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Original Study

How Important Are Health Care Expenditures for Life Expectancy? A Comparative, European Analysis

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A B S T R A C T

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Objectives: The relationship between health care expenditures and health care outcomes, such as life expectancy and mortality, is complex. Research outcomes show different and contradictory results on this relationship. How and why health care expenditures affect health outcomes is not clear. A causal link between the two is not proven. Without such knowledge, effects of increase/decrease in health care expenses on health outcomes may be overestimated/underestimated. This study analyzes the relationship between life expectancy at birth and expenditures on health care, taking into account expenditures of social production and education, as well as the quantity and quality of health care provisions and lifestyles.

Design: This is a cross-sectional study, analyzing national data of 31 European countries. First, the bivariate correlation between the dependent variable and independent variables are calculated and described. Next a forward linear regression analysis is applied.

Measurement: The data are derived from standardized, comparative data bases as available in the Organisation for Economic Co-operation and Development and Eurostat. Health care expenditures are assessed as a percentage of the Gross Domestic Product (GDP).

Results: Health care expenditures are not the main determinant of life expectancy at birth, but social protection expenditures are. The regression analysis shows that in countries that spend a high percentage of their GDP on social protection, that have fewer curative beds and low infant mortality, whose citizens report fewer unmet health care needs and drink less alcohol, citizens have a significant longer life expectancy.

Conclusion: To realize high life expectancy of citizens, policy measures have to be directed on investment in social protection expenditures, on improving quality of care, and on promoting a healthy life style.

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Following Grossman's¹ health investment theory, health care expenditures (HCEs) are a key investment in health and potential productivity. Citizens in good health have higher productivity. Research has shown that higher health care spending by governments, mostly assessed as a percentage of the Gross Domestic Product (GDP), is related to better health outcomes, such as high life expectancy or longevity.^{2,3} Comparing HCEs of European Union (EU) countries shows that higher HCEs are related to higher life expectancy (LE) and lower infant mortality.^{3–5} This finding is also confirmed by a worldwide analysis of less-developed countries.⁶ Also

the reverse is found: decreased governmental HCEs are related to increasing mortality.⁷ Is there a causal link between HCE and LE? Deshpande et al⁸ found that no significant correlation between HCE and LE exists in developing countries, but it does in developed countries. This difference may be caused by the difference in the quality of HCEs (ie, in developed countries the spending is related to quality and is therefore more effective),⁸ so living longer is also related to high-quality health care technology,⁹ whereas medical technology is an important factor to explain HCEs.^{10,11} Van Baal et al¹² conclude, based on a review of empirical studies, that a causal link between HCE and LE is difficult to demonstrate. They recommend searching for underlying mechanisms, such as developments in medical technology, to understand this (weak) relationship. For an effective health policy, it is important to understand whether and how HCEs and other investments in health care affect the health status of a population, and so LE.²

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Aging of the population might be seen as an outcome of health care investments, especially when citizens grow old in good health. At the same time, aging of the population also may increase HCE, directly or indirectly.¹² Aging of the population and high LE are sometimes seen as “explaining” factors for increase of HCE in developed countries, especially the increase in long-term care expenditures; but aging itself has a small effect on HCE, only expenditures on long-term care are strongly related to aging.¹³ This may be not surprising because chronic morbidity is increasing with aging, causing dependency and need for long-term care. That aging explains the increase of HCE seems to be a myth.¹⁴ Overall, there is no significant relationship between the number of elderly people and national health care spending.¹⁵ Nevertheless, increasing HCE in (western) European countries resulted in health policies to reduce health care costs by, for example, strengthening primary care.¹⁶ In the past 5 years, various European countries have tried to reduce HCEs, especially on long-term care, due to the economic crisis, as well as to the aging of the population. As compared with other countries in the Organisation for Economic Co-operation and Development, EU countries dramatically reduced their spending in health care between 2010 and 2014.¹⁷ Reducing HCEs may be risky if a causal link exists between positive health outcomes and high HCEs.

Research outcomes show different and contradictory results on the relationship between HCE and LE. More detailed analyses are needed to understand whether and why HCEs are related to high LE. The relationship between health care outcomes and HCE is complex and, without taking this complexity into consideration, effects of increase/decrease in HCE may be overestimated/underestimated⁹; also, trends of growing LE may change due to changes in life styles or financing health care.¹⁸ Stenholm et al¹⁹ reported that persons between 50 and 75 years, who do not show 2 of the risk factors of smoking, being physically inactive, or being obese, could expect to live on average 8 years longer in good health and 6 years longer free of chronic diseases. So, increasing HCEs is not necessary the right way to realize a longer life.

