Spatial Analysis of the Relationship between Health Capital and the Level of Health Care Expenditure in Poland

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Abstract:

Purpose: Considering the importance of social health in the national economy the aim of the article is to diagnose the level of health capital and health expenditure as well as to analyse the impact of expenditure on the level of health capital and to assess the spatial differentiation of their spatial distribution.

Approach/Methodology/Design: The analysis was carried out in spatial terms at the NUTS 3 level for the years 2013-2019; the main source of data was the Local Data Bank of Statistics Poland. Taxonomic hierarchization methods (model-free) and classification of multi-feature objects were used. As a result, each object has been assigned a synthetic measure-indicator of the level of health capital (HCV) and an indicator of the level of expenses on health (HCM).

Findings: There is a statistically significant negative nature of the relationship between the analysed categories. The spatial systems of the analysed measures differed from each other. One of the features most strongly influencing the level of health capital turned out to be the location and distance of a given unit (county) in relation to a larger urban centre, which is the centre of local growth.

Practical Implications: The used approach at the local level provides institutions, local government authorities and all other interested units with important information that can be used in planning specific instruments supporting individuals with a deficit level of health capital.

Originality/Value: In this paper has been suggested that it is necessary to increase expenditure on health in units with a relatively low level of health capital to deal with inequalities in this area and support local development. Otherwise, local governments that are currently in the worst situation in the future may never even come close to the level of the phenomenon in the most developed areas, which at the same time will constantly distance the others.

Keywords: Human capital, public health, relationship, spatial disparities.

JEL classification: J24, I15.

Paper Type: Research study.

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1. Introduction

Increased interest in the subject of human capital over the last 60 years is related to both the increase in social awareness of its importance for the entire economy, and its growing role in shaping continuous economic growth. In the history of economics, human capital has long been interpreted from a narrow perspective, but over time it has been noticed that labor resources cannot be identified mainly with the quantitative aspect. This includes the development of science, which resulted in successive industrial revolutions, contributed to a completely new approach in the sphere of economic activity of the population. According to this approach the qualitative aspect is gaining more and more importance.

Human capital consists of smaller elements that can be broadly divided into knowledge, values, skills, motivation and health (Gołaszewska-Kaczan, 2012). This indicates that achieving a relatively high level of it is difficult, as it is burdened with the necessity of consistent stimulation of various factors. The key importance of human capital for the economy is indisputable, and the policy of developed countries in this matter clearly indicates that the qualitative development of labor resources is the basic determinant of creating constant growth and, consequently, economic development. The European Union as an example has implemented programmes aimed at the development of society since its inception. One of the programmes covered by co-financing is The European Social Fund Investing in people, for which in 2007-2013, due to the contributions of the Member States, EUR 115 billion was allocated (European Commission, 2020), and in the years 2014-2020 the amount of funding has reached the level of approx. 121 billion euro (European Structural and Investment Funds Open Data Portal, 2020).

Among the elements of human capital, initially overlooked but now considered to be one of the most important, is health capital. This is due to the fact that health capital is the condition of life and prosperity, and therefore it is the factor that the other components cannot exist without (Mirvis, Chang, and Cosby, 2008; Keeley, 2007; Weil, 2005; Schuller, Preston, Hammond, Brassett-Grundy, and Bynner, 2004; Barro, 1991). Health is a supreme value for human being, which cannot be exchanged for another good or service, and for which people are ready to give up all other aspects of life. The development of health capital has only positive consequences on the micro and macroeconomic scale. All diseases and similar conditions cause, among others, increasing public sector expenditure on health care and social assistance, which with a simultaneous decrease in the activity of labor resources, is a highly undesirable and harmful phenomenon (Klonowska-Matynia, 2019). For this reason, countries decide to allocate relatively high amounts of money to health care, which in the case of Poland means almost PLN 108 billion in 2020 (Local Data Bank of the Central Polish Statistical Office, 2020), i.e., approximatelly 5% of GDP for 2019 (World Bank, 2020).

Moreover, the domain of developed economic areas is the implementation of additive measures for health, an example of which is the European Union Health Programme where since 2003 over 1 billion euro has been allocated (European Commission, 2020).

Health capital, as the leading element of human capital, depends on many factors (including expenditure on health care), therefore the level of differentiation of the phenomenon in selected areas may be significant. The issue of inequality in this area is invariably present in economic literature, and researchers analyze the diversification of the development of entire economies (Barro, 1999; Mankiw, Romer, and Weil, 1992), selected regions (Klonowska-Matynia, 2016; Klonowska-Matynia, 2019a; Di Liberto and Symons, 2001; Badinger and Tondl, 2000; Persson and Malmberg, 1996) or local spatial systems (Rosner and Stanny, 2014). The case of municipalities and counties seems particularly interesting, as the units of the lowest level of territorial division they reflect the features and problems of the local community. Local governments are in direct state-citizen relationship with the inhabitants, which should naturally determine more effective management of local human capital for example due to shaping the optimal policy of spending on health capital. Taking into account the importance of social health in the national economy, an attempt to diagnose the level of health capital and expenditure on public health was made.

