of 72. The spread between the minimum and maximum is on the comparable level in the all years of analysis.

**Table 3: Descriptive statistics of health care resources in the years from 2013 to 2017**

| Health care resource | Statistics/ year | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|
| Employed doctors in the main place of work per 10 thousand population | average | 46 | 49 | 50 | 53 | 53 |
| | minimum | 31 | 35 | 37 | 36 | 38 |
| | maximum | 61 | 68 | 69 | 71 | 72 |
| | median | 46 | 47 | 50 | 53 | 52 |
| | Standard deviation | 9 | 10 | 10 | 10 | 11 |
| | | | | | | |
| Employed nurses and midwives in the main place of work per 10 thousand population | average | 58 | 57 | 57 | 57 | 56 |
| | minimum | 47 | 47 | 45 | 44 | 45 |
| | maximum | 67 | 65 | 67 | 66 | 66 |
| | median | 59 | 57 | 57 | 57 | 56 |
| | Standard deviation | 5 | 5 | 6 | 7 | 6 |
| | | | | | | |
| Outpatient entities per 10 thousand population | average | 5.06 | 5.21 | 5.39 | 5.52 | 5.61 |
| | minimum | 3.62 | 3.70 | 3.91 | 4.00 | 4.14 |
| | maximum | 6.15 | 6.30 | 6.38 | 6.49 | 6.52 |
| | median | 5.14 | 5.29 | 5.38 | 5.58 | 5.68 |
| | Standard deviation | 0.67 | 0.72 | 0.70 | 0.69 | 0.66 |
| | | | | | | |
| General hospital beds per 10 thousand population | average | 48.17 | 48.34 | 48.07 | 48.11 | 47.71 |
| | minimum | 41.30 | 40.65 | 41.29 | 39.52 | 39.97 |
| | maximum | 56.11 | 56.00 | 55.66 | 55.61 | 55.03 |
| | median | 48.74 | 48.47 | 48.17 | 48.19 | 47.51 |
| | Standard deviation | 4.13 | 3.87 | 3.74 | 4.03 | 3.76 |

*Source: own calculation based on data from the Statistics Poland. Local Data Bank [23]*

Moreover, it is appeared that the average number of employed nurses and midwives in the main place of work per 10 thousand population decreased during the period of analysis from 58 of them per 10 thousand population in 2013 to 56 of them per 10 thousand population in 2017. The median was at the level of 59 in 2013 and 56 in 2017, which means that in 2013, at least 50% of voivodeships had number of employed nurses and midwives per 10 thousand population above 59, which also means - at the level of above the average while in 2017, at least 50% of voivodeships had number of employed nurses and midwives per 10 thousand population above 56, which means at the level of average and above the average. As the standard deviation was at the level from 5 in 2013 to 6 in 2017, so it shows that the number of nurses and midwives in the main place of work per 10 thousand population is moderately varied among voivodeships in Poland. Moreover, the voivodeship with the minimum number of employed nurses and midwives per 10 thousand population had 47 of them in 2013 and 45 of them in 2017 while the voivodeship with the maximum number of employed nurses and midwives per 10 thousand population had 67 of them in 2013 and 66 of them in 2017. This spread between minimum and maximum is on the comparable level during all years of analysis.

Then, it can be also noted that the average number of outpatient entities per 10 thousand population increased during the period of analysis from 5.06 of them per 10 thousand population in 2013 to 5.61 of them per 10 thousand population in 2017. The median was at the level of 5.14 in 2013 and 5.68 in 2017, which means that in 2013, at least 50% of voivodeships had number of outpatients entities per 10 thousand population above 5.14, which also means - at the level of above the average while in 2017, at least 50% of voivodeships had number of them above 5.68, which also means - at the level of above the average. As the standard deviation was at the level from 0.67 in 2013 to 0.66 in 2017, so it shows that the

number of outpatients entities per 10 thousand population does not so much vary among voivodeships in Poland. Moreover, the voivodeship with the minimum number of outpatient's entities per 10 thousand population had 3.62 of them in 2013 and 4.14 of them in 2017 while the voivodeship with the maximum number of outpatients per 10 thousand population had 6.15 of them in 2013 and 6.52 of them in 2017. This spread between minimum and maximum is on the comparable level during all years of analysis.

Then, it can be noted that the average number of general hospital beds per 10 thousand population slightly decreased during the period of analysis from 48.17 of them per 10 thousand population in 2013 to 47.71 of them per 10 thousand population in 2017. The median was at the level of 48.74 in 2013 and 47.51 in 2017, which means that in 2013, at least 50% of voivodeships had number of general hospital beds per 10 thousand population above 48.74, which also means - at the level of above the average while in 2017, at least 50% of voivodeships had number of them above 47.51, which also means at the level of close and above the average. As the standard deviation was at the level from 4.13 in 2013 to 3.76 in 2017, so it shows that the number of general hospital beds per 10 thousand population does not so much vary among voivodeships in Poland and even it decreased in the analyzed period. Moreover, the voivodeship with the minimum number of general hospital beds per 10

Thousand population had 41.30 of them in 2013 and 39.97 of them in 2017 while the voivodeship with the maximum number of general hospital beds per 10 thousand population had 56.11 of them in 2013 and 55.03 of them in 2017. This spread between minimum and maximum is on the comparable level during all years of analysis.

