THE VARIATION OF HEALTHY LIFE EXPECTANCY AND HEALTH EXPENSES IN EUROPE

Elisabeta JABA
Faculty of Economics and Business Administration
Alexandru Ioan Cuza University
Iasi, Romania
ejaba@uaic.ro

Christiana Brigitte BALAN
Faculty of Economics and Business Administration
Alexandru Ioan Cuza University
Iasi, Romania
christiana.balan@uaic.ro

Abstract

In the paper we aim to study the European health systems by analysing the relationship between the outcome and the input of health systems. The indicator that measures the output is healthy life expectancy at birth and at 65 years of age for the female and male population. The input consists in the health expenses by type of health services and medical goods provided.

We observe a sample of 21 European countries, including Romania, on health indicators, such as healthy life years and health expenses, available from Eurostat database. We applied both correlation and regression methods in order to study the variation of healthy life expectancy according to health expenses.

The results of the study point out high variations of healthy life expectancy per country. One of the factors that explain these differences is the varying volume of resources allocated in order to fund health services.

Keywords: health system, healthy life expectancy, gender differences, health expenses, correlation, linear regression
JEL classification: C21, I14, I15, J11

1. INTRODUCTION

In Europe, wide variations are recorded in what concerns the health of the population, the risk factors for health, the inputs, outputs, and results of the health systems, as well as the level of expenses for health and funding sources.

Health expenses have increased, in recent years, in a more alert rhythm than the general economic growth (OECD, 2010, p. 3). The main factors that explain the accelerated growth of the health expenses are: the development and flow of medical technologies (the technological progress explains approximately half of the growth of the health expenses on

the long term), the aging process of the population, and the life standards (Newhouse J.P. 1992, p. 5-6).

The results obtained by the health systems are based on various funding manners and a varying volume of allocated resources. In any health system, health expenses vary according to the type of health services and medical goods provided. Between countries with different health systems, the size of health expenses varies together with the types of funding and performance of resource usage (Paris, V. et. al., 2010, p.7).

Healthcare includes all the activities performed by institutions or individuals that aim, by applying medical, paramedical, and caring knowledge, to:

- Promote health and prevent illness;
- Cure illness and reduce premature mortality;
- Take care of the persons affected by chronic illness, who need medical assistance;
- Take care of the persons with health deficiencies or disabilities, who need medical assistance;
- Provide and manage public health services;
- Provide and manage health programs, health insurances, and other funding agreements.

The mentioned objectives are the basic functions of the healthcare system. The main types of services that fulfil these functions are: therapeutic (curative) services, recovery (rehabilitation) services, long-term healthcare services, prevention and public health services, the provision of health goods to ambulatory patients, administrative and health insurance services, auxiliary services, etc.

The quantification of the inequalities in the health of the population provides useful information for directing the resources for promoting health and for identifying the determining factors of health (Anell A. et al. 2000, p. 771).

One of the most often used indicators to measure the results of a health system is life expectancy (Asiskovitvh S. 2010, p. 887). The better the health of the population, the higher its life expectancy is. Therefore, life expectancy reflects both the health of a population and the impact of the health policies (Nixon, J., Ulmann P. 2006, p. 7).

The variation of life expectancy by country and by gender is mainly explained through several factors, such as the characteristics of a country's health system, the access to healthcare services, the education level of the individuals, the distribution of income, the behaviors that influence the health of an individual (smoking and alcohol consumption) (Joumard I. et al. 2008, pp. 18-19). The health of the population is under the impact of both the health systems and of their funding method.

Another outcome indicator is healthy life expectancy, or health expectancy, which focuses not only on life duration, but also on the quality of health during a person's lifetime. This indicator is the number of years that a person is expected to live in good health.

In official statistics, in order to measure healthy life expectancy, two indicators are used:

- The EU structural indicator: Healthy Life Years or HLY. This indicator measures life expectancy taking into account the health limitations in performing daily activities. HLY is equal to the mean number of years that people are expected to live with no health related limitations in their activity (Eurostat Glossary).