The aim of the article is to diagnose the level of health capital and health expenditure as well as to analyze the impact of expenditure on the level of health capital. The existence and nature of relationships between the level of health capital in given territorial units (counties) and the public expenditure on health incurred by them were verified. Answering the questions about the level and spatial differentiation of public health expenditure and the level of health capital and the relationships between them is believed to be interesting. In response to such a problem, the hypothesis according to which there is a negative relationship between the expenditure on health care and the local health capital were verified. It was also assumed that the level of expenditure and human capital varies regionally, and their distributions are not similar. The research was based on annual average data from 2013-2019. The subjects of the research were counties and, importantly, cities with of units. The sample size was 314 local governments. The source of the data was the Local Data Bank of the Central Polish Statistical Office.

2. Literature Review

The evolution of the economy has led to the emergence of a completely new view of factors of production, and in particular of human resources, which until the 1950s were interpreted in a limited way. Only the creation of the initial outline of human capital made researchers realize that this economic category is one of the most important factors shaping economic growth, and thus social inequalities (Klonowska-Matynia, 2016). Already in the 1960s, the basic assumptions of the theory of human capital appeared, mainly thanks to the achievements of Mincer (1958), Schultz (1961)

and Becker (1962). The elementary development of the issue however, took place in the next decade due to the works of, among others Becker (1964), Ben-Porath (1967) and Mincer (1974).

The theory of human capital was created on the basis of the thought created by Smith (1954), according to which the quality of labour resources was primarily influenced by the skills obtained in the education process. This view had a significant impact on the initial period of intensive research on this subject, as it was assumed that human capital is the result of formal education, i.e., both the level of education and the time devoted to this purpose (Schultz, 1963; Mincer, 1958; Schultz, 1961; Becker, 1964; Mincer, 1962; Hanushek, Ruhose, and Woessmann, 2015; Hanushek and Woessmann, 2010). It was only over the years that this question was supplemented with an element of physical and mental health (e.g., commitment and motivation) (Schultz, 1975), as the result of publications, among others S.J. Mushkin (1962). Therefore, there is no doubt that the extension of the theory of human capital contributed to the creation of the theoretical framework for the analysis of health capital (Galama and van Kippersluis, 2013) and, consequently, the development of the so-called health capital model (Grossman, 1972; 2000).

The importance of health capital in the valuation of the general level of human capital is particularly visible in the qualitative dimension, as it is health that is the main determinant of the quality of labour resources (Klonowska-Matynia, 2016). It is important to mention the important role of knowledge and skills, which are the qualitative basis of the individual's productivity and income (Callander, Schofield, and Shrestha, 2012; Garcia-Gomez, van Kippersluis; O'Donnell, and van Doorslaer, 2013; Smith, 1999). However, as noted by Grossman (1999), health capital shapes the period in which people will use the achieved level of wisdom. Jones (2001) claims that the positive impact of health on increasing the quality and efficiency of work performed is undeniable on the micro and macro scale.

Alsan, Bloom, and Canning (2004) see the reasons for this phenomenon e.g., in the fact that the optimal level of health of an employee determines his mental and physical resistance to effort and fatigue, which in turn leads to a relatively low absenteeism. Moreover, the authors indicate that better health results in an increased life expectancy in terms of professional activity, thanks to which labour resources have the opportunity to obtain more advanced professional experience. Alsan, Bloom, and Canning (2004) admit that all this leads to the maximization of the value of return on other forms of human capital, such as professional experience or the level of education.

On the basis of many years of economic achievements, a fairly widespread belief has arisen that health capital is currently one of the most important factors of economic growth (Rój, 2006). Such conclusions were significantly contributed by the development of the endogenous growth theory in the 1980s, according to which economic growth is mainly dependent on innovation and human capital (health)

(Graniewska, 1999; Klonowska-Matynia, 2016). Health has a direct impact on better physical, emotional, mental and intellectual development. Moreover, it also indirectly shapes the activity of the population in the labour market. It is very important, especially when analysing the negative consequences of the deterioration of the health capital of the society. All illnesses and other reasons for absenteeism reduce the activity of employees on the labour market, and therefore incomes in the economy decrease. Deterioration of the health of individuals, relatively often, necessitates an increase in expenditure on health care or social welfare, while simultaneously reducing activity in other areas of socio-economic life, which not only reduces the quality of life of those affected but also of the others (Kuczek, 2009). On this basis, it can be concluded that the consequence of diseases is a declining economic growth rate not only at the time of their occurrence but also in the future (Pęciłło, 2012; Jones, 2001).