From the analysis of health care resources it can be noted that number of doctors per 10 thousand population as well as the number of outpatient entities per 10 thousand population increased during the period of analysis, while the number of employed nurses and midwives per 10 thousand population as well as the number of bed per 10 thousand population decreased.

Then the results of calculated HHI for these health care resources were analysed. The descriptive statistics of calculated HHI for employed doctors in the main place of work (Table 4) suggest that the average concentration result expressed by HHI is from 0.2224 with the median of 0.2247 in 2013 and average of 0.2335 with the median of 0.2392 in 2017. According to these numbers for the year of 2017, at least 50% of Polish voivodeships have doctors (expressed as employed in the main place of work) market with a concentration of 0.2392 or above, which means moderately concentrated market of doctors. However, these markets are well close the threshold of 0.25, which usually serves as an indicator for a highly concentrated market. In addition to it, the standard deviation presents that around 0.09 in 2017, so it shows that the doctor's concentration is also moderately differentiated in Poland. Also, it was found out that the average value of HHI of analysed human resources within this period increased from 0.2224 in 2013 to 0.2335 in 2017, what means that at average their became more concentrated and thus less competitive. The HHI in the sample cities in 2017, the maximum values being at around 0.3794 and the minimum of 0.0618, which implies that the value of HHI of voivodeships with the most concentrated market (0.3794) is around six times higher than the value of the least concentrated market (0.0618). As HHI is a measure of provider's concentration in an industry thus it is also the indicator of inequality as well. So, based on the results, it can be found that there is moderate level of concentration but very close to the amount of 0.25, which is an indicator of high concentration. So, the doctors sectors is quite concentrated, which can generate the problem with the equitable access to their services.

**Table 4: Descriptive statistic of HHI for employed doctors in the main place of work in the years from 2013 to 2017**

| voivodeship / year | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|
| average | 0,2224 | 0,2246 | 0,2266 | 0,2322 | 0,2335 |
| minimum | 0,0627 | 0,0605 | 0,0613 | 0,0628 | 0,0618 |
| maximum | 0,3670 | 0,3836 | 0,3936 | 0,4078 | 0,3794 |
| median | 0,2247 | 0,2262 | 0,2236 | 0,2293 | 0,2392 |
| standard deviation | 0,0835 | 0,0868 | 0,0850 | 0,0872 | 0,0880 |

Source: own calculation based on the data from Statistics Poland. Local Data Bank. [23].

The descriptive statistics of calculated HHI for employed nurses and midwives in the main place of work are presented in the Table 5. The descriptive statistics suggest that the average concentration result expressed by HHI are from 0.1553 with the median of 0.1514 in 2013 and 0.1667 with the median of 0.1614 in 2017. According to these numbers for the year of 2017, at least 50% of Polish voivodeships have nurses and midwives market with a concentration level of 0.1614 or above, which means moderately concentrated market. However, the value of HHI for this market is well close the threshold of 0.15, which usually serves as an indicator for unconcentration. As the standard deviation presents that around 0.06 in 2017, so it shows that the nurses and midwives concentration is moderately varied in Poland. The HHI in the sample cities, the maximum values being at around 0.2620 and the minimum of 0.0568 in 2017, which implies that the value of HHI of voivodeships with the most concentrated market (0.2620) is around five times higher than the value of the least concentrated market (0.0568).

As HHI is a measure of provider's concentration in an industry thus it is also the indicator of inequality as well. So, based on the results, it can be found that there is moderate level of concentration but very close to the amount of 0.15, which is a indicator of unconcentration. So, the nurses and midwives sectors is less concentrated then the doctors and more equitable in the access to them.

**Table 5: Descriptive statistic of HHI for employed nurses and midwives in the main place of work in the years from 2013 to 2017**

| voivodeship / year | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|
| average | 0,1553 | 0,1571 | 0,1617 | 0,1634 | 0,1667 |
| minimum | 0,0554 | 0,0554 | 0,0562 | 0,0555 | 0,0568 |
| maximum | 0,2529 | 0,2609 | 0,2654 | 0,2712 | 0,2620 |
| median | 0,1514 | 0,1560 | 0,1547 | 0,1576 | 0,1614 |
| standard deviation | 0,0527 | 0,0546 | 0,0564 | 0,0580 | 0,0569 |

Source: own calculation based on the data from Statistics Poland. Local Data Bank. [23].

