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Health Inequality Determined by Education and Income in European Countries

Summary: It was revealed that in the years 2006–2015 the highest health inequalities characterized the inhabitants of Europe with low level of education and in the second income group GIH-Q20-40. The lowest inequalities in terms of health were revealed among the Europeans with secondary education and the highest income group. The highest inequalities with bad health were found among Europeans with higher education and the highest income group. The reason for the inequalities are other determinants of the state of health, e.g. availability of health care services. The lowest inequalities with bad health were revealed in a group of people with secondary and lower education and occurred in 2014 in the first and third income group.

Keywords: health inequality, health determinants, education, income, the Gini index.

Introduction

The aim of the article is an assessment of health inequalities that were taking place in the years 2006–2015 among inhabitants of European countries. The analysis was developed on the basis of health variables of the European Statistics of Income and Living Condition (EU-SILC), European Health Interview Survey (EHIS) [6]. The *SRH-self-rated health* variable depending on education and income has been used. The research on inequality has been focussed on inequalities determined by age, education, income ([1], [7], [19], [20]). When verifying the relations health-income, S.H. Preston proved that a higher income determines a higher level of health protection expenses, higher possibility of education as well as a better quality of the consumed food [12]. Results of social studies, carried out in different European countries, reveal that the lower socio-economic status (particularly the educational one), the worse statistically the health behaviour, motivation to introduce changes in one's life, and thereby health [9]. What is more, the level of education, particularly of women in individual households is important for the state of health and the income factor, as

a variable diversifying the state of health, diminishes together with the increase of the level of education of the population ([10], [13], [5], [21]).

Earlier studies carried out by the authoress show, that there is a clear correlation between the Social Determinants of Health (SDH) in the social groups (urban-rural). Increase of education results in better state of health. This relation is more clear and significantly higher in rural areas. The subjective assessment of the state of health of the inhabitants of Poland is getting better, but there is also health inequality dependent on other Social Determinants of Health (SDH) [4]. The studies carried out by the authoress show that the employed and living in close relationships inhabitants of the urban areas of Poland are healthier than the unemployed and vocationally passive single ones. In the relation health-income in the empirical research to date, the authoress showed that people in Poland declaring income in the 1st and 2nd quintile group rate their health as worse contrary to the inhabitants with income in the 3rd, 4th, 5th quintile group. Whereas, affiliation to a higher quintile group of income increases an opportunity of a household to take advantage of bank loans or credits in comparison to the poorest households (the 1st quintile group of income), which may influence improvement of their lifestyle.

The research was started in order to investigate and understand the degree of inequality in health taking place in European countries, and it was assumed that there is probably a distinct correlation between the Social Determinants of Health (SDH), i.e. education and income and the state of health of the population in Europe.

There were two research hypotheses formulated during the process of planning the research:

H1: low health inequality in the European population is determined by education and income;

H2: the highest health inequalities characterised the European population with low level of education and income.

Hypothesis H1 assumes that there is a statistically significant connection among, *inter alia*, education and income and health inequality.

Verifying the H1 hypothesis includes not only an analysis of the relations between health determinants and the level of inequality of the population, but allows indicating occurrence of concentration of a positive state of health among people with higher education and negative state of health in people with lower education. The construction of the hypothesis H2 is based on analysing the differences in the general health of the population in social groups with different levels of education and different income as consequences of using one's skills and knowledge in healthy lifestyle.

1. Methodology

The research is focussed on analysis of the relation between the socio-economic status and the health inequality of the populations of the European countries.

The Gini index has been calculated by analysing the relations between the state of health and education and income. The Gini index is a measure of concentration (inequality) of the random variable distribution. Because the data is presented by Eurostat MSO in the form of association tables, the following formula was used to describe the *GIH(x)* index:

$$G(x) = \frac{\sum_{i=1}^{n}(2i-n-1)x_i}{n^2\overline{x}} \qquad (1)$$

where the used symbols denote:
x_i – individual *i*-th value of a given phenomenon,
x – arithmetic mean,
i – position of a rank,
n – number of the sample group.

