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Concentration of Inpatient Health Care Providers in Poland

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Abstract
The purpose of this study is to measure the concentration level of inpatient health care providers such as general hospitals, psychiatric hospitals, chronic medical care home, nursing homes, hospices in Poland, which will allow to identify inequities to access to inpatient health care services. The Herfindahl-Hirschman Index (HHI) was used to investigate the concentration level of the inpatient health care providers sector in Poland, which is also treated in the literature as a proxy of competition. To understand how market of each particular inpatient health care providers has become structured and thus competitive the data for inpatient health care providers spanning all Poland for the period of 2010-2017 were collected. The concentration of inpatient health care providers was measured based on the aggregated data at the voivodeship level and for general hospitals, it was measured separately 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 Data are collected from the public statistical system. The HHI indices support the assertion that in the period of analysis the entire inpatient health care providers sector in Poland has not been at average concentrated – apart from the nursing homes where the moderate level of concentration was identified. Moreover, the increase of HHI in analyzed period in case of hospices and chronic medical care homes can be troublesome, because it can signal of growing concentration in the future and then getting also less competitive. However, concentration of general hospitals when analyzed at the lower level of hospital structure appeared uneven.

Keywords: health care, inpatieitn care, concentration, Herfindahl-Hirschman Index, Poland

I. INTRODUCTION

Both developed and developing countries are faced with the problem of inability to satisfy health needs of their inhabitants [1]. Thus, most of industrialized countries have been developing their health care systems continuously in purpose to improve their equality, efficiency as well as quality of health care. However, to devise an effective, fair, accessible and cost-conscious healthcare system is difficult for any country [2]. To guarantee the rights to health mentioned in the Constitution of World Health Organization, the realization of them must involve not only a concerted and sustained effort to improve health across all populations but also reduction of inequities in the enjoyment health. According to WHO, equity must be reached not only between countries but also within countries [3].

A common interpretation of equity in health care is that health care services ought to be allocated on the basis of medical need, rather than on the basis of such features as race, income, gender or area of residence [4]. Equity matters as it refers to fair opportunity for everyone to attain their full health potential regardless of biological or demographic, geographic, social, economic status. It entails the minimization of differences in access, quality, coverage, use and utility of health care between groups of the population categorized by above characteristics [5].

As a significant share of gross domestic product is consumed by the health services and especially for these provided in the form of inpatient care, thus inpatient care seems to be also crucial from the point of view of society's welfare [6]. The difference between the inpatient and outpatient care is how long a patient must remain in the facility to have their procedure to be performed. 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. In case of outpatient care, such procedures are performed, which do not require the patients to spend night being supervised [7].

Thus measuring concentration of inpatient health care providers is increasingly important for analysis of health care markets as well as policies and as inpatient health care providers and especially general hospitals are the largest part of health care systems in every developed country. Thus the purpose of this study is to fill an important gap in the literature on health inequalities through empirical research on concentration of inpatient infrastructural resources such as beds in Poland. Polish studies in this area are very limited. thus, the purpose of this article is the analysis of their level concentration in Poland. The higher the level of concentration thus the distribution of particular resource can be very uneven.

The literature has almost an exclusive focus on the U.S.health care market [8] and there is growing literature on hospital concentration as well as competition in the Netherlands - for example [9] as well as some fragmented information on hospital market concentration in other countries like Greece [10] the U.K. [11] or Taiwan [12] and Germany [13]. Considering the relevance of the Polish hospital sector for the whole health care system, there is surprisingly little research addressing these issues. There are some in Poland but from the different context [14] In the context of the above setting, the aim of this study is to calculate concentration measures for the Polish inpatient care market and to find out the clear picture of how strong the concentration actually is. 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. THE POLISH HEALTH CARE SECTOR CHARACTERISTIC

The Republic of Poland 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 [15]. It is also the largest country among the new Member States admitted to the EU after 2004. The Human Development Index for Poland was 0.865 in 2018.

The elimination of geographical and social inequalities in health is being one of the strategic objectives of the past and present National Health Programs in Poland [3]. However, the right to equity in health is also guaranteed by the Polish Constitutions. As according to Article 68 of the 1997 Constitution of the Republic of Poland, all citizens, regardless of their financial status have the right to equal access, which should be ensured by the public authorities. Thus, the Polish Constitution of 1997 grants a general right to health care to every citizen as detailed conditions for as well as the scope of, the provision of services shall be established by statute. Moreover, special health care should be granted to children, pregnant women, handicapped people and persons of advanced age. In addition, public authorities are mandated to combat epidemics illnesses and prevent the negative health consequences of environmental degradation. They should also support the development of physical culture especially among children and adolescents [16].