The descriptive statistics of calculated HHI for outpatient entities are presented in the Table 6 and suggest that the average concentration results expressed by HHI is from 0.1128 with the median of 0.1007 in 2013 and average of 0.1177 with the median of 0.1032 in 2017. According to these numbers for the year of 2017, at least 50% of Polish voivodeships have outpatient's entities with a concentration of 0.1032 or above, which means unconcentrated market of outpatient entities. In fact, the values of HHI for this sector are mostly below the threshold of 0.15, which usually serves as an indicator for unconcentrated market. As the standard deviation presents that around 0.05 in 2017, so it shows that the outpatient's entities concentration is slightly varied in Poland. The HHI in the sample cities, the maximum values being at around 0.2060 in 2017 and the minimum of 0.0406, which implies that the value of HHI of voivodeships with the most concentrated market (0.2060) is around five times higher than the value of the least concentrated market (0.05406). As HHI is a measure of provider's concentration in an industry thus it is also the indicator of inequality as well. So, based on the results, it can be found that outpatient entities sector is rather unconcentrated, which means also with quite equitable access to such facilities.

**Table 6: Descriptive statistic of HHI for outpatient entities in the years from 2013to 2017**

| voivodeship / year | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|
| average | 0,1128 | 0,1134 | 0,1139 | 0,1155 | 0,1177 |
| minimum | 0,0397 | 0,0398 | 0,0404 | 0,0408 | 0,0406 |
| maximum | 0,1964 | 0,1996 | 0,1981 | 0,1983 | 0,2060 |
| median | 0,1007 | 0,1010 | 0,1029 | 0,1032 | 0,1032 |
| standard deviation | 0,0461 | 0,0466 | 0,0462 | 0,0473 | 0,0488 |

Source: own calculation based on the data from Statistics Poland. Local Data Bank. [23].

The descriptive statistics of calculated HHI for general hospitals beds are presented in the Table 7. The descriptive statistics suggest that the average concentration results expressed by HHI is from 0.1564 with the median of 0.1567 in 2013 and average of 0.1598 with the median of 0.1580 in 2017. According to these numbers for the year of 2017, at least 50% of Polish voivodeships have general hospitals beds with a concentration of 0.1580 or above, which means moderate concentrated market of general hospitals beds. In fact, the value of HHI are mostly below the threshold of 0.15, which usually serves as an indicator for unconcentration. As the standard deviation presents that around 0.0522 in 2017, so it shows that the general hospitals beds concentration is quite varied in Poland. In the sample cities, the maximum value of HHI was at around 0.2458 in 2017 and the minimum at the level of 0.0532, which implies that the value of HHI of voivodeships with the most concentrated market (0.2458) is around five times higher than the value of the least concentrated market (0.0532).
So, based on the results, it can be found that there is moderately concentrated market of general hospital beds, which means also moderately equitable access to such facilities.

**Table 7: Descriptive statistics of HHI for general hospital beds in the years from 2013 to 2017**

| Statistcs / year | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|
| average | 0,1564 | 0,1590 | 0,1567 | 0,1585 | 0,1598 |
| minimum | 0,0534 | 0,0516 | 0,0519 | 0,0529 | 0,0532 |
| maximum | 0,2340 | 0,2372 | 0,2295 | 0,2399 | 0,2458 |
| median | 0,1567 | 0,1546 | 0,1556 | 0,1558 | 0,1580 |
| standard deviation | 0,0487 | 0,0521 | 0,0492 | 0,0515 | 0,0522 |

Source: own calculation based on the data from Statistics Poland. Local Data Bank. [23]

The calculated HHI for doctors markets by voivodeships and year are presented in the Table 8. So, based on the results, it can be noted that the concentration of doctors expressed as the number of employed persons in the main place in the analyzed voivodeships is uneven. As there are some voivodeships that have the value of HHI at around 0.06 and there are voivodeships with the value of HHI more than 0.37. It means, that the value of HHI of voivodeships with the most concentrated market is more than six times higher than the value of the least concentrated market.

In addition to it, in case of three voivodeships (lubuskie, pomorskie and śląskie), the decrease of concentration can be observed during the analyzed period, which indicates that the doctors market in these voivodeships has become more competitive over time. In case of three voivodeships such as kujawsko-pomorskie, podkarpackie and wielkopolskie, the increase of concentration can be observed by almost more than 12% (it means from 12.23% to 13.16%). In case of the rest the change was at the level between 0.81% to 8.04%. According to the idea of HHI measurement and also according to the empirical literature, this trend is likely to have a negative effect on competition outcomes. High levels of market concentration in the human resources of health care sector are likely to result in market power which can hamper competition and has negative effects on both patients and as well as third party payers. Then such distribution of doctors might affect equities in access to services provided by them.

