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Health condition of ageing populations of the European Union

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Abstract. The paper is a comparative analysis of health condition of EU-27 states that are differentiated with respect to demographic situation and the level of social and economic development with the use of methods of multidimensional comparative analysis. Relationships between macroeconomic values and health indices of EU populations were also studied with the use of demometric models. The study was performed for 2009.

The most favourable health situation (in the light of diagnostic qualities adopted for the study) was observed in Cyprus, where the value of synthetic measure was almost 0.9. Cyprus is a relatively young country, with the lowest rate of mortality due to malicious tumours among all the countries of the European Community. Apart from Cyprus, Ireland was found in the first group (the lowest rate of people at 65+ years of age of all EU countries), Luxembourg (low rate of infant mortality) and Spain (relatively low mortality due to diseases of circulatory system). Definitely the worst health situation was observed in majority of the countries of the former Eastern bloc.

On the grounds of the correlation diagram it was possible to conclude that, together with social and economic development of the country and resulting growth in expenditures on health protection *per capita,* mean life expectancy at birth significantly extended. However, these relations are not linear. Logarithmically constructed regression functions proved a strong and statistically significant impact of macroeconomic values on indices of population health condition.

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1. Introduction

The subject of this case study is a comparative analysis of the health condition of European community states that are differentiated with respect to demographic situation and the level of social and economic development as measured by GDP size per one inhabitant or the amount of total expenditures on health protection per capita.

In the first part, attention is drawn to unfavourable changes in population structure by age. Also, a forecast of the process of population ageing for 2050 is presented. In the next stage of the analysis basic indices describing health condition of the population are discussed and compared with the help of the synthetic variable. The last stage of the study is an attempt to analyse the relations between macroeconomic values and health indices of EU populations with the use of demometric models. An attempt is made to obtain the answer to two fundamental questions: what is the distance between new European Union member states and previous area of the Community (EU-15) with respect to selected, both positive and negative, rates of health condition of population, and whether major macroeconomic values are significant determinants of the health condition of the analysed populations?

The study was performed for 2009, and Eurostat data of European Union Statistical Office and WHO database were the sources of statistical data.

2. Ageing population of the EU

Without any doubt, the demographic situation of a population, particularly in the sphere of population structure by age, is one of the factors determining the health condition of that population. For the last ten years the rate of elderly people has been dramatically growing. In the whole European Union the rate of people over 65 years of age increased by 1.6% (from 15.6% in 2000 to 17.2% in 2009). The largest changes were reported in Germany, where the growth by even 4.2% was observed.

The impact of the process of ageing of the population of the European Union may have a great significance in the forthcoming decades. Low values of birth rate and higher values of mean life expectancy observed in a lot of countries change the population pyramids. A clear transition to a much older population structure will probably be the most significant one, and such changes are already observed in several member states.

Between the years 2010 and 2050 the share of elderly people at 65 years of age and more will increase in the whole EU even by 11.2% (from 17.4% to 27.6%). Adopting a lower age limit of 60 years to determine old age increases the rate of elderly people from 23.2% in 2010 to 34.9% in 2050, which shows that this sub-population will account for over 1/3 of the whole EU population in forty years. Population ageing has a dual nature, which means that within the group of elderly people the number of the oldest people is growing the fastest. If we separate people at 80 years of age or more from the group of elderly people it appears that this group will grow really fast. As a result, in 2050 almost every tenth inhabitant of the European Union will be found in the group of people at the so-called 'fourth age' (in 2010 it was every twenty fifth person).

Spatial differentiation of the rate of population of 65 years of age or more proves that population ageing is not a process that is proceeding, and will proceed, with the same intensity for the whole European Community (Fig. 1). In 2010 the values of the rate fluctuated from 11.3% to 13.6% in the demographically youngest EU states (Ireland, Slovakia, Cyprus and Poland) to over 20% in the countries that are demographically oldest, such as Germany or Italy.

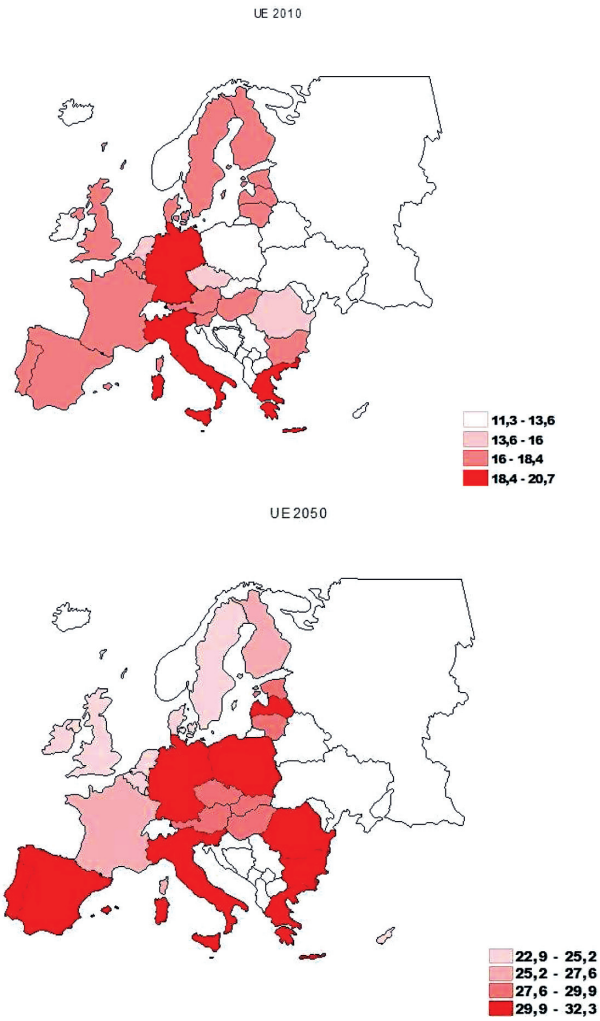

Fig. 1. Share of population aged 65 and more in European Union states in 2010 and 2050

Source: Own case study based on EUROPOP2010

According to the forecast, in 2050 we should expect an increase in the rates of elderly people in all countries of Eastern Europe, while the largest increase in this rate will be reported in Slovakia (by 17.3%) and in Poland (by 16.8%). On the other hand, in all the countries of Western Europe the increase in the rate will probably be lower than the mean growth for EU amounting to 11.5%.