Research aimed at estimating economic losses in connection with the deterioration of health condition clearly shows that there is a strong positive relationship between the level of health capital and the micro and macroeconomic environment (including even the phenomenon of technological progress) (Jones, 1999). The same conclusions regarding the symmetry of the relationship between human capital and economic growth are suggested by the results of the analyses which, in a broader sense, also show the mutual dependence between categories (Jessua, Labdrousse, and Vity, 2001; Lucas, 1988; Romer, 1986; Jones and Schneider, 2006; Jones and Manuelli, 1990; Romer, 1990).

One of the universal features of health capital is that every human being is born with its limited resource, which, under favourable conditions, grows up to a certain age, and then becomes depreciated in the ageing process. An individual's genetic makeup has a key impact on health capital, but there are many other factors that can determine its level. Most studies look for the causes of health inequalities in the aspect of functioning pro-health attitudes (Vogl, Cutler, and Lleras-Muney, 2011). They can be shaped mainly due to health awareness, which, according to Gołaszewska-Kaczan (2012), is inextricably linked with the level of education. This is confirmed by numerous analyses showing the strong positive impact of education on health (Cutler and Lleras-Muney, 2010; Conti, Heckman, and Urzua, 2010; van Kippersluis, O'Donnell, and van Doorslaer, 2011; Grossman, 2015). Research shows that people with relatively higher education more often examine themselves, spend more on preventive healthcare, eat better, maintain higher physical and mental fitness despite the passage of years, which, depending on age, results in a reduction in the incidence, mortality and disability rates (Winkleby, Jatuulis, and Fortmann, 1992; Kunst and Mackenbach, 1994; Ross and Wu, 1996; Mirowsky and Ross, 1998; Lleras-Muney, 2005; Kuntsche, Rehm and Gmel, 2004; Brunello, Fort, Scheeweis, and Winter-Ember, 2016; Oreopoulos, 2006; Heckman, Stixrud, and Urzua, 2006; Chevalier and Feinstein, 2007). The relation is not mutual, however, because, as Wilkinson (1986) notes, no significant influence of health on the education of an individual has been found.

Another important feature from the perspective of scientific achievements, shaping the inequalities of health capital, is the profession performed by the population (Adler, Boyce, Chesney, Folkman, and Syme, 1993). As noted by Marmot (1997), Borg, Kristensen, and Burr (2000), and Case and Deaton (2005), people with a relatively lower social status are more likely to work physically or in occupations with relatively higher levels of stress and other negative psychosocial factors. This seems to be in line with the opinion of Smith (1999), Adams, Hurd, McFadden, Merrill, and Ribeiro (2003) and Michaud and van Soest (2008), whose research showed the impact of economic difficulties of individuals on their deterioration in health. This leads to the conclusion that the level of affluence also plays an important role in shaping health capital. Interestingly, the research conducted so far proves that economic status is a strong determinant of health, but only for middle-aged groups (Moller-Dano, 2005; Halla and Zweimuller, 2013; Garcia-Gomez, van Kippersluis, O'Donnel, and van Doorslaer, 2013; Case and Deaton, 2005). The analysis by Maer, Richars, and Cutler (2008) went a step further and presented a specific age range in which the relationship is statistically significant. The authors proved that the phenomenon occurs in society only between the ages of 20 and 60.

Health is undoubtedly of key importance to the economy, therefore in developed countries one of the basic goals of socio-economic policy is the reduction of health inequalities (Klonowska-Matynia, 2019). However, making decisions by governments in this aspect is hampered by the complexity of the issues of the broad area of health. The model of health capital has a particularly large contribution to the resolution of this issue, thanks to which it was possible to better understand health inequalities and, consequently, to make more effective actions by the authorities (Grossman, 2000). Researchers indicate that the range of actions that could be taken by states includes creating an insurance policy and access to health care (Adler, Boyce, Chesney, Folkman, and Syme, 1993), or protection of the population against the economic consequences of job loss and potential poverty (Smith, 2007; Smith, 1999).