- The OMS indicator: Health-Adjusted Life Expectancy or HALE. At birth, HALE is equal to the general life expectancy minus the number of years of precarious health, weighted by the seriousness of the affection. HALE at 65 years of age is a measure of the quality of life of elderly people (WHO Statistical Information System).

In order to compute the two indicators, various data, hypotheses and methodologies are used, and therefore the results are different. For the HALE indicator, more complex calculations are necessary, as well as more data, than for HLY.

Measuring life expectancy is useful for evaluating the health of a population and the impact of health policies. It is used to identify health inequalities, and it can also be used to direct resources for promoting health and to improve the understanding of the determining factors of health. The information provided by healthy life expectancy is used ever more in the long term planning of retirement, fiscal, health, and social care policies. Policy makers are interested in the connection between the perceived health of the population and the activity and retirement models, as this information is useful for the policies concerning the reform of the benefits related to work incapacity. Healthy life expectancy is used, at present, in many countries to monitor the progresses made in the direction of meeting the objectives of a wide array of policies: increase of the life expectancy for the elderly population, long-term fiscal sustainability, the reduction of poverty and social exclusion, etc.

This paper aims to assess the relationship between the output and the input of the healthcare systems. It focuses on analysing the variation of healthy life expectancy according to health expenses for various types of medical goods and services.

Previous studies assess countries performance in achieving better health outcomes especially for industrialised countries (Or, Z., 2000, p. 6; Hitiris, T. and Posnett, J., 1992, p. 175). A rich review of main findings and methodological approaches of the most important papers in this field is reported by Nixon and Ulmann (2006, pp. 10-13).

Our analysis starts from these findings and seeks to include a more detailed range of indicators measuring health expenditures. The effect of each type of health expenses is quantified using country-level data for European countries. The results are used to explore the differences in health performance of the observed countries.

2. DATA AND METHOD

The database consists of 11 analyzed variables for a sample of 21 European countries, for 2009. The data source is the EU official statistics bureau UE, Eurostat.

The resources (input) of the health system are measured by health expenses (Euro/inhabitant). The health expenses are differentiated per type of medical goods and services provided by the health system:

- Curative (therapeutic) services (HC1)
- Recovery (rehabilitation) services (HC2)
- Long-term healthcare services (HC3)
- Auxiliary medical care services (HC4): clinical laboratory, medical imagery, transport, emergency salvation
- Medical goods provided to ambulatory patients (HC5): pharmaceutical products, treatment apparatuses, etc.
- Prevention and public health services (HC6)
- Administrative and health insurance services (HC7)

The results (output) of the health system are measured by healthy life expectancy:
- HLY at birth and
- HLY at 65 years of age, both for the female and for the male population.

For processing the data, the correlation and regression analyses have been used, applied through the SPSS software.

The correlation analysis allows identifying the significant correlations between healthy life expectancy (at birth and at 65 years of age) and the type of health expenses.

The simple regression analysis provides estimations of the regression coefficients between healthy life expectancy and the types of expenses with a significant impact.

The simple linear regression model implies analyzing the connection between 2 variables based on the linear equation of the form (Jaba E. 2002, p. 379):

$$Y = \alpha + \beta X + \varepsilon$$

where:
Y –dependent variable
X –independent variable
ε – residual variable
α and β – parameters of the regression model

The interpretation of the results of the regression model implies interpreting the estimations of parameters α and β, testing the significance of parameters α and β (using the t Student test), testing the significance of the model (using the Fisher test) and interpreting the value of the correlation ratio corresponding to each regression model.

3. RESULTS AND DISCUSSIONS

Health expenses vary per country and according to the types of medical goods and services.

For the total health expenses considered in the analysis, Norway and Luxemburg are the countries with the highest level of expenses (5176.24 euro/inhabitant, respectively 5134.56 euro/inhabitant), while Bulgaria and Romania are the countries with the lowest level of health expenses (450.15 euro/inhabitant and respectively 441.33 euro/inhabitant).