In Poland, many reforms were performed. The national government budget has historically been the main source of health care financing and radical change of this system happened in 1999 while the implementation of market economy took placed earlier it means in 1989 [17]. In January 1999 - by introducing the 1997 General Health Insurance Act [18]- a new general obligatory health insurance system entered into force, which changed the system of financing. And as a result of this reform the purchaser and provider functions were split. It can be said that the decentralization of the system was placed [19]. It means that a first step toward introducing elements of competition was made to ensure to foster competition between providers in purpose to improve quality and efficiency.

These changes in Polish healthcare system to some extent follow principals of the Bismarck's model as gradual decentralization of management and financing have been implemented since the early 1990 [20]. Thus it has the character of an insurance model, although in fact it can be thought of as a insurance – budget health care system with the dominance of insurance [21].

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. Thus funds for health care came from two main sources the first from above insurance funds and second, government budgets (state, provinces or gminas) continued to finance public health services [17]. Also in order to promote the efficient use of financial resources, a split between the payer and the owners of health care institutions was introduced [22].

And 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 [3].

What is also important, that in this same year (1999), a new administrative organization of the country was introduced: as powiats (districts/counties) were entered as the intermediate level of territorial self-government, between the gminas (municipalities), at the lowest level, and the voivodeship (regions). It is important in the context of health care as powiat authorities became the owners/funding bodies for the with the remaining public hospitals owned by the voivodeship and medical universities and others (mainly the Ministry of Health). Moreover, the number of voivodeships was reduced from 49 to 16. As a result of this reform and changes the ownership structure of especially public hospitals became not only more complex but also more fragmented [23, 24].

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 [25]. 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.

While, the major task of the NHF is to finance health services provided to the entitled population, 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. The quality and accessibility of health care services are to a certain extent influenced by the negotiated terms [25]. It means that NHF regional branches are responsible for the entire process of contracting and as result of it, each regional branch of the NHF is responsible for securing continuous provision of health care services for its population within the available financial resources. All health care providers must meet certain criteria to be able to apply and compete for the contracts with the NHF [16]. Thus the provision of is determined by health care service provider resources on the one hand while also by the ability to finance the services by the NHF on the other hand [24].All principles regarding to contracting are specified in the 2004 Law on Health Care Services Financed from Public Sources and are also regulated by the Civil Code. The specification of contracting procedures for various types of service is provided in the decrees of the President of the NHF [3].

Then the new regulations, which apply to among others inpatient health care – it means the 2011 Law on Therapeutic Activity, which came into force on 1 July 2011'[26]. Apart from transformation of many public providers into companies governed by the Commercial Code (i.e. a limited liability company or a joint stock company), the Act on Therapeutic Activity 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 [23].

Some further fundamental changes took placed in 2011 by introducing the 2011 Law on Therapeutic Activity, 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 [23]. According to articles 8 and 9 of Act 2011 inpatient care can be provided by either hospital or units different then hospitals such as: chronic medical care homes, nursing homes and hospices. In hospices, comprehensive healthcare, psychological and social care for patients in the terminal state are provided as well as a care for the families of these patients. In nursing homes, 24-hour health services are provided that cover the care and rehabilitation of patients who do not require hospitalization, and provide them with medicinal products and medical devices, rooms and meals appropriate to their health, as well as providing health education for patients and their family members, and preparing them for self-care and self-care at home. In chronic medical care homes, providing 24-hour health services that cover the care, care and rehabilitation of patients who do not require hospitalization, and provide them with medicinal products needed to continue treatment, rooms and meals appropriate to health, as well as providing health education for patients and their family members, and preparing these people for self-care and self-care at home. While the hospital is characterized by offering permanent readiness to admit patients and providing them with medical services [26]. General hospitals provide the most complex health services and of the highest level of specialization thus they play an extremely important role in the health care system. That's why, so much attention on their activity is paid by local communities especially on public hospitals especially that apart of provision of health services they also often fulfill additional social tasks [27].

III. DATA AND METHOD

To understand how hospital markets have become structured and thus also competitive the data for general hospitals, psychiatric hospitals, chronic medical care home, nursing homes, hospices spanning all Poland for the period of 2010-2017 were collected. Data are collected from the public statistical system, it means from the Statistic Poland from the database such as Knowledge Database Health and Health Care of Statistic Poland (Statistics Poland, 2010-2017) [28] and also from the next one such as the Local Data Bank [29].

In this study, number of beds was used as the measure of inpatient health care activity because these data are available but it also very good indicator of market share. Thus, the market shares of inpatient care providers in this study are based on share of their beds. There are three different basic concepts, which are frequently applied in empirical research to define the relevant geographic market to measure concentration and also competition i.e. geopolitical boundaries, the

fixed radius and the patient flow technique [30]. For the purpose of this empirical research the approach of geopolitical boundaries was chosen. In accordance with the 1998 Law, Polish territory is divided into three level. First, all territory is divided into 16 voivodeships, which are further divided into powiats and these are divided into communities.
So, the concentration of hospitals was measured in each of the 16 voivodeship in Poland but because of limited access to data of individual inpatient health care providers (at micro level) thus in this research the aggregated data at the powiats (counties) level were used. As there is two types of powiats (counties) in Poland – rural and town with district rights thus results will be also discussed in the context of different type of powiats (counties) as well.
As some regions in Poland can be differentiated according to their similarities in terms of economic, landscape, ethnographic features. The division of voivodeships by region – according to Central Statistical Office is presented in the table 3.1.

