COMPETITION MEASUREMENT OF HOSPITALS IN POLAND: THE HERFINDAHL-HIRSCHMAN INDEX APPROACH

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Abstract. *The purpose of this study was to measure the competition level of general hospitals in Poland. The Herfindahl-Hirschman Index (HHI) was used to investigate the concentration level of the general hospital sector in Poland, which is treated in the literature as a proxy of competition. To understand how general hospitals' market has been structured and thus competitive, the data for general hospitals spanning all Poland for the period of 2005-2013 were collected. The concentration of hospitals was measured in each of the 16 provinces in Poland based on the aggregated data at the counties level. Data are collected from the public statistical system. The HHI indices support the assertion that in the period of analysis the entire general hospitals' sector in Poland has been on average moderately concentrated and thus, moderately competitive with the growing tendency to higher concentration and less competition. Moreover, the concentration of hospitals' services is diversified across the provinces and regions of Poland and it is quite uneven. The analysis also shows that changes in the health care market, which took place in the analysed period, especially statutory changes regarding hospitals in 2011, affected the level of concentration and thus competition. Including this introduction, this paper is organized into six sections. Section 2 outlines the Polish health care reforms especially those applying to hospitals. Section 3 and 4 presents the concept of empirical research, such as data and method. Section 5 provides results of empirical research and section 6 concludes.*

Keywords: *health care, hospitals, competition, concentration, Herfindahl-Hirschman Index*

1. Introduction

Most of the industrialized countries have been developing their health care systems continuously in purpose to improve their effectiveness, fairness and quality of health care (Rój, 2009). Generally, policy makers aim to maintain a very challenging task – improving the quality and efficiency at the same time. Many of them, according to Cutler (2002), experience three stages in health care system development. The main goal of the first stage is the extension of coverage to larger parts of the population. In the second stage, many instruments/incentives are implemented to contain the cost of care and third, focuses on competition (Cutler, 2002).

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Generally, competition, in case of health care, is perceived as a mechanism, which allows to increase value for patients. It eliminates inefficiencies that would otherwise yield high costs of producing and delivering services, which are ultimately, transferred to patients (or insurers) via high health service and delivery costs. Thus, one of the main roles of competition in health care is the potential to provide a mechanism for reducing health care costs. But, it also ensures the provision of better services to satisfy the needs of patients (Rivers, Glover, 2008). The increased competition and the significant implications on costs and prices, as well as quality of health care services, resulted in health care industries merging and acquiring other hospitals. This may result in dominance of a few hospitals on the health care markets (Boutsioli, 2007).

However, the possible results of the competition depend on several conditions such as: the extension to which insurers, hospitals and physicians as well as other participants in the health care system compete, and the dimensions in which this competition takes place (Gaynor, Vogt, 2000; Schmidt, Ulrich, 2013).

Traditionally, competition in health care involves one or more elements, such as price, quality, convenience and superior services or products. But, it can also be based on new technology and innovation. Moreover, competition within the health care industry impacts several relational perspectives, therefore, it can be analysed from a different perspective, such as: quality of health care, health care system costs and patient satisfaction. It can also be analysed using the different matters it incorporates – all the major stakeholders, including providers (physicians and other practitioners such as hospitals), payers, employers and patients (Rivers, Glover, 2008).

Hospitals among other health care providers – are a central part of every health care system, accounting for a substantial share of health care expenditure. That's what makes this sector a prime target for policy makers who want to foster efficiency by stimulating competition (Schmid, Ulrich, 2013). As hospitals are the larger consumers of scarce health care resources, it is particularly important to use these scarce resources as effectively and efficiently as possible. It is the reason why special attention is paid to them while reforming the health care system. Particularly because the frequent use of advanced technology in hospitals has been associated with tremendous costs, even if the technology provides great benefits (Zelman, McCue, Millikan, Glick, 2004).

A hospital can be defined as an organization, which maximizes its goal function by rendering health care services regarding inside and outside limitations (Berki, 1974). The hospital is characterized by offering permanent readiness to admit patients and providing them with medical services (Jachowicz, 1970). Hospitals compete for physicians, third-party payers and patients simultaneously. They could compete for physicians by offering more highly trained supportive staff or better equipment. However, hospitals are more likely to compete for patients by providing more services, better amenities or prices. Hospitals compete in this same way for third-party payers (Rivers, Glover, 2008).

As (measuring) competition is increasingly more important for analysis of health care markets and policies, with hospitals being the largest part of health care systems in every developed country – the purpose of this article is to analyse the competition among hospitals in Poland.