**Table 8: HHI of number of employed doctors in the main place of work in the years from 2013 to 2017**

| voivodeship / year | 2013 | 2014 | 2015 | 2016 | 2017 | change |
|---|---|---|---|---|---|---|
| DOLNOŚLĄSKIE | 0,2389 | 0,2478 | 0,2370 | 0,2564 | 0,2573 | 7,70% |
| KUJAWSKO-POMORSKIE | 0,1833 | 0,1852 | 0,1967 | 0,2041 | 0,2059 | 12,31% |
| LUBELSKIE | 0,2781 | 0,2912 | 0,2960 | 0,2967 | 0,2967 | 6,69% |
| LUBUSKIE | 0,1267 | 0,1278 | 0,1275 | 0,1306 | 0,1259 | -0,59% |
| ŁÓDZKIE | 0,2931 | 0,2814 | 0,2944 | 0,3049 | 0,2954 | 0,81% |
| MAŁOPOLSKIE | 0,2957 | 0,2954 | 0,2913 | 0,2910 | 0,3104 | 4,98% |
| MAZOWIECKIE | 0,3478 | 0,3836 | 0,3936 | 0,4078 | 0,3757 | 8,04% |
| OPOLSKIE | 0,1865 | 0,1897 | 0,1908 | 0,2048 | 0,1997 | 7,06% |
| PODKARPACKIE | 0,1223 | 0,1224 | 0,1304 | 0,1378 | 0,1384 | 13,16% |
| PODLASKIE | 0,3670 | 0,3569 | 0,3377 | 0,3485 | 0,3794 | 3,36% |
| POMORSKIE | 0,2258 | 0,2169 | 0,2132 | 0,2090 | 0,2124 | -5,92% |
| ŚLĄSKIE | 0,0627 | 0,0605 | 0,0613 | 0,0628 | 0,0618 | -1,44% |
| ŚWIĘTOKRZYSKIE | 0,2161 | 0,2356 | 0,2338 | 0,2337 | 0,2298 | 6,36% |
| WARMIŃSKO-MAZURSKIE | 0,1446 | 0,1457 | 0,1567 | 0,1550 | 0,1483 | 2,52% |
| WIELKOPOLSKIE | 0,2236 | 0,2016 | 0,2134 | 0,2249 | 0,2509 | 12,23% |
| ZACHODNIOPOMORSKIE | 0,2463 | 0,2511 | 0,2513 | 0,2469 | 0,2486 | 0,95% |

Source: own calculation based on the data from Statistics Poland. Local Data Bank. [23]

From the analysis in which the type of powiats (counties) and percent share of doctors in their respective voivodeships were taken into account, some some tendency also was noticed. First at all that there are some towns with powiat (countie) right which are characterized by the relatively high as above 30% - at average 33-61 percent share of all doctors in their respective voivodeships (Table 9). While the rest of both types of powiats in these voivodeships presented the share market below 13%, but mostly below 5%. It is appeared that only in two voivodeships, there are no towns with powiat right with the share in the market at the level higher then 25%. These are: lubuskie and śląskie.

**Table 9 Cities with powiat status and their market shares measured by the number of employed doctors in the main place of work in the years from 2013 to 2017**

| voivodeship | name of city with powiat status | 2013 | 2014 | 2015 | 2016 | 2017 | average |
|---|---|---|---|---|---|---|---|
| DOLNOŚLĄSKIE | Wrocław | 0,47 | 0,48 | 0,47 | 0,49 | 0,49 | 0,48 |
| KUJAWSKO-POMORSKIE | Bydgoszcz | 0,38 | 0,39 | 0,40 | 0,41 | 0,41 | 0,40 |
| LUBELSKIE | Lublin | 0,51 | 0,53 | 0,53 | 0,53 | 0,53 | 0,53 |
| ŁÓDZKIE | Łódź | 0,53 | 0,52 | 0,53 | 0,54 | 0,53 | 0,53 |
| MAŁOPOLSKIE | Kraków | 0,53 | 0,53 | 0,53 | 0,53 | 0,55 | 0,53 |
| MAZOWIECKIE | Warszawa | 0,58 | 0,61 | 0,62 | 0,63 | 0,61 | 0,61 |
| OPOLSKIE | Opole | 0,38 | 0,38 | 0,38 | 0,40 | 0,40 | 0,39 |
| PODKARPACKIE | Rzeszów | 0,31 | 0,31 | 0,33 | 0,34 | 0,34 | 0,33 |
| PODLASKIE | Białystok | 0,59 | 0,58 | 0,57 | 0,58 | 0,60 | 0,58 |
| POMORSKIE | Gdańsk | 0,44 | 0,42 | 0,42 | 0,41 | 0,42 | 0,42 |
| ŚWIĘTOKRZYSKIE | Kielce | 0,43 | 0,46 | 0,45 | 0,45 | 0,45 | 0,45 |
| WARMIŃSKO-MAZURSKIE | Olsztyn | 0,32 | 0,32 | 0,34 | 0,34 | 0,32 | 0,33 |
| WIELKOPOLSKIE | Poznań | 0,46 | 0,43 | 0,45 | 0,46 | 0,49 | 0,46 |
| ZACHODNIOPOMORSKIE | Szczecin | 0,48 | 0,48 | 0,48 | 0,48 | 0,48 | 0,48 |

Source: Source: own calculation based on the data from Statistics Poland. Local Data Bank. [23]

The calculated HHI for nurses and midwives markets (expressed as number of employed persons in the main place of work) by voivodeships and year are presented in the Table 10. So, based on the results, above all, it can be found that the concentration of employed nurses and midwives in the analyzed voivodeships is also uneven. However this means that it is less concentrated compering with the doctors market (sector). This tendency as the increase of the concentration ratio can be observed in case of all voivodeships. There are three out of sixteen voivodeships with the increase at the level between 12.04% to 14.62% (lubelskie, podlaskie, zachodniopomorskie). In case of the rest of voivodeships this increase took place by below 10%, it means at the level between 0.52% and 9.96%. It implies the increase of concentration, however for most of the voivodeships, HHI was below 0.25 in 2017, which means moderate concentration, while for two of them as for łódzkie and mazowieckie it was higher than 0.25 which means high level of concentration. Thus high levels of market concentration in the nurses and midwives sector are likely to result in market power which can have negative effects on both patients and as well as third party payers. Then such distribution of these human resources in health care might lead to inequities in access to services provided by them.