Table 3.1: The division of voivodeships by region in Poland in the years from 2010-2017

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

Source: Statistics Poland [15].

As the both 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 and also competition. Because some of the most important changes in the health care system took place in the analyzed period thus it is quite sufficient period for such analysis.
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 firms (hospitals) within one industry and thus it is the most commonly employed variable to indicate the degree of competition [31].
In fact both the theory of economics and considerable empirical evidence suggest that, other things being equal, the concentration of firms / hospitals is an important element of the market structure and a determinant of competition [32] Thus, the Herfindahl-Hirschman Index (HHI) is also used as the proxy for hospital competition. The Herfindahl-Hirschman index as a statistical measure of concentration, was developed independently by A. O. Hirschman (1945) [33] and O. C. Herfindahl (1950) [34], however it is better known as the Herfindahl index [36]. It capture the number and relative size of firms / hospitals and thus the HHI accounts for the number of hospitals in a market, as well as concentration, by incorporating the relative size (that is, market share) of all hospitals in a market [32].
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 [32]. HHIs are the standard measure used for example in empirical work in economics, health services research and other disciplines. The HHI is also used by the U.S. antitrust authorities as a first starting point for more thorough investigations if a merger or an acquisition is to be assessed [37].
The HHI can be defined as the sum of squared market (area) shares of hospitals participating in the market (area). And it is expressed by the following formula [35]:

$$HHI = \sum^{n}_{i=1} (MS_i)^2 \qquad (1)$$

where:

MS_i - represents the market (area) share of hospital I as well as it stands for market concentration

n – number of hospitals in the market (area).

As this index is the sum of the squared market share of each inpatient car providers or hospital system in the market (and ofently multiplied then by 10 000) then for example, a market with only one particular provider would have a squared market share equal to 1, (and thus an HHI of 10 000). Conversely, a market with a large number of small providers would have a small sum of squared market shares, and thus an HHI near 0. As is standard, the markets are considered highly concentrated if they have an HHI greater than 0.25 (2500), moderately concentrated if they have an HHI between 0.15 and 0.25 (1500 and 2500), unconcentrated if they have an HHI between 0.01 and 0.15 (100 and 1500), and highly competitive if they have an HHI below 0.01 (100) [38]. Reductions in the number of providers and concentration of marketshare into fewer of them increases the HHI, so that higher HHI values are consistent with less competitive markets. Considering the extreme case of only one firm, i.e. a monopolist, it would have the highest level of concentration (1 or 10 000). On the other hand, a perfectly competitive market would have the lowest level of concentration, determined by the large number of providers / hospitals [35].
Thus the results of empirical analysis of concentration among hospitals in Poland are presented in the next sections.

IV. Results and Discussion

This section gives a detailed account of research results. The number of hospitals varies over the period of analysis but at average the empirical research includes the group of at average 916 general hospitals yearly and only 48 psychiatric hospitals. The base of chronical medical care home is at the level of 381 at average yearly and 151 nursing homes and almost a half less of hospices as 79 of them at average yearly. Generally the number of each in patient health care providers presents the growing tendency. The relatively highest change can be observed for hospices as the number of them increased by almost 42%, the smallest is in case of psychiatric hospitals as the increase by 2.13%, which nominally means the increase by only such hospitals in period from 2010 to 2017. The number of rest kinds of inpatient health care providers increased from 17.52% to 25.76% in the analyzed period.

Table 4.1: Number of inpatients care providers in Poland in years 2010 to 2017

year	general hospitals	psychiatric hospitals	chronic medical care home	nursing homes	hospices
2010	795	47	330	137	67
2011	814	48	367	138	79
2012	913	49	361	158	83
2013	966	48	379	152	73
2014	979	49	388	155	73
2015	956	48	408	152	82
2016	957	48	400	154	80
2017	951	48	415	161	95
average	916	48	381	151	79
change	19.62%	2.13%	25.76%	17.52%	41.79%

Source: Statistics Poland (2010-2017)[28]

According to the data, which are presented in the table 4.2, it is appeared that at average the highest base of beds are in the disposition of general hospitals (185.656 beds), then of chronic medical care homes (22.827) and psychiatrist hospitals (17.705). Relatively smaller base of beds is in the dispositions of nursing homes as at average it was 6.569 and in case of hospices as it was 1.427. Moreover, the number of beds also increased in analyzed period at inpatient health care providers apart from psychiatric hospitals, where slight decrease of beds took place.

