CAN HIGHER WAGES PROTECT YOUR HEART? REGIONAL EVIDENCE FROM ROMANIA

Cristian INCALTARAU[*]
Adrian-Vasile HORODNIC[**]
Doru BOTEZAT[***]

Abstract: *There is a bilateral influence between health and economic development. On the one hand, population health influences economic performance, both at micro and macro levels. On the other, being reflected in higher wellbeing, economic performance also influences health of population. Therefore, according to the materialist view, health status is dependent on the standard of living, whereas low living standards can increase the probability of morbidity and mortality by feeding poverty, poor hygiene and restricting access to health care and education, which is truly important in preventing diseases. Being generally considered to be a representative indicator for the standards of living, we have assessed the impact of wage variations on cardiovascular diseases (CVD) mortality, as CVD were proved to be more sensitive to socio-economic conditions, but also generally the main mortality cause in post-communist countries including Romania. Carrying out a panel data analysis over the 1995-2012 period on Romanian NUTSIII regions, the results showed a direct link between wage level and CVD mortality proving that the higher wages reach, the lower mortality is, thus confirming assumed materialist hypothesis.*

Keywords: wage level; cardiovascular diseases; mortality; Romania; panel data analysis
JEL Classification: J31; I14

Theoretical background

Lately, a major interest for studying cardiovascular diseases (CVD) emerged, not surprisingly however, considering that World Health Organization places them in the first position among the worldwide causes of death. Therefore, approximately 17.5 million people died from CVD in 2012, accounting for 31% of all global deaths. Moreover, according to the same organization, around three quarters of CVD deaths occurred in countries ranked in the low- and middle-income categories (World Health Organization, 2015).

Literature shows that there is a bilateral relation between health and economic development. On the one hand, population health influences economic performance, both at micro and macro levels. At micro level, health problems can force individuals to drop out labour market or it can discourage further human capital accumulation. At macroeconomic level, health condition can influence growth

[*] Researcher, Centre for European Studies, Alexandru Ioan Cuza University of Iasi, e-mail: cristian.incaltarau@uaic.ro
[**] Corresponding author, Centre for Ethics and Health Policy, Grigore T. Popa University of Medicine and Pharmacy, Iasi, e-mail: adi_horodnic@yahoo.com
[***] Centre for Ethics and Health Policy, Grigore T. Popa University of Medicine and Pharmacy, Iasi, e-mail: do_botezat@yahoo.com

through labour market mechanisms or by raising social expenditure. For example, focusing on the impact of CVD mortality on economic growth, Suhrcke and Urban (2010) used a worldwide sample, separated between low- and middle-income countries, and high-income countries. The results showed that there is no significant impact in the low- and middle-income countries. However, the authors found a robust negative contribution of increasing CVD mortality rate in the case of high income countries (Suhrcke and Urban, 2010).

On the other hand, socio-economic development can affect health in both ways, including CVD incidence and mortality. On the one hand, wage growth and lower unemployment induce an increase in the standard of living, decreasing CVD incidence, but, on the other hand, a decrease in unemployment can lead to a higher intake of hours worked, fatigue and additional stress, causing increased cardiovascular problems. Moreover, economic development and medicine improvement (together with the medicalisation phenomenon) can generate undesirable social consequences such as urban congestion, pollution, malnutrition, stress etc. There are numerous studies linking CVD incidence and socio-economic factors. For instace, using data from Germany, in order to evaluate the effect of state unemployment and economic growth rates on mortality caused by CVD, Neumayer (2004) concludes that CVD mortality rates are lower when the economic situation is worsening (e.g. when is economic recession). In another study, analysing the impact of fluctuation in economic status on CVD, the results show that predominantly procyclical CVD mortality is subject to substantial state-to-state variation (Ionides *et al*., 2013).

In order to further investigate how is the economic evolution affecting CVD incidence and mortality, previous studies have analysed the association between the socio-economic characteristics and CVD. Hence, a burgeoning literature reveals that CVD affect not only the poor across countries, but also the poor within countries (Fuster and Kelly, 2010). Indeed, CVD hardest hit among the poor and the association between these particular diseases and socio-economic status considers poverty both a cause and a consequence. Also, the link between socioeconomic characteristics and some specific CVD, such as myocardial infarction, hypertension or ischaemic heart disease has been investigated (Avendano *et al*., 2006; World Bank, 2005; Kolegard *et al*., 2002). For instance, Kolegard *et al*. (2002) showed that the living area socioeconomic context increases the risk of myocardial infarction, when analysing a Swedish urban population, during 1992-1994. In Brazil, the prevalence of hypertension was 30 to 130 per cent higher among the less educated and those with lowest income (World Bank, 2005). Also, was found that, for certain age groups, ischaemic heart disease mortality is higher for individuals with a lower socioeconomic status than in those with a higher socioeconomic status. The same study concludes that, for the period considered (1990s), socioeconomic disparities in ischaemic heart disease mortality were larger in northern nations than in Southern Europe (Avendano *et al*., 2006).