Therefore, it can be assumed that, apart from generating legal conditions, national, local and regional authorities may directly influence the level of health capital by incurring specific expenses for this purpose. Currently, there is an opinion in economics that investments in health capital, apart from having a significant impact on economic growth, also determine the economic advantage of individual administrative areas (Graniewska, 1999). However, Korporowicz (2005) notes that such expenses are very expensive, and the so-called potential return from them must be considered only from the long-term perspective, which limits the possibility of a quick assessment of the correctness of decisions made in this area. Despite certain difficulties in managing health capital, this issue should be a priority of the financial policy of countries, because underinvestment in this category may constitute a significant barrier to growth, especially in relatively less developed countries (Gołaszewska-Kaczan, 2012). According to, among others, Rój (2006) and Gołaszewska-Kaczan (2012), this situation also occurs in Poland, as the expenditure

on health, which is a component of human capital, is insufficient, and results in limited socio-economic development.

3. Method and Scope of Research

Health capital is a broad topic that is relatively difficult to define and measure. There are no universal measures enabling the quantification of this phenomenon in the same way, regardless of the area of analysis, and there is no universally accepted measure of health capital, which causes some relativism in the selection of categories characterizing the phenomenon. The existing knowledge in this field suggests that health capital should be calculated on the basis of such diagnostic features that will enable a broad description of the demographic situation in a given area such as births, deaths, diseases, size of the population etc. Based on access to data, statistical requirements (Kukuła, 2014) and the current literature on the subject (Klonowska-Matynia, 2016; 2019; 2019a), the following indicators were adopted as diagnostic variables forming the image of health capital (HCV – health capital value):

- indicator of the youth potential of labour resources (relation of the number of pre-working age population to working age population) – the higher the value of the indicator, the better the prospect of achieving higher economic growth (greater production capacity);
- number of live births per 1 thousand – the higher the value, the better the situation in shaping the demographic potential;
- number of deaths per 1 thousand – high value may indicate the phenomenon of an ageing society, depreciation of human capital, insufficient level of health protection or poor quality of medical care services;
- natural increase rate per 1 thousand – the higher the value, the greater the demographic potential, it determines the attractiveness of a given unit, development possibilities of a given unit;
- the demographic dependency ratio (the ratio of the number of people in non-productive age per 100 people in working age) – high unfavourable values are characteristic of ageing societies, they may indicate a contraction of labour resources and a reduction in the production capacity of a given economy;
- number of infant deaths per 1,000 births – a measure reflecting the level of health care or the health and living conditions of the population.

Bearing in mind the strong links between health capital and other areas of life, such as education and the labour market, the selection of diagnostic variables to measure the level of health expenditure should take into account not only issues strictly related to health protection, but also aspects related to education, social support or physical culture. The use of literature studies in the area of the subject of the research (Klonowska-Matynia, 2016; 2019; 2019a), considering the criterion of data availability and statistical verification allowed the adoption of the following indicators, which take into account the cross-section of the ability of expenditure

(other than lawmaking) local governments to influence the level of health capital from birth to the death of labour resources (HCM – general level of expenditure on health):

- social assistance expenses per capita,
- expenditure on physical education per capita,
- expenditure on education and upbringing per capita,
- health care expenditure per capita,
- capital expenditure on health care per capita.

After listing the variables characterizing both complex phenomena, calculations using the appropriate research method were made. The research uses the synthetic measure method, which makes it possible to obtain a unitized measure characterizing a given category based on selected variables (Wysocki and Lira, 2003). The main feature of the method is that one of its stages is the process of normalizing diagnostic variables into simple features (Feltynowski, 2009). Zero unitization method was used for this purpose (Wysocki and Lira, 2003). Based on the obtained simple features, it is necessary to calculate the synthetic measure according to the formula (Klóska, 2012):

$$q_i = \frac{\sum_{j=1}^{m} z_{ij}}{m} \alpha_j, (i = 1, 2, 3, \dots, n) \tag{1}$$

where: q_i – calculated value of the synthetic measure, z_{ij} – standardized value of the j feature of the i unit, m – number of features included, α_j – weight of the j variable.

On the basis of the above procedure, two synthetic measures were calculated: the first one expressing the general level of health capital (HCV) and the second one defining the general level of expenditure on health (HCM). The synthetic measure method is characterized by the fact that the obtained measure is always in the range from 0 to 1, with 1 being the maximum value of the studied phenomenon in relation to the remaining units from the sample. The last element that allows to organize the obtained results of the synthetic measure is to put them into classes or groups. In the research, it was decided to organize the counties into equal (quintile) groups based on a synthetic measure.