**Table 10: HHI for number of employed nurses and midwives in the main place of work in the years from 2013 to 2017**

| voivodeship / year | 2013 | 2014 | 2015 | 2016 | 2017 | change |
|---|---|---|---|---|---|---|
| DOLNOŚLĄSKIE | 0,1492 | 0,1555 | 0,1538 | 0,1598 | 0,1641 | 9,96% |
| KUJAWSKO-POMORSKIE | 0,1492 | 0,1566 | 0,1556 | 0,1555 | 0,1588 | 6,46% |
| LUBELSKIE | 0,1554 | 0,1610 | 0,1714 | 0,1699 | 0,1781 | 14,62% |
| LUBUSKIE | 0,1087 | 0,1070 | 0,1128 | 0,1161 | 0,1167 | 7,45% |
| ŁÓDZKIE | 0,2400 | 0,2452 | 0,2605 | 0,2663 | 0,2620 | 9,17% |
| MAŁOPOLSKIE | 0,1910 | 0,1983 | 0,2024 | 0,2013 | 0,2053 | 7,45% |
| MAZOWIECKIE | 0,2529 | 0,2609 | 0,2654 | 0,2712 | 0,2602 | 2,90% |
| OPOLSKIE | 0,1709 | 0,1667 | 0,1714 | 0,1679 | 0,1724 | 0,90% |
| PODKARPACKIE | 0,0770 | 0,0780 | 0,0823 | 0,0837 | 0,0845 | 9,67% |
| PODLASKIE | 0,2037 | 0,1976 | 0,2084 | 0,2126 | 0,2282 | 12,04% |
| POMORSKIE | 0,1536 | 0,1477 | 0,1507 | 0,1478 | 0,1544 | 0,52% |
| ŚLĄSKIE | 0,0554 | 0,0554 | 0,0562 | 0,0555 | 0,0568 | 2,44% |
| ŚWIĘTOKRZYSKIE | 0,1445 | 0,1489 | 0,1491 | 0,1516 | 0,1540 | 6,53% |
| WARMIŃSKO-MAZURSKIE | 0,1088 | 0,1096 | 0,1149 | 0,1115 | 0,1184 | 8,80% |
| WIELKOPOLSKIE | 0,1478 | 0,1383 | 0,1477 | 0,1517 | 0,1532 | 3,66% |
| ZACHODNIOPOMORSKIE | 0,1760 | 0,1874 | 0,1851 | 0,1919 | 0,2000 | 13,63% |

Source: Source: own calculation based on the data from Statistics Poland. Local Data Bank. [23].

Based on the analysis of every voivodeships and powiats (counties), some tendency also was noticed. First at all that there are some towns with powiat (county) right which are characterized by the relatively high as above 30% - at average 33-50 percent share of all nurses and midwives in their respective voivodeships (Table 11). While the rest of both types of powiats in these voivodeships presented the share market below 16%, but mostly below 7%. It is appeared that only in four voivodeships, there are no towns with powiat right with the share in the market at the level higher then 25%. These are: lubuskie, podkarpackie, śląskie, and warmińsko-mazurskie.

**Table 11. Cities with powiat status and their market shares measured by the number of employed nurses and midwives in the main place of work year 2013-2017**

| voivodeship | name of city with powiat status | 2013 | 2014 | 2015 | 2016 | 2017 | average |
|---|---|---|---|---|---|---|---|
| DOLNOŚLĄSKIE | Wrocław | 0,35 | 0,36 | 0,36 | 0,37 | 0,38 | 0,36 |
| KUJAWSKO-POMORSKIE | Bydgoszcz | 0,33 | 0,34 | 0,34 | 0,34 | 0,35 | 0,34 |
| LUBELSKIE | Lublin | 0,36 | 0,37 | 0,39 | 0,38 | 0,40 | 0,38 |
| ŁÓDZKIE | Łódź | 0,47 | 0,48 | 0,49 | 0,50 | 0,49 | 0,49 |
| MAŁOPOLSKIE | Kraków | 0,41 | 0,42 | 0,43 | 0,43 | 0,43 | 0,42 |
| MAZOWIECKIE | Warszawa | 0,49 | 0,50 | 0,50 | 0,51 | 0,50 | 0,50 |
| OPOLSKIE | Opole | 0,34 | 0,34 | 0,35 | 0,34 | 0,35 | 0,34 |
| PODLASKIE | Białystok | 0,42 | 0,41 | 0,42 | 0,43 | 0,44 | 0,42 |
| POMORSKIE | Gdańsk | 0,34 | 0,33 | 0,34 | 0,33 | 0,34 | 0,34 |
| ŚWIĘTOKRZYSKIE | Kielce | 0,32 | 0,33 | 0,33 | 0,33 | 0,33 | 0,33 |
| WIELKOPOLSKIE | Poznań | 0,36 | 0,35 | 0,36 | 0,37 | 0,37 | 0,36 |
| ZACHODNIOPOMORSKIE | Szczecin | 0,38 | 0,40 | 0,39 | 0,40 | 0,41 | 0,40 |

Source: Source: own calculation based on the data from Statistics Poland. Local Data Bank. [23].

