International Journal of Health Policy and Management, 2013, 1(1), 57-61

Kerman University of Medical Sciences

International Journal of
Health Policy and Management
doi: 10.15171/ijhpm.2013.09
Journal homepage: http://ijhpm.com

Original Article

Determinants of Life Expectancy in Eastern Mediterranean Region: A Health Production Function

Mohsen Bayati[1], **Reza Akbarian**[2], **Zahra Kavosi**[1*]

[1]Department of Health Economics, School of Management and Medical Information, Shiraz University of Medical Sciences, Shiraz, Iran
[2]Department of Economics, School of Economics, Management and Social Sciences, Shiraz University, Shiraz, Iran

ARTICLE INFO

Article History:
Received: 17 April 2013
Accepted: 13 May 2013
ePublished: 22 May 2013

Keywords:
Health Production Function
Healthcare System
Life Expectancy
Eastern Mediterranean Region
Panel Data Model

ABSTRACT

Background: Determinants of health or health production function in health economics literature constitute noticeable issues in health promotion. This study aimed at estimating a health production function for East Mediterranean Region (EMR) based on the Grossman theoretical model.

Methods: This ecological study was performed using the econometric methods. The panel data model was used in order to determine the relationship between life expectancy and socioeconomic factors. The data for 21 EMR countries between 1995 and 2007 were used. Fixed-effect-model was employed to estimate the parameters based on Hausman test.

Results: In estimating the health production function, factors such as income per capita (β=0.05, P<0.001), education index (β=0.07, P<0.001), food availability (β=0.01, P<0.001), level of urbanisation (β=0.10, P<0.001), and employment ratio (β=0.11, P<0.001) were specified as determinants of health status, proxied by life expectancy at birth. A notable result was the elasticity of life expectancy with respect to the employment rate and its significance level was different between males (β=0.13, P<0.001) and females (β=0.08, P>0.001).

Conclusion: In order to improve the health status in EMR countries, health policymakers should focus on the factors which lie outside the healthcare system. These factors are mainly associated with economic growth and development level. Thus, the economic stabilisation policies with the aim of increasing the productivity, economic growth, and reducing unemployment play significant roles in the health status of the people of the region.

Background

Today, maintaining, expanding, and improving the health of human populations is considered as one of the key policies for sustainable development in developing countries (1). As shown in macro level studies, several factors, such as the socioeconomic development level, education, culture, environment, health expenditures, urbanisation, and life style are associated with the overall health status (2,3).

The World Health Organization (WHO) started a specific commission in 2005 focusing on the Social Determinants of Health (SDH). East Mediterranean Region (EMR) is one of WHO's six regions. Regardless of their income level, all the countries in this region are facing an increase in chronic diseases associated with lifestyle changes, life expectancy (LE), and deaths and injuries resulting from road accidents. LE at birth in EMR countries varied from 44 to 77 years in 2006 (4).

Auster *et al*. were the first researchers who studied a population's production function for health. In their study, the relationship between the mortality of whites and both medical care and environmental variables was examined in a regression analysis across states in 1960 (5). Their research motivations and questions still remain compelling.

The present study aimed at estimating the health production function in EMR based on the Grossman theoretical model. The main assumption of Grossman model is that health is capital goods. In this model individuals are born with an initial inventory of health which depreciates over time and they can invest in it with consuming medical care. When the health inventory decreases to a definite level death will happen (6).

Health production functions can be characterized as:

$$H = F(X,M) \quad \text{(equation 1)}$$

in which, H represents individual health output, X is a vector of individual inputs, and M is medical care. The components of the vector include nutrient intake, housing, income, recreation, consumption of public goods, education, time devoted to health-related procedures, initial individual

*Corresponding author: Zahra Kavosi; Email: zhr.kavosi@gmail.com

Citation: Bayati M, Akbarian R, Kavosi Z. Determinants of Life Expectancy in Eastern Mediterranean Region: A Health Production Function. *International Journal of Health Policy and Management* 2013; 1: 57-61.

endowments like genetic makeup, community endowments such as the environment, and other factors. To go from micro to macro analysis, the health output (H), elements of vector X and medical care (M) were represented by per capita variables and regrouped into sub-sectorial vectors of economic, social, and environmental factors as: (3,6)

H= F (E,S,En) (equation 2)