The literature has almost an exclusive focus on the U.S. health care market (Gaynor, Town, 2011) and there is an increase in literature on hospitals' competition in the Netherlands (for example Halbersma, Mikkers, Motchenkova, Seinen, 2011), as well as some fragmented information on hospital market concentration in other countries like Greece (Boutsioli, 2007) the U.K. (Shiell, 1991) or Taiwan (Chen, Cheng, 2010) and Germany (Schmid, Ulrich, 2013). Generally, these studies have focused largely on measuring and analysing the level of competition, as well as, on examining the impact of competition on quality and reduction of costs. Some other studies are focused on the evaluation of the effects of recent marketplace changes, like growth in managed care, which can have an impact on the nature and the degree of competition. Others have evaluated the effects of regulation and other policies on the amount and effects of competition (Baker, 2001).

Considering the relevance of the Polish hospital sector for the whole health care system, there is surprisingly little research addressing these issues. To the best knowledge of the author, there is no study regarding the Polish hospital sector in such a range as in the presented study. In the context of the above setting, the aim of this study is to calculate the concentration measures for the Polish hospital market and to find a clear picture of how strong the competition actually is. This research aims to bridge the gap in the literature through an empirical study in Poland. 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.

2. The characteristics of the Polish health care sector

In Poland, the government's budget has historically been the main source of health care financing and a radical change of this system happened in 1999, while the implementation of market economy took place earlier, in 1989 (Rój, 2009).

In January 1999 – by introducing the 1997 General Health Insurance Act – 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 (Rój, 2004). It means that the first step towards introducing elements of competition was made to ensure and foster the competition between providers, to improve quality and efficiency.

The function of the 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, the funds for health care came from

two main sources: the first, from the insurance funds mentioned above and second, government budgets (state, provinces or gminas) continued to finance public health services (Rój, 2009).

The health care system reform, which was implemented on 1st of January 1999 in Poland, meant serious changes, especially in the conditions of hospital activity. Most importantly, the hospitals' status changed from a budget entity and institution (until then funded by the subjective funding mechanism), to an independent public institution of health care. As a result of simultaneous administration reform, generally, the self-governments became the owners of those hospitals. Hospitals started to contract their services – without clearly defined rules of finance economy and generally without any experience in contracting their services – mainly with Health Insurance Organizations, and with the Health Ministry (among other highly specialized medical procedures financed directly from the state budget) (Rój, 2004).

Because of the considerable differentiation of the number and quality of services in individual regions, this system was met with criticism from the new left-side government. The new government adopted a different solution, instead of improving this system, they enforced a law on general insurance in the National Health Fund on April 1, 2003 – (Kuszewski, Gericke, 2005).

Under this law Health Insurance Organizations ceased to exist. The National Health Fund with many branches – each in one region, has replaced them. It meant that the public funds for health care were again centralized. The positive aspect of this change is that all branches of National Health Funds started to use the same payment unit (uniform across the country) in contracting hospital services.

Shortly after, the law on universal insurance in the National Health Fund was met with the criticism of opposition. In January 2004 it was legally qualified as not standing in accordance with the Constitution. As a result, the Seym of the Republic of Poland passed the law on health benefits financed from public means on 30 July 2004, but the general idea of insurance in National Health Fund remained.

The next change in funding method took place just in the beginning of July 2008. The system of Jednorodne Grupy Pacjentów – which is the type of diagnosis related groups system – was implemented. This system brought a pricing system, which led to intensive competition between hospitals on the basis of costs. The setup of this payment system requires hospitals to cut down on costs (Rój, 2009).

Some further fundamental changes took place in 2011, by attempting to make hospitals financially independent through the introduction of the Law on medicinal entities. Hospitals were confronted with the risk of going out of business, if they were not able to reach their economic target volume.

3. Data

To understand how hospital markets have become structured, competitive data for general hospitals spanning all across Poland for the period of 2005–2013 were collected.

This empirical research covered the all of the general hospitals in Poland. The number of hospitals varies over the period of analysis, but on average the empirical research includes the group of 805 general hospitals yearly. Generally, the number of hospitals presents the growing tendency. It increased from 781 in 2005 to 966 in 2013.

TABLE 1. **Number of general hospitals in Poland in years 2005–2013 (excluding hospital branches)**

province / year	2005	2006	2007	2008	2009	2010	2011	2012	2013
DOLNOŚLĄSKIE	69	68	64	60	60	67	72	80	80
KUJAWSKO-POMORSKIE	35	34	39	36	39	38	39	42	42
LUBELSKIE	41	37	37	37	38	42	45	50	58
LUBUSKIE	23	21	22	21	20	19	20	25	25
ŁÓDZKIE	60	59	60	58	56	61	62	66	74
MAŁOPOLSKIE	75	61	63	61	68	71	69	75	84
MAZOWIECKIE	98	90	92	88	93	98	106	115	120
OPOLSKIE	21	20	20	20	22	22	23	28	28
PODKARPACKIE	29	30	31	32	34	35	32	39	39
PODLASKIE	26	27	28	29	30	30	31	33	35
POMORSKIE	37	37	36	37	36	41	40	51	54
ŚLĄSKIE	104	106	105	106	107	115	116	134	145
ŚWIĘTOKRZYSKIE	23	20	20	22	22	22	22	25	25
WARMIŃSKO-MAZURSKIE	38	34	34	35	37	37	39	43	42
WIELKOPOLSKIE	69	64	63	60	61	66	65	67	64
ZACHODNIOPOMORSKIE	33	34	34	30	31	31	33	40	51
total	781	742	748	732	754	795	814	913	966

Source: GUS; Local Data Bank

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.