The Gini index assumes the values from the [0; 1] range, though it is often expressed in percentage. Inequality in distribution means increased value of the coefficient, whereas full evenness in distribution is expressed by zero value. Moreover, 0.01 means that almost each individual person in a given age range or in a given country has the same, equal level of health. In turn, the coefficient 0.99 informs that a person within a given age range or in a given country is „fully" healthful and the others do not reach it at all. Countries in which the Gini index exceeds 0.5 are usually described as oligarchic.

The convenient range of the Gini index from 0 to 1 is a relative measure allowing easy comparison of the degree of inequality in populationsm of different number of inhabitants and different mean health variables [8], [11].

Technically dividing the bracket [0; 1] into three parts: <0–0.3(3)>, <0.3(3)–0.6(6)>, <0.6(6)–1>, it is possible to assign the values of the Gini index to respective level notations: low, moderate and high [14], [22].

The questionnaire for investigating the SRH-self-rated health assessment as well as the scale of responses was discussed by the authoress in papers [15]–[18]. In this study, in order to analyse variables characterising, the SRH assessment was transformed into the dichotomous variable with such categories as: good health (very good and good) and bad health (bad and very bad).

The analysis was based on the data of Health Variables of the European Statistics of Income and Living Condition (EU-SILC)[1] taken from Eurostate. The

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[1] The European Statistics of Income and Living Condition (EU-SILC) survey contains a small module on health, composed of 3 variables on health status and 4 variables on unmet needs for health care.

investigation included Austria, Belgium , Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, the United Kingdom. The time range includes the years 2006–2015.

2. Results and discussion

The analysis was started from examination of the relations between self--rated health in terms of gender, age and educational attainment level. The level of education of a natural person is classified according to the International Standard of Classifying Education (ISCED) and grouped in the following way: pre-primary, primary and lower secondary education (ED02), upper secondary and post-secondary non-tertiary education (ED3_4), first and second stage of tertiary education (ED5_6) [6].

Spatial distribution of the expected healthy lifespan for people with low education, the values of which were assessed for 2014 in reference to the European countries is presented in Fig. 1.
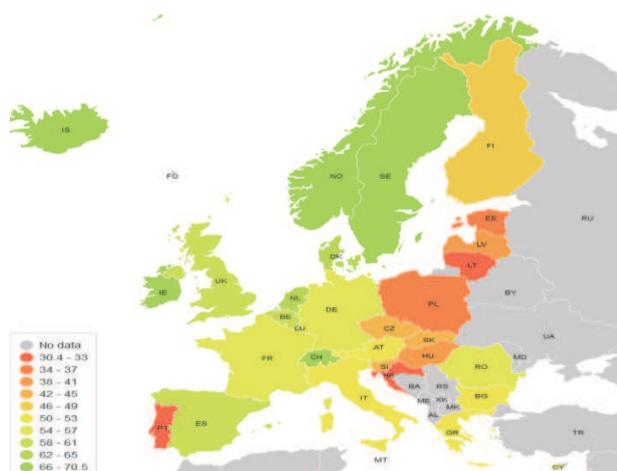

Fig. 1. Proportion of people with low educational level, who rate their health to be *very good* or *good*

The self-rated health index (Fig. 1) shows the proportion of people, who rate their health as *good* or *very good*. There are clear differences between the SRH--self-rated health index and *Healthy Life Expectancy* HLE for the population with low education, the value of which assessed for 2014 fluctuated from 70.5 to 30.4 years. As an illustration, values of the *Healthy Life Expectancy* HLE index of the best five and the worst five countries, calculated for the population with low education, are given underneath.