The calculated HHI for outpatient entities by voivodeships and year are presented in the Table 12. So, based on the results, above all, it can be found that the concentration of outpatient entities in the analyzed voivodeships is quite uneven. However it is less concentrated compering with the doctors market (sector). This tendency as the increase of the concentration ratio can be observed in case of twelve out of sixteen voivodeships. Among them, in case of two of them, the increase - by more then 11% - was observed. It means in the dolnośląskie (12.07%) and wielkopolskie (11.58%). In case of the rest the increased took place at the level below 10%. In four out of sixteen voivodeships the decrease of the HHI can be observed in the analyzed period of time. These are: lubelskie, łódzkie, podkarpackie and zachodniopomorskie).

**Table 12: HHI for outpatient entities in the years from 2013 to 2017**

| voivodeship / year | 2013 | 2014 | 2015 | 2016 | 2017 | change |
|---|---|---|---|---|---|---|
| DOLNOŚLĄSKIE | 0,1215 | 0,1183 | 0,1236 | 0,1331 | 0,1362 | 12,07% |
| KUJAWSKO-POMORSKIE | 0,0828 | 0,0848 | 0,0852 | 0,0857 | 0,0884 | 6,76% |
| LUBELSKIE | 0,0891 | 0,0904 | 0,0877 | 0,0865 | 0,0886 | -0,52% |
| LUBUSKIE | 0,0943 | 0,0929 | 0,0956 | 0,0961 | 0,0971 | 3,01% |
| ŁÓDZKIE | 0,1964 | 0,1996 | 0,1981 | 0,1948 | 0,1962 | -0,08% |
| MAŁOPOLSKIE | 0,1378 | 0,1383 | 0,1435 | 0,1453 | 0,1441 | 4,55% |
| MAZOWIECKIE | 0,1901 | 0,1889 | 0,1928 | 0,1983 | 0,2060 | 8,36% |
| OPOLSKIE | 0,1070 | 0,1090 | 0,1103 | 0,1083 | 0,1075 | 0,45% |
| PODKARPACKIE | 0,0612 | 0,0607 | 0,0599 | 0,0594 | 0,0598 | -2,43% |
| PODLASKIE | 0,1874 | 0,1900 | 0,1839 | 0,1914 | 0,1954 | 4,31% |
| POMORSKIE | 0,0873 | 0,0892 | 0,0880 | 0,0873 | 0,0881 | 0,92% |
| ŚLĄSKIE | 0,0397 | 0,0398 | 0,0404 | 0,0408 | 0,0406 | 2,29% |
| ŚWIĘTOKRZYSKIE | 0,1246 | 0,1303 | 0,1251 | 0,1285 | 0,1369 | 9,89% |
| WARMIŃSKO-MAZURSKIE | 0,0755 | 0,0751 | 0,0771 | 0,0790 | 0,0786 | 4,11% |
| WIELKOPOLSKIE | 0,0886 | 0,0884 | 0,0922 | 0,0980 | 0,0988 | 11,58% |
| ZACHODNIOPOMORSKIE | 0,1221 | 0,1183 | 0,1187 | 0,1158 | 0,1202 | -1,55% |

Source: Source: own calculation based on the data from Statistics Poland. Local Data Bank. […].

As HHI in all years of analysis was below 0.21, it means moderate concentration, however in case of three-teen voivodeships it was even below 0.15 which means unconcentrated sector. Generally, this increase in the level of concentration from 2013 to 2017 can be troublesome because it is likely to have negative effects on both patients and as well as third party payers. Then such distribution of these facilities in health care might affect equities in access to services provided in them.

Based on the analysis of every voivodeships and powiats (counties), some tendency also was noticed. First at all that there are some towns with powiat (county) right which are characterized by the relatively high as above 30 percent - at average 30-43 percent share of all outpatient entities in their respective voivodeships (Table 13). While the rest of both types of powiats in these voivodeships presented the share market below 25%,. It is appeared that in ten voivodeships, there are not towns with powiat right with the share in the market at the level higher then 25%. These are: kujawsko-pomorskie, lubelskie, lubuskie, opolskie, podkarpackie, pomorskie, śląskie, świętokrzyskie, warmińsko- mazurskie, wielkopolskie.