According to the data, which are presented in the table 2, it appeared that all general hospitals had in common was the base of an average 181.784 beds yearly. The number of beds also increased from 179.493 in 2005 to 187.763 in 2013. However, during the period of 2009–2011, a relatively small decrease took place.

Table 3 presents data regarding number of persons per bed. The average is 216 persons per bed during one year. Even the number of hospitals and the number of bed presents a growing tendency, however the number of persons per bed shows a decreasing tendency. Especially, it decreased in the year 2012 and 2013.

The average length of stay, which allows to estimate the swiftness of treatment is illustrated by the decreasing tendency in the analysed period: from 6,6 in 2005 to 5,4 in 2013 (table no 4). This means that the hospital's treatment was intensified. Reduction of average length of stay allows to increase the number of treated patients. If there is a simultaneous increase in the number of beds, as it happened then, there is an opportunity to maximize the effect of hospital activity, and there is a technical chance to improve the hospital's service effectiveness.

TABLE 2. **Number of beds in general hospitals in Poland in years 2005–2013**

province / year	2005	2006	2007	2008	2009	2010	2011	2012	2013
DOLNOŚLĄSKIE	14 146	13 578	13 132	13 582	13 907	14 126	14 111	14 816	15 073
KUJAWSKO-POMORSKIE	9 015	8 771	8 747	9 276	9 038	9 018	9 024	9 507	9 642
LUBELSKIE	11 072	11 022	10 982	11 437	11 477	11 290	11 293	11 836	11 502
LUBUSKIE	4 329	4 233	4 312	4 445	4 357	4 191	4 219	4 537	4 469
ŁÓDZKIE	13 713	13 181	13 200	13 672	13 624	13 533	13 407	13 134	13 428
MAŁOPOLSKIE	13 900	13 714	13 623	14 536	14 387	14 274	14 362	14 952	14 868
MAZOWIECKIE	23 516	23 101	22 958	24 228	24 110	24 186	24 353	26 259	26 525
OPOLSKIE	4 165	4 169	4 216	4 448	4 451	4 387	4 381	4 973	4 930
PODKARPACKIE	8 870	8 964	9 021	9 744	9 717	9 556	9 555	10 100	10 180
PODLASKIE	6 109	5 952	5 934	6 126	6 230	5 970	5 699	5 851	5 850
POMORSKIE	8 552	8 389	8 259	8 719	8 875	8 708	8 542	9 068	9 459
ŚLĄSKIE	26 764	26 607	25 978	26 949	26 624	25 989	25 568	26 001	25 898
ŚWIĘTOKRZYSKIE	5 778	5 734	5 665	6 238	6 312	6 445	6 447	6 581	6 202
WARMIŃSKO-MAZURSKIE	6 034	5 939	5 873	6 153	6 056	5 985	6 282	6 700	6 675
WIELKOPOLSKIE	15 698	15 479	15 402	16 041	15 923	15 633	15 617	16 118	14 659
ZACHODNIOPOMORSKIE	7 832	7 840	7 721	7 971	7 952	7 786	7 746	8 387	8 403

Source: GUS, Local Data Bank

TABLE 3. **Number of persons per bed in general hospitals in Poland in years 2005–2013**

province / year	2005	2006	2007	2008	2009	2010	2011	2012	2013
DOLNOŚLĄSKIE	204	212	219	212	207	207	207	197	193
KUJAWSKO-POMORSKIE	229	236	236	223	229	233	233	221	217
LUBELSKIE	197	197	197	189	188	193	192	183	187
LUBUSKIE	233	238	234	227	232	244	243	226	229
ŁÓDZKIE	188	195	194	186	187	188	189	192	187
MAŁOPOLSKIE	235	239	241	226	229	234	233	224	226
MAZOWIECKIE	219	224	226	215	217	218	217	202	200
OPOLSKIE	251	250	246	232	232	232	231	203	204
PODKARPACKIE	237	234	232	215	216	223	223	211	209
PODLASKIE	196	201	201	194	191	202	211	205	204
POMORSKIE	257	263	268	255	251	261	267	253	243
ŚLĄSKIE	175	175	179	172	174	178	181	178	178
ŚWIĘTOKRZYSKIE	222	223	225	204	201	199	198	194	204
WARMIŃSKO-MAZURSKIE	237	240	243	232	236	243	231	217	217
WIELKOPOLSKIE	215	218	220	212	214	220	221	215	237
ZACHODNIOPOMORSKIE	216	216	219	212	213	221	222	205	205
average	**219**	**223**	**224**	**213**	**214**	**219**	**219**	**208**	**209**