Table 1. Value of the low education HLE index for the countries of the highest and the lowest levels

Countries	*HLE education low*	Countries	*HLE education low*
Norway	70,5	Poland	37,6
Switzerland	68,7	Estonia	35,6
Iceland	68,0	Croatia	33,8
Ireland	67,7	Portugal	33,5
Sweden	67,6	Lithuania	30,4

Source: own study based on data [6].

In the case of the Healthy Life Expectancy for the population (without dividing it into genders) with low education Poland occupies the 5th place from the end. No significant changes of the index have been made for the last few years.

Spatial distribution of the expected healthy lifespan for people with secondary education, the values of which were assessed for 2014 in reference to the European countries is presented in Fig. 2.
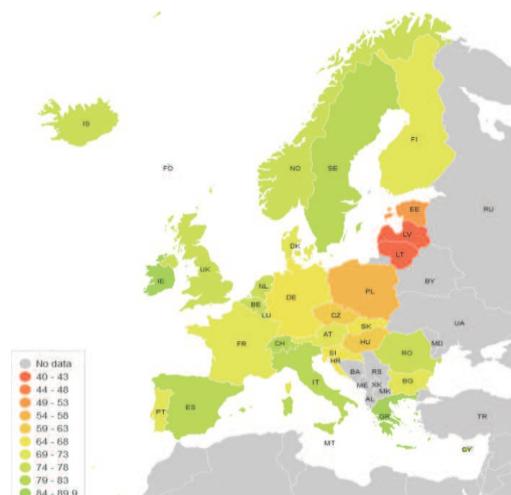

Fig. 2. Proportion of people with medium educational level, who assess their health to be *very good* or *good*

Fig 2 shows that the HLE value in the population having secondary education is generally higher than that of the previously discussed social group. Table 2 illustrates the value of the *Healthy Life Expectancy* – HLE index of the best five and the worst five countries, calculated for the population with secondary education.

The gap between the HLE values increases along with the growth of the level of education. The value of HLE significantly increases in the group of countries with the highest index. The values calculated for 2014 fluctuate between 89.9 and 40.0 years.

Table 2. Value of the secondary education HLE index for the countries of the highest and the lowest level

Countries	HLE education medium	Countries	HLE education medium
Malta	89,9	Czech Republic	60,1
Ireland	87,4	Poland	58,0
Greece	85,3	Estonia	50,4
Cyprus	83,8	Latvia	42,8
Spain	83,7	Lithuania	40,0

Source: own study based on data [6].

Spatial distribution of the Healthy Life Expectancy for people with higher education, the values of which were assessed for 2014 in reference to the European countries is presented in Fig. 3.
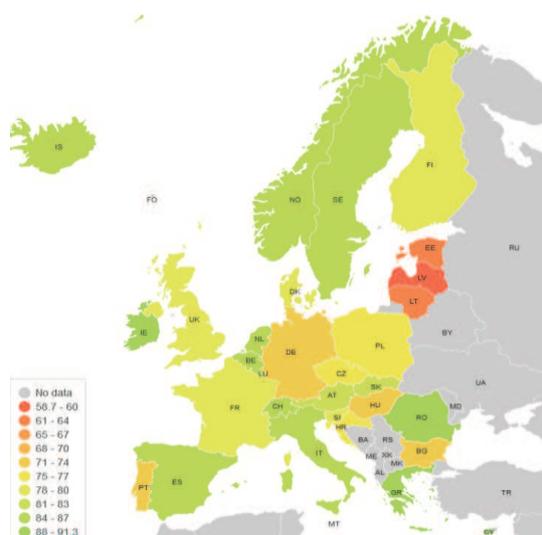
Fig. 3. Proportion of people with high educational level, who assess their health to be *very good* or *good*

Table 3. Value of the HLE index with high educational level for the countries with the highest and the lowest level

Countries	HLE education high	Countries	HLE education high
Ireland	91,3	Germany	73,5
Cyprus	90,8	Hungary	71,6
Malta	90,7	Lithuania	63,7
Greece	88,7	Estonia	62,7
Romania	89,1	Latvia	58,7

Source: own study based on data [6].