**Table 13. Cities with powiat status and their market shares measured by the number of outpatient entities in the years from 2013 to 2017.**

| voivodeship | name of city with powiat status | 2013 | 2014 | 2015 | 2016 | 2017 | average |
|---|---|---|---|---|---|---|---|
| DOLNOŚLĄSKIE | Wrocław | 0,32 | 0,31 | 0,32 | 0,34 | 0,34 | 0,33 |
| ŁÓDZKIE | Łódź | 0,42 | 0,43 | 0,42 | 0,42 | 0,42 | 0,42 |
| MAŁOPOLSKIE | Kraków | 0,34 | 0,34 | 0,35 | 0,35 | 0,35 | 0,34 |
| MAZOWIECKIE | Warszawa | 0,42 | 0,42 | 0,43 | 0,43 | 0,44 | 0,43 |
| PODLASKIE | Białystok | 0,40 | 0,40 | 0,39 | 0,40 | 0,41 | 0,40 |
| ZACHODNIOPOMORSKIE | Szczecin | 0,31 | 0,30 | 0,30 | 0,30 | 0,30 | 0,30 |

Source: own calculation based on the data from Statistics Poland. Local Data Bank. [23].

The calculated HHI for general hospital beds market by voivodeships and year are presented in the Table 14. So, based on the results, above all, it can be found that the concentration of general hospital beds in the analyzed voivodeships is

uneven. In case of six voivodeships the decrease of the HHI value can be noticed, which means the improvement in the level of competition because of the decrease of concentration level. These are: opolskie, podlaskie, pomorskie, śląskie, warmińsko-mazurskie and wielkopolskie. However, for the rest of voivodeships the increase can be noticed which means the increase of concentration. The relatively highest increase took place in the voivodeship of łódzkie- it means by 19.16%. In case of the rest of voivodeships the increase was lower than 7.17%. So, high level of market concentration in the general hospital beds sector are likely to result in market power which can hamper competition and has negative effects on both patients and as well as third party payers. Then such distribution of hospital infrastructure might affect both the performance of the hospital sector as well as inequities in access to services.

**Table 14: HHI for general hospital beds in the years from 2013 to 2017**

| | | | | | | |
|---|---|---|---|---|---|---|
| DOLNOŚLĄSKIE | 0,1548 | 0,1490 | 0,1499 | 0,1509 | 0,1579 | 1,94% |
| KUJAWSKO-POMORSKIE | 0,1601 | 0,1602 | 0,1612 | 0,1627 | 0,1660 | 3,71% |
| LUBELSKIE | 0,1425 | 0,1403 | 0,1390 | 0,1388 | 0,1428 | 0,24% |
| LUBUSKIE | 0,1134 | 0,1130 | 0,1160 | 0,1205 | 0,1180 | 4,04% |
| ŁÓDZKIE | 0,2063 | 0,2336 | 0,2264 | 0,2352 | 0,2458 | 19,16% |
| MAŁOPOLSKIE | 0,1911 | 0,1941 | 0,1915 | 0,1915 | 0,1912 | 0,06% |
| MAZOWIECKIE | 0,2340 | 0,2372 | 0,2295 | 0,2399 | 0,2390 | 2,15% |
| OPOLSKIE | 0,1761 | 0,1811 | 0,1717 | 0,1684 | 0,1657 | -5,91% |
| PODKARPACKIE | 0,0841 | 0,0856 | 0,0880 | 0,0870 | 0,0898 | 6,72% |
| PODLASKIE | 0,2162 | 0,2168 | 0,2064 | 0,2094 | 0,2070 | -4,27% |
| POMORSKIE | 0,1531 | 0,1479 | 0,1417 | 0,1476 | 0,1422 | -7,10% |
| ŚLĄSKIE | 0,0534 | 0,0516 | 0,0519 | 0,0529 | 0,0532 | -0,32% |
| ŚWIĘTOKRZYSKIE | 0,1307 | 0,1325 | 0,1321 | 0,1323 | 0,1392 | 6,48% |
| WARMIŃSKO-MAZURSKIE | 0,1239 | 0,1235 | 0,1255 | 0,1225 | 0,1216 | -1,83% |
| WIELKOPOLSKIE | 0,1586 | 0,1713 | 0,1684 | 0,1607 | 0,1581 | -0,33% |
| ZACHODNIOPOMORSKIE | 0,2042 | 0,2065 | 0,2076 | 0,2158 | 0,2189 | 7,17% |

Source: Source: own calculation based on the data from Statistics Poland. Local Data Bank. [23].

Based on the analysis of every voivodeships and powiats (counties), some tendency also was noticed (Table 15) . First at all that there are some towns with powiat (county) right which are characterized by the relatively high as at average 34-47 percent share of all hospitals beds in their respective province. There are ten of such voivodeships. While, six out sixteen voivodeship do not have any towns with powiat right with the market share above 25%. These are: lubuskie, opolskie, podkarpackie, świętokrzyskie, śląskie and warmińskomazurskie.