Source: GUS; Local Data Bank

In the literature (Tiemann, Schreyögg, 2009; Herr, 2010) one of the three different basic concepts are frequently applied to define the relevant geographic market to measure competition i.e., geopolitical boundaries, the fixed radius and the patient flow technique. In this research, the approach of geopolitical boundaries was chosen. In accordance with the 1998 Law, Polish territory is divided into three levels. First, all territory is divided into 16 provinces, which are further divided into counties (380) and these are divided into communities (2479).

TABLE 4. **Average length of stay in general hospitals in Poland in years 2005–2013**

province / year	2005	2006	2007	2008	2009	2010	2011	2012	2013
DOLNOŚLĄSKIE	6,2	5,5	5,4	5,1	5,1	5,2	5,2	5,3	5,5
KUJAWSKO-POMORSKIE	6,2	6,0	5,9	5,7	5,5	5,5	5,4	5,4	5,5
LUBELSKIE	7,2	6,9	7,0	6,7	6,6	6,5	6,3	6,1	6,1
LUBUSKIE	6,7	6,6	6,1	5,9	5,7	5,7	5,4	5,3	5,2
ŁÓDZKIE	6,9	6,3	6,3	6,1	5,7	5,4	5,2	5,2	5,1
MAŁOPOLSKIE	7,2	7,0	6,8	6,3	6,0	5,9	5,8	5,9	5,9
MAZOWIECKIE	6,8	6,2	6,2	5,9	5,7	5,4	5,3	5,3	5,2
OPOLSKIE	6,7	6,7	6,5	6,2	6,2	6,0	6,0	6,1	5,8
PODKARPACKIE	6,7	6,5	6,3	5,9	5,9	5,8	5,6	5,7	5,5
PODLASKIE	6,8	6,4	6,1	5,9	5,8	5,7	5,7	5,5	5,3
POMORSKIE	6,0	5,7	5,8	5,3	5,3	5,3	5,2	5,3	5,0
ŚLĄSKIE	8,0	7,7	7,3	7,0	6,8	6,7	6,6	6,4	6,1
ŚWIĘTOKRZYSKIE	6,5	6,1	5,9	5,5	5,3	5,5	5,5	5,5	5,2
WARMIŃSKO-MAZURSKIE	5,8	5,6	5,6	5,3	5,5	5,4	5,4	5,2	5,2
WIELKOPOLSKIE	6,0	5,7	5,5	5,2	5,2	5,0	4,8	4,8	4,5
ZACHODNIOPOMORSKIE	6,1	6,0	5,9	5,8	5,7	5,7	5,6	5,4	5,4
average	6,6	6,3	6,2	5,9	5,8	5,7	5,6	5,5	5,4

Source: Biuletyn Statystyczny Ministerstwa Zdrowia [2006–2014], CSIOZ

So, the concentration of hospitals was measured in each of the 16 provinces in Poland, but because of limited access to data of individual hospitals (at micro level), data collected at the counties level were used in this research. As there are two types of counties in Poland – rural and town with district rights, the results will also be discussed in the context of different types of counties as well.

Moreover, in Poland some regions can be differentiated according to their similarities in terms of economic, landscape and ethnographic features. The division of provinces by region – according to Central Statistical Office is presented in the table 5.

TABLE 5. **The division of provinces by region in Poland**

Region of Poland	Province
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: GUS

This stage of analysis is mainly determined by the availability of data. The data is sufficient to examine the dynamics of the chosen geographic market in the aspect of degree of competition. Moreover, it is a sufficient period as it covers some important changes in the health care system.

Data are collected from the public statistical system – from the Central Statistical Office database (from the Local Data Bank[1]) and from the Center of Information Systems on Health Care (Centrum Systemów Informacyjnych Ochrony Zdrowia – CSIOZ).

The hospital's activity can be measured by the diagnosis related groups or number of dischargers, number of beds and the number of patient's bed days. In this study, the number of beds was used as the measure of hospital's activity, because such data are available. Thus, the market shares of hospitals in this study are based on the share of hospitals beds.

