Trends in avoidable mortality in Central and Eastern European countries*

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Abstract

The aim of the study of avoidable mortality is to analyze the trends and the impact of medical treatment and health care in the selected Central and Eastern European countries since 1980 up to the recent years. Since the collapse of the communist regime, mortality has improved rapidly in these countries. The concept of avoidable mortality has been used as a methodological instrument for measuring the efficiency of the health care system in order to reduce the intensity of mortality in the population under study. Using the method of decomposition of the temporary life expectancy, contributions of each category of causes of death were investigated. The results of the time analysis show that improvements in health care and prevention, and changes in lifestyle significantly contribute to the increase of the temporary life expectancy. On the contrary, an impact of the health care system was not found in the study of differences in mortality between observed countries.

Keywords: avoidable mortality, causes of death, Central and Eastern Europe, temporary life expectancy, method of decomposition

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Introduction

The Central and Eastern European countries were for several decades exposed to the political ideology of communism. During the communist era, health services were highly centralized and concentrated in big hospitals that took most of the health budget, whereas primary health care was neglected (Healy, McKee, 1997). The health sector was represented by a large number of medical staff with limited expenditures on equipment, drugs and maintenance and by outdated diagnostic and medical technologies. High-cost medical procedures were lacking in the socialistic environment. Especially elderly and middle-aged persons were disadvantaged (Rychtaříková, 2004). Furthermore, low level of investment into the health care system decreased the power of treatment and effectiveness of prevention. In addition, the unhealthy lifestyle, such as heavy smoking and drinking, high consumption of fat food and insufficient physical activity was responsible for a high number of the deaths caused by cardiovascular diseases, lung cancer or liver cirrhosis and contributed to the massive impairment of the health status in the population of Central and Eastern Europe. Concerning the impact of the inadequate health policy on the deterioration of the health status, the region of Central and Eastern Europe seemed to be homogenous for that period.

Although these countries experienced the same political regime until the year 1989, different dynamics of economic transformation contributed to the diverse development in mortality in each country. From a long-term perspective, the health situation improved and a decline of mortality appeared after the collapse of the socialist system. The observed changes in mortality were closely connected with the new social, political and economic perspectives that the end of the communist era brought. New opportunities were created by the opening of borders to international trade. Healthier food was imported from the West and information regarding healthier lifestyle was easier accessible (McKee, Nolte, 2004). The health care system has been transformed particularly in the area of prevention, diagnostics and therapy. The improvement of diagnostics has been accompanied by the better therapy and modern, more efficient medications (Rychtaříková, 2004). On the other hand, dramatic changes in Central and Eastern Europe influenced staff working in the health sector, labour force relations, working conditions and wages. As an example, the dissatisfaction with salaries in the health sector led to the strikes of the medical staff, especially in the Czech Republic and Poland (Healy, McKee, 1997).

The majority of the Central and Eastern European countries experienced an economic shock and faced a decline in expenditure on health services due to fall in economic output during the economic crisis in the years 1993–1994. Fortunately, a dramatic increase in death rates observed in most post-communist countries after the year 1990 was prevented in Poland and the Czech Republic because they implemented rapid and deep reforms (Healy, McKee, 1997; Brainerd, 1998; Rychtaříková, 2004). Since the beginning of the 1990s, the proportion of the total health care expenses to GDP is increasing in the Czech Republic and the average duration of stay in hospital was shortened, pharmacies and physician practices were privatized, modern health equipment and highly effective pharmaceuticals became available, health services fundamentally improved, dietary habits changed towards to higher consumption of fruit and vegetable, environment improved due to the industrial transformation from the heavy industry to the service sector that even caused changes in population structure of economic active people and led to the improvement of working conditions (Earl-Slater,

1996; Rychtaříková, 2004; Burcin, 2008). According to Rychtaříková (2004), the significant decrease in mortality during the transitional period indicates a high efficiency of the Czech health care system.