For most countries in the analyzed sample, the expenses for curative (therapeutic) services (HC1) have the highest weight in the total health expenses. In countries such as Spain, Luxemburg and Finland, the weight of the expenses for curative services is over 50% of the total health expenses. HC1 expenses vary from 2786.35 euro/inhabitant in Luxemburg to 136.25 euro/inhabitant in Romania.

The highest level of expenses for recovery services (HC2) can be noticed in Belgium (181.78 euro/inhabitant). Expenses for recovery services have the highest weight in the total expenses in Cyprus (9.8%) and Austria (7.4%).

The expenses for long-term healthcare services (HC3) are approximately 25% of the total expenses in Norway and Austria, 22% in Holland, and approximately 19% in Norway and Belgium. In exchange, in Slovakia and Bulgaria, the weight of these expenses is under 2.5% from the total expenses. In Romania, the expenses for healthcare services amount to 9.3% of the total health expenses.

For Norway and Luxemburg, we can notice the highest level of expenses for auxiliary healthcare services (318.51 euro/inhabitant, respectively 291.24 euro/ inhabitant). HC4 expenses (clinic laboratory services, medical imagery, transport, emergency salvation) record the lowest level in Romania (12.18 euro/inhabitant) and Bulgaria (10.92 euro/inhabitant).

The expenses for medical goods provided to ambulatory patients (HC5) have a weight of over 16% in the total health expenses, except Holland (14.1%). The highest level of these expenses is recorded in France (710.52 euro/inhabitant), and the lowest can be seen in Romania (78.40 euro/inhabitant).

Holland and Finland are the countries where prevention and public health services (HC6) have the highest level (166.02 euro/inhabitant, respectively 154.34 euro/ inhabitant). The lowest level for this type of expenses can be noticed in Cyprus (8.33 euro/inhabitant) and Lithuania (6.80 euro/inhabitant).

The expenses for administrative and self insurance services (HC7) vary from 237 euro/inhabitant in France to 13.26 euro/inhabitant in Bulgaria.

According to the mean level of health expenses, Romania is ranked 20th from 21 analyzed countries. We can therefore notice an insufficient funding of the health system in Romania, compared to the other European countries.

The performance of the heath system is measured by the value of the healthy life expectancy, places Romania on the 13th position, which means in the second half of the sample of European countries.

Healthy life expectancies for the observed sample presents a high range of values, both for males and females (Figure 1).
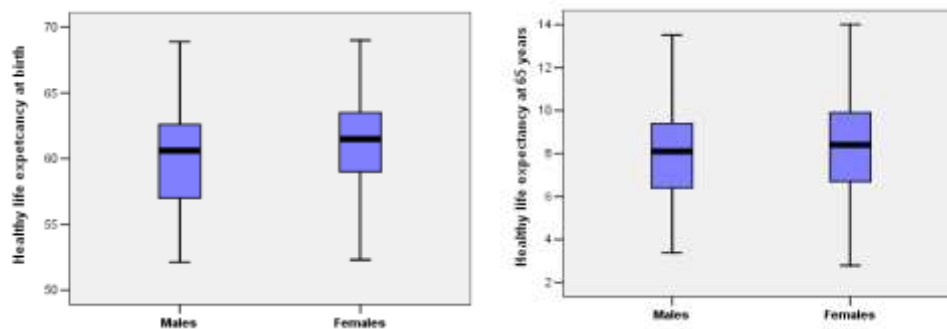
Source: [Own procession (Eurostat data)]
**Figure no. 1 Distribution of HLY at birth and at 65 years, by gender, in Europe, in 2009**

Norway and Island are the countries with the best performance of the health indicators. Island records the highest level of healthy life expectancy at birth for the female population (69 years). Norway records the highest level of healthy life expectancy at birth for the male population (68.9 years) and of healthy life expectancy at 65 years of age, both for the male population (13.5 years) and for the female population (14 years).

The gender gap in healthy life expectancy is higher for HLY at birth than for HLY at 65 years, in most countries the HLY for female population being superior to the HLY for male population.