Significant spatial differentiation also concerns the group of elderly people, especially the oldest. In 2050, the highest shares of people 80+ will be reported in two demographically oldest countries of the EU: Germany (14.4%) and Italy (12.5%), whereas on the other pole we should expect Ireland with the rate value of 7.4%. In the studied period, the rate growth will be highest in Germany (by 9.3%) and in Holland (by 7.3%), and lowest in Sweden (by 4.1%) and Ireland (by 4.6%). In the same period of time, in Poland we should expect an increase in the rate of the 'fourth age group' from 3.3% in 2010 to 9.6% in 2050, which in relative approach gives a three-fold increase in this rate.

Considering the synthetic measure of old age, represented by the age median, we have to observe that in 2050 the spatial arrangement of this measure will be similar to the arrangement of the rate of elderly people. In 19 countries of contemporary European Union the mean population age will be higher than 45 years of age, out of which half of the inhabitants of Germany, Latvia, Poland and Slovakia will be at least 50 years old. Ireland will be at the time demographically the youngest country with the age median not higher than 40 years of age. Ireland is a country of high fertility rate and such rate was assumed in the period included in the forecast (1). Differences in the growth of the age median can be clearly seen. This shows diversified pace of the process of population ageing in member states. The lowest increase in mean age (from 2 to 2.5 years) will be reported in countries with high women's fertility rate, that is in Finland, Sweden, Great Britain and Belgium, and the highest increase will be reported in countries of the former Eastern bloc, that is in Poland, Slovakia, Romania (increase in over 13 years), Latvia (in 2 years), Hungary (in 10 years) and Lithuania (in 9 years).

Unfavourable changes in population age structure imply serious threats for efficient long-term functioning of the Union member states. The problems that arise are mainly associated with inevitable increase in demographic load coefficients and with unpredictable changes in the sphere of mortality or disability of elderly people.

The value of demographic load coefficient on population at 15 to 64 years of age with elderly people for the whole EU will amount to 50.2% in 2050 and it will be twice as high as in the initial year of the forecast. In the case of over half of the countries, this coefficient will probably be below the EU mean, the lowest in Great Britain, Ireland and in Cyprus - below 40%, and the highest – in Germany (58.1%), Greece (57.1%) and in Italy (56.3%).

The comparison of data in time for individual countries shows that the load of elderly people

on working people will be significantly growing. According to the analysis of data, the most unfavourable changes in this respect will be reported in Poland, where in 2050 the analysed coefficient of demographic load will be almost four times higher than in 2010.

3. Major indices of health condition

Mean *Life Expectancy (LE),* that is the mean number of years of living, measured on the grounds of statistics concerning mortality in a particular year for a particular population, and the complex measure *Healthy Life Years (HLY)*, also called the life span of able-bodied population coefficient, are the major indices often applied to assess he health condition of a population(2). The first parameter refers to life expectancy and the other one defines two qualities of the assessed population, that is the life span and the quality of life that refers to health. Both factors belong to major measures that serve to assess the health condition of population in all the countries, and provide a strong foundation for monitoring health as the element influencing efficiency and economy.

Despite constant extension of life expectancy, differences between individual countries of the Union are observed. Larger differentiations in this parameter, measured with variability coefficient are observed in the sub-population of males (5%) than in females (2.8%) (Table 1).The inhabitants of Lithuania, Latvia, Romania and Bulgaria, where mean life expectancy for both sexes in total was not higher than 74 years of age, live the shortest. The highest values of the analysed parameter were observed in the countries of Western and Southern Europe, and the difference between extreme values for the whole EU - 27 was around 9 years.

Generally speaking, mean life expectancy in the countries of the former socialist block is a few years shorter than in the countries of the 'old' EU, and relative differences between the life expectancy of females and males are much higher . The largest difference occurred in Lithuania (17%) and Latvia (15%), and the smallest in Denmark, Sweden and Great Britain (5%). In the group of countries of the former Eastern bloc, the Czech Republic draws attention since males there live on average from about 3 to almost 7 years longer when compared with other countries of that bloc. In the ranking of 27 states of the European Community, Poland occupies, the 20th position in the case of males and the 21st position in the case of women. Countries at the highest level of social and economic development, such as France, Sweden, Belgium, Germany or Holland, reached the level of mean life expectancy at birth amounting to 75.9 years of age for both sexes in Poland almost twenty years ago. It should be noticed that distribution of the analysed parameter in each sub-population is characterised by moderate left-side asymmetry, which means that in majority of the states the mean life expectancy was in 2009 higher than the Union mean.

The comparison of the difference between the life span of males and females shows that the largest differences occur in the countries where inhabitants live short, while the smallest are observed in the countries of long mean life expectancy (Table 1). In 2009 this difference was 4 years in Great Britain, Sweden, Denmark and Holland, and 10 to 11 years in Estonia, Lithuania and Latvia.

Long life is nowadays a desired value, especially if it is accompanied by good health and when there are no limitations in performing everyday activities. The fact that a particular society is characterised by a high value of mean life expectancy does not mean that the people are healthy.

The European Union states show quite significant differences within the rate of life span in able-bodied condition (Table 1).

Differences between the countries with respect to this index in studied sub-populations are slightly bigger than in the case of mean life expectancy (coefficient of variability is 7%), but on the whole, difference between old and new Union members can be observed. Newly-born babies have the chance to live the longest in Sweden and Malta – 70 years of age in 2009, and the shortest in Slovakia – 53 years of age. The life span in healthy conditions in Poland was 58.3 years of age in the case of males and 62.5 years of age in the case of females. This means that women live without disabilities 78% of their whole life and males 81.5% (Fig. 2). It ought to be reported that males in Slovakia may expect living in good health for 6 years shorter than in the case of males in Poland at the same value of mean life expectancy for this sub-population (71.5 years). As the analysis

of Fig. 2 shows, the problem of losing health concerns mostly women. While it is true that they live longer than males, they live a long part of their life in an 'unhealthy condition' (limited body ability, occurrence of particular chronic diseases or bad self-assessment of health condition). Thus, for all EU-27 states higher shares of males than females are observed in living in good health.