However, the timing and speed of mortality decline differs from country to country in regard to the economic situation during the transition. "Preliminary evidence across all transition countries indicated that countries that reformed more rapidly or intensely avoided rising mortality while the more gradual reformers experienced rising death rates" (Brainerd 1998: 2013). That might be a reason for the heterogeneity in mortality development during the transitional period in those countries and cause differences in efficiency of health care system. Nevertheless, efficiency of the health care system might increase after the year 1989 in all countries. The efficiency is related to the process of care and does not necessarily improve the quality of care (Rutstein et al., 1976). Improvement in quality should be reflected by better population health status that has to be measured as a positive health outcome. Concerning the measurement of the health outcome, Rutstein and co-workers proposed an approach that enables to evaluate health and medical care through the diseases or untimely deaths avoidable by medical treatment.

The aim of this study is to examine the impact of the health care system on development of mortality during the 1980s and quantify the contribution of improvements in medical care to the changes in mortality observed after the collapse of communism in five selected Central and Eastern European countries (Bulgaria, the Czech Republic, Estonia, Hungary and Poland) during the period 1980–2005 building upon the concept of avoidable mortality using the method of decomposition.

The paper is organized as follows. Initially, the concept of avoidable mortality and the existing international literature based on this concept will be described. Afterwards, the data and applied methodology will be explained, results obtained by means of decomposition of two different temporary life expectancies between ages 0 and 75 years and 0 and 80 years will be presented. Finally, the challenge for further research will be outlined and the study will be concluded.

Concept of avoidable mortality

The concept of avoidable mortality was originally developed by Rutstein and co-workers in 1970s to measure the quality of medical care and health policy (Rutstein et al., 1976). The main idea of the concept is to identify health care outcomes, such as death, disease and disability that should not occur in a system of effective medical care. Since the list of avoidable causes of death include conditions that could be eliminated by appropriate medical treatment and conditions reducible by sufficient prevention, avoidable causes of death are considered as an indicator for measurement of health care quality. Occurrence or even increase in avoidable mortality represents a warning signal for improvement in provided health services. Rutstein and co-workers pointed out that over 80 different causes of death could be eliminated by the means of medical treatment and prevention and developed the concept in such a way, that countries, in both, North and South can be compared to each other.

There is a large international literature building upon the concept of avoidable mortality proposed by Rutstein and his colleagues. In the year 1978, Adler conducted the first empirical study applying the theoretical concept of avoidable mortality. Few years later, in the year 1983, Charlton and his co-workers updated the original list of avoidable causes of death in order to keep up with progress in medicine. In addition, they set up an age limit to 65 years and continue to investigate the development

in avoidable mortality at the regional, national and international level focusing primarily on the Western European countries.

The European Community Atlas of Avoidable Death created by a working group under the guidance of Holland represents a fundamental change in the classification of avoidable causes of death (Holland, 1988; Holland, 1991; Holland, 1993). The first publication in the year 1988 was based upon the work by Charlton at al. (1983) and contained 17 groups of causes of death effectively treatable under the medical knowledge at that time. Two further revision of the European Community Atlas of Avoidable Death made it possible to include an updated list of causes of death.

In recent years, the concept of avoidable mortality attracts many scholars. Existing studies analyze mostly either Western European countries (Poikolainen, Eskola, 1986; Treurniet, Boshuizen, Harteloh, 1995; Nolte, McKee, 2004; Bautista et al., 2005) or non-European countries, such as New Zealand (Tobias, Jackson, 2001), Singapore (Niti, Ng, 2001) and Australia (Korda, Butler, 2004; Piers et al. 2007). Eastern Europe was mostly studied as a comparison between the East and West (Bojan, Hajdu, Belicza, 1991; Gaižauskiene, Westerling, 1995; Velkova et al., 1997; Nolte et al., 2002; Newey et al., 2004). The most recent investigation of avoidable mortality examine the Czech Republic at the national level (Burcin, 2008) and for the 77 districts of the Czech Republic at the regional level (Burcin, Kučera, 2008).

According to the literature review elaborated by Mackenbach, Bouvier-Colle and Jougla (1990), existing studies on avoidable mortality can be divided into analyses of time trends and the geographical variation between or within countries. Results from time trends studies demonstrate more rapid decrease in mortality from avoidable causes of death compared to the decline in mortality from non-avoidable causes of death. In contrast, studies of geographical variation give evidence on impact of socio-economic factors on differences observed between countries. Although the studies differ substantially in the methodology and in the selection of causes of death, their findings give comparable results. Since the findings are obtained by using different methods, they might reflect reality (Mackenbach, Bouvier-Colle, Jougla, 1990).