Beside materialist perspective stating the importance of socio-economic determinants, the CVD mortality is also related with psychosocial factors like daily stress. Using a prospective cohort study, Kivimäki *et al.* (2002), including cases of CVD, behavioural and biological risks, and stressful characteristics of work have proved that employees reporting high job strain and high *effort-reward imbalance* have a twofold higher risk of death from CVD than their colleagues scoring low in these dimensions. Later, Stringhini *et al*. (2011) showed that health behaviours are equally important mediators of the socioeconomic-health association in different cultural settings and that there is a causal chain leading to social inequalities in mortality. The greater the socioeconomic gradient in smoking, unhealthy diet, and physical inactivity is, the greater differences in mortality are. In a recent study, Davis *et al*. (2014) assessed the association of multiple social determinants on poor cardiovascular health by also including key variables of psychosocial factors like daily stress, racial discrimination, and stress due to discrimination. Their results showed that the socioeconomic status indicators and daily stress were generally inversely associated with cardiovascular health. Also, Jood *et al*. (2009), in a case-control study, suggested that the association between permanent self-perceived stress (stress is described as *feeling tense, irritable, anxious, or as having sleeping difficulties as a result of conditions at home or at work*) and ischemic stroke differed by ischemic stroke subtype. Considering the same stress – stroke incidence association, we note that prior similar investigation, conducted by Surtees *et al*. (2007) revealed that a strong sense of coherence (defined as individual's social stress adaptive capacity) is associated with a reduced rate of stroke incidence, after adjustment for various socio-economic variables, including "social class" as a way of assessing the individual economic status.

Overall, studies conducted either at individual or macroeconomic level, generally prove that socio-economic characteristics are related with CVD, standing out not only the effect of CVD on household-level economic status or macroeconomic level, but also the impact of socio-economic status on CVD incidence and mortality, considering that CVD affects the poor across and within countries as well as marginalised socio-economic groups (European Commission, 2013; Stringhini *et al*., 2011; Fuster and Kelly, 2010).

Turning to the Romanian specific, relating health status with socio-economic characteristics proved to be of actual interest in literature (Incaltarau *et al*., 2015; Horodnic *et al*., 2015; Burlea and Muntele, 2013; Precupetu *et al*., 2013; Bulgaru-Iliescu *et al*., 2012). This is mainly due to the high mortality the CVD are still causing. According to National Institute of Statistics, in 2013 Romania recorded an all-cause mortality rate of 249 deaths per 1000 inhabitants, circulatory diseases accounting for about 60% of all deaths. Stressing on the high share of CVD mortality, a dynamic panel data analysis (on 1995-2012 period within counties in Romania) was used to assess the impact of real wages, as a proxy for socio-economic status on mortality (all-cause and CDV mortality). Hence, it was argued that CVD mortality rather support than undermine the economic performance (Incaltarau *et al*., 2015). However, what is the impact generated by the wage level variations on CVD mortality at the regional level in Romania? As there is no study focusing on this topic, the objective here is to fill this gap.

Data, methods and results

The generally dominant view regarding the health-development relation is that poor economic development is believed to contribute to poor health (Sala-i-Martin, 2005). According to the neo-materialist interpretation, the wage level limits the access of individuals to resources thus exposing them to higher health risks. Therefore, the current article tests the impact of wage level, as a proxy for socio-economic determinants, on CVD mortality, assuming the wealth-health gradient hypothesis (see Deaton, 2002) stating that the lower wages are, the higher the incidence of CVD is. Therefore, looking to the distribution of Romanian regions (NUTIII level) according to the wage level and CVD mortality, it seems that indeed there is a negative relation between them. If in 1996 Hunedoara, Galati and Gorj were the first three counties in terms of medium wage (see figure 1), with over 125% of national average (137, 129 and 125%), they were encountering less CVD mortality (95, 72 and 97% - see figure 3). Contrarily, if Teleorman, Giurgiu, Salaj and Arad encountered the highest CVD mortality with values higher than national average (154, 143 and 130% - see figure 3), in terms of wage they reach less than national average (94, 92, 90 and 86%).