In order to verify the relationship between the level of health expenditure (HCM) and the level of health capital (HCV), the appropriate research method had to be selected. This requires knowledge of the statistical parameters of the studied variables. For this purpose, they were tested for stationarity using ADF test (Khim-Sen, Zubaidi-Baharumshah, and Tai-Leung Chong, 2003), normality of the random component distribution using Doornik-Hansen test (Yigit and Mendes, 2016) and autocorrelation of residual distribution using Durbin-Watson test (Savin and White, 1977). On this basis, the ordinary least squares method (OLS) was used to examine the relationship (George, Seber, and Lee, 2003; Yan and Gang Sun, 2009).

The analysis was performed at the county level, excluding cities with county rights. Overall, the study covered 314 local government units in Poland. The annual average data for 2013-2019 from the Local Data Bank of the Central Polish Statistical Office was used to estimate the synthetic indicators of the general level of health capital and public expenditure on health.

4. Research Results

Based on the values of the estimated synthetic indicator of the general level of health care expenditure (HCM), the counties were prioritized and classified into equal groups. On this basis, an assessment of the spatial differentiation of the distribution of health care expenditure in Poland was made (Figure 1). In the group of the first five counties with the highest level of expenditure on health care in the country, there are: Mogileński, Sępoleński, Pułtuski, Słupecki, and Krotoszyński counties (the level of expenditure is 30% and more than the national average). The lowest expenditure on health care is incurred by the following counties: Skierniewicki, Kaliski, Leszczyński, Częstochowa, and Siedlce (the level of expenditure is approximately 90% or less than the national average). The analysis of the spatial distribution of health care expenditures allowed to state that counties with a relatively high level of expenditures are grouped in the area of eastern Poland, especially in the Warmińsko-Mazurskie, Podlaskie and Podkarpackie voivodeships.

In the western part of the country, counties with above-average expenditure are numerous in the Wielkopolskie and Lubuskie voivodships. There are also counties with relatively high public health expenditure on the border of three voivodeships: Zachodniopomorskie and Pomorskie, and on the western wall of the Kujawsko-Pomorskie voivodeship on the border with the Pomorskie voivodeship. In the remaining parts of the country, counties with relatively high expenditure occur incidentally.

Figure 1. *The expenditure on health (HCM)*


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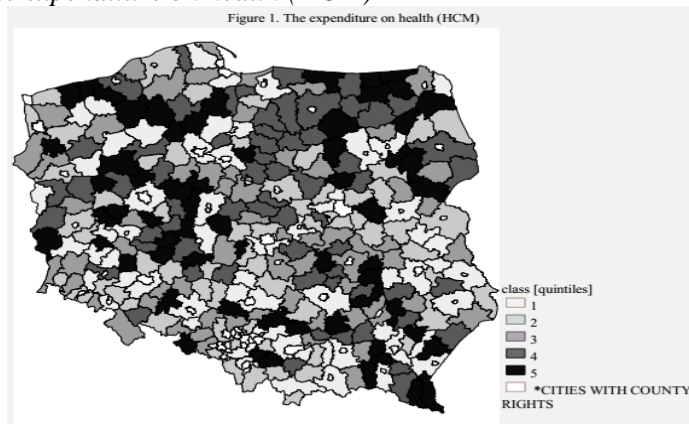
Source: *Own study.*

The spatial analysis of the distribution of the general level of health capital (HCV) indicates a relatively strong concentration of counties with an above-average level of health capital in three voivodeships in the country (Figure 2): Pomorskie (counties: Kartuski, Gdańsk, Wejherowski, Kościerski, Puck, Bytowski, Chojnicki), Małopolskie (counties: limanowski, nowosądecki, bochnia, wielicki, and Myślenice), wielkopolskie (counties: poznański, leszczyński, średzki). In other parts of the country, larger clusters of counties with a relatively high level of health capital are relatively rare and, in fact, only in the central and eastern part of Mazowieckie voivodeship (counties: Wołomiński, Piaseczyński, Garwoliński, Grodziski). In other areas of the country, the presence of counties with a high level of health capital is incidental, with no tendency to spatial concentration.

A characteristic phenomenon of a stronger spatial concentration of counties with a relatively high level of health capital was observed around the largest and most economically developed urban centres, such as: Warsaw, Trójmiasto, Szczecin, Poznań, Bydgoszcz, Kraków or Wrocław. The observed regularity is consistent with the theory of the so-called satellite areas, explaining the mechanisms occurring around specific cities, which strongly affect the surrounding municipalities or entire counties. For this reason, areas concentrated around economically strong urban units are characterized by more developed and more attractive labour markets, greater access to specialist medical care, or a higher level and access to education, and thus higher awareness about health in human life.