Additional attention should be devoted to the innovative studies of avoidable mortality (Niti, Ng, 2001; Tobias, Jackson, 2001; Bautista et al., 2005). Niti and Ng (2001) bring a new element into the examination of avoidable mortality by analysing differences in ethnic groups. Although the majority of scholars use the classical classification of avoidable mortality in a framework of treatable and preventable causes of death, Tobias and Jackson (2001) developed their own classification dividing avoidable causes of death in three categories: primary, secondary and tertiary avoidable mortality. According to them, primary avoidable mortality includes conditions that are preventable either by changes in lifestyle or by public health policy. Secondary avoidable mortality comprises conditions that respond to early detection and intervention in a primary health care setting. Tertiary avoidable mortality contains conditions that could be significantly reduced by existing medical and surgical treatments. Moreover, reflecting the improvement in life expectancy at birth and the progress in coding practice of causes of death at higher ages, they extended the age limit to 75 years (Tobias, Jackson, 2001). While the majority of analyses of avoidable mortality use aggregated data, Spanish scholars conducted a unique study using individual data based on a case study from a hospital in Valencia to investigate the role of socio-economic factors in premature deaths (Bautista et al., 2005). They pointed out that education is an important factor of avoidable mortality regardless age and health

care. Even Nolte and McKee (2004) confirmed the importance of education and unemployment rate for explanation of differences in avoidable mortality between countries using aggregated data.

The concept of avoidable mortality was often criticized (Carr-Hill, Hardman, Russel, 1987; Mackenbach, Bouvier-Colle, Jougla, 1990; Bojan, Hajdu, Belicza, 1991; Gaižauskiené, Westerling, 1995; Nolte, McKee, 2004; Meslé, 2006). Many scholars refer to the fact that authors analyzed the quantity of health care instead of the quality. Since the quality of health care cannot be expressed in numbers, existing studies apply as explanatory variables only quantitative measures such as number of patients per medical doctor, number of beds in hospitals, availability of health care or presence of hospital in the region. Subsequently, the impact of the health care on the level of avoidable mortality might be overestimated (Nolte, McKee, 2004). Furthermore, Gaižauskiené and Westerling (1995) and Treurniet, Boshuizen and Harteloh (2004) advert to the quality of classification of avoidable causes of death that complicates the international comparison between countries and refer to the possible inconsistency in time series data. In relation to the recent advances in medicine, the avoidable causes of death should be continuously specified and revised. Moreover, the age limit set up for the investigation of avoidable mortality should reflect the improvements in life expectancy at birth.

This study should contribute to the large amount of studies with an innovation regarding the age limit for males and females and take into account the differences between countries in Eastern Europe. First of all, the region of Eastern Europe was neglected in the international literature. Especially due to the political and economic change after the year 1989, this region should receive higher attention in regard to the measurement of health care system. Secondly, one of the major questions discussed in the international literature is the different sex age limit in avoidable mortality. A few scholars mentioned that since the life expectancy at birth differ for males and females, the age limit concerning the avoidable mortality should be set up differently as well. The idea was often considered, but authors mostly decided against the innovation to achieve comparable results with other studies. In this analysis, two age limits of avoidable mortality are calculated. One age limit set up to the age of 75 years in males and regarding the sex difference in life expectancy at birth that is on average approximately 8 years for life expectancy at birth and 5 years for temporary life expectancy, the second age limit was set up to the age of 80 years in females.

Data and methods

Data

The number of deaths and population size by sex and 5-year age groups were obtained from the Human Mortality Database. The World Health Organization (WHO) mortality files and the Czech Statistical Office served as a source for the number of deaths by cause. In consideration of available good quality data, five countries of the Central and Eastern Europe – Bulgaria, the Czech Republic, Estonia, Hungary and Poland – were selected for the following analysis. Although the Human Mortality Database contains information covering the whole observed period 1980–2005 in all investigated countries, the data according to the causes of death included in the WHO mortality database are not available for each year of observation. While the time series of deaths by cause is continuous during the entire period in Bulgaria and Hungary, it is not the case in the Czech Republic,

Estonia or Poland. The data for the Czech Republic are available only from the year 1986. Until this year, the Czech Republic was coded together with Slovakia. Fortunately, the gap can be filled by data provided by the Czech Statistical Office[4]. The data for Estonia are available only from the year 1981. Moreover, the years 1983 and 1984 are not included in the database. Regarding Poland, there is a gap for the years 1997 and 1998. During the years 1997 and 1998, a strike of medical doctors proceeded in Poland. The strike resulted in the neglecting of reporting the underlying cause of death. More than 20 % of death certificates were affected by the strike and the non-reported causes of death were coded as unknown (Eatock et al., 1997; Jasinski, 2005; Fihel, 2010). It might be the reason why the World Health Organization does not include those years in the mortality database.