The role of sociocultural factors in explaining LE has become matter of scientific dispute in understanding the relationship between health outcomes (like LE) and HCE. A range of other than demographic and economic factors, like family traditions, level of education, housing, lifestyle, health behavior, and environmental risk factors, also play a role in this relationship.^{9,20–22} Looking at the state-of-the-art, the question “how are HCE and health outcomes related and which other factors may influence this relationship?” is not answered. But knowing and understanding the “predictive value” of such factors are needed for effective health policy measures.

In this study, we analyzed the relationship between LE at birth (LEaB) and expenditures on health care, on social production, and on education as a percentage of GDP, taking into account the quantity (such as the number of curative beds, number of general practitioners) and the quality (such as the percentage of vaccinated children and unmet medical needs) of the health care system and various lifestyle indicators (such as alcohol consumption and illiteracy).

Methodology

The output of the health care systems is expressed by indicators on LE (LEaB, LE at 65 years, healthy LE).⁵ Because these indicators are strongly correlated, we use LEaB as a health outcome.²³ LEaB shows the mean number of years that a person can expect to live at birth if subjected to current mortality conditions through the rest of his or her life.

Based on available data and findings in other studies, we selected expenditures on health care, on social protection, and on education, as a percentage of GDP in 2013.^{24–26} HCE is based on 3 types of costs: health care functions, health care providers, and health care financing schemes. Social protection expenditure is based on the coverage of

Table 1

Bivariate Pearson Correlations Between LEaB and Expenditure Indicators, in 2013

	Expenditure Indicators as % of GDP in 2013 on		
	Health Care	Social Protection	Education
LEaB	0.700*	0.747*	0.549*

*Significant at $P < .01$ level.

precisely defined risks and needs associated with illness, disability, housing, parental responsibility, unemployment, old age, and social exclusion. Public expenditure on education as a percentage of GDP gives an indication of how a country prioritizes education in relation to its overall allocation of resources. It includes spending on schools, universities, and other public and private institutions involved in delivering or supporting educational services.

As quantitative measures of the health care system, we used number of curative beds, of long-term beds, of practicing physicians, of general practitioners, and of nursing and care personnel per 100,000 inhabitants in 2013. All indicators are by Eurostat and are derived from their statistics.^{27–30}

The following indicators for quality of health care were used: percentage of vaccinated children aged 1 year for diphtheria, tetanus, and pertussis in 2012; percentage of women (age 20–69) screened for cervical cancer in 2012³¹; the overall volume of prescribed antibiotics in defined daily doses per 1000 population in 2013³²; standardized infant mortality (number of deaths of infants younger than 1 year per 1000 live births)³³; 30-day mortality after hospital admission; age-sex standardized of 45 years and older per 100 patients in 2013³⁴; and percentage of persons aged 16 and older reporting unmet needs for medical care in 2013.³⁵

The following indicators for health risks were used: percentage of low reading literacy of 15-year-old pupils in 2012 (ie, share at level 1 or less of the Programme for International Student Assessment combined reading literacy scale)³⁶; percentage of smokers 15 years and older in 2009³⁷; percentage of adults with insufficient physical activity in 2010³⁸; percentage of people with obesity in 2014³⁹; and alcohol consumption in liters in 2010.⁴⁰

We analyzed the data of 31 European countries as published in international databases.^{23–40} In some cases, the yearly data were replaced by data from 1 or 2 years earlier, as mentioned in the statistics used. Missing data were replaced by the mean score of the participating countries.

First, the bivariate correlations between the mentioned indicators and LEaB are presented. Next, the indicators that showed a bivariate statistically significant relationship with LEaB are analyzed by forward linear regression analysis. The indicators were entered per block. The final model in step 5 is presented. Outcomes were checked for collinearity; tolerance scores were between 0.7 and 0.9.

Results

HCE, social protection expenditures (SPE), and education expenditures, calculated as percentage of the GDP, correlate all statistically

Table 2

Bivariate Pearson Correlations Between LEaB and Quantitative Health Care Indicators, in 2013

	Quantitative Health Care Indicators Per 100,000 Inhabitants Number in 2013				
	Curative Beds	Long-Term Beds	Practicing Doctors	General Practitioners	Nursing and Caring Personnel
LEaB	−0.578 [†]	−0.231	0.139	0.302	0.447*

*Significant at $P < .05$ level.

[†]Significant at $P < .01$ level.

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