Figure 2. *Spatial distribution of the level of health capital (HCV) – a synthetic approach*

Figure 2. The level of health capital (HCV)

class [quintiles]
1
2
3
4
5
*CITIES WITH COUNTY RIGHTS
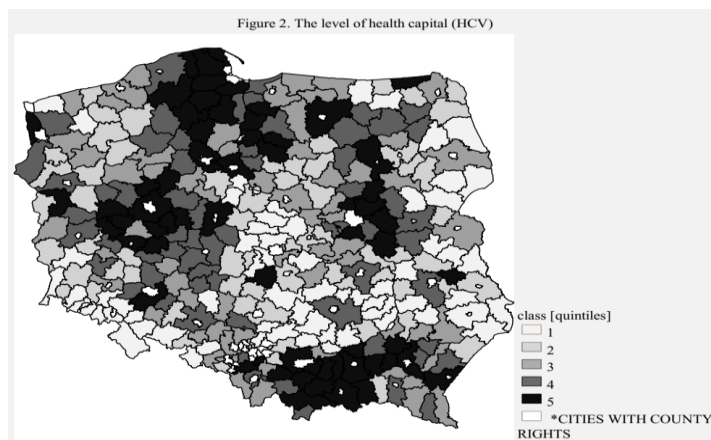
Source: *Own study.*

The spatial presentation of the level of both analysed phenomena does not give an unambiguous answer to the question about the dependence between them. There are cases of counties in which both categories are relatively high (e.g., counties in the Olsztyn Lakeland) or low (e.g., counties in the Kraków-Częstochowa Upland). There are also cases of counties in which, for example, the level of health capital is at a

relatively high level, and expenditure on health is low (counties in the Małopolskie Voivodeship) or vice versa (counties in the Podlaskie Voivodeship). To illustrate the described phenomenon, the indicator of the level of health capital (rHCV) and expenditure on health in relative terms (rHCM), i.e., in relation to the average level of the measure, was used. Due to this fact it was possible to assign a given local government unit to one of the four groups of counties: A, B, C and D (Figure 3). The spatial distribution of A-type counties (areas of favourable assessment) indicates that they are most numerous in the Małopolskie and Pomorskie voivodeships. There are also visible clusters of poviats from this group in the central part of the Mazowieckie, eastern Lower Śląsk, southern and eastern Wielkopolskie and central Lubelskie voivodeships. The situation was completely different for the C counties (deficit areas), which dominated in the western and southern part of the Pomorskie Voivodeship, most of the Warmińsko-Mazurskie Voivodeship, the central and southern part of the Wielkopolskie Voivodeship, the southern part of the Zachodniopomorskie Voivodeship, as well as the central and south-eastern voivodeship Kujawsko-Pomorskie.

Figure 3. *Relation between the measure of health capital (rHCV) and the measure of health expenditure (rHCM) in relative terms*

a) Effects of unit positioning
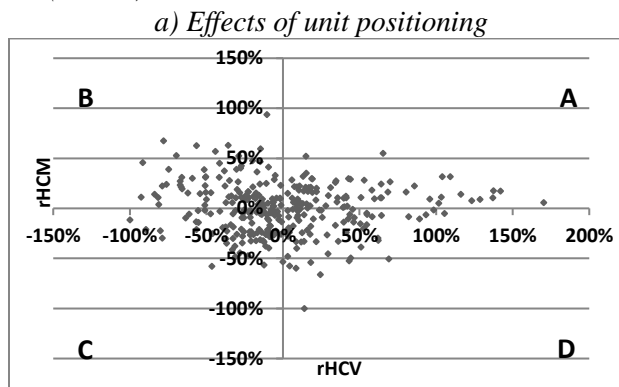
b) Spatial differentiation
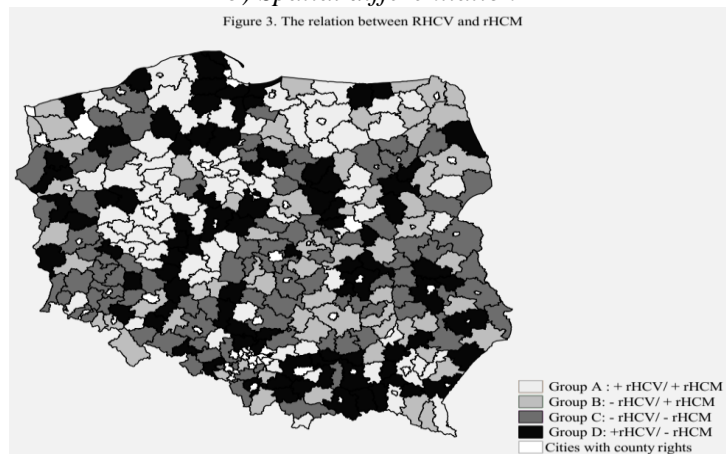
Where:
Group A : + rHCV/ + rHCM [percentage share 23%]
Group B: - rHCV/ + rHCM [percentage share 21%]
Group C: - rHCV/ - rHCM [percentage share 28%]
Group D: +rHCV/ - rHCM [percentage share 28%]
Source: *Own study.*