Table 1. Mean life expectancy at birth and expected life span in good health in EU-27 states in 2009

Region	Countries	A			B	
		a	b	c	b	c
	EU-27	79.7	76.7	82.6	61.3	62.0
Western Europe	Austria	80.5	77.6	83.2	59.5	60.8
	Belgium	80.1	77.3	82.8	64.0	63.7
	France	81.6	78.0	85.0	62.7	63.3
	Holland	80.9	78.7	82.9	61.7	60.0
	Luxembourg	80.8	78.1	83.3	65.5	66.2
	Germany	80.3	77.8	82.8	57.1	58.0
Eastern Europe	Bulgaria	73.7	70.1	77.4	62.1	65.9
	The Czech Republic	77.4	74.2	80.5	61.1	62.7
	Poland	75.9	71.5	80.1	58.3	62.5
	Slovakia	75.3	71.4	79.1	52.4	52.6
	Hungary	74.4	70.3	78.4	55.8	58.3
Northern Europe	Denmark	79.0	76.9	81.1	61.3	60.3
	Estonia	75.2	69.8	80.2	55.2	59.2
	Finland	80.1	76.6	83.5	58.1	58.3
	Ireland	79.9	77.4	82.5	63.6	65.1
	Lithuania	73.2	67.5	78.7	57.3	61.1
	Latvia	73.3	68.1	78.0	52.8	56.1
	Sweden	81.5	79.4	83.5	70.7	69.6
	Great Britain	80.5	78.3	82.5	65.1	66.0
Southern Europe	Cyprus	81.1	78.6	83.6	65.3	66.4
	Greece	80.2	77.8	82.7	66.0	66.7
	Spain	81.9	78.7	84.9	62.8	62.3
	Malta	80.3	77.9	82.7	69.6	71.0
	Portugal	79.6	76.5	82.6	58.2	56.2
	Romania	73.5	69.8	77.4	59.8	61.7
	Slovenia	79.4	75.9	82.7	60.5	61.3
	Italy	82.1	79.4	84.6	63.4	62.5

Explanation: A - mean life expectancy at birth; B - years of good health (without disability), a – total; b – males; c - females

Source: http://appsso.eurostat.ec.europa.eu/nui/setupModifyTableLayout.do (DoA: 15 October 2012)

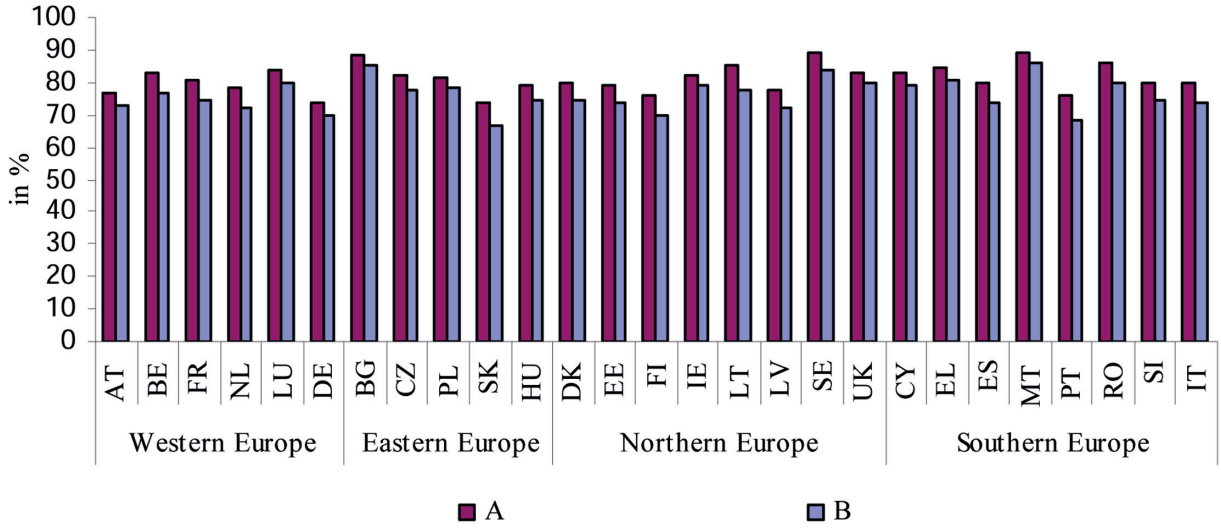

Fig. 2. Good health life expectancy in per cent of mean lifespan at birth in EU-27 states in 2009

Explanation: A – males; B - females

Source: Own case study

Mortality rates and derivative indices that are based on the number and causes of death are negative measures of health condition (Panek, 2007). While comparing death rates in various populations (or in time) it is necessary to standardise them with respect to age because the value of those coefficients depends not only on the intensity of mortality in particular age groups but also on the age structure of the population. The lower the life expectancy, the higher the values of standardised coefficients of death (Fig. 3-6). As Fig. 3 shows, standardised death rate in total had in the studied period the highest values (over 950 deaths for 100 thousand people) in such countries as Bulgaria, Lithuania, Latvia and Romania, and the lowest in Italy, Spain, France and Sweden – around 500 deaths for 100 thousand people.