4. Method

To measure the intensity (degree) of competition, the Herfindahl-Hirschman Index (HHI) is employed. It is a 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 (Pan, Qin, Li, Messina, Delamater, 2015)

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 (Rhoades, 1993). Thus**,** the Herfindahl-Hirschman Index (HHI) is also used as a proxy for hospitals competition. As a statistical measure of concentration, the Herfindahl-Hirschman index was developed independently by A. O. Hirschman (1945) and O. C. Herfindahl (1950), however, it is better known as the Herfindahl index (Baker, 2001). It captures 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 (market share) of all hospitals in a market (Rhoades, 1993).

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 (Rhoades, 1993). HHIs are the standard measure used for example, in empirical work in economics, health services research and other disciplines. The U.S. antitrust authorities also use the HHI as a first starting point for more thorough investigations if a merger or an acquisition is to be assessed (Schmid, Ulrich, 2013).

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[1] http://stat.gov.pl/bdlen/app/dane_podgrup.hier?p_id=25991&p_token=2128957222 availiable 20.04.2015

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 (Baker, 2001):

$$\text{HHI} = \sum_{i=1}^{n} (MS_i)^2 \qquad (1.1)$$

where:

MS_i – represents the market (area) share of the 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 hospital or hospital system in the market (and openly multiplied by 10 000) then for example, a market with only one hospital 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 hospitals 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 1500 and 2500 and un-concentrated if they have an HHI between 100 and 1500, and highly competitive if they have an HHI below 100 (Cutler, 2013). Reductions in the number of hospitals and the concentration of market share into fewer hospitals 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 firms/ hospitals (Baker, 2001).

Of course, it is supported by the classical economic definition of competition, according to which markets with more evenly balanced firms are apt to be more competitive than markets in which there are some firms that are larger and more powerful than their neighbours (Djolov, 2013)

Therefore the results of the empirical analysis of competition among hospitals in Poland are presented in the next sections.

5. Empirical results

This section gives a detailed account of the research results. First, table 6 presents the descriptive statistics of HHI.

The descriptive statistics reported in Table 6 suggest that the average concentration results in an HHI are 0.1489 with an average of 0.1491. According to these numbers, at least 50% of Polish hospitals (counties' hospital systems as measured at the level of counties) are located in markets with a concentration of 0.1491 or above. These markets are very close to the threshold of 0.15, which usually serves as an indicator for a moderate level of concentration. As the standard deviation presents around 0.04, it shows that the

hospital concentration is quite differentiated in Poland. The HHI in the sample cities averages around 0.1491 in the analysed period, with the maximum values being an average at around 0.2101 and an average minimum of 0.0512 for all hospitals in Poland.

TABLE 6. **Descriptive statistics of HHI of general hospitals in Poland for years 2005–2013**

Statistcs / year	2005	2006	2007	2008	2009	2010	2011	2012	2013
average	0,1491	0,1489	0,1473	0,1461	0,1459	0,1455	0,1451	0,1561	0,1564
standard deviation	0,0497	0,0499	0,0496	0,0473	0,0467	0,0460	0,0441	0,0491	0,0487
median	0,1455	0,1495	0,1454	0,1478	0,1471	0,1478	0,1445	0,1576	0,1567
maximum	0,2239	0,2252	0,2217	0,2126	0,2045	0,1975	0,1992	0,2025	0,2042
minimum	0,0503	0,0515	0,0516	0,0515	0,0500	0,0502	0,0503	0,0521	0,0534
coefficient of variation	0,3332	0,3351	0,3370	0,3234	0,3205	0,3164	0,3041	0,3147	0,3114

Source: author's calculation according to the data from GUS, Local Data Bank

The calculated HHI for hospital markets by provinces and year are presented in the table 7. As HHI is also a proxy of competition, therefore this table also displays the changes in the structure of Polish hospital market from 2005 to 2013. HHI is also a measure of hospitals concentration in an industry and it is also a measurement of inequality.