Then, after diagnosing the data, which shows the problem of health inequality in European countries, Gini index health – GIH, Gini index without health – GIwH were calculated with the use of the formula (1). To carry out a more extensive analysis of the problem of inequality, the GIH, GIwH indexes were calculated according the indicated categories of individual educational levels (ED0-2), (ED3_4), (ED5_8). The level of concentration of the positive health inequality measured with the Gini index was determined making use of the data collected during the ECHI studies taking into account the people describing their state of health at least at the good level. The level of concentration of the negative health inequality was determined analogically, taking into account the people who assessed their state of health at the bad level.

Small disproportions of value can be found for the group with low level of education of the category (EDO-2) between the years 2006–2015.

Table 4. Gini health index and Gini index without health values for the (EDO-2) category

Inequality indexes		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
GIH-ED0-2	Gini index health	0,036	0,036	0,037	0,042	0,036	0,037	0,039	0,037	0,040	0,040
GIwH-ED0-2	Gini index without health	0,008	0,010	0,008	0,005	0,009	0,004	0,005	0,010	0,003	0,003

Source: own study based on the data [14].

Table 5. Gini index health and Gini index without health values for the (ED3-4) category

Inequality indexes		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
GIH-ED3-4	Gini index health	0,033	0,031	0,034	0,034	0,035	0,033	0,035	0,034	0,034	0,036
GIwH-ED3-4	Gini index without health	0,005	0,014	0,003	0,003	0,002	0,006	0,000	0,003	0,004	0,002

Source: own study based on the data [14].

Table 6. Gini index health and Gini index without health values for the (ED5-8) category

Inequality indexes		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
GIH-ED5-8	Gini index health	0,036	0,036	0,038	0,039	0,037	0,036	0,038	0,037	0,036	0,037
GIwH-ED5-8	Gini index without health	0,016	0,015	0,033	0,043	0,032	0,023	0,037	0,028	0,021	0,026

Source: own study based on the data [14].

Health inequalities measured with the Gini index health and Gini index without health analysed in terms of the specified categories of education show different values (Fig. 4). It results from specific determinants in functioning of those groups with different education within the society.

There is an interesting sharp increase by 3 percentage points of the Ginex index without health (ED5-6) in the years 2007–2009.

All the Gini indexes without health (ED0-2), (ED3-4), (ED5-8) were very stable during the 10-year study, the average value of the positive Gini index health was 0.0363.

In the second part of the analysis, the relations between self-perceived health by gender, age and income quintile was studied. Income levels of natural people were classified, ordered according to their total values, equivalent disposable income i.e.: first quintile group of equivalised income (Q0_20), second quintile group of equivalised income (Q20_40), third quintile group of equivalised income (Q40_60), fourth quintile group of equivalised income (Q60_80), fifth quintile group of equivalised income (Q80_100).

By way of illustration, values of the best five and the worst five HLE in terms of value are given, calculated for the population with low level of education.

Table 7. Percentage share of the European population, in the first and the fifth quintile group, of the *very good, good* self-perceived health , for countries of the highest and the lowest level

The highest self-perceived health state *very good, good*				The lowest self-perceived health state *very good, good*			
(Q0_20)	[%]	(Q80_100)	[%]	(Q0_20)	[%]	(Q80_100)	[%]
Ireland	76,0	Ireland	92,3	Croatia	46,5	Poland	71,5
Greece	75,2	Sweden	89,1	Portugal	38,9	Hungary	68,2
Romania	74,8	Malta	88,3	Estonia	36,0	Latvia	64,3
Spain	71,9	Switzerland	87,9	Lithuania	36,0	Lithuania	61,7
Norway	70,5	Norway	87,3	Latvia	30,9	Portugal	61,0

Source: own study based on the data [6].