Table 4.2: Number of beds of inpatient care providers in Poland in years 2010 to 2017

year	general hospitals	psychiatric hospitals	chronic medical care homes	nursing homes	hospices
2010	181 077	17 750	19 250	5 688	1 126
2011	180 606	17 761	21 118	5 699	1 263
2012	188 820	17 529	21 187	6 755	1 389
2013	187 763	17 505	22 302	6 401	1 307
2014	188 116	17 736	23 099	7 027	1 334
2015	186 994	17 759	24 872	6 706	1 550
2016	186 607	17 868	25 176	6 749	1 640
2017	185 263	17 730	25 615	7 528	1 809
average	185 656	17 705	22 827	6 569	1 427
change	2.31%	-0.11%	33.06%	32.35%	60.66%

Source: Statistics Poland (2010-2017)[28]

The calculated HHI for inpatient health care markets by each types of providers and year are presented in the table 4.3 . And as HHI is also a proxy of competition thus this table displays the changes in the structure of Polish hospital market from 2010 to 2017 , but also as HHI is a measure of providers 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 not concentration of general hospitals, psychistric hospitals, chronic medical care home and hospices in any of the voidaships in Poland. Some moderate level of concentration can be noticed only in case of nursing homes. So it means that the distribution of nursing homes beds is less even comparing with the others inpatient care. However, the positive is that HHI decreased from 1170.99 in 2010 to 1147.39 in 2017. This same tendency can be observed for the general hospitals, psychistric hospital as the HHI change from 816.61 in 2010 to 811.57 in 2017 for the first type of hospital and respectively from 844.12 in 2010 to 843.90 in 2017 for the psychiatric hospitals. It is higly positive as apart from not existance of concentrations, there is also the improvement, which means quite even distribution of them. That's way, the increase of HHI in case of hospices and chronic medical care homes can be troublesome, because it can signal of growing concentration in the future and then getting also less competitive. While, high levels of market concentration in the inpatient 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 inpatieitn infrastructure might affect both the performance of the hospital sector as well as inequities in access to services.

Table 4.3. The value of HHI* for inpatient care market in Poland in years 2010-2017

year	general hospitals	psychiatric hospitals	chronic medical care homes	nursing homes	hospices
2010	816.61	844.12	960.11	1170.99	882.97
2011	815.35	835.32	991.41	1138.68	887.26
2012	811.65	835.32	933.33	1232.69	877.29
2013	813.57	847.74	937.83	1088.07	918.16
2014	810.26	861.32	951.14	1112.53	886.75
2015	809.48	851.77	937.29	1179.49	929.43
2016	811.05	847.35	951.03	1098.14	946.21
2017	811.57	843.90	971.77	1147.39	902.84
average	812.44	846.81	954.24	1146.00	903.86

Source: Statistics Poland (2010-2017)[28]

** because of low level of the HHI, this apparoach as multipluing by 10000 was used.*

Because of availability of data it was possible to analyze the concentration level of general hospitals in deeper way it means the the level of powiats. The general hospitals are characterized by multi-profile activity where patients stay no longer than 30 days and are the main, dominant form of inpatient health care, however after the increasing tendency of the number of them in the year from 2010- 2014 then the decrease can be observed as the number of general hospitals changed from 979 in 2014 to 951 in the year 2017, it means by 19.62%. The relatively higher change can be observed in case of zachodnipomorskie and opolskie as by 41.94% and 40.91% relatively. Only in one voivodeship the decreased can be observed as in wielkopolskie at the level of 6.06% (table 4.4).

Table 4.4: Number of general hospitals in Poland in years 2010-2017 (excluding hospital branches)

voivodeship / year	2010	2011	2012	2013	2014	2015	2016	2017	change
DOLNOŚLĄSKIE	67	72	80	80	83	79	82	81	20,90%
KUJAWSKO-POMORSKIE	38	39	42	42	42	43	40	41	7,89%
LUBELSKIE	42	45	50	58	59	57	55	53	26,19%
LUBUSKIE	19	20	25	25	25	26	24	24	26,32%
ŁÓDZKIE	61	62	66	74	71	68	67	65	6,56%
MAŁOPOLSKIE	71	69	75	84	85	81	90	87	22,54%
MAZOWIECKIE	98	106	115	120	120	112	108	118	20,41%
OPOLSKIE	22	23	28	28	29	28	30	31	40,91%
PODKARPACKIE	35	32	39	39	41	41	40	41	17,14%
PODLASKIE	30	31	33	35	36	34	37	36	20,00%
POMORSKIE	41	40	51	54	55	54	53	44	7,32%
ŚLĄSKIE	115	116	134	145	151	152	155	155	34,78%
ŚWIĘTOKRZYSKIE	22	22	25	25	25	25	25	25	13,64%
WARMIŃSKO-MAZURSKIE	37	39	43	42	44	43	45	44	18,92%
WIELKOPOLSKIE	66	65	67	64	63	65	60	62	-6,06%
ZACHODNIOPOMORSKIE	31	33	40	51	50	48	46	44	41,94%
Poland – total	**795**	**814**	**913**	**966**	**979**	**956**	**957**	**951**	19,62%

Source: Statistics Poland; Local Data Bank [29]

According to the data, which are presented in the table 4.5, it is appeared that all general hospitals had in the disposition the base of at average 185.656 bed yearly. The number of beds also increased from 181,077 in 2010 to 188,820 in 2012 and then after slight variation again increased in 2014 to 188,116 and then the decrease can be observed to 185,263 in 2017. Generally during all period of analysis, there is the increase of number of beds in general hospitals by 2,31%.