TABLE 7. **The value of HHI for hospital market in Poland in years 2005–2013**

Province / year	2005	2006	2007	2008	2009	2010	2011	2012	2013	average
DOLNOŚLĄSKIE	0,1454	0,1480	0,1401	0,1490	0,1444	0,1401	0,1320	0,1580	0,1548	0,1458
KUJAWSKO-POMORSKIE	0,1456	0,1511	0,1524	0,1468	0,1461	0,1462	0,1408	0,1620	0,1601	0,1501
LUBELSKIE	0,1380	0,1385	0,1363	0,1341	0,1360	0,1281	0,1298	0,1380	0,1425	0,1357
LUBUSKIE	0,1219	0,1245	0,1148	0,1203	0,1192	0,1196	0,1212	0,1129	0,1134	0,1186
ŁÓDZKIE	0,2052	0,2033	0,2039	0,1992	0,2078	0,2075	0,2064	0,2164	0,2063	0,2062
MAŁOPOLSKIE	0,1806	0,1751	0,1747	0,1725	0,1757	0,1715	0,1700	0,1858	0,1911	0,1774
MAZOWIECKIE	0,2212	0,2186	0,2191	0,2083	0,2062	0,1984	0,1984	0,2323	0,2340	0,2152
OPOLSKIE	0,1572	0,1585	0,1535	0,1490	0,1481	0,1526	0,1525	0,1754	0,1761	0,1581
PODKARPACKIE	0,0796	0,0798	0,0787	0,0779	0,0777	0,0781	0,0797	0,0847	0,0841	0,0800
PODLASKIE	0,2005	0,2064	0,2067	0,2084	0,2020	0,2115	0,2020	0,2157	0,2162	0,2077
POMORSKIE	0,1596	0,1612	0,1471	0,1478	0,1499	0,1513	0,1496	0,1444	0,1531	0,1516
ŚLĄSKIE	0,0503	0,0515	0,0516	0,0515	0,0500	0,0502	0,0503	0,0521	0,0534	0,0512
ŚWIĘTOKRZYSKIE	0,1170	0,1153	0,1168	0,1171	0,1192	0,1288	0,1331	0,1400	0,1307	0,1242
WARMIŃSKO-MAZURSKIE	0,0973	0,0935	0,0955	0,0957	0,0967	0,0968	0,1083	0,1205	0,1239	0,1031
WIELKOPOLSKIE	0,1416	0,1322	0,1437	0,1477	0,1502	0,1495	0,1483	0,1572	0,1586	0,1476
ZACHODNIOPOMORSKIE	0,2239	0,2252	0,2217	0,2126	0,2045	0,1975	0,1992	0,2025	0,2042	0,2101
average	0,1491	0,1489	0,1473	0,1461	0,1459	0,1455	0,1451	0,1561	0,1564	0,1489

Source: author's calculation according to the data from GUS, Local Data Bank

So, based on the results, above all, it was found that the concentration of general hospitals in the analysed provinces is uneven. There are some provinces that have the value of HHI at around 0.05 and there are provinces with the value of HHI more then 0.20. It means, that the value of HHI of provinces 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 analysed hospitals within this period increased from 0.1491 in 2005 to 0.1564 in 2013, which means that on average hospitals became more concentrated and thus less competitive.

However, in the period of 2005–2011, the value of the HHI was generally decreasing and then after implementing the statutory change regarding hospitals in 2011, it started to increase from 0.1451 in 2011 to 0.1561 in 2012 and then to 0.1564 in 2013. This indicates that the hospital market in Poland has become less competitive over time. However, a province such as lubuskie is an exception to this trend, where in 2012 and 2013 the increase of competitiveness degree took place. This province is located in the West 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 hospitals' sector are likely to result in market power, which can hamper competition and has negative effects on both – patients and third party payers. Such distribution of hospitals infrastructure might affect both, the performance of the hospital sector and the inequities in access to services.

According to the literature, if the HHI takes the value between 0.15 to 0.25 then the hospital market is moderately concentrated. In Poland, the HHI took an average of the value above 0.15 and less then 0.25 in the following provinces: kujawsko-pomorskie, łodzkie, małopolskie, mazowieckie, opolskie, podlaskie, pomorskie and zachodniopomorskie. Four of them had even more then 0.20 those include: łodzkie, mazowieckie, podlaskie and zachodniopomorskie. At average the un-concentrated markets are: dolnośląskie, lubelskie, lubuskie, podkarpackie, ślaskie, świętokrzyskie, warmińsko – mazurskie and wielkopolskie with the HHI taking the value lower then 0.15.

From Table 7, it is also evident that in the whole period of analysis there are no significant changes in the regions of least competitive and most competitive. In every year of analysis, the leading province in terms of market concentration was: zachodniopomorskie in the period of 2005-2008, then łódzkie from 2009 to 2011 and mazowieckie in the years: 2012 and 2013. The lowest degree of hospital market concentration is relatively small, which suggest that the hospital market is quite competitive displayed by the province of śląskie in every year of analysis.

Based on the analysis of every province and county, some tendencies also were noticed. First of all, there are some towns with county rights, which are characterized by relatively high average of 33-45 percent share of all hospitals' beds in their respective provinces. These are the following cities: Warsaw (45%), Szczecin (43%) Łódż (43%), Białystok (42%), Kraków (39%), Poznań (36%), Wrocław (35%), Gdańsk (34%), Bydgoszcz (33%) and Lublin (33%), which are located all over the territory of Poland.

All results were also analysed taking into account the type of counties and percent share of all hospitals beds in their respective province. In this analysis, also the location of province in the geographical region (according to table 5 in the data section) were taken into account.

The central region covers two provinces: mazowieckie and łódzkie. From the analysis presented above it appeared that those two provinces were the leading provinces in terms of market concentration in years 2009–2013. In this region, two cities with the highest percent share of all hospitals beds in their respective provinces are located those are: Warsaw with a 45 percent share of all hospitals beds in the mazowieckie province and Łódź with a 43 percent share of all hospitals beds in the łódzkie province.