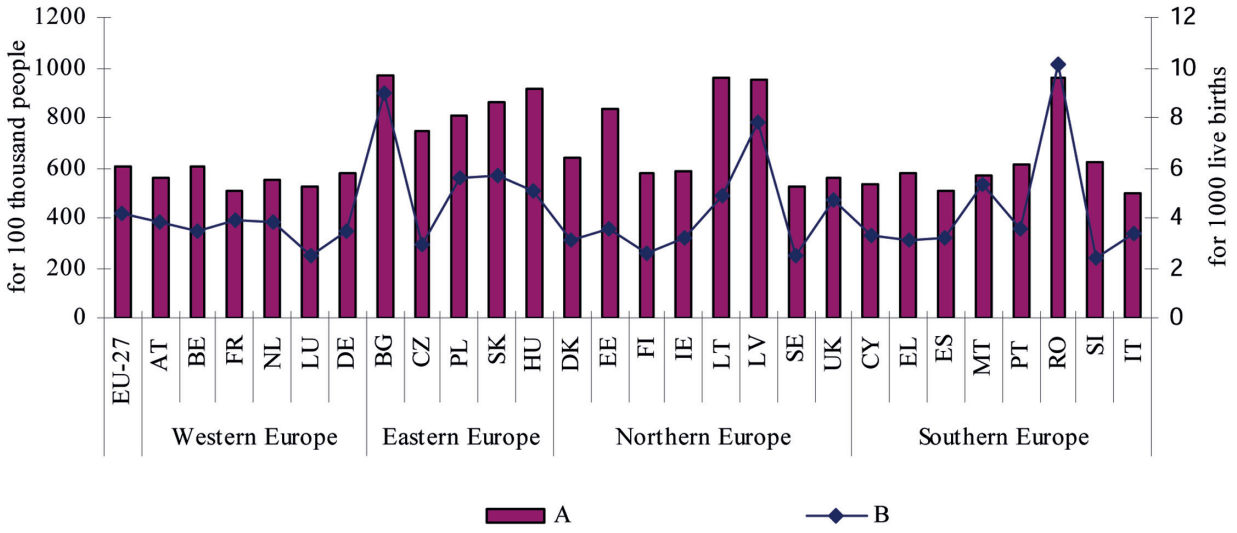

Fig. 3. Death rate in total and infant mortality in EU-27 states in 2009

Explanation: A – total standardised death rate; B – infant desths

Source: Own case study

Among the analysed countries, a clear difference in mortality by causes is observed. For many years, diseases of circulatory system have remained on the first position in statistics of major causes of deaths in majority of countries (Fig. 4). In 2009, mortality due to circulatory system diseases accounted for about 25% of all deaths in Denmark and France to around 63% in Bulgaria. In the group of new members of the European Union, mortality due to circulatory system diseases was on a higher level than in the countries of the so called 'old' Union (Fig. 5). The difference in mortality between the country with the highest (Romania) and the lowest (France) value of the rate was 429 deaths for 100 thousand people, which means that progress in the sphere of treatment of this group of diseases is possible and gives remarkable results. In Poland and the Czech Republic, death rates due to diseases of circulatory system were the lowest of all in the group of countries of former socialist bloc and amounted to around 350 deaths for 100 thousand inhabitants. However, the value of the rate is still three times higher than the value observed in, for example, France (120 deaths for 100 thousand).

There are also countries in the EU in which the intensity of mortality due to diseases of circulatory system was lower than that due to malicious tumour. France, Holland, Denmark, Great Britain and Malta can be mentioned here (Fig. 5).

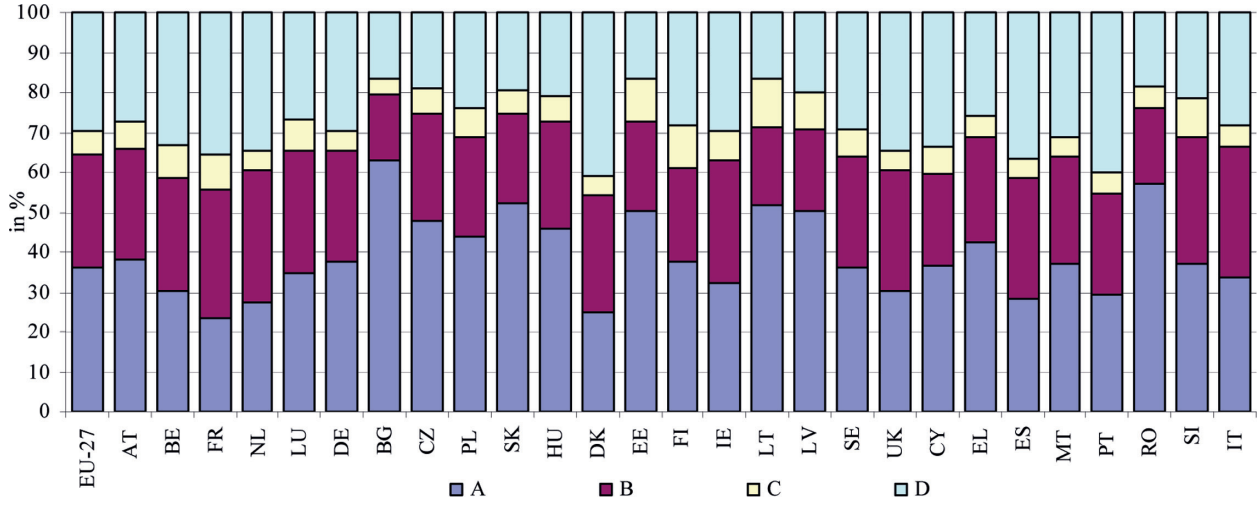

Fig. 4. Standardised structure of mortality by causes in EU-27 states in 2009

Explanation: A – circulatory system diseases; B – malicious tumours; C – external causes of deaths; D – other causes

Source: Own case study

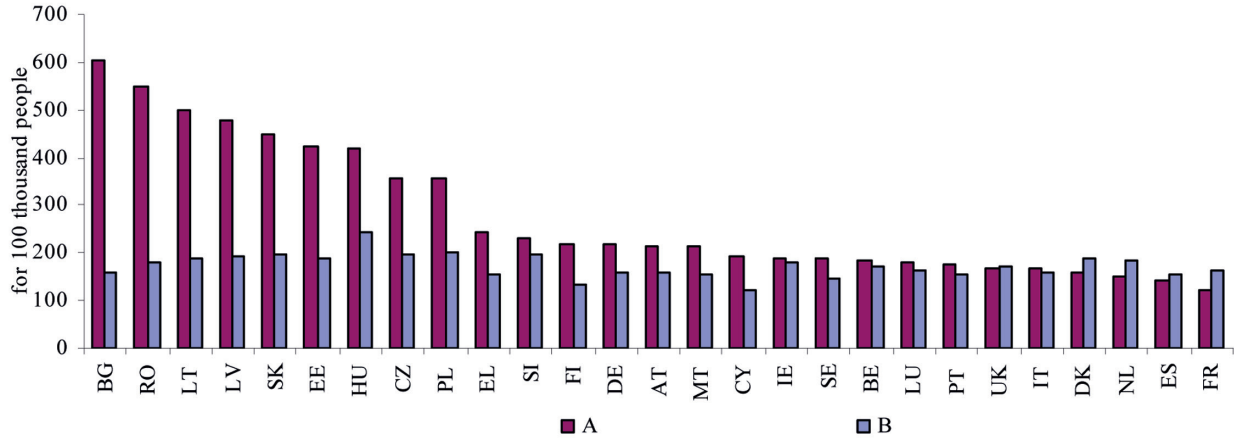

Fig. 5. Standardised rates of deaths due to disease of circulatory system and malicious tumours (for 100 thousand people)