**Table 15. Cities with powiat status and their market shares measured by the number of general hospital beds in the years from 2013 to 2017.**

| voivodeship | name of city with powiat status | **2013** | **2014** | **2015** | **2016** | **2017** | **average** |
|---|---|---|---|---|---|---|---|
| DOLNOŚLĄSKIE | Wrocław | 0,36 | 0,35 | 0,35 | 0,35 | 0,36 | 0,36 |
| KUJAWSKO-POMORSKIE | Bydgoszcz | 0,34 | 0,34 | 0,34 | 0,35 | 0,35 | 0,35 |
| LUBELSKIE | Lublin | 0,34 | 0,34 | 0,34 | 0,34 | 0,34 | 0,34 |
| ŁÓDZKIE | Łódź | 0,43 | 0,46 | 0,45 | 0,46 | 0,47 | 0,46 |
| MAŁOPOLSKIE | Kraków | 0,41 | 0,42 | 0,41 | 0,41 | 0,41 | 0,41 |
| MAZOWIECKIE | Warszawa | 0,47 | 0,47 | 0,46 | 0,48 | 0,48 | 0,47 |
| PODLASKIE | Białystok | 0,43 | 0,43 | 0,42 | 0,42 | 0,42 | 0,42 |
| POMORSKIE | Gdańsk | 0,35 | 0,34 | 0,33 | 0,34 | 0,33 | 0,34 |
| WIELKOPOLSKIE | Poznań | 0,37 | 0,39 | 0,39 | 0,38 | 0,38 | 0,38 |
| ZACHODNIOPOMORSKIE | Szczecin | 0,42 | 0,43 | 0,43 | 0,44 | 0,44 | 0,43 |

Source: Source: own calculation based on the data from Statistics Poland. Local Data Bank. [23].

At the end, then in this analysis, also the location of voivodeships in the geographical region (according to Table 2) was taken into account. From the analysis of regions it is appeared that the central region, which covers two voivodeships: mazowieckie and łódzkie is a leading region in Poland in terms of market concentration in years 2013 – 2017 in case of all analyzed health resources. Also in this region, two cities with the highest percent market share of all types health care resources in their respective voivodeships are located – it means: Warsaw and Łódź.

Southern region covers two voivodeships: małopolskie and śląskie. Voivodeship of śląskie was characterized as the one with the lowest degree of concentration of each types of analyzed health care resources and moreover relatively small. Also it is a voivodeships, which does not have any city with the market share of any health care resources above 25%.

In case of małopolska, the pattern is different as it has very concentrated market of doctors and unconcentrated of the rest health care resources and one dominant city - Krakow – regarding to the market share of all health care resources.

Eastern region covers four voivodeships: lubelskie, podkarpackie, podlaskie, świętokrzyskie. There is no regular pattern for these voivodeships in this region. In the province of lubelskie, very high level of market share of city Lublin can be noticed and this same tendency can be observed in case of the city Białystok, which is located in the next voivodeship – podlaskie. In case of świętokrzyskie voivodeship there is also one city with the higher market share – Kielce – however in case of only three types of analyzed resources such as doctors, nurses and midwives and general hospital beds.

In the third voivodeship of this region - podkarpackie there is no city with the market share higher than 25%.

Northern region of Poland covers three voivodeships: kujawsko-pomorskie, pomorskie, and warmińsko-mazurskie. It is generally moderately concentrated sector in case of all health care resources. In the kujawsko-pomorskie voivodeship, the city of Bydgoszcz is very dominant city in case of all health care resources apart from the outpatient's entities. And this same tendency can be observed in case of pomorskie voivodeship with the city of Gdańsk. The third voivodeship – warmińsko- mazurskie presented different pattern as there is not dominant city apart from the doctors markets.

North-western region of Poland covers three voivodeships: lubuskie, wielkopolskie, zachodniopomorskie. In the voivodeship of lubuskie there was not any cities with the highest percentage share of health care resources in the voivodeship, it means with the market share higher than 25%. In case of wielkopolskie and zachodniopomorskie, this same pattern can be recognized. There is one main city in each of these voivodeships - Poznań and Szczecin respectively – with the high market share but apart from outpatient entities for Poznań and general hospital beds market in case o Szczecin.

South – western region of Poland covers two voivodeships: dolnośląskie and opolskie. It is characterized by the moderate concentration of all health care resources and in case of opolskie voivodeship, there is also one city with the high market share but only in case of doctors and nurses with midwives market.

Based on the above analysis it can be summed up that the pattern of market concentration across settlement structures in Poland can be defined as moderately concentrated and thus moderately competitive with tendency to higher degree of concentration and less competitiveness in case of doctors sector. Also the central region was recognized as the most concentrated in case of every types of analyzed health care resources and also with the cities with the highest market share. Results also proved that the concentration of health care resources is uneven and thus the access to services can be differential.

## IV.**Conclusion**

On basis of the HHI, this paper reports on a concentration level of health care resources. This study has several major findings. Empirical results discussed above support the assertion that in the period of analysis the entire general hospital beds, doctors and nurses with midwives sectors in Poland have been at average moderately concentrated and thus moderately competitive with the growing tendency to higher concentration and less competitive. The sector of outpatient's entities appeared to be mainly unconcentrated. Moreover, the concentration of all health care resources is diversified across the voivodeships of Poland and it is quite uneven.

However, as with most empirical studies, the findings are also limited mainly by the scope of available data set. This is why, the serious efforts - to develop better sources of data to improve concentration and thus equity measurement should be taken by government. It could have a large impact on studies of equity.

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