Table 8. Percentage share in the European population of a given *bad, very bad* self-rated health quintile group for countries of the highest and the lowest level

The highest self-perceived health state *bad, very bad*				The lowest self-perceived health state *bad, very bad*			
(Q0_20)	[%]	(Q80_100)	[%]	(Q0_20)	[%]	(Q80_100)	[%]
Latvia	62,5	Lithuania	37,9	Norway	27,3	Cyprus	11,9
Lithuania	60,5	Portugal	37,6	Spain	26,3	Switzerlad	11,8
Estonia	60,2	Latvia	34,8	Romania	23,7	Malta	11,6
Portugal	54,1	Hungary	30,5	Ireland	22,6	Sweden	10,6
Czech Republic	48,9	Croatia	27,0	Greece	22,0	Ireland	7,3

Source: own study based on the data [6].

It was observed in Table 7 that the fifth quintile of the group of 20% of the population with the highest income, the highest percentage of the population

positively rating their state of health is in the countries like Ireland, Sweden, Malta. The first quintile group, which includes 20% of the population with the lowest income includes populations of countries like Ireland, Greece, Romania.
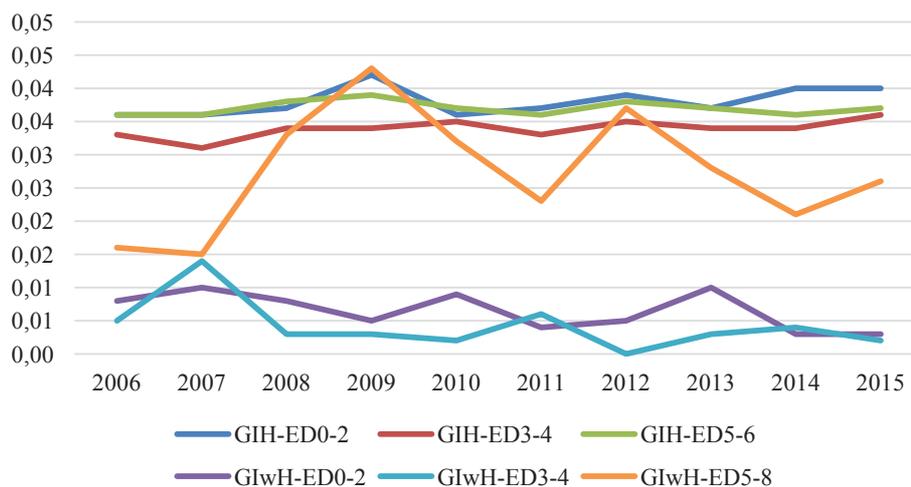

Fig. 4. Gini index health and Gini index without health according to the level of education of social groups in the years 2006–2015

Source: own study based on the data [6].

The fall of values of the Gini index without health (ED0-2), and the Gini index without health (ED3-4) is visible in the years 2007–2009, before the economic crisis in Europe. Comparing extreme values in the years of the study, the Gini index without health (ED0-2) decreased by 0.5 percentage point and is low. Whereas the Gini index without health (ED3-4) was very low and stable in the years of the study.

In Table 8, it was observed that in the fifth quintile of the 20 percent group of the population with the highest incomes the highest percentage of the population rating their health *negatively* is visible in three countries on the Baltic Sea. The first quintile group constituting 20% of the population with the lowest incomes included the populations of Lithuania, Portugal, Latvia, Hungary, Croatia.

Table 9. Gini health index and Gini index without health values for the (Q0-20) category

Inequality indexes		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
GIH-Q0-20	Gini index health	0,043	0,042	0,047	0,051	0,042	0,040	0,041	0,040	0,039	0,041
GIwH-Q0-20	Gini index without health	0,011	0,006	0,017	0,030	0,011	0,006	0,008	0,005	0,001	0,006

Source: own study based on the data [6].