Table 4.5: Number of beds in general hospitals in Poland in years 2010-2017

voivodeship / year	2010	2011	2012	2013	2014	2015	2016	2017	change
DOLNOŚLĄSKIE	14 126	14 111	14 816	15 073	14 907	14 841	14 899	14 637	3,62%
KUJAWSKO-POMORSKIE	9 018	9 024	9 507	9 642	9 891	9 846	9 860	9 794	8,61%
LUBELSKIE	11 290	11 293	11 836	11 502	11 367	11 307	11 256	11 190	-0,89%
LUBUSKIE	4 191	4 219	4 537	4 469	4 443	4 402	4 347	4 401	5,01%
ŁÓDZKIE	13 533	13 407	13 134	13 428	13 291	12 985	12 777	12 776	-5,59%
MAŁOPOLSKIE	14 274	14 362	14 952	14 868	14 976	14 861	14 919	14 988	5,00%
MAZOWIECKIE	24 186	24 353	26 259	26 525	26 147	25 929	26 240	26 049	7,70%
OPOLSKIE	4 387	4 381	4 973	4 930	4 857	4 604	4 741	4 569	4,15%
PODKARPACKIE	9 556	9 555	10 100	10 180	10 289	10 249	10 342	10 219	6,94%
PODLASKIE	5 970	5 699	5 851	5 850	5 893	5 933	6 025	5 964	-0,10%
POMORSKIE	8 708	8 542	9 068	9 459	9 333	9 506	9 119	9 256	6,29%
ŚLĄSKIE	25 989	25 568	26 001	25 898	25 757	25 526	25 418	25 091	-3,46%
ŚWIĘTOKRZYSKIE	6 445	6 447	6 581	6 202	6 309	6 313	6 312	6 125	-4,97%
WARMIŃSKO-MAZURSKIE	5 985	6 282	6 700	6 675	6 639	6 668	6 757	6 709	12,10%
WIELKOPOLSKIE	15 633	15 617	16 118	14 659	15 665	15 756	15 422	15 600	-0,21%
ZACHODNIOPOMORSKIE	7 786	7 746	8 387	8 403	8 352	8 268	8 173	7 895	1,40%
TOTAL	**181 077**	**180 606**	**188 820**	**187 763**	**188 116**	**186 994**	**186 607**	**185 263**	**2,31%**

Source: Statistics Poland, Local Data Bank [29]

It can be also noted that in case of 10 voivodeships, the increase of beds took place while in case of 6 of them the decrease. The higher relatively increase too place in the warmińsko-mazurskie as it was 12.10% while the higher decrease in łódzkie as it was by 5.59%. It means, that some variation and differentiation between voivodeships can be observed.

Table 4.6: Number of persons per bed in general hospitals in Poland in years 2010-2017

voivodeship / year	2010	2011	2012	2013	2014	2015	2016	2017	change
DOLNOŚLĄSKIE	207	207	197	193	195	196	195	198	-4,20%
KUJAWSKO-POMORSKIE	233	233	221	217	211	212	211	213	-8,72%
LUBELSKIE	193	192	183	187	189	189	190	190	-1,54%
LUBUSKIE	244	243	226	229	230	231	234	231	-5,31%
ŁÓDZKIE	188	189	192	187	188	192	195	194	3,10%
MAŁOPOLSKIE	234	233	224	226	225	227	227	226	-3,30%
MAZOWIECKIE	218	217	202	200	204	206	204	207	-5,18%
OPOLSKIE	232	231	203	204	206	216	209	217	-6,60%
PODKARPACKIE	223	223	211	209	207	208	206	208	-6,57%
PODLASKIE	202	211	205	204	202	200	197	199	-1,68%
POMORSKIE	261	267	253	243	247	243	254	251	-3,79%
ŚLĄSKIE	178	181	178	178	178	179	179	181	1,84%
ŚWIĘTOKRZYSKIE	199	198	194	204	200	199	198	204	2,37%
WARMIŃSKO-MAZURSKIE	243	231	217	217	217	216	213	214	-12,04%
WIELKOPOLSKIE	220	221	215	237	222	221	226	224	1,67%
ZACHODNIOPOMORSKIE	221	222	205	205	205	207	209	216	-2,25%
Poland	**213**	**213**	**204**	**205**	**205**	**206**	**206**	**207**	**-2,50%**

Source: Statistics Poland; Local Data Bank [29]

Table 4.6. presents data regarding number of persons per bed. Generally the decrease can be observed as at level of Poland by 2.50%. Even the number of hospitals and number of bed present growing tendency thus the number of persons per bed shows decreasing tendency. Only in 4 voivodeships the increase took place as in łódzkie, śląskie, świetokrzyskie and wielkopolskie. Especially the interesting situation can be noticed in the voivodeship wielkopolskie as the decrease of number of general hospitals and beds was followed by the increase of number of persons per bed.