Although the WHO mortality files contain data until 2006 for Bulgaria and 2007 for the Czech Republic and Poland, the year 2005 is the last available year for Estonia and Hungary. For the sake of comparability between countries, the last observed year was limited to the last available data for all examined countries.

Data quality

Reliability of data plays an important role in the causes of death research. The quality of data may be violated due to mistakes of coding, filling of the death certificate or by diagnose identification. The selection of the underlying cause of death is to a certain extent subjective and depends on the coding practice, the local coding instructions and progress in medical knowledge (Pechholdová, 2008). Diverse reporting, transmitting and coding practice may lead to the over- or underestimation and deteriorate the comparability of results. "The percentage of ill-defined causes provides a proxy measure of the data quality and points at specific diagnostic or coding-related problems" (Pechholdová, 2008: 15). In most countries, autopsy plays an important role in recognition of the right diagnoses. The autopsy is also used to verify the quality of death certificates. According to the health statistics of the Czech Republic, in approximately 30 % of the cases, the diagnosis on the death certificate differed from the autopsy results. It cannot be excluded that this incorrectness of data by causes of death will have some effect on the results, but the use of broad categories (treatable causes of death, ischaemic heart disease, and preventable causes of death) could reduce the inaccuracy.

In addition, using different versions of the International Classification of Diseases (ICD) may represent definitional problems and result in discontinuity in the statistical series. Furthermore, the adoption of different versions of ICD at different time point in diverse countries complicated the international comparability. During the study period (1980–2005), two of the ICD revisions were valid in the selected countries (ICD-9 and ICD-10). Each country adopted the given revision at different time points. While Bulgaria adopted the ICD-10 as late as the year 2005, the ICD-10 is in use since 1994 in the Czech Republic, 1996 in Hungary and 1997 in Estonia and Poland.

[4] Publication "Zemřelí podle podrobného seznamu příčin smrti, pohlaví a věku v ČR (1919–2005)" available on http://www.czso.cz/csu/2006edicniplan.nfs/p/4017-06

Selection of causes of death

The selection of causes of death considered as "avoidable" is based on the list proposed by Nolte et al. (2002) and Newey et al. (2004), separating the causes of death in three main groups: treatable causes of death, preventable causes of death and ischaemic heart disease. These three groups take into consideration either health policy (primary prevention), or medical care (secondary prevention or medical treatment). It is assumed that health services could minimize mortality from the causes of death characterized as avoidable. Ischaemic heart disease is treated separately since the precise contribution of medical care or health policy to the reduction in deaths is not clear. And even thought the ischaemic heart disease may be understood as an indicator of medical care, the large number of deaths from this disease would likely conceal the impact of medical care on other diseases which is not desired (Nolte et al., 2002; Nolte, McKee, 2004).

In the context of avoidable mortality, an age limit is set up. One of the reasons for an age limit in avoidable mortality is the questionable reliability of death certification at older ages due to multiple causes that could lead to death. Moreover, the prospect to avoid or postpone death from certain causes of death at higher ages becomes less probable. In the first studies from the 1980s, the age limit was 65 years for both sexes. With the increase of life expectancy at birth, the age limit for avoidable mortality was set up to the age of 75 years for both sexes during the 1990s. In the following analysis, two age limits were determined. One age limit following the classical setting at age of 75 years for both sexes and the second one extended to the age of 80 years for females taking into consideration the sex difference in life expectancy at birth. In addition, there are different age limits for few specific causes of death. For instance, since the effectiveness of good diabetic control in reducing vascular complications is controversial, diabetes mellitus is considered to be avoidable only up to the age of 50 years. The intestinal infectious diseases, whooping cough, measles and childhood respiratory disease can be avoided up to the age of 15 years and the age limit of 45 years was set up for leukaemia and malignant neoplasm of cervix uteri (Newey et al., 2004).