Table 10. Gini health index and Gini index without health values for the (Q20-40) category

Inequality indexes		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
GIH-Q20-40	Gini index health	0,047	0,040	0,045	0,045	0,046	0,043	0,045	0,043	0,045	0,045
GIwH-Q20-40	Gini index without health	0,025	0,007	0,021	0,022	0,023	0,016	0,018	0,011	0,017	0,019

Source: own study based on the data [6].

Table 11. Values of the Gini health index and Gini index without health for the (Q40-60) category

Inequality indexes		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
GIH-Q40-60	Gini index health	0,035	0,036	0,040	0,036	0,037	0,034	0,036	0,040	0,037	0,036
GIwH-Q40-60	Gini index without health	0,005	0,001	0,016	0,000	0,002	0,007	0,005	0,010	0,001	0,003

Source: own study based on the data [6].

Table 12. Values of the Gini health index and Gini index without health for the (Q60-80) category

Inequality indexes		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
GIH-Q60-80	Gini index health	0,032	0,031	0,031	0,035	0,034	0,032	0,036	0,032	0,033	0,034
GIwH-Q60-80	Gini index without health	0,017	0,020	0,018	0,001	0,006	0,013	0,001	0,015	0,013	0,010

Source: own study based on the data [6].

Table 13. Values of the Gini health index and Gini index without health for the (Q80-100) category

Inequality indexes		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
GIH-Q80-100	Gini index health	0,030	0,030	0,030	0,030	0,031	0,032	0,032	0,031	0,031	0,032
GIwH-Q80-100	Gini index without health	0,024	0,027	0,029	0,024	0,023	0,013	0,012	0,021	0,020	0,020

Source: own study based on the data [6].

Health inequalities measured with the Gini index, positive and negative health analysed in terms of the designated categories of income are shown by the differences (Fig. 5). It results from specific determinants in functioning of those groups with different levels of education in a society.

Values of the Gini index health indexes (Q0-20), (Q20-40), (Q40-60), (Q60-80), (Q80-100), are low and assume values from 0.03 to 0.051. Health inequalities of the Europeans is most clearly seen in the (Q0-20) income group, where the index increased in the years 2007–2009, before the economic crisis. In the three social groups with incomes lower than those of the other two social groups, the index gap is a higher than 0.051–0.034. It may be due to the influence of other factors on the general health of the population in those groups.
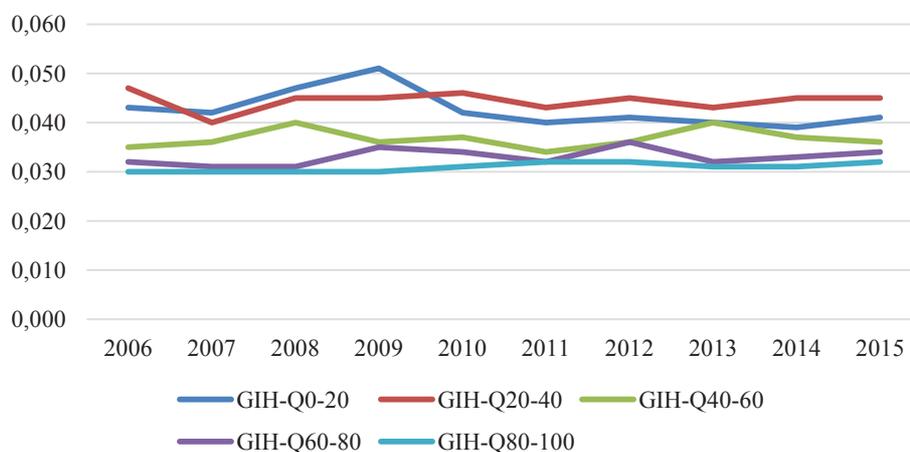
Fig. 5. The Gini index health according to income of social groups in the years 2006–2015