The highest gender gap for HLY at birth is recorded in Estonia (4.2 years), while the smallest gender gap for HLY at birth is observed for Slovakia (0.2 years) and Belgium (-0.2

years). The countries where the HLY at birth is higher for males than females are Nether-lands, Norway, Belgium and Spain, Netherlands being the country with the highest negative gap (-1.6 years).

The highest gender gap in HLY at 65 years is in Cyprus (-1.4 years), while the smallest gender gap in HLY at 65 years is noticed for Germany (0.1 years), Austria (-0.1 years) and Hungary (-0.1 years). The countries with a negative gender gap in HLY at 65 years are more numerous than for HLY at birth: Cyprus, Spain, Slovakia, Belgium, Estonia, Romania, Hungary, and Austria.
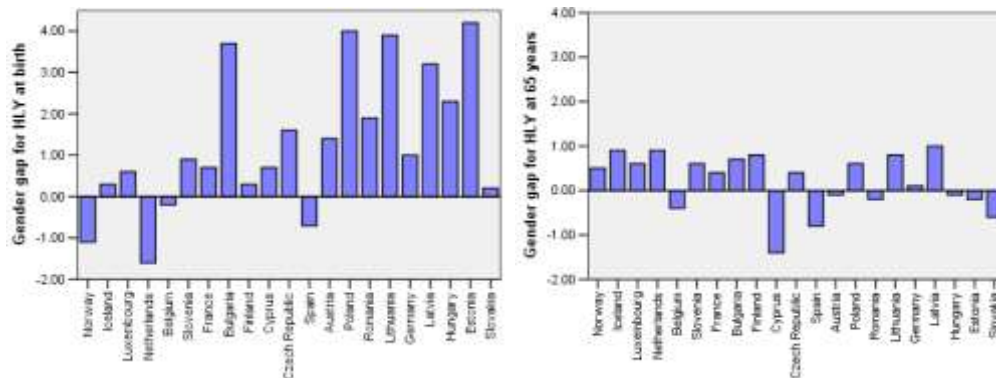
Source: [Own procession (Eurostat data)]
Figure no. 2 Gender gap (HLY females – HLY males) for HLY at birth and at 65 years, in Eu-rope, in 2009

For the entire sample of countries, health expenses are correlated to the healthy life ex-pectancy. The most important correlations can be noticed for the healthy life expectancy at 65 years of age (Table 1). The lowest correlations are between health expenses and the healthy life expectancy for the female population at birth. The expenses for prevention and public health services have an impact only on the life expectancy of the female population at 65 years of age. The expenses for administrative services are not correlated with the studied health indicators.

Table no. 1 Estimations of bivariate correlation coefficients between HLY and health expenses

Health expenses per type of medical goods and services	Healthy life expectancy			
	At birth (M)	At birth (F)	At 65 years (M)	At 65 years (F)
Curative services	.597(***)	.384(*)	.671(***)	.682(***)
Recovery services	.566(***)	.424(*)	.609(***)	.560(***)
Long term healthcare services	.619(***)	.433(**)	.713(***)	.732(***)
Auxiliary services	.497(**)	.357	.530(**)	.497(**)
Medical goods	.448(**)	.196	.527(**)	.497(**)
Prevention services	.231	-.044	.362	.394(*)
Administrative services	.216	.028	.255	.235

*** (p value < .001), ** (p value < .05) * (p value < .10)
Source: [Own procession (Eurostat data)]

The effect of health expenses on healthy life expectancy differ according to the type of medical goods and services. These effects are reflected by the regression coefficients in the

simple regression model between healthy life expectancy at birth/at 65 years of age (the dependent variable *Y*) and the health expenses for the various types of goods and services (the independent variable *X*). The most important effect on the life expectancy at birth/at 65 years of age is that of expenses for recovery services (Table 2).

The regression models are valid as the goodness-of-fit Fisher test is statistically significant.