In order to verify whether there is a relationship between the level of health capital and health care expenditure, the variables were first tested in terms of specific statistical features (Sobko and Klonowska-Matynia, 2019; Wang and Jain, 2003; De Gooijer, 2017). It was found that the series were stationary at level I (0), random distribution normality and no residual autocorrelation phenomenon. On this basis, the analysis of the relationships was performed using the ordinary least squares method (OLS). The study of the relationship between health expenditure and health capital was programmed in such a way as to verify all possible annual delays of the explanatory variable (the level of health expenditure measure) in relation to the dependent variable (health capital measure). Such an approach was dictated by the fact that, in accordance with the substantive premises and the literature on the subject, the impact of expenditure on health in shaping health capital should be considered in the longer term (Korporowicz, 2005). The analysis was carried out using a synthetic measure of the level of health expenditure and the level of health capital estimated separately for subsequent years in the period 2013-2019.

The results of the analysis of the relationship between health expenditure and health capital showed that the statistical relationship between the analysed categories existed in the selected period of time. The relationship was negative, which means that with the increase in expenditure there was a decrease in the level of health capital.

Table 1. *Statistical impact of health expenditure on health capital*

Year (lag)	R2 (%)	F	p(F, X)	X	Constant term	Standard error (%)
2013**	2	5,3	0,022	-0,14	0,62	14
2014**	2	5,1	0,026	-0,11	0,55	14
2014(-1)*	1	2,8	0,094	-0,09	0,55	14
2015***	2	7,1	0,008	-0,15	0,58	14
2015(-1)***	3	10,6	0,002	-0,16	0,59	14
2015(-2)**	2	6,1	0,014	-0,14	0,58	14
2016***	3	8,2	0,004	-0,14	0,61	13
2016(-1)***	3	8,6	0,003	-0,16	0,61	13
2016(-2)***	4	12,3	0,002	-0,16	0,61	13
2016(-3)***	3	9,8	0,002	-0,17	0,61	13
2017*	1	2,8	0,093	-0,11	0,51	14
2017(-1)**	2	4,9	0,027	-0,12	0,52	14
2017(-2)**	1	4,6	0,034	-0,12	0,51	14
2017(-3)***	3	9,1	0,003	-0,15	0,53	14
2017(-4)**	2	6,4	0,012	-0,15	0,53	14
2018	1	1,2	0,284	-0,05	0,49	15
2018(-1)**	1	4,1	0,044	-0,13	0,51	15
2018(-2)***	3	8,3	0,004	-0,16	0,53	15

2018(-3)***	3	11,1	0,001	-0,19	0,53	14
2018(-4)***	5	16,4	0,001	-0,21	0,54	14
2018(-5)***	3	10,4	0,002	-0,19	0,54	14
2019***	2	7,8	0,006	-0,16	0,54	14
2019(-1)	1	1,5	0,221	-0,06	0,52	15
2019(-2)**	2	6,7	0,011	-0,16	0,55	14
2019(-3)***	4	13,5	0,001	-0,19	0,57	14
2019(-4)***	4	13,8	0,001	-0,22	0,56	14
2019(-5)***	6	18,5	0,001	-0,21	0,57	14
2019(-6)***	5	14,8	0,001	-0,23	0,57	14

(***) In the selected year, the regression equation and independent variables statistically significant at the level of significance α=1%, (**): α=5%, (*): α=10%.
Source: Own study.

Interestingly, the relation was found annually (e.g., the impact of changes in the level of expenditure in 2013 on changes in the level of health capital in 2013) for 86% of the analysed cases and in the area of delays (e.g., the impact of changes in the level of expenditure in 2013 on changes in the level of health capital in 2014) for 93% of cases. It is one of the premises confirming the phenomenon of the impact of expenditure on health capital in the perspective of several or many years.

5. Discussion

The theory of economics clearly indicates the need to invest in health capital in order to stimulate and maintain a certain level of economic development through a certain level of expenditure (Jaworzyńska, 2011; Cooray, 2013). The previous achievements of science show that the real effects of the expenditures for this purpose can only be expected in the long term (Zarzycki and Malaczewski, 2020). The key importance of health capital for the economy is also confirmed by Zarzycki and Malaczewski (2020), who suggest the possibility of using this measure as an alternative indicator of the economic situation. However, as noted by Cooray (2013), a significant impact of health capital on the economy can be observed only in more developed countries. Verulava and Dangadze (2018) suggest that in some sense this is due to the fact that in relatively poorer countries people on average work more and earn less (they are overworked and do not have the time or sufficient resources to take better care of their health), and the state does not have adequate possibilities to allocate greater expenditure to health capital. Moreover, the authors point out that in poorer countries the population lives shorter on average, and, for example, expenditure on education seems more attractive to society if the prospect of a longer life is visible.