Figure 1 - Monthly medium gross wage 1996 (% national)

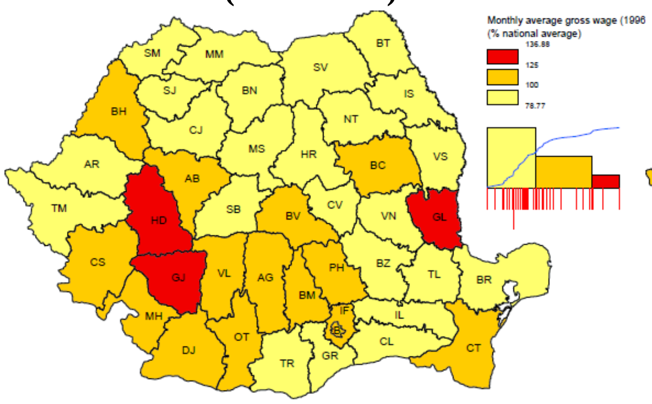


Figure 2 - Monthly medium gross wage 2013 (% national)

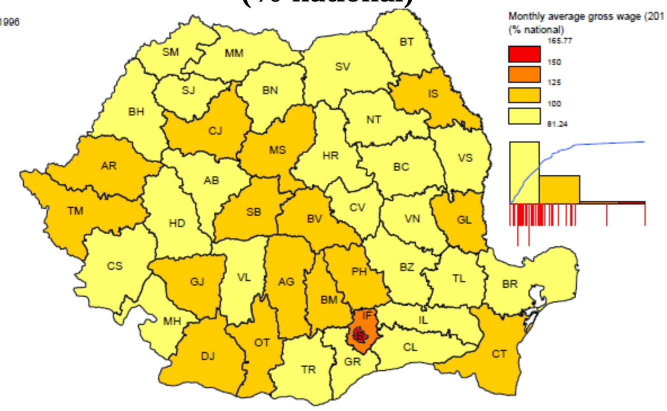


Figure 3 - CVD mortality rate 1996 (per 1000 inhabitants, % national)

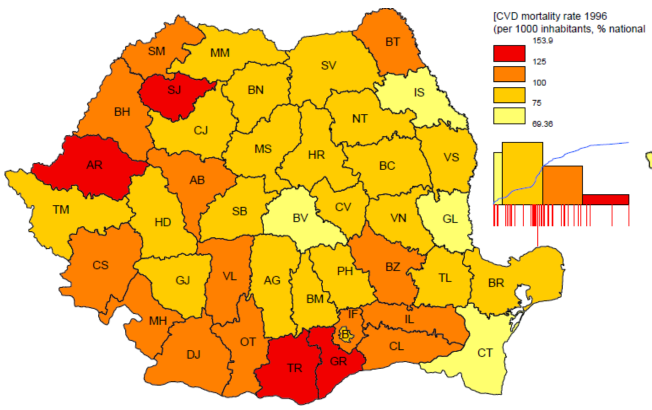
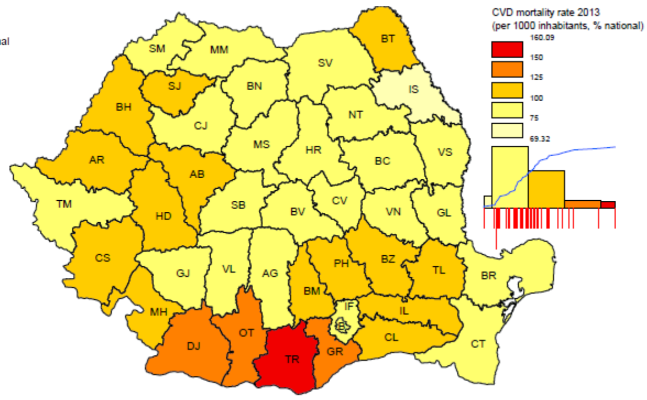


Figure 4 - CVD mortality rate 2013 (per 1000 inhabitants, % national)



Source: own representation using data from the Romanian National Institute of Statistics.
Made with Philcarto * http://philcarto.free.fr

In 2013, as the top has changed due to significant structural changes during the transition period, the inverse relation seems to continue. Thus, if Bucharest and Ilfov fully overcome all the other counties, reaching 166 and 142% of the national medium gross wage, they are facing lower CVD mortality (78 and 86% - see figure 4). It turns the opposite when looking to CVD mortality rate. Teleorman, Giurgiu, Olt and Dolj (160, 148, 131 and 128% - see figure 4), the counties with the highest CVD mortality, also have lower wage levels (90, 96, 100 and 106% - see figure 2)

In order to test our hypothesis, we have performed a panel data analysis using data from the National Institute for Statistics which generally covers the 1995-2012 period (data for Bucharest and Ilfov are starting from 1997 and 1998; data for higher education population has other scattered gaps) (see Table 1).