In addition to Grossman, Wise, Khuder, Pedrick, Nixon and Ulmann, and Balia and Jones also did research in this area at micro level (7-11). Other studies with various titles almost have been done at macro level. The major advantage of this approach is that estimates of the overall effect of healthcare utilisation and other general factors on the health status of the population can also be obtained. Because of the mentioned advantage, quite a number of studies have adopted the same approach including studies by Auster *et al.*, Rodgers, Peltzman, McAvinchey, Babazono and Hillman, Siddiqui and Mahmood, Barlow and Vissandjee, Cremieux *et al*., Ngongo *et al.*, Filmer and Pritchett, Miller and Frech, Martinez-Sanchez *et al.*, Lichtenberg, Thornton, Audrey, Fayissa and Gutema, Shaw *et al.*, Chang and Ying, Kabir, Shin-Jong, Lei *et al.*, Halicioglu, Baltagi *et al.* and Bayati *et al*. Most of these studies have been conducted in developed countries (2,3,5,12-32).

In comparison with other factors, medical care is one of the health production inputs, which based on existence evidences, has less effect on health outcomes (33).

Different variables have been used to explain the health status. Income forms the condition of people's lives (34) and is a main socioeconomic determinant of health. Several studies (e.g. 2,3,26,28,32,35) considered income as one of the main determinants of health.

Unemployment causes social deprivation, anxiety, and having health threatening behaviours such as suicide (34). Therefore, it is another factor that explains health status (5,35,36). Education is another important factor that determines health in several ways (2,3,5,28,30,35,37). People with high education are more likely to have better jobs, higher incomes, and lower risky behaviours (34).

Food quality and quantity are central to health promotion. Shortage of food and excess intake both contribute to several health problems (38). Food has been considered in some studies as an input of health production function (3,26,30).

Health expenditure, as representative of resources allocated to health care, shows the access of people to health care production facilities. In many studies (3,26,28,30-32,37,39) it has been considered for explaining the health status of the society.

Urbanisation is another determinant of health (3,28,30,32) which can have both positive (increasing access to medical centres and information) and negative (pollution) impacts on the overall health (24).

Other factors such as pharmaceutical expenditures, life style, pollution, income inequality, and crime rate have been mentioned as determinants of health. In this study, we selected the explanatory variables based on the literature and data availability for EMR countries.

The present study extends previous literature in two ways. First, it provides a better understanding of the overall determinants of health in EMR. Second, the current study uses panel data tracing 21 EMR countries over the past 13 years, which provides results with less bias and better estimation in comparison to time series and cross sectional data.

Methods

Data and variables

The primary model was characterized as:

H= F (E,S,En) (equation 2)

In addition, health status (H) was determined by economic (E), social (S), and environmental (En) factors. In this study, the variables representing the economic factors were limited to income per capita, health expenditure, food availability, and employment ratio. Besides, the variables representing the social factors were limited to education and one-year-olds immunized with Measles Containing Vaccine (MCV). Finally, the variables representing the environmental factors included urbanisation and carbon dioxide emissions per capita. Therefore,

LE= f (GDP,HE,FPI,EMP,EDU,MCV,URB,CO2) (equation 3)

These explanatory variables were selected based on literature review in this area [e.g. Fayissa and Gutema (3)] and data availability for EMR countries in statistics provided by international organisations.

LE: Direct measurement of the health status is somewhat difficult. For studies at the macro level, some researchers suggested LE, particularly at birth, and mortality rate, particularly for infants and children, as indicators of the health output. In this study, LE at birth was employed as a dependent variable. It indicates the number of years a newborn would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life.

GDP: Gross Domestic Product per capita in Purchasing Power Parities (GDP PPP) was used as a measure of income per capita. The inflation and differences in the cost of living between countries were taken into account.

HE: A proportion of GDP which was allocated for health was used in order to show the Health Expenditure (HE). Generally, it is considered as an indicator of availability of the health production facilities to a society.

FPI: Food Production Index (FPI) was used as a measure of food availability. FPI covers food crops which are considered edible and contain nutrients. Coffee and tea were excluded because although edible, they have no nutritional value.

EMP: This shows the percentage of the total population aging above 15 that has been employed during the given year.

EDU: Education index of HDI (Human Development Index) was used as a measure of education level. Since the data regarding other education criteria (e.g. adult literacy and mean years of school) were missing, we used education index of HDI from annual human development reports.