The descriptive statistics reported in Table 4.7. suggest that the average concentration results in an HHI of 0.1455 in 2010 and 0.1598 in 2017 with a median of 0.1478 in 2010 and 0.1580 in 2017. According to these numbers, at least 50% of Polish hospitals (in fact powiats hospital systems as measured at the level of powiats) are located in markets with a concentration of 0.1580 in 2017 or above. These markets are above of 0.15, which usually serves as an indicator for a moderately level of concentration. As the standard deviation presents that between 0.0460 in 2010 and 0.0522 in 2017, so it shows that the hospital concentration is quite differentiated in Poland.

Table 4.7: Descriptive statistics of HHI of general hospitals in Poland for years 2010-2017

Statistcs / year	2010	2011	2012	2013	2014	2015	2016	2017
average	0,1455	0,1451	0,1561	0,1564	0,1590	0,1567	0,1585	0,1598
standard deviation	0,0460	0,0441	0,0491	0,0487	0,0521	0,0492	0,0515	0,0522
median	0,1478	0,1445	0,1576	0,1567	0,1546	0,1556	0,1558	0,1580
maximum	0,2115	0,2064	0,2323	0,2340	0,2372	0,2295	0,2399	0,2458
minimum	0,0502	0,0503	0,0521	0,0534	0,0516	0,0519	0,0529	0,0532
coeff cient of variation	0,0021	0,0019	0,0024	0,0024	0,0027	0,0024	0,0027	0,0027

Source: author's calculation according to the data from Statistics Poland, Local Data Bank [29]

The calculated HHI for hospital markets by voivodeships and year are presented in the table 4.8. As HHI is a measure of hospitals concentration in an industry thus it shows also the level of inequality. In addition to it, HHI is also a proxy of competition thus this table displays the changes in the structure of Polish hospital market from 2010 to 2017.
So, based on the results, above all, it can be found that the concentration of general hospitals in the analyzed

voivodeships is uneven. There are some voivodeships that have the value of HHI at around 0.0520 and there are voivodeships with the value of HHI more then 0.20. It means, that the value of HHI of voivodeships with the most concentrated market is around fourth times higher then the value of the least concentrated market.
Also, it was found out that the average value of HHI of analyzed hospitals within this period increased from 0.145 in 2010 to 0.155 in 2017, what means that at average their became more concentrated and thus less competitive. In case of only one voivodeship 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. 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 following voivodeships such as: warmińsko-mazurskie by 25.69% then mazowieckie – by 20.49% and in łódzkie – by 18.45%. This voivodeships are located at the East and Central of Poland.
According to both the idea of HHI measurement and the empirical literature on hospital markets, this trend is likely to have a negative effect on competition outcomes. High levels of market concentration in the hospital 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 4.8: The value of HHI for hospital market in Poland in years 2010-2017

voivodeship / year	2010	2011	2012	2013	2014	2015	2016	2017	average	change
DOLNOŚLĄSKIE	0,14	0,13	0,16	0,15	0,15	0,15	0,15	0,16	0,15	12,64%
KUJAWSKO-POMORSKIE	0,15	0,14	0,16	0,16	0,16	0,16	0,16	0,17	0,16	13,60%
LUBELSKIE	0,13	0,13	0,14	0,14	0,14	0,14	0,14	0,14	0,14	11,53%
LUBUSKIE	0,12	0,12	0,11	0,11	0,11	0,12	0,12	0,12	0,12	-1,37%
ŁÓDZKIE	0,21	0,21	0,22	0,21	0,23	0,23	0,24	0,25	0,22	18,45%
MAŁOPOLSKIE	0,17	0,17	0,19	0,19	0,19	0,19	0,19	0,19	0,19	11,47%
MAZOWIECKIE	0,20	0,20	0,23	0,23	0,24	0,23	0,24	0,24	0,23	20,49%
OPOLSKIE	0,15	0,15	0,18	0,18	0,18	0,17	0,17	0,17	0,17	8,56%
PODKARPACKIE	0,08	0,08	0,08	0,08	0,09	0,09	0,09	0,09	0,08	15,00%
PODLASKIE	0,21	0,20	0,22	0,22	0,22	0,21	0,21	0,21	0,21	-2,15%
POMORSKIE	0,15	0,15	0,14	0,15	0,15	0,14	0,15	0,14	0,15	-6,02%
ŚLĄSKIE	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	6,03%
ŚWIĘTOKRZYSKIE	0,13	0,13	0,14	0,13	0,13	0,13	0,13	0,14	0,13	8,11%
WARMIŃSKO-MAZURSKIE	0,10	0,11	0,12	0,12	0,12	0,13	0,12	0,12	0,12	25,69%
WIELKOPOLSKIE	0,15	0,15	0,16	0,16	0,17	0,17	0,16	0,16	0,16	5,73%
ZACHODNIOPOMORSKIE	0,20	0,20	0,20	0,20	0,21	0,21	0,22	0,22	0,21	10,81%
average	0,145	0,145	0,156	0,156	0,159	0,157	0,158	0,160	0,155	9,82%