Table 1 – Data description

Variable	Description
All-cause mortality (*dependent*)	All-cause mortality rate per 1000 inhabitants (National Institute of Statistics)
Cardiovascular diseases mortality (CVD) (*dependent*)	Mortality caused by diseases of the circulatory system (per 1000 inhabitants); causes of death correspond to the International Classification of Diseases - Tenth Revision of WHO (National Institute of Statistics)
Wage	log of monthly average gross wage in real prices (1990 prices, National Institute of Statistics)
Higher education share	People with higher education degree (% of total population of the county, National Institute of Statistics)
Urban population share	Urban population (% of total population of the county, National Institute of Statistics)
Old population share	Population over 65 years old (% of total population of the county, National Institute of Statistics)
Doctors	Doctors (excluding dentists) per 1000 inhabitants (National Institute of Statistics)

The basic specification of the fixed effects model we have used for estimating the effect of economic growth on health condition of population is:

$$CVDmortality_{c,t} = c + \beta_0 wage_{c,t} + \beta_1 X_{c,t} + \gamma_c + \delta_t + \varepsilon_{i,t},$$

where $CVDmortality_{i,t}$ is the mortality caused by CVD in the county c, during year t, $wage_{c,t}$ is the monthly average gross wage in real prices, $X_{c,t}$ includes a set of control variables, γ_c represents the county territory specific time-invariant effects, δ_t are the year fixed effects, and $\varepsilon_{i,t}$ is a stochastic error term. The decision for using fixed effects was based on the results of the Hausman test. We have first tested weather fixed or random effects are suitable or a pooled OLS estimation would be a better choice. Both Wald test and Breusch-Pagan Lagrange multiplier (LM) test (Breusch and Pagan, 1980) indicated that fixed effects as well as random effects are both preferable to pooled OLS. For choosing between the two, the Hausman test was performed showing that fixed effects are required. Heteroscedasticity and serial correlation were both present as indicated by the modified Wald statistic (Greene, 2000, p. 598) and the test discussed by Wooldridge (2002), respectively. Furthermore, cross-sectional dependence was signalised by the Pasaran CD test. Hence, considering the presence of heteroscedasticity, serial and contemporaneous correlation, but also the fact that we are dealing with unbalanced panels, we have opted for using Driscoll and Kraay (1998) standard errors which are assumed to be heteroskedastic, autocorrelated up to some lag, and possibly correlated between the groups (panels). The estimation results are further shown in table 2.

Table 2 – Estimation results regarding the impact of the wage level on CVD mortality in Romania (NUTSIII)

	(1) all-cause mortality	(2) CVD	(3) all-cause mortality	(4) CVD
Wage	-0.811***	-0.785***	-0.142	-0.485***
	(0.214)	(0.151)	(0.219)	(0.157)
Urban share			-0.0852***	-0.0515***
			(0.0169)	(0.0122)
Old share			-0.0265	0.0629
			(0.0640)	(0.0409)
Doctors			-0.495**	-0.560***
			(0.178)	(0.121)
Higher education share			-0.133**	-0.0591
			(0.0549)	(0.0380)
_cons	18.39***	13.71***	18.58***	14.02***
	(1.791)	(1.258)	(1.370)	(0.899)
N	916	916	587	587

Estimation using fixed-effects regression with Driscoll-Kraay standard errors (in parentheses). The maximum lag to be considered in the autocorrelation structure was 2. Significance levels * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

The results provided in Table 2 are showing that wage raising have negatively impacted mortality, confirming the neo-materialist hypothesis. The negative relation between wage level and mortality is showed when considering both all-cause and CVD mortality. A 1% increase in real wage level is supposed to lead to a 0.48% percent decrease in CVD mortality (equation 4). In the first two equations (first 2 columns) we have only introduced the variables referring to mortality, as a proxy for health condition, and both proved to be statistically significant. When adding the control variables, all-cause mortality became statistically insignificant. Although CVD mortality accounted and still does for a considerable share in all-cause mortality (62% in 1996 and 59% in 2013), it seems that variations in wage level can indeed explain CVD mortality, which looks to be more sensitive to wage variation, but not also all-cause mortality.