MCV: Shows the percentage of one-year-olds immunized with Measles-Containing Vaccine (MCV).

URB: It is one of the environmental factors showing the percentage of the urban population.

CO2: CO2 emission (metric tons per capita) was used for indicating the effect of air pollution on the health status. Carbon dioxide emissions are those stemming from burning of fossil fuels and manufacturing cement. They include carbon dioxide produced during the consumption of solid, liquid, gas fuels, and gas flaring.

Citation: Bayati M, Akbarian R, Kavosi Z. Determinants of Life Expectancy in Eastern Mediterranean Region: A Health Production Function. *International Journal of Health Policy and Management* 2013; 1: 57-61.

Econometrics model

The econometrics model was developed as:

$lLE_{it} = \beta_0 + \beta_1 lGDP_{it} + \beta_2 lHE_{it} + \beta_3 lFPI_{it} + \beta_4 lEMP_{it} + \beta_5 lEDU_{it} + \beta_6 lMCV_{it} + \beta_7 lURB_{it} + \beta_8 lCO2_{it} + u_{it}$ (equation 4)

In equation 4, because different variables with various units were used in this study, the variables were presented in logarithm. We used a log-log model (Cobb Douglas model) for easier interpretation of the results. In this model, the coefficient shows the percentage of changes in LE compared to one percent change in explanatory variables. So, β_1 to β_8 indicate the elasticity of LE with respect to the explanatory variables. u_{it} is error term with classical assumptions. Country and time period were shown by i and t, respectively.

Data collection

In this study, the data of 21 EMR countries (Afghanistan, Bahrain, Djibouti, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, Somalia, South Sudan, Sudan, Syria, Tunisia, United Arab Emirates, and Yemen) from 1995 to 2007 were studied. Because of the lack of data on Pakistan, the country was excluded from the study. The required data were gathered from statistics and data sources of World Bank, WHO, United Nations, International Labour Organization (ILO), and Gapminder website (40-44).

Estimation methods

For estimating the models, the following steps were taken. In order to prevent spurious regression and autocorrelation problem, stationary and cointegration tests had to be performed. Moreover, Im-Pesaran and Shin stationary, and Kao cointegration tests were used to verify the existence of long-term relationship among the variables. Eviews 7 software was used for performing the tests.

Results

Descriptive statistics

Descriptive statistics of the variables are presented in Table 1.

Table 1. Descriptive statistics of the variables in EMR, 1995-2007

Variable (unit)	Mean	Standard Deviation	Minimum	Maximum
LE (years)	67.97	8.62	41.75	77.83
LE^m (years)	66.34	8.28	41.75	76.55
LE^f (years)	69.68	9.01	41.73	79.81
GDP (ppp per capita)	28.19	33.83	1.30	168.64
HE (health expenditure % of GDP)	4.70	2.08	1.10	11.70
FPI (food availability; 1999-2001=100)	102.45	19.16	38.00	154.00
EMP (Total above 15 employment to population (%))	55.35	9.88	41.80	77.70
EDU (HDI Index)	0.63	0.17	0.24	0.87
MCV (One-year-olds immunized with MCV (%))	84.64	18.03	21.00	99.00
URB (Urban population % of total)	64.95	22.44	19.80	98.34
CO2 (metric tons per capita)	10.06	14.06	0.01	65.77

In EMR countries, mean LE at birth was 67.97±8.62 years (range: from 41.75 to 77.83 years) between 1995 and 2007. Besides, female's mean LE at birth was 3.34 years more than that of males. Also, LE standard deviation of females (9.01) was more than that of males (8.28). The mean of income per capita was 28.19±33.83 (PPP). Moreover, the percentage of HE, as a share of GDP, ranged from 1.10 to 11.70. The mean of FPI was 102.45±19.16 (range: from 38 to 154).

The mean of EMP was 55.35 and the maximum and minimum of the ratio were 77.70 and 41.80, respectively. The mean of EDU was 0.65±0.15. In addition, the mean percentage of one-year-olds immunized with MCV in EMR in the mentioned period was 84.64±18.03. It should be noted that 64.95% of the total population in EMR were settled in urban regions in this period. The CO2 emissions varied between 0.01 and 65.77.