Source: author's calculation according to the data from Statistcs Poland, Local Data Bank [29]

When the HHI takes the value between 0.15 to 0.25 then the hospital market is treated as moderately concentrated. In Poland, the HHI for general hospitals took at average the value above 0.15 and less then 0.25 in the following provinces: dolnośląskie, kujawsko-pomorskie, łodzkie, małopolskie, mazowieckie, opolskie, podlaskie, pomorskie, wielkopolskie, zachodniopomorskie. Four of them had even more then 0.20 – it means łodzkie, mazowieckie, podlaskie, zachodniopomorskie. At average the unconcentrated market are: lubelskie, lubuskie, podkarpackie, ślaskie, świętokrzyskie, warmińsko – mazurskie with the HHI taken the value lower then 0.15 and in case of śląskie and podkarpackie the HHI took the lowest value as 0.05 and 0.08 respectively. Such values displayed by the voivodeships śląsie and podkarpackie showed that hospital market is quite competitive.

Based on the analysis of every voivodeships and powiats (counties), some tendency also was noticed. First at all that there are some town with powiats (counties) rights which are characterized by the relatively high as at average 34-46 percent share of all hospitals beds in their respective province. These are the following cities: Warsaw (46%), Łódż (45%), Szczecin (43%), Białystok (42%), Kraków (40%), Poznań (38%), Wrocław (35%), Gdańsk (34%), Bydgoszcz (34%), Lublin (33%), which are located all over the territory of Poland.

4.9.: Cities with powiat status and their market shares measured by the number of beds in year 2010-2017

voivodeship	name of city with powiat status	2010	2011	2012	2013	2014	2015	2016	2017	average
DOLNOŚLĄSKIE	Wrocław	0,34	0,33	0,37	0,36	0,35	0,35	0,35	0,36	0,35
KUJAWSKO-POMORSKIE	Bydgoszcz	0,32	0,31	0,35	0,34	0,34	0,34	0,35	0,35	0,34
LUBELSKIE	Lublin	0,32	0,32	0,34	0,34	0,34	0,34	0,34	0,34	0,33
ŁÓDZKIE	Łódź	0,43	0,43	0,44	0,43	0,46	0,45	0,46	0,47	0,45
MAŁOPOLSKIE	Kraków	0,38	0,38	0,40	0,41	0,42	0,41	0,41	0,41	0,40
MAZOWIECKIE	Warszawa	0,43	0,43	0,47	0,47	0,47	0,46	0,48	0,48	0,46
PODLASKIE	Białystok	0,42	0,41	0,43	0,43	0,43	0,42	0,42	0,42	0,42
POMORSKIE	Gdańsk	0,34	0,34	0,33	0,35	0,34	0,33	0,34	0,33	0,34
WIELKOPOLSKIE	Poznań	0,36	0,36	0,37	0,37	0,39	0,39	0,38	0,38	0,38
ZACHODNIOPOMORSKIE	Szczecin	0,41	0,41	0,42	0,42	0,43	0,43	0,44	0,44	0,43

Source: author's calculation according to the data from Statistcs Poland, Local Data Bank [29]

All results were also analyzed taking into account the type of powiats (counties) and percent share of all hospitals beds in their respective voivodeships. In this analysis, also the location of voivodeships in the geographical region (according to table 3.1) was taken into account

The central region covers two voivodeships: mazowieckie and łódzkie. From the analysis presented above it is appeared that those two voivodeships were one of the leading voivodeships in terms of market concentration in years 2010 - 2017. Also in this region two cities with the highest percent share of all hospitals beds in their respective voivodeships are located – it means: Warsaw with the 46 percent share of all hospitals beds in mazowieckie voivodeships and Łódź with 45 percent share of all hospitals beds in łódzkie voivodeship.