Explanation: A – circulatory system diseases; B – malicious tumours

Source: Own case study

In the case of malicious tumours spatial differentiation in mortality intensity was definitely lower than in the case of diseases of circulatory system (Fig. 5). With respect to this, the most favourable values occurred in Finland and Cyprus (around 130 deaths for 100 thousand people), whereas the highest values were reported in Hungary (over 243 deaths for 100 thousand people) and also in Poland, Czech Republic and Slovakia (200 deaths for 100 thousand).

The so-called external causes (traffic accidents, intentional personal injuries and other injuries) are another important group of death causes (Fig. 4 and Fig. 6). The highest share of deaths due to external causes was reported in Lithuania (12%) and Finland (11%), while the lowest was reported in Bulgaria (4.1%). Furthermore, death intensity in Lithuania was from two to four times higher when compared with the countries of the 'old' Union. In many countries the intensity of this type of deaths is growing because of fast development of motorisation and concomitant lack of appropriate infrastructure.

In Poland this group of causes of mortality accounted for 7% of total deaths in 2009. However, this cause of death influences the inhabitants of Poland with larger intensity than in many other countries of the Union. For example, in Italy, Spain, Germany, Holland and Malta mortality due to external causes was twice as high as in Poland (Fig. 6).

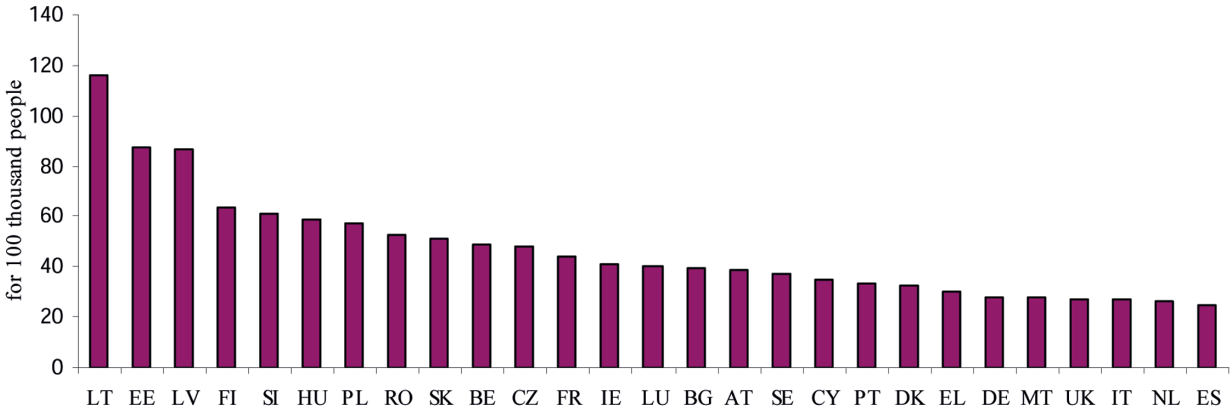

Fig. 6. Standardised rates of mortality due to external causes (per 100 thousand people)

Explanation: A – external causes of deaths

Source: Own case study

Standardised mortality rates by various causes do not close the analysis with respect to health condition measures. Infant mortality rate is also a frequently used index. This measure provides information about the social and economic level of development of a country and the quality of mother and baby health care. In social sciences it is treated as a general measure of civilisational development.

In this sphere, the distance that differentiates the countries that joined the European Union in 2004 from many of the countries of former EU-15 is still remarkable (Fig. 3). In this group, the Czech Republic is an exception. With the values of infant mortality rate amounting to 2.9%, the Czech Republic occupied the fifth position after Slovenia, Sweden, Luxembourg and Holland. However, as Fig. 3 shows, the most unfavourable situation with regard to infant mortality was reported in Romania, Bulgaria and Latvia. Mortality rates for children of up to 1 year of age were a few times higher than in other countries of the Union. In the case of Poland, the value of infant mortality rate was higher than the mean level observed for the EU-27.

4. Synthetic variable in the assessment of health condition

The analyses of the health condition of European Union populations that have been performed so far were one-dimensional descriptions. To obtain a wider perspective, multi-dimensional analyses were performed with the use of synthetic measure that made it possible to aggregate information about various aspects of population health condition. An arithmetic mean of normalised values was adopted as development measure (3). This measure adopts the values from the range [0, 1] and its higher values prove a more favourable health condition of the population. After the measure value was determined, the units were grouped into four classes of similarities by means of the method of standard deviation. In this way EU-27 states were divided into four typological groups: from the 'best' (group I) through 'good', 'moderately good' to the 'worst' (group IV) with respect to the studied phenomenon.

While constructing the synthetic measure, four qualities were taken into account: X_1 – standardised rate of mortality due to circulatory system diseases for 100 thousand people, X_2 – standardised rate of mortality due to tumours for 100 thousand people, X_3 – standardised rate of mortality due to external causes for 100 thousand people, X_4 – infant mortality for 1,000 live births. All variables taken for the analysis have the quality of destimulants. The ranking of countries with respect to the value of synthetic measure in 2009 with parallel marking of four typological groups is shown in Fig. 7.