Regression results

The results of Kao cointegration test verified the existence of long-term relationship among the variables (-5.57, $P<0.001$). Based on Hausman test result (67.55, $P<0.001$) the parameters were estimated by the fixed effect model. The model was estimated for males, females, and total population (Table 2).

The estimated coefficients indicated the elasticity of LE with respect to the explanatory variables. The results showed that income elasticity of LE was positive and significant. For the total population, it was measured as 0.05, showing that an average increase of one percent in income per capita would increase the average of LE by about 0.05 percent.

HE coefficients were different between males (-0.01), females (>0.001), and total population (>0.001).

Elasticity of LE with respect to FPI was positive and significant. It showed that an average increase of one percent in FPI would increase the average LE by about 0.01%. The elasticity of LE with respect to employment ratio and its significance level was different between males (E=0.13, $P=0.00$) and females (E=0.08, $P>0.001$). The parameters of the EDU were estimated positive and significant for males, females, and total population.

The parameters of MCV were different for males, females, and total population; however, none of them were significant. The elasticity of LE with respect to urbanisation ratio and its significance level was very high for the 3 groups. The parameters of CO2 emission were insignificant.

The overall F-statistic of the model was significant. According to the results, the estimated model was significant ($P=0.00$) for males, females, and total population. Moreover, adjusted R^2 shows the model's goodness of fit. The results showed that the adjusted R^2 for both the total population was 1.00. This showed that more than 95% of the changes in LE in this region can be illustrated by the changes in the independent variables.

Discussion

In this study, we estimated a health production function.

Table 2. Fixed-effect estimates of health production function in EMR, 1995-2007

Variable	Total			Male			Female		
	Coefficient	t-stat	*P*	Coefficient	t-stat	*P*	Coefficient	t-stat	*P*
Constant	3.19	25.25	0.00	3.15	22.50	0.00	3.24	25.43	0.00
lGDP	0.05	10.10	0.00	0.07	11.41	0.00	0.04	7.56	0.00
lHE	<-0.001	-0.67	0.50	-0.01	-2.42	0.02	>0.001	1.28	0.20
lFPI	0.01	3.90	0.00	0.01	2.94	>0.001	0.01	4.53	0.00
lEMP	0.11	3.66	0.00	0.13	4.02	0.00	0.08	2.83	>0.001
lEDU	0.07	9.98	0.00	0.07	9.26	0.00	0.07	9.62	0.00
lMCV	0.00	0.12	0.90	>0.001	0.92	0.36	<-0.001	-0.75	0.45
lURB	0.10	5.00	0.00	0.07	3.33	>0.001	0.12	6.25	0.00
lCO2	>0.001	1.39	0.16	>0.001	0.59	0.55	0.01	2.09	0.04
F stat			3898			3018			
P			0.00			0.00			
R^2 (Adjusted)			1.00			1.00			

In other words, we assessed the economic, social, and environmental factors affecting LE at birth in EMR countries (1995-2007). Except for HE, the economic factors showed a positive effect on the LE. Similar to other studies (2,3,32,39), income per capita had also a positive effect on health. In fact, higher levels of income allow more access to consumption of high quality goods and services, better housing, and medical care services which affect the health status (3).

HE is considered as a measure of the provision of the health facilities to the society (37). In most studies, its effect is estimated as positive (30,31,37). While it has shown negative effects in some studies (3), it showed no significant relationship with LE in the present study. It is believed that the high expenditure in health in this area is related to high user fee; thus, the good effect of health facility provision due to increment expending in health is offset by reduction of financial access.

Like other studies (3,30), in this study food availability had a main positive effect on improving the longevity.

The health status of population, particularly the overall mortality, can be influenced by accessibility and intrinsic of employment opportunities (45). In our study, employment ratio showed a positive effect on the longevity. Differences between LE elasticity with respect to employment in males and females showed that its effect on the health status was higher in males compared to females. This might be due to the fact that the responsibility of males in meeting the families' needs in EMR countries would increase the social and mental stress on males and, as a result, unemployment has more effects on the males' health status in comparison to females.

The findings about education verified the results of the previous studies. In general, the individuals with higher levels of education had higher sensitivity and awareness about their health; therefore, they took more actions to improve the quantity and quality of their health (3,9).

Urbanisation was one of the main determinants of LE in this study as well as other studies. It is argued that the people in urban areas have more access to medical care services and heath information (24,30).