Table no. 2 Estimated regression models between HLY and health expenses

Health expenses per type of medical goods and services (independent variable X)	Healthy life expectancy (dependent variable Y)			
	At birth (M)	At birth (F)	At 65 years (M)	At 65 years (F)
Curative services	.003** (.001) R^2 =.356	.002* (.001) R^2 =.148	.002** (.001) R^2 =.450	.002** (.001) R^2 =.465
Recovery services	.045** (.015) R^2 =.320	.029* (.014) R^2 =.180	.026** (.008) R^2 =.371	.025** (.009) R^2 =.314
	.008** (.002) R^2 =.383	.005* (.002) R^2 =.187	.005*** (.001) R^2 =.509	.005*** (.001) R^2 =.536
Auxiliary services	.028** (.011) R^2 =.247	-	.016** (.011) R^2 =.281	.016** (.007) R^2 =.247
Medical goods	.010** (.005) R^2 =.201	-	.006** (.002) R^2 =.278	.006** (.003) R^2 =.247

*** (p value < .001), ** (p value < .05) * (p value < .10)

Source: [Own procession (Eurostat data)]

An increase by 100 Euro/inhabitant of the expenses for recovery (rehabilitation) services determines an increase by 4.5 years of life expectancy at birth of the male population and by 2.9 years of life expectancy at birth of the female population.

An increase by 100 Euro/inhabitant of the expenses for auxiliary services (transport, emergencies) determines an increase by 2.8 years of the life expectancy at birth for the male population. An increase by 100 Euro/inhabitant of the expenses for medical goods determines an increase by 1 year of the life expectancy at birth for the male population.

The weight of the variation of the healthy life expectancy explained by the variation of the health expenses is reflected by the value of the determination ratio (R^2). Healthy life expectancy at birth for the male population is explained to a proportion of 38.3% by the variation of the expenses for long-term healthcare services. At the same time, the variation of the expenses for curative services explains to a proportion of 35.6% the variation of the healthy life expectancy at birth for the male population.

The effects of the health expenses on life expectancy at 65 years of age are approximately equal for the two categories of population, male and female. An increase by 100 Euro/inhabitant of the expenses for recovery (rehabilitation) services determines an increase by 2.6 years of the life expectancy at 65 years of age for the male population and by 2.5 years of the life expectancy at 65 years of age for the female population.

The variation of long-term healthcare services explains to a proportion of 53.6% the variation of life expectancy at 65 years of age for the female population and to a proportion of 50.9% the variation of life expectancy at 65 years of age for the male population.

An increase by 100 Euro/inhabitant of the expenses for auxiliary services (transport, emergencies) determines an increase by 1.6 years of the life expectancy at 65 years of age for the male/female population.

The expenses for curative services explain to a proportion of 46.5% the variation of healthy life expectancy at 65 years of age for the female population, and to a proportion of 45% the variation of healthy life expectancy at 65 years of age for the male population.

4. CONCLUSIONS

Healthy life expectancy is a useful indicator in measuring the health of a population. Based on this indicator, it is possible to identify inequalities concerning health according to a person's gender. As a whole, the life expectancy of the female population is greater than that of the male population, but the additional life expectancy of the females is not necessarily accompanied by better health. Healthy life expectancy for the female population at 65 years of age can be a useful indicator for identifying the needs of the elderly female population and adjusting the health and social services accordingly.

The different performance of the European countries concerning life expectancy can be explained through the level of health expenses per type of goods and services. Norway and Island are the countries with the best performance of life expectancy as a result of the high level of health expenses.

An important role in explaining the differences between countries is played by the type of the health systems. Germany, Holland, Austria, Belgium, and France are countries where the health system is funded by social insurances. The expenses for administrative services are sensibly higher in these countries where private health insurances have an important role. Finland, Norway, Denmark, and the UK have state health systems. In these countries, there is a direct control of the expenses, the distribution of the resources is more balanced, and administrative expenses are lower. Our results are consistent with other studies, for example with the paper of Joumard at al. (2010) that identifies French health system as performing relatively well, with high spending on health but also high life expectancy.

The relationship between health expenses and health outcomes is of crucial concern to policy makers. Health status of population could be increased by enhancing the health system performance and by spending more effectively the public funds.

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