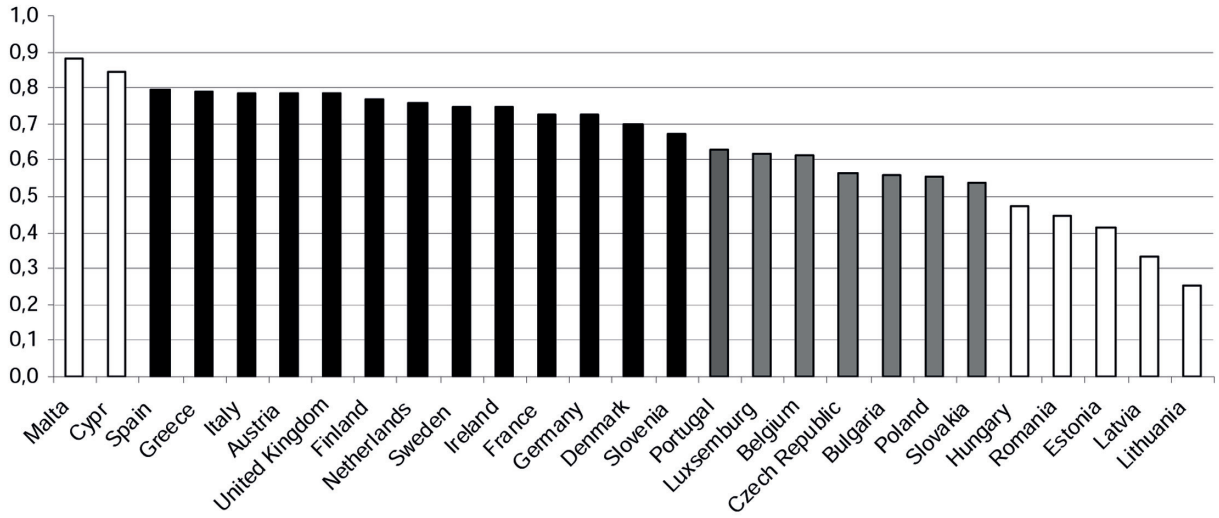

Fig. 7. Classification of EU-27 states with respect to the values of synthetic measure

Source: Own case study

The most favourable health condition (in the light of the diagnostic features adopted for the study) characterised two countries in the group of twelve newly accessed EU member states – Malta and Cyprus, and in the group of fifteen 'old' member states – Spain and Greece. In each of these countries the lowest rates of mortality due to cancer were reported.

On the other hand, the least favourable health condition was observed in majority of the countries of former Eastern bloc that joined the EU in 2004. They are Hungary, Romania, Estonia, Latvia and Lithuania. For three of them the value of the measure was twice as high as in the countries in group I. The features that are characteristic of the fourth group include the highest mortality due to circulatory system diseases (Romania and Latvia) and external causes (Lithuania, Latvia, Estonia), and also high infant mortality (Romania, Latvia). The results of taxonomic analysis confirmed previous considerations concerning the differentiation in the health condition of EU-27 states.

5. Relationship between indices of health condition and macroeconomic variables

It is generally known that there is a relationship between economic development of the country and indices of population health condition. As the country develops economically, the share in expenditures on health in GDP grows and the amount of these expenditures per 1 inhabitant is higher. This allows for better healthcare and thereby influences significantly the population health condition.

In this part of the case study, the relationship between major macroeconomic variables and indices of health condition was analysed. In the case of the first ones, GDP per 1 inhabitant and the level of total expenditures on health protection *per capita* (in USD according to PPP) were taken into account (4). The amount of GDP reflects the economic potential of the state and the level of income of the community, whereas total expenditures on health protection include expenditures incurred both in the public and private sector on all material and human resources that are involved in satisfying health requirements. Total expenditures are the amount of consumer and investment expenditures. Fig. 8 and 9 present differences between EU states with respect to mean life expectancy and the level of analysed macroeconomic values.

Fig. 8. Mean life expectancy at birth and the level of expenditures on health protection *per capita* in EU-27 states in 2009

Explanation: A – expenditures on health protection per capita; B – mean life expectancy at birth

Source: Own case study

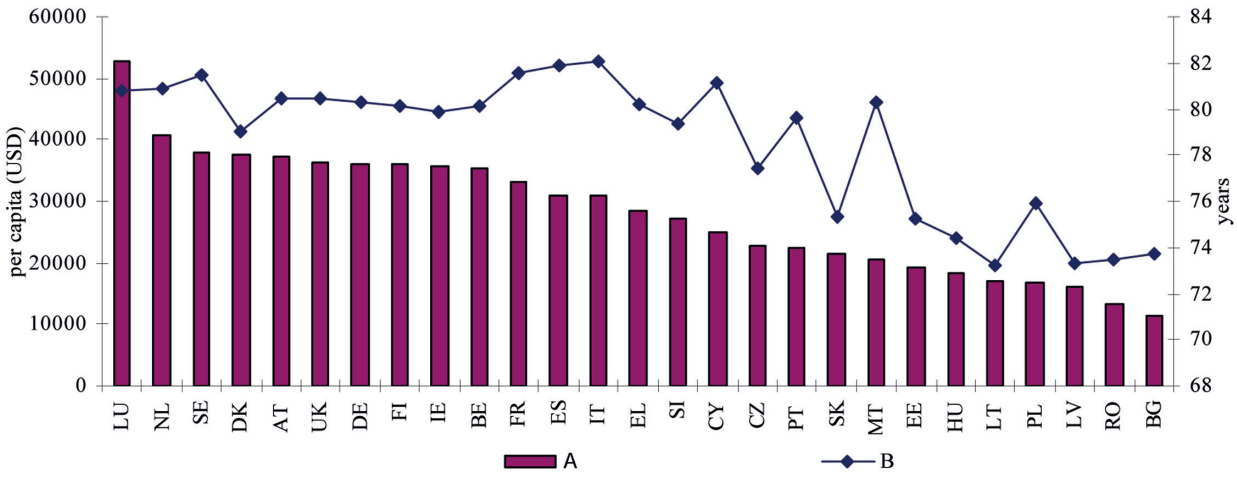

Fig. 9. Mean life expectancy at birth and the level of GDP *per capita* in EU-27 states in 2009