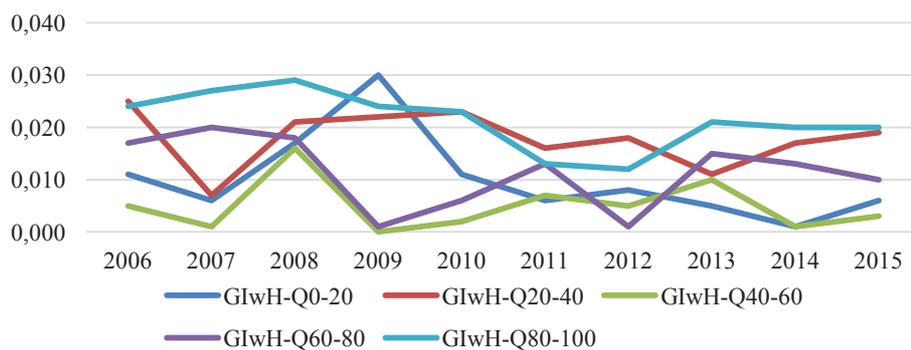Source: own study based on the data [6].

Fig. 6. The Gini index without health according to the income of social groups in the years 2006–2007

Source: own study based on the data [6].

Inequality in bad health distribution is very low. The spacing of the Gini index without health coefficients in all the income groups in the years covered by the study was 0.03.

3. Conclusions

The subjective measurement of health contributes to rating of health problems, burden of illnesses and health needs at the level of a population. The perceived general health is not a substitute for the more objective indexes but it is

the index, which monitors, inter alia, the relation between education, income and the rating of health. Health inequality in health and lack of health was calculated in this paper with the use of one of the measures use to study the inequalities – the Gini index. It is demonstrated that in the years 2006–2015 the highest health inequalities characterised the inhabitants of Europe with low level of education and in the second income group GIH-Q20-40. The conclusion confirms the research hypothesis. People with low level of education and in the second income group are probably also young people entering the labour market. This relation induces to analyse inequalities of the people 40+. In the other groups health inequalities reached lower level and did not show any significant deviations. The lowest health inequalities occurred among the inhabitants of Europe with secondary and higher education in 2014 and in the highest income group.

The highest inequalities with bad health occurred among the inhabitants of Europe with higher education and the highest income group. The reason for this inequality are other determinants of health, e.g. accessibility of health care [2], [3].

The lowest inequalities with bad health occurred among the group of people with secondary and low education and in 2014 in the first and third group of income.

The conclusions resulting from the rating of the general health in Poland indicate the need for continuous verification of the statistical data in order to implement health promotions, chronic disease treatment as well as prevention of biological disability.

The relations observed during empirical studies encourage further use of the Gini coefficient in rating general health of a population in order to extend observation of changes with time.

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Nierówność zdrowotna determinowana wykształceniem i dochodem w krajach europejskich

Synopsis: Wykazano, że w latach 2006–2015 najwyższymi nierównościami zdrowotnymi charak-
teryzowali się mieszkańcy Europy z niskim wykształceniem i w drugiej grupie dochodowej
GIH-Q20-40. Najniższe nierównomierności związane ze zdrowiem wystąpiły u mieszkańców Eu-
ropy ze średnim wykształceniem i w najwyższej grupie dochodowej. Najwyższe nierównomierno-
ści związane ze złym zdrowiem wystąpiły u mieszkańców Europy z wysokim wykształceniem
i w najwyższej grupie dochodowej. Ich powodem są inne determinanty stanu zdrowia, np. dostęp-
ność opieki zdrowotnej. Najniższe nierównomierności w związku ze złym zdrowiem wystąpiły
w grupie osób ze średnim i niskim wykształceniem w 2014 roku w pierwszej i trzeciej grupie docho-
dowej.
Słowa kluczowe: nierówność zdrowotna, determinanty zdrowia, wykształcenie, dochód, współ-
czynnik Giniego.