Previous studies on health capital in Poland are not optimistic, as they confirm the occurrence of an unfavourable phenomenon in the form of underinvestment in public health, which translates into a low level of general assessment of human capital (Gołaszewska-Kaczan, 2012; Rój, 2006; Klonowska-Matynia, 2016). The subject research of local government units confirms that problems with the deficit of this resource occur both at the local and regional level. Klonowska-Matynia (2019; 2016) in her studies shows that there is a significant differentiation of local government units

in health capital and health expenditure, which in the long run leads to the unfavourable phenomenon of inequality and may be the cause of a different level of socio-economic development, as well as different dynamics and direction of ongoing development processes. Klonowska-Matynia (2019; 2016) proves that the spatial arrangements of both categories are different. The analysis conducted in this article leads to similar conclusions. There may be many reasons for this (e.g., the geographical location of a given local government, peripherally, distance to the regional development centre), but the opinion of Mear, Richards, and Cutler (2008) is certainly interesting, as they claim that relatively often despite the increase in the value of expenditure on health capital, the disproportions in its level between specific units are constantly growing.

The spatial distributions of health capital and health expenditure obtained in this study are consistent with the results of analogous studies carried out at the level of counties, carried out by Klonowska-Matynia (2019). Comparing the obtained results with regional analyses, the subject of which were voivodeships, the relative similarity of spatial systems for both the health capital level and public health expenditure is visible (Klonowska-Matynia, 2016; Mossakowska and Zawojska, 2009; Klonowska-Matynia, 2019a). An important issue related to the conducted analysis is the found and statistically significant negative nature of the relationship between the level of health capital and the level of health expenditure. This may be surprising in the sense that expenditure on health should increase the level of health capital. Considering the issue of the delayed real impact of health expenditure on health capital, the obtained results are correct and mean that the units that incurred the highest health expenditure in the analysed period were characterized by a relatively low level of health capital.

Therefore, the increased expenses incurred are justified in this case, with the expectation that in the long term they will contribute to an increase in the level of health capital in each unit. In the long run, it might turn out that the results would indicate a positive relationship. However, at this stage, insufficient evidence has been obtained to support this assumption, which indicates the need for in-depth, further analysis of this issue.

6. Conclusion

This article deals with important issues concerning the level and spatial differentiation of health capital and health care expenditure in Poland. It is extremely necessary in the context of growing inequalities in the socio-economic space observed both in the international, interregional and local perspective. It is also part of the research stream that searches for the causative factors of the existing diversification. The conducted research made it possible to achieve the aim of the article, which was to diagnose the level of health capital and public health expenditure, and to analyse the impact of expenditure on the level of health capital. The selection of research methods allowed to positively verify the research hypothesis. As expected, there is a negative relationship between the analysed categories. The presence of spatial differentiation

in the level of both health capital and expenditure for this purpose was also confirmed. The spatial systems of the analysed measures differed from each other, and one of the features most strongly influencing the level of health capital turned out to be the location and distance of a given unit (county) in relation to a larger urban centre, which is the centre of local growth. The research results are consistent with the conclusions of the previous studies by other authors on the spatial differentiation of human capital in Poland (Klonowska-Matynia, 2016; 2019; 2019a; Mossakowska and Zawojska, 2009).

The article broadens the knowledge of the qualitative factors that significantly differentiate the socio-economic space in Poland. It has an application character, as it provides institutions, local government authorities and all other interested units with important information that can be used in planning specific instruments supporting individuals with a deficit level of health capital at the local level. This is extremely important as it means that the usefulness of the research results is much higher than in other more general approaches, e.g., at the regional or international level. This enabled the identification of local units either in deficit or in surplus of this key resource.

The conclusions from the article may suggest the need to revise current policy of transferring funds to health capital and to transfer the direction of activities to a greater extent from the regional to the local level. The suggested approach at the lowest local level should make it possible to see to a greater extent the internal differences between individual units, which is not always visible from a regional perspective. The results contained in the article may to some extent suggest that it is necessary, inter alia, to increase expenditure on health in units with a relatively low level of health capital. Otherwise, local governments that are currently in the worst situation in the future may never even come close to the level of the phenomenon in the most developed areas, which at the same time will constantly distance the others.

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