In the current study, CO2 emission was expected to have a negative impact on the health status; however, this was not verified in the study and the results showed no significant relationship between CO2 emission and LE.

The study findings about health expenditure and one-year-olds immunised with MCV revealed that the variables related to healthcare system did not have a significant effect on LE in EMR region. This might have resulted from the disparity of the socioeconomic status of the country and different structures of the healthcare system in the region. On the other hand, the most significant inputs of health production in this study lied outside the healthcare system. These factors are basically related to the socioeconomic development level of the countries. Thus, it is the responsibility of the national as well as international authorities to attain the goal of health improvement.

The main conclusion of the present study is that the economic stabilisation policies, such as increasing the productivity as well as the economic growth and reduction of unemployment, play significant roles in the health status of the people of the region.

One of the limitations of our research was that multicolinearity might have occurred between some variables, these include income and employment, but this probable collinearity did not cause any trouble for estimating the coefficients. Of course, the estimated parameters should be interpreted with caution.

Another point that should be considered is that the study estimated a health production function for EMR countries in general. Therefore, for providing evidences especially for a single country, we need to estimate the function separately for each country.

Acknowledgements

This paper was extracted from a research project that was funded (Grant No. 90-5846) by the Vice-Chancellery of Research and Technology of Shiraz University of Medical Sciences (SUMS). We also thank Research Improvement Center of SUMS and Ms. A. Keivanshekouh for improving the use of English in the manuscript.

Ethical issues

This study was approved by ethics committee of Shiraz University of Medical

Sciences.

Competing interests
The authors declare no competing interests.

Authors' contributions
Study conception and design: MB and RK. Data analysis and Interpretation of results: MB, RK and ZK. Drafting of manuscript: MB and ZK. Revision of manuscript: MB. Guarantor of the manuscript: ZK.