Explanation: A- GDP per capita; B – mean life expectancy at birth

Source: Own case study

The analysis of the figures above allows to state clearly that together with decrease in GDP per 1 inhabitant and reduction in expenditures on health protection, mean life expectancy at birth is shorter. In the most economically developed countries of the European Union – in Holland, Sweden, Denmark, Austria, Great Britain, Germany, Finland, Ireland and Belgium, the value of GDP per 1 inhabitant was over twice as high as in Poland, and in Portugal, one of the poorest countries of the 'old' Union, it was higher by over a third. With respect to GDP per 1 inhabitant, Poland was located only on the 24th position in the ranking. In this respect it came after Czech Republic, Slovakia, Estonia, Hungary and Lithuania. In 2009 GDP per 1 inhabitant amounted in Poland to 16710 USD (according to PPP) which made 73% of GDP presented in the same way in the Czech Republic, 78% of GDP in Slovakia and 86% of GDP in Estonia. Bulgaria, with the value of 11370 USD (according to PPP), was located at the end of the list.

The comparison of expenditures on health *per capita* proves to be unfavourable for patients. The analysis of Fig. 9 shows that there is a gap between the old and new European Union member states. The most favourable result was reported for Luxembourg (6592 USD), and the expenditures for six countries (Holland, Denmark, Austria, Germany, France, Belgium) were in the range between 4,000 to 5,000 USD per 1 inhabitant (according to PPP).

In the case of new members of the EU significant differences are also observed. Expenditures *per capita* in the Czech Republic and Slovakia were in 2009 by a half higher than in Poland, which is a continuation of relations from 2000. On the other hand, in Romania and Bulgaria, their level did not exceed 1,000 USD per 1 inhabitant. The comparison of Poland with Western neighbours determines the strategic goal for central administration because in the studied period, for example, the Germans spent 303% of the amount of Polish expenditures per 1 inhabitant on health, the French spent 285%, the Irish – 270% and the British people spent 247% of this amount.

Nevertheless, the general relationship between economic development and health is relatively complicated. Economic development itself does not bring reduction in health differences. Appropriate policy and larger involvement in social benefit schemes are necessary. The relationship between GDP per 1 inhabitant and health condition of citizens and health equality depends to a larger degree on appropriate policy to eliminate differences and improve the general health condition through optimal use of available resources. It should also be noticed that owing to such factors as diet, some EU member states are characterised by more favourable health indices than countries that are better economically developed areas of EU (for example France, Spain, Italy or Cyprus).

On the grounds of correlation diagrams (Fig. 10) we can conclude that, as the country develops socially and economically and, as a result, increases expenditures on heath protection *per capita*, mean life expectancy at birth occurs to be significantly longer. However, these relations are not linear.

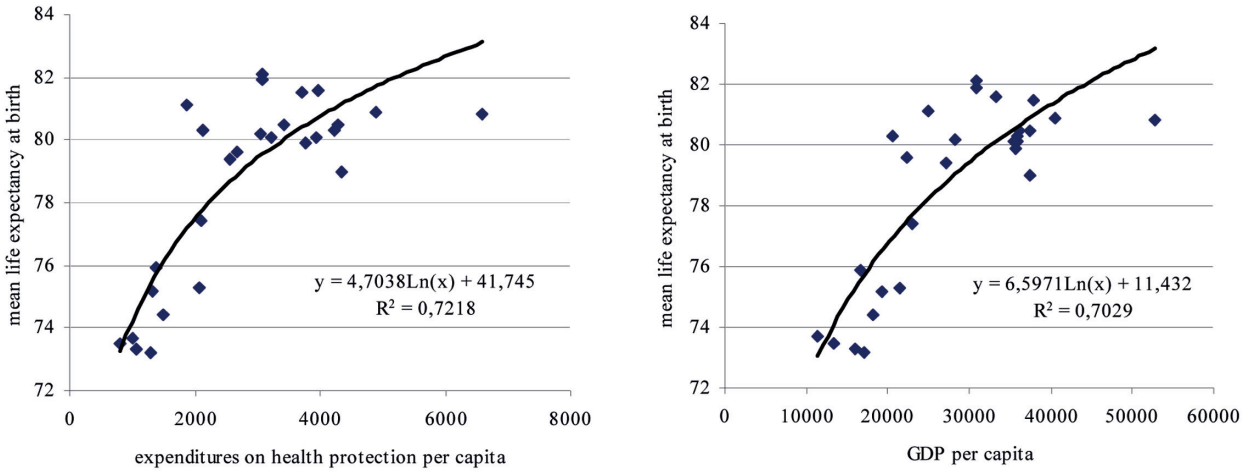

Fig. 10. Relationship between mean life expectancy at birth (Y) and the level of expenditures on health protection (X_1) and the level of GDP(X_2) *per capita* in EU-27 states in 2009

Source: Own case study

Logarithmic function turned out to be the function best adjusted for actual data. Structural parameters of models and parameters of stochastic structure were graphed with the use of the smallest squares and the results of estimations for 2009 are presented in equations (a) – (d):

$$y = 4{,}7038 \ln x_1 + 41{,}7448$$
$$(0{,}5840) \qquad (4{,}5843) \qquad \text{(a)}$$
$$S_u = 1{,}6224 \qquad V_z = 2{,}06\% \qquad R^2 = 0{,}7218$$

$$y = 6{,}5971 \ln x_2 + 11{,}4319$$
$$(0{,}8578) \qquad (8{,}7374) \qquad \text{(b)}$$
$$S_u = 1{,}6767 \qquad V_z = 2{,}13\% \qquad R^2 = 0{,}7029$$

$$z = 0{,}2316 \ln x_1 - 1{,}1681$$
$$(0{,}0339) \qquad (0{,}2666) \qquad \text{(c)}$$
$$S_u = 0{,}0944 \qquad V_z = 14{,}6\% \qquad R^2 = 0{,}6503$$

$$z = 0{,}3236 \ln x_2 - 2{,}6481$$
$$(0{,}0498) \qquad (0{,}5069) \qquad \text{(d)}$$
$$S_u = 0{,}0973 \qquad V_z = 15{,}1\% \qquad R^2 = 0{,}6285$$

where :