The causes of death characterized as avoidable for the purpose of the following analysis (see table 1 in Appendix) were sort out from WHO mortality files using the statistical software Stata version 10.1.

Methods

Initially, the age-standardized death rates by sex were calculated for all ages by direct standardization using the European standard population as standard to examine the mortality development over time in Bulgaria, the Czech Republic, Estonia, Hungary and Poland (Doll, Cook, 1967).

In order to estimate the contribution of medical care to the changes in mortality trends in the selected Central and Eastern European countries, the method of decomposition of differences in life expectancy developed independently by Andreev (1983), Arriaga (1984), and Pressat (1985) was applied. This method enables us to separate the differences in two life expectancies into contribution by age group and by category of causes of death. The life expectancies for each year of observation were calculated using the standard life table technique (Chiang, 1984). Due to the age limit proposed for the examination of avoidable mortality, the temporary life expectancy between birth and age 75 years (ie_{0-75}) and the temporary life expectancy between birth and age 80 years (ie_{0-80}) were

computed and further decomposed by age group and by the four main categories of the causes of death (treatable causes of death, ischaemic heart disease, preventable causes of death and non-avoidable causes of death).

The contribution of each five-year age group and each category of the causes of death to the overall change in the temporary life expectancy was calculated between the years 1985–1989, 1989–1995 and 1995–2005 and over the entire period 1985–2005 by means of method of decomposition. For a better comparability of avoidable mortality between countries, four time points (1985, 1989, 1995 and 2005) were chosen for the decomposition. The year 1980 as a first year of the observation, should be used as a time point. The problem occurred by selection of avoidable causes of death. Unfortunately, the WHO mortality database does not provide data with a breakdown of all external causes for Poland during the years 1980–1982. From this point of view, the number of deaths from the motor vehicle accidents is unknown and it cannot be easily extracted from given number for Injury and Poisoning. The number of deaths could be overestimated using back extrapolation based on the sequence of the years for which data are available. Since motor vehicle accidents belongs to the major causes of death especially for young adult males, using the year 1980 as a reference point would increase the uncertainty and inaccuracy of the results. The year 1984 would be appropriate selection as a time point for the decomposition because it corresponds to the last year before the anti-alcohol campaign was introduced by Gorbatchev. Regrettably, the year 1984 is not included in the WHO mortality database for Estonia. In order to insure comparability between countries, authors decided for uniformity in the time point selection. The year 1985 represent a compromise taken after considering above discussed difficulties. The year 1989 is a symbol for the fall of communist regime and the beginning of the economic transformation in the Central and Eastern Europe. The year 1995 was the first year after the economic crisis that most of the countries of Eastern Europe experienced in the period 1993–1994. Moreover, the endeavour to avoid the discrepancy in time series of causes of death caused by changes from ICD-9 to ICD-10 plays a role in selection of time points. The year 1995 was the last year when all observed countries (except the Czech Republic) still used the ICD-9 revision. The year 2005 is the last year for that the data are available in all five countries.