In the province of mazowieckie, the rest of the counties (both types) were characterized by 0-6 percent shares of all hospitals beds. Exactly the same pattern was noticed in case of łódzkie province (Łódź – 43 percent and the rest of both types of counties with 0–6 percent share of hospitals beds).

The southern region covers two provinces: małopolskie and śląskie. The province of śląskie was characterized as the province with the lowest degree of hospital market concentration and relatively small. In fact, only one town with counties rights – Katowice – had an average of 14 percent share of all hospitals beds in the province and the rest of the counties of both types had from 0–6 percent shares of all hospitals' beds in this province.

In case of małopolska, the pattern is similar but with a higher percent share of hospitals beds in the city of Kraków – 39 percent. The rest of both types of counties had an average of 0–7 percent shares of all hospitals beds in the province.

The eastern region covers four provinces: lubelskie, podkarpackie, podlaskie and świętokrzyskie.

In the province of lubelskie, the dominance of the city Lublin could be seen. This city had 33 percent while the rest of provinces had a range from 0,30 to 7 percent share of all hospitals beds in this province. In the second province of this region – podkarpackie – there was one city of Rzeszów with 21 percent and the rest of provinces with 1–8 percent share of all hospitals beds in this province. Third province of this region had one city – Białystok – with a 42 percent share and two cities – Suwałki and Łomża – with 10 percent shares of all hospitals beds in the province. The rest of the counties had between 0–5 percent shares of all hospitals beds in the province. The last province in this region is świętokrzyskie with the dominating city Kielce, with 27 percent shares of all hospitals beds in the province. There were three counties with 8 - 9 percent and the rest counties (10 of them) with the 0-7 percent shares of all hospitals beds in the province.

Northern region of Poland covers three provinces: kujawsko-pomorskie, pomorskie and warmińsko-mazurskie. In the kujawsko-pomorskie province, the city of Bydgoszcz had 33 percent and the following cities had: Toruń – 14 percent, Grudziąc – 9 percent and Wrocławek – 7 percent shares of all hospitals beds in the province. The rest of the counties had 0–3 percent shares of all hospitals' beds in the province. The second province – warmińsko- mazurskie presented a different pattern: the city of Olsztyn had

23 percent and the city of Elbląg 16 percent shares of all hospitals beds in the province, while the rest of the counties were with a 0–7 percent shares of all hospitals beds in the province. The last province in this region – pomorskie – could be characterized by the city of Gdańsk with 34 percent and the city of Gdynia with 11 percent share of all hospitals beds in the province. The rest of the counties had between 0–8 percent shares of all hospitals' beds in the province.

The North-west region of Poland covers three provinces: lubuskie, wielkopolskie and zachodniopomorskie. In the province of lubuskie there were two cities with the highest percentage of shares of all hospitals' beds in the province. These are: Gorzów Wielkopolski – 22 percent and Zielona Góra with 19 percent. The rest of the counties had from 2-6 percent shares of all hospitals' beds in the province apart from one county (powiat) sulęciński with more then 8 percent. In the province of wielkopolska, the only city of Poznań had 36 percent and the rest of both types of counties had 0-6 percent shares of all hospitals beds in the province. In the third province of this region – zachodniopomorskie – the city of Szczecin had 43 percent and city of Koszalin had 9 percent with the rest of both types of counties with 0-6 percent shares of all hospitals beds in the province.

South–west region of Poland covers two provinces: dolnośląskie and opolskie. In the dolnośląskie province, Wrocław had 35 percent of shares of all hospitals beds in the province . The rest of both types counties had from 1–6 percent shares of all hospitals beds in the province. Then in opolskie province, the city of Opole had 29 percent and one other type of county – (powiat) nyski – 22 percent shares of all hospitals beds in the province. The remaining counties had between 3 to 8 percent shares of all hospitals beds in the province.

Also, it was concluded that the central and southern regions present the same pattern – the dominance of one city and the rest of the counties had the percentage share between 0–6/7 percent.

Then, the south – west regions and the north – west regions could be characterized as regions with provinces where in every province (apart from wielkopolska, which presents the pattern typical for central and Southern regions) there were two dominant cities with higher percent shares of all hospitals beds in relevant provinces, and the shares of the rest of the counties varied from 0–8 percent. The Northern regions shows similar tendencies or patterns with the exception, that in every province there were two or three cities with high percentage shares of all hospitals beds and then the share of rest of the counties varied from 0–7 percent or 0–3 percent. The eastern region of Poland was quite differential.

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 a tendency to higher degree of concentration and less competitiveness. In every province there is one to three dominant cities because of the relatively high percentage share of all hospitals beds in the relevant province. 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.