The model controls for urban concentration, old population, healthcare availability and socio-economic status. A negative relation was shown with urban share, healthcare availability and education level, proving the higher mortality in counties with higher rural areas, with a lower concentration of doctors and a less educated population. Also, as expected, a positive, although statistically insignificant, relation was identified between mortality and counties with a higher share of population over 65 years old.

However, these results are facing several limits, failing to take into account other important characteristics, like cultural context, historical and geographical determinants. For instance, counties like Iasi, Brasov, Timisoara and Ilfov (Bucharest) are facing CVD mortality rates below the national average, despite higher variations in the wage level. This can be explained by the fact that important national universities are located within cities in these counties (consequently reaching high population density) and also because these are more developed in terms of healthcare infrastructure. Also, the study correlates the average wages with CVD mortality without taking into account social inequalities, which can also increase CVD mortality due to perceived relative deprivation as argued by the psychosocial view. Accordingly, future studies that analyse the socio-economic determinants of CVD should be carefully designed in such a manner to include these social characteristics as well.

Conclusions

Previous studies proved that CVD are closely related with socio-economic determinants, affecting the poor across and within regions, and also marginalised socio-economic groups (e.g. because of poor hygiene and limiting access to health care and education). In regions facing rapid socio-economic changes, like the ex-communist space, CVD shortly became the first mortality cause (Pająk and Kozela, 2012). In Romania, CVD is the main mortality cause by far, accounting for around 60% of all-cause mortality ever since the communist regime has fallen. Considering the high share of CVD mortality and their increased sensitiveness to the changes in socio-economic conditions, we have tested for the impact of wage fluctuations, as a proxy for socio-economic status, on CVD mortality evolution in Romanian NUTSIII regions during 1995-2012 period. While wage fluctuations was proven not to be statistically significant for overall mortality, it proved to negatively influence CVD mortality. A 1% increase in real wage level leaded to a 0.48% percent decrease in CVD mortality. Furthermore, a negative relation was shown with urban share, healthcare availability and education level, proving the higher mortality in regions with large rural population, lower number of doctors and a less educated population. Also, although statistically insignificant, the mortality was proven to be directly related to old share, as the share of population over 65 years old. Overall, it seems that all over the transition period CVD mortality was proven to be sensitive to real wage evolution across Romanian regions, confirming the wages are still low, barely ensuring subsistence, and a decrease in wages considerably impacts population health. Of course, this studies have several limits, as it does not control for inequality within regions, testing for the psychosocial perspective, or the differences in lifestyle across the regions in terms of alimentation behaviour, housing or work culture.

Acknowledgments: This work was supported through the "Program of Excellence in doctoral and postdoctoral research in multidisciplinary chronic diseases", contract no. POSDRU / 159 / 1.5 / S / 133377, beneficiary "Gr. T. Popa" University of Medicine and Pharmacy of Iasi, cofinanced by the European Social Fund through the Sectoral Operational Programme "Human Resources Development" 2007-2013.

References

Avendano, M., Kunst, A.E., Huisman, M., Lenthe. F.V., Bopp, M., Regidor, E., Glickman, M., Costa, G., Spadea, T., Deboosere, P., Borrell, C., Valkonen, T., Gisser, R., Borgan, J.K., Gadeyne, S. and Mackenbac, J.P. (2006), "Socioeconomic status and ischaemic heart disease mortality in 10 western European populations during the 1990s", *Heart*, Vol. 92, Issue 4, pp. 461-467.

Breusch, T. S. and Pagan, A. R. (1980), "The Lagrange multiplier test and its applications to model specification in econometrics", *Review of Economic Studies*, Vol. 47, No. 1, pp. 239-253.

Bulgaru-Iliescu, D., Botezat, D. and Oprea, L. (2012), "Chronic care model and personal responsibility for health", *Revista Romana de Bioetica*, Vol. 10, Issue 4, pp. 77-83.

Burlea, A. and Muntele, I. (2013), "Geographic and socio – economic health inequalities in Neamt county, Romania", *Present Environmenta and Sustainable Development*, Vol. 7, Issue 1, pp. 58-71.

Davis, S. K., Gebreab, S., Quarells R. and Gibbons, G. H. (2014), "Social Determinants of Cardiovascular Health among Black and White Women Residing in Stroke Belt and Buckle Regions of the South", *Ethnicity & Disease*, Vol. 24 Issue 2, pp. 133-143.