Y – mean life expectancy at birth,
Z – synthetic variable that describes population heath,
X_1 – expenditures on health protection *per capita*,
X_2 – GDP *per capita.*

Analysing the results of model estimations it should be noticed that all explanatory variables proved to be statistically significant (at α = 0.05), and the best adjustment was obtained in the case of models (a) and (b) in which over 70% of changes in endogenous variable were explained with changes in explanatory variables. According to model (a) at minimum expenditures on health protection *per capita* amounting to 818 USD, mean life expectancy (theoretical value of endogenous variable) is about 73.29 years of age. However, life expectancy does not change linearly together with the change in the amount of expenditures on health protection. At a low level of expenditures, their efficiency from the perspective of life expectancy is relatively high, and is weaker at a high level. A similar relationship can be observed between mean life expectancy at birth and the level of GDP *per capita* (X_2) – (equation b). More and more often it is stated that prosperity occurring at some stages of social and economic development causes a threat to community that is manifested in intensification of civilization diseases that, as a consequence, lead to shortening the life span (5).

6. Final remarks

The analysis of the collected material lets us formulate the following conclusions:

1. In significant majority of analysed states the predicted life expectancy in good health condition was higher for females than for males. However, in as many as 9 out of 12 new EU member states, the number of years in good health condition was lower than 65 years of age and the lowest rate was reported in Slovakia – 52.6 years of age. In the population of men, the differences were even more striking. In two countries that joined the Union in 2004 (Slovakia and Latvia), the estimated number of years in good health condition for males was lower than 55 years of age, and in 7 of them it was not higher than 60 years of age. In contrast, in as many as 11 states of the group of EU–15 states this factor was not estimated on the level that was lower than 60 years of age. In the case of males, the highest values of this parameter were reported for Sweden (70.7 years of age) and in the case of women for Malta (71 years of age).
2. The general health condition of Polish women, in comparison with all states of the Community, looks much better if the fact that only a part of life is lived in good health conditions is considered while calculating the lifespan. According to Eurostat estimates, Polish women occupy the 13th position among EU member states with respect to length of life in good condition. Thereby, they come before all member states of the previous Eastern bloc (except for the Czech Republic). What is more, the predicted female length of life in good health condition in Poland is two years longer than for women in Holland, Denmark or Austria. Polish men occupy only 19th position in the ranking of EU–27 member states. Unfortunately, the difference between the length of life in good health condition of females and males in Poland is the biggest among Community member states and is over 4 years.
3. Significant differences in infant mortality are observed between new and old member states of the Union. In fifteen member states (except for the United Kingdom), the number of infant deaths was not higher than 4 per 1,000 live births, while in the case of new member states in extreme cases (Bulgaria, Romania) it reached the level of 10 deaths.
4. Both in the 15 'old' member states and in the group of new EU member states circulatory system diseases and malicious tumours were major causes of death. Death mortality due to both of these causes is lower in EU–15 states, while a larger difference is observed between those two groups of countries in the sphere of fighting circulatory system diseases. This can be the result of, on the one hand, the quality of health protection system and, on the other hand, of long-term preventive and educational actions.
5. The lowest rates of mortality due to cancer were reported in two new EU member states: Cyprus and Malta, and in the fifteen 'old' states: in Spain and Greece. Central Europe (Hungary, the Czech Republic, Poland and Slovakia) reported the highest number of deaths due to cancer per 1,000 thousand people.
6. Data concerning circulatory system diseases were similar to data concerning cancer. Newly accessed Union states were characterised by much higher mortality due to circulatory system diseases, but this time France and Spain looked really well against all EU–27 member states. Among new members of the Community, only Cyprus and Malta can pride themselves on death rates due to circulatory system diseases below Union average. Baltic States (Latvia and Lithuania), countries of Central Europe as well as Bulgaria and Romania observed a very high mortality rate – twice or three times higher than in Cyprus and Malta.
7. Analyses show that there is a clear correlation between macroeconomic values (expenditures on health protection and GDP per capita) and health condition of population measured by mean life expectancy at birth or by means of mortality measures that may constitute components of synthetic measure of health condition of populations. However, these correlations are not of linear nature. At the low level of expenditures, their efficiency, from the perspective of mean life expectancy, is relatively high, and at the high level they become weaker. Without any doubts, this factor is influenced by a number of other factors. If we look at the relationship between average

length of life in good health and expenditures on health per capita, we can observe that, for example, Slovakia reported the lowest length of life in good health of males and females among all EU countries, yet it annually spent on health (calculated per one citizen) twice as much resources as Bulgaria. In the case of the latter country, males can expect to live in good health for 10 years more, and females for 13 years more than inhabitants of Slovakia.

Notes

(1) In 2050 theoretical fertility rate on the level of 2.0 children per 1 woman of child bearing potential.

(2) Assessments of length of life in good health for EU member states provided by Eurostat are based on incidence of limited capability of performing common activities lasting for 6 months or longer due to health condition.

(3) Normalisation of variables was performed with the use of zero unitarisation method. Cf.: Balcerowicz-Szkutnik, M. and Sojka, E., 2011, Metody jakościowe i ilościowe w rozwiązywaniu problemów społecznych (Qualitative and Quantitative Methods in Social Problem Solving – in Polish), Research works of University of Economics in Katowice, Katowice: Wydawnictwo Uniwersytetu Ekonomicznego, pp. 99-110.

(4) In international comparisons GDPs of individual countries are calculated in one currency, most often in American dollars (USD) or in euro (EUR), according to the exchange rate or according to Purchasing Power Parity – PPP. Expressing the value of GDP per 1 inhabitant in the selected currency that is generally applied in trade (USD, EUR) according to PPP is more objective than calculation according to the current exchange rate. It eliminates the impact of exchange policy and includes GDP value considering price differences in compared countries. Cf. http://www.csioz.gov.pl/publikacja.php?id=5. In this study the value of GDP per 1 inhabitant and also the amount of expenditures on health protection (per capita) in USD according to PPP was applied to compare macroeconomic values in selected countries of the European Union.

(5) ec.europa.eu/social/BlobServlet?docId=6265&langId=pl, Levelling health inequalities in the European Union, European Commission 2011 (DoA: 12 November 2012).

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