References

1. Von Schirnding Y. The World Summit on Sustainable Development: reaffirming the centrality of health. *Global Health* 2005; 1: 8.
2. Lei H, Li L, Liu X, Mao A. Quantitative study on socioeconomic Determinants of life expectancy in Beijing, China. JEBM 2009; 2: 92-8.
3. Fayissa B, Gutema P. Estimating a health production function for Sub-Saharan Africa (SSA). *Appl Econ* 2005; 37: 155-64.
4. World Health Organization. Regional Office for the Eastern Mediterranean. Building the knowledge base on the social determinants of health: review of seven countries in the Eastern Mediterranean Region. WHO. Regional Publications, Eastern Mediterranean Series; 31. 2008.
5. Auster RA, Levenson I, Sarachek D. The Production of Health: An Exploratory Study. *J Hum Resour* 1969; 4: 411-36.
6. Grossman M. The Demand for Health: A theoretical and Empirical Investigation. NBER: New York; 1972.
7. Wise RA. Changing smoking patterns and mortality from chronic obstructive pulmonary disease. *Prev Med* 1997; 26: 418-21.
8. Khuder SA. Effects of cigarette smoking on major histological types of lung cancer: a meta-analysis. *Lung Cancer* 2001; 31: 139-48.
9. Pedrick AM. The Health Production Function: The effect of socio-economic variables on an individual's health status 2001, the Department of Economics In Partial Fulfillment of the Requirements for the Degree of Bachelor of Arts.
10. Nixon J, Ulmann P. The relationship between health care expenditure and health outcomes: evidence and caveats for a causal link. *Eur J Health Econ* 2006; 7: 7-18.
11. Balia S, Jones AM. Mortality, lifestyle and socio-economic status. J *Health Econ* 2008; 27: 1-26.
12. Rodgers GB. Income and inequality as determinants of mortality: an international cross-sectional analysis. *Popul Stud* 1979; 33: 343-51.
13. Peltzman S. Regulation and health: the case of mandatory prescriptions and an extension. *Managerial and Decision Economics* 1987; 8: 41-6.
14. McAvinchey ID. A comparison of unemployment, income and mortality interaction for five European countries. *Appl Econ* 1988; 20: 453-71.
15. Babazono A, Hillman A L. A comparison of international health outcomes and health care spending. *Int J Technol Assess Health Care* 1994; 10: 40-53.
16. Siddiqui R, Mahmood MA. The Determinants of health status: A cross-country analysis. *The pakistan development review* 1994; 33: 745-58.
17. Barlow R, Vissandjee B. Determinants of national life expectancy. *Canadian Journal of Development Studies* 1999; 20: 9-28.
18. Cremieux PY, Ouellette P, Pion C. Health care spending as determinants of health outcomes. *Health Econ* 1999; 8: 627-39.
19. Ngongo K N, Nante N, Chenet L, McKee M. What has contributed to the change in life expectancy in Italy between 1980 and 1992? *Health Policy* 1999; 48: 1-12.
20. Filmer D, Pritchett L. The impact of public spending on health: does money matter? *Soc Sci Med* 1999; 49: 1309-23.
21. Miller R D, Frech HE. Is there link between pharmaceutical consumption and improved health in OECD countries? *Pharmacoeconomics* 2000; 18: 33-45.
22. Martinez-Sanchez E, Gutierrez-Fisac JL, Gispert R, Regidor E. Educational differences in health expectancy in Madrid and Barcelona. *Health Policy* 2001; 55: 227-31.
23. Lichtenberg FR. Sources of U.S. longevity increase, 1960-1997. NBER .Working Paper, No.8755. 2002.
24. Thornton J. Estimating a health production function for the US: some new evidence. *Appl Econ* 2002; 34: 59-62.
25. Audrey L. Do economic cycles have a permanent effect on population health? Revisiting the Brener hypothesis. *Health Econ* 2004; 13: 767-79.
26. Shaw JW, Horrace WC, Vogel RJ. The Determinants of Life Expectancy: An Analysis of the OECD Health Data. *South Econ J* 2005; 71: 768-83.
27. Chang K, Ying Y H. An empirical study on health in TAIWAN and its long-term adjustment .*The Japanese Economic Review* 2008; 59: 84-98.
28. Kabir M. Determinants of life expectancy in developing countries. *The Journal of Developing Areas* 2008; 41: 185-204.
29. Shing-Jong L. Economic fluctuations and health outcome: a panel analysis of Asia-Pacific countries. *Appl Econ* 2009; 41: 519-30.
30. Halicioglu F. Modelling life expectancy in Turkey. MPRA Paper No. 30840. Available at : http://mpra.ub.uni-muenchen.de/30840/, 2010.
31. Baltagi BH, Moscone F, Tosetti E. Medical Technology and the Production of Health Care. Discussion Paper No. 5545. 2011.
32. Bayati M, Akbarian R, Kavosi Z, SadraeiJavaheri A, AminiRarani M, Delavari S. Socioeconomic Determinants of Health in Western Pacific Region: A Panel Data Analysis. *Social welfare quarterly* 2013; 47 [in press]
33. Stahl MJ. *Encyclopedia of Health Care Management*. United States of America: SAGE publication; 2004.
34. Mikkonen J, Raphael D. Social Determinants of Health: the canadian facts. 2010, Library and Archives Canada Cataloguing in Publication.
35. Or Z. Determinants of Health outcomes in industrials countries: APooled, Cross-Country, Time-Series Analysis. *OECD Economic Studies* 2000; 30: 53-78.
36. Lin SJ. Economic fluctuations and health outcome: a panel analysis of Asia-Pacific countries. *Appl Econ* 2009; 41: 519-30.
37. Mohan R, Mirmirani S. An Assessment of OECD Health Care System Using Panel Data Analysis. Bryant University, 2007.
38.Wilkinson R, Marot M . *Social Determinants of Health: The Solid Facts*. edition 2. World Health Organization; 2003.
39. Schoder O, Zweifel P. Flat-of-the-curve medicine: a new perspective on the production of health. *Health Econ Rev* 2011; 1: 1-10.
40.World Bank, World Development Indicators, available at: http://www.worldbank.org/
41.World Health Organization, WHO Statistical Information System, available at: http://www.who.int/
42. United Nations, Human Development Reports 1995-2006, available at: http://hdr.undp.org/en/
43.International LabourOrganization(ILO), Key Indicators of the Labour Market Programme, available at: http://www.ilo.org/global/lang--en/index.htm
44. GDP per capita by purchasing power parities. Available at: www.gapminder.org/downloads/documentation/gd001
45. Gerdtham UG, Johannesson J. Business cycles and mortality: Results from Swedish micro data. *Soc Sci Med* 2005; 60: 205–18.