Deaton, A. (2002), "Policy implications of the gradient of health and wealth. An economist asks, would redistributing income improve population health?", *Health Affairs* (Millwood), Vol. 21, pp. 13–30.

Driscoll, J. C. and Kraay, A. C. (1998), "Consistent Covariance Matrix Estimation with Spatially Dependent Panel Data", *Review of Economics and Statistics*, Vol. 80, No. 4, pp. 549-560.

Fuster, V. and Kelly, B. B. (eds.) (2010), *Promoting Cardiovascular Health in the Developing World*, National Academies Press (US), Washington (DC).

Greene, W. (2000), *Econometric Analysis*, Prentice-Hall, New York.

Horodnic, A. V., Incaltarau, C., Botezat, D.L, Oprea, L. (2015), “Evaluating socio-economic variations in the prevalence of chronic diseases: some evidence from Romania”, *Social Research Reports* (forthcoming).

Incaltarau, C., Horodnic, A. V., Botezat, D. L., Astarastoae, V. and Oprea, L. (2015), “Is health status associated with macroeconomic development? Analysing all-cause and cardiovascular diseases mortality: some evidence from Romania”, *Revista Romana de Bioetica*, Vol. 13, Issue 1, pp. 159-175.

Ionides, E. L., Wang, Z. and Granados, J.A.T. (2013) “Macroeconomic effects on mortality revealed by panel analysis with nonlinear trends”, *The Annals of Applied Statistics*, Vol. 7, No. 3, pp. 1362–1385.

Jood, K, Redfors, P., Rosengren, A., Blomstrand, C. and Jern, C. (2009), “Self-perceived psychological stress and ischemic stroke: a case-control study”, BMC Medicine, Vol. 7, Art. no. 53.

Kivimäki, M., Leino-Arjas, P., Luukkonen, R., Riihimäki, H., Vahtera, J. and Kirjonen, J. (2002), “Work stress and risk of cardiovascular mortality: prospective cohort study of industrial employees”, *British Medical Journal*, Vol. 325, Art. no. 857.

Kolegard, S.M., Diderichsen, F., Reuterwall, C. and Hallqvist, J. (2002), “Socioeconomic context in area of living and risk of myocardial infarction: results from Stockholm Heart Epidemiology Program (SHEEP)”, *Journal of Epidemiology & Community Health*, Vol. 56, Issue 1, pp. 29-35.

Neumayer, E. (2004), “Recessions lower (some) mortality rates: evidence from Germany”, Social Science & Medicine, Vol. 58, No. 6, pp. 1037-1047.

Pająk, A and Kozela, M. (2012), “Cardiovascular Disease in Central and East Europe”, *Public Health Reviews*, Vol. 33, No. 2, pp. 416-435.

Precupetu, I., Vasile, M. and Vlase, I. (2013), “Individual and contextual factors in self-rated health inequalities: a comparison between Romania, 10NMS and EU15”, *Revista de cercetare si interventie sociala*, Vol. 41, pp. 28-39.

Sala-i-Martin, X. (2005) *On the health-poverty trap*, The MIT Press, Cambridge.

Stringhini, S. and Dugravot, A., Shipley, M., Goldberg, M., Zins, M., Kivimäki, M. and Marmot, M. (2011), “Health Behaviours, Socioeconomic Status, and Mortality: Further Analyses of the

British Whitehall II and the French GAZEL Prospective Cohorts", *PLoS Medicine*, Vol. 8, Issue 2, e1000419.

Suhrcke, M. (2010), "Urban D. Are cardiovascular diseases bad for economic growth?", *Health Economics*, Vol. 19, Issue 12, pp. 1478-1496.

Surtees, P. G., Wainwright, N. W. J., Luben, R. L., Wareham, N. J., Bingham, S.A. and Khaw, K.T. (2007), "Adaptation to social adversity is associated with stroke incidence - evidence from the EPIC-Norfolk prospective cohort study", *Stroke*, Vol. 38, Issue 5, pp. 1447-1453.

Wooldridge, J. M. (2002), *Econometric Analysis of Cross Section and Panel Data*, MIT Press, Cambridge, MA.

World Bank (2005), *Brazil: Addressing the challenge of non-communicable diseases in Brazil*, World Bank, Washington, DC.

World Health Organization (2015), "Europe: WHO European Region Fact sheet N° 317", available at: http://www.who.int/mediacentre/factsheets/fs317/en/ [accessed in October 2015]