Conclusions

Empirical results discussed above support the assertion that in the period of analysis the entire general hospitals sector in Poland has been on average moderately concentrated and thus moderately competitive with the growing tendency to higher concentration and less competition. Moreover, the concentration of hospitals services is diversified across the provinces of Poland and is quite uneven.

The analysis also shows that changes of the health care market, which took place in the analysed period, especially statutory changes regarding hospitals in 2011, affected the level of concentration and thus competition.

As it is also confirmed in the literature that for the competition forces to be effective, several conditions need to be met. Also, an introduction of competition in health care often depends on the proper design of regulation. In this context, the empirical results also suggest that hospital market competition arrangements in Poland do not meet all of the required conditions, because improvement in competition was not observed. Thus some more attention to these fundamental factors, which determine the results of the competitive process should be paid.

However, as with most empirical studies, the findings are also limited mainly by the scope of available data. As this paper has relied on the aggregated data, therefore, the validity of the conclusions is limited to some extent. This is why, serious efforts to develop better sources of data to improve competition measurement should be taken by government. It could have a large impact on studies of competition.

Later on, it is possible to also test whether the level of concentration and thus competition has any influence on the quality and costs of hospital activities. Then, whether variations in market characteristics, such as the number and size of hospitals and physicians are associated with outcomes, such as quality of care etc.

REFERENCES

Baker L.C., (2001), Measuring Competition in Health Care Markets, Health Services Research, Vol. 36, No. 1, Part II

Berki S.E., (1974), Hospital Economics, Lexington Books

Boutsioli Z., (2007), Concentration in the Greek private hospital sector. Health Policy 82

Chen C., Cheng S., (2010), Hospital competition and patient-perceived quality of care: evidence from a single-payer system in Taiwan. Health Policy ; 98 (1)

Cutler D.M., Morton F.S.,(2013),Hospitals, Market Share, and Consolidation, JAMA 310, No 18

Cutler D.M., (2002) Equality, efficiency, and market fundamentals: the dynamics of international medical-care reform. Journal of Economic Literature; 40 (3)

Djolov G., (2013), The Herfindahl-Hirschman Index as a decision guide to business concentration: A statistical exploration, Journal of Economic and Social Measurement 38

Gaynor M., Town RJ., (2011), Competition in health care markets. NBER Working Paper Series,

Gaynor M., Vogt W.B., (2000), Antitrust and competition in health care markets. In: Culyer AJ, Newhouse JP, Handbook of health economics. Amsterdam: Elsevier Science

Halbersma R., Mikkers M., Motchenkova E., Seinen I., (2011), Market structure and hospital–insurer bargaining in the Netherlands. The European Journal of Health Economics

Herfindahl O.C., (1955), Comment on Rosenbluth's measures of concentration, in: Business Concentration and Price Policy, G. Stigler, ed., Princeton University Press, Princeton

Hirschman A.O., (1964), The paternity of an index, *American Economic Review* 54

Jachowicz R, (1970), Zarys technologii współczesnego szpitala, PZWL, Warszawa

Kuszewski K. , Gericke Ch. (2005)., Health systems In transitions Poland, WHO

Pan J., Qin X., Li Q., Messina J.P., Delamater P.L., (2015), Does hospital competition improve health care delivery in China? China Economic Review 33

Rivers P.A., Glover S.H.,(2008), Health care competition, strategic mission, and patient satisfaction. Journal of Health Organization and Management, Vol. 22, No. 6

Rhoades S.A.,(1993), The Herfindahl-Hirschman Index, Federal Reserve Bulletin, Vol.79, No.3

Rój J., (2004), Relationship between Funding Mechanism and Service Effectiveness of Hospital. J. N. Yfantopoulos (ed), The economics of health reforms, Athens: ATINER

Rój J., (2009), The Cost Efficiency of Hospitals in Poland in Zoe Boutsioli (ed),Themes on Health Care: Challenges and Future Actions, Athens: ATINER

Shiell A., (1991), Competing hospitals: assessing the impact of self-governing status in the United Kingdom. Health Policy 19

Schmid A., Ulrich V., (2013), Consolidation and concentration in the German hospital market: The two sides of the coin, Health Policy 109

Tiemann O., Schreyögg J., (2009), Effects of ownership on hospital efficiency in Germany. Business Research; 2(2)

Zelman W.N., McCue M.J., Millikan A.R., Glick N.D., (2004), Financial Management of Health Care Organizations, Blackwell Publishing U.K.

Zwanziger J., Melnick G., Mann J.M., (1990), Measures of hospital market structure: a review of the alternatives and a proposed approach. Socio-Economic Planning; 24(2)

GUS – http://stat.gov.pl/bdlen/app/dane_podgrup.hier?p_id=25991&p_token=2128957222 20.04.15

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