Southern region covers two voivodeships: małopolskie and śląskie. Voivodeship of śląskie was characterized as the one with the lowest degree of hospital market concentration and relatively small. In fact, only one town with powiat (counties) rights – it means Katowice – had at average 14 percent share of all hospitals beds in the voivodeship and the rest of powiats of both types had from 0-6 percent share of all hospitals beds in this voivodeship. In case of małopolska, the pattern is similar but with higher percent share of hospitals beds in the city of Krakow – it means 40 percent. The rest of both types of powiats (counties) had at average 0-7 percent share of all hospitals beds in the voivodeships.

Eastern region covers four voivodeships: lubelskie, podkarpackie, podlaskie, świętokrzyskie. In the province of lubelskie, the dominance of city Lublin could be seen. This city had 33 percent while the rest of voivodeships had of from 0.004 to 7 percent share of all hospitals beds in this voivodeship. In the second voivodeship of this region - podkarpackie - there was one city of Rzeszów with 22 percent at average in the analyzed period and the rest of powiats with 1-9 percent share of all hospitals beds in this voivodeships. Third voivodeship of this region had one city – Białystok – with the 42 percent share and two cities – Suwałki and Łomża – with 8.5 and 10.3 percent share of all hospitals beds in the voivodeships respectively. The rest of powiats had between 0-5.6 percent share of all hospitals beds in the voivodeship. The last of voivodeship in this region is świętokrzyskie with the dominance of city Kielce with the 29.5 percent share of all hospitals beds in the voivodeship. There were three powiats with 8 - 9 percent and the rest powiats with the 1-7 percent share of all hospitals beds in the voivodeship.

Northern region of Poland covers three voivodeships: kujawsko-pomorskie, pomorskie, warmińsko-mazurskie. In the kujawsko-pomorskie voivodeship, the city of Bydgoszcz had 34 percent then the following cities: Toruń - 14 percent, Grudziąc - 10 percent and Wrocławek – 7 percent shares of all hospitals beds in the voivodeship. The rest of powiats had 0.32-5.55 percent share of all hospitals beds in the voivodeship. The second voivodeship – warmińsko- mazurskie presented different pattern: the city of Olsztyn had 26 percent and city of Elbląg 17 percent share of all hospitals beds in the voivodeship while the rest powiats were with the 0.67-7 percent share of all hospitals beds in the province. The last voivodeship in this region – pomorskie – could be characterized by the city of Gdańsk with 34 percent and the city of Gdynia with 10 percent share of all hospitals beds in the voivodeship. The rest of both types powiats had below 7.48 percent share of all hospitals beds in the voivodeship.

North-western region of Poland covers three voivodeships: lubuskie, wielkopolskie, zachodniopomorskie. In the province of lubuskie there were two cities with the highest percentage share of all hospitals beds in the voivodeship. These are: Gorzów Wielkopolski – 20 percent and Zielona Góra with 19 percent. The rest of powiats had from 1-9 percent share of all hospitals beds in the voivodeship apart from powiat nowosolski with more then 11 percent. In the voivodeship of wielkopolska, only city of Poznań had 38 percent and the rest of both types of powiats had 0-6 percent share of all hospitals beds in the voivodeship. In the third voivodeship of this region – it means – zachodniopomorskie – the city of Szczecin had 43 percent and city of Koszalin had 9 percent with the rest of both types of powiats of 0-5 percent share of all hospitals beds in the voivodeship.

South – western region of Poland covers two voivodeships: dolnośląskie and opolskie. In the dolnośląskie voivodeship one city had 35 percent share of all hospitals beds in the voivodeship and it is Wrocław. The rest of both types powiats had from 1-7 percent share of all hospitals beds in the voivodeship. Then in opolskie voivodeship, the city of Opole had 29 percent and one of another type of county - (powiat) nyski - 24 percent share of all hospitals beds in the voivodeship. While the rest of powiats had between 3 to 9 percent share of all hospitals beds in the voivodeship.

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 every voivodeship there is one to three dominant cities because of the relatively high percentage share of all hospitals beds in the relevant voivodeship. Results also proved that the concentration of general hospitals services measured by hospitals beds is uneven and thus the access to services can be differential.

V. Conclusion

On basis of the HHI, this paper reports on a concentration level of inpatient health care providers. This study has several major findings. Empirical results discussed above support the assertion that in the period of analysis the entire general hospitals sector in Poland has been at average moderately concentrated and thus moderately competitive with the growing tendency to higher concentration and less competitive. Moreover, the concentration of hospitals services is diversified across the voivodeships of Poland and it is quite uneven. In case of others inpatient health care providers – when making the analysis on more aggregated level of data – it appeared that the moderate level of concentration was found in case of nursing homes. The analysis also shows that changes on the health care market which took place in the analyzed period especially statutory changes regarding hospitals in 2011 affected the level of concentration and thus competition.

However, as with most empirical studies, the findings are also limited mainly by the scope of available data set. As this paper has relied on the aggregated data thus the validity conclusions is limited to some extend. 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.

Later on, it is possible also to test whether the level of concentration has any influence on the quality and costs of inpatients health care providers activities.

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