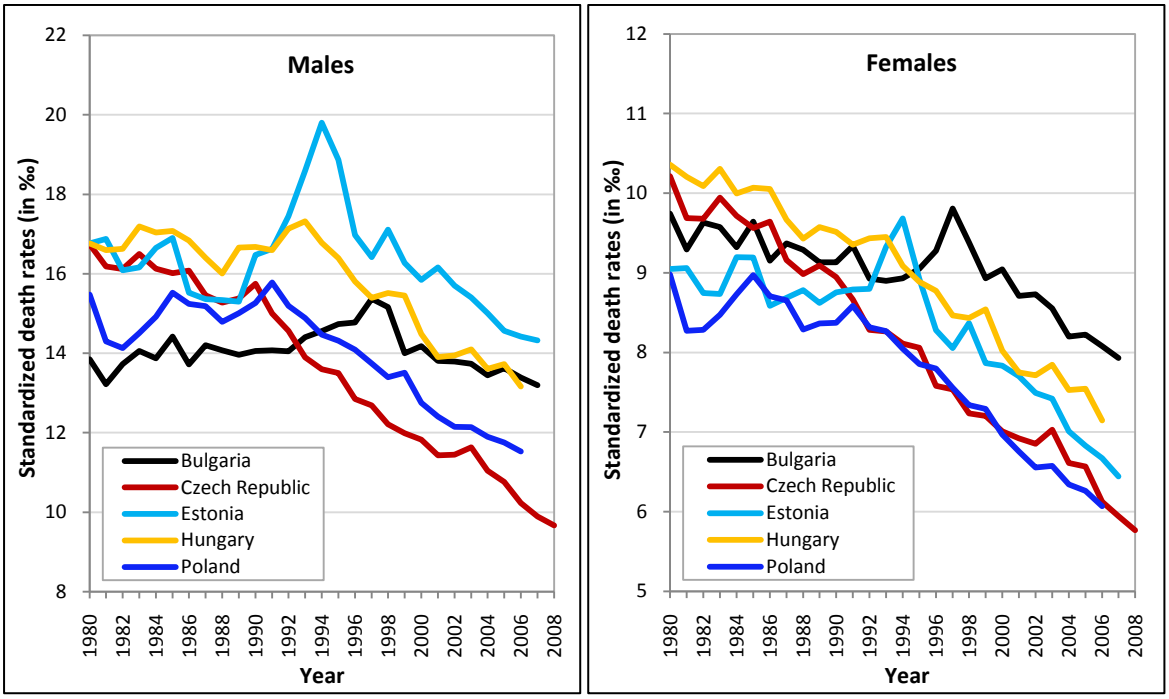
According to the assumptions, avoidable causes of death should decrease more rapidly compared to the non-avoidable causes of death if the improvements in health care system are responsible for the mortality decline. If the medical care is the main contributor to the decline of mortality, a larger decrease should be observed in treatable mortality. In case, that the main factor contributing to the decline of mortality is a change in life style characterized by decline in alcohol and tobacco consumption, increase in physical activity and improvements in dietary habits, the major decline in mortality should be observed from the preventable causes of death. Since the economic crisis common for the Eastern European countries in the years 1993–1994 was prevented in the Czech Republic due to a rapid transformation of society and economy, it is assumed that the Czech Republic would be the best performing country in regard to the recent mortality level in the Eastern Europe.

Results

Mortality development

In order to compare mortality development over time in Bulgaria, the Czech Republic, Estonia, Hungary and Poland, the age-standardized death rates were calculated for the entire period from the year 1980 to the recent years. The mortality decline after the fall of communism in the year 1989 is evident in all observed countries for both sexes just with several delays depending on the economy of each country. According to the figure 1, female death rates are far lower and more stable compared to the male ones[5].

Figure 1: Standardized death rates (per 1000 persons), selected countries of Central and Eastern Europe, 1980–2008



Source: Human Mortality Database, authors´calculations

Obviously, the death rates respond to the political engagements and economic situation of each country. The anti-alcohol campaign launched by Gorbatchev in the year 1985 plays an important role in the mortality development, particularly in the countries with high mortality from alcohol-related causes of death such as Estonia and Hungary (Meslé, 2004). Since the alcohol consumption is higher among male population, the anti-alcohol campaign distinctively influenced the male death rates especially in Estonia during the year 1985–1987. Since 1990, after the collapse of the communist system, diverse trends in mortality are observed in the selected Central and Eastern European countries depending on the transformation towards the market economy. Shapiro (1995) and Sachs (1996) notified that the countries reforming rapidly and effectively avoided the deterioration in the life expectancy. This fact is evident in the figure 1. Mortality decreases continuously in the Czech Republic and Poland since the year 1990. As few scholars pointed out, these two post-communist

[5] For sake of illustration, different y-axis scale was chosen in males and females.

countries implemented rapid economic reforms (Healy, McKee, 1997; Brainerd, 1998; Rychtaříková, 2004). While the mortality started to decrease immediately in the year 1990 in the Czech Republic, a one-year delay in mortality decline is observed in Poland. In contrast, the mortality increased after the end of the socialism in Bulgaria, Hungary and above all in Estonia. The deterioration in mortality accelerated during the years 1993–1994 caused by severe economic crisis due to the drastic change to market economy (Meslé, 2004). An extremely unstable macroeconomic situation evoked stress in population and contributed to increase in cardiovascular diseases and excessive alcohol consumption. Change in mortality development occurs after the economic stabilization in each country. The more fundamental improvements in death rates are observed in Bulgaria since 1993, in Estonia since 1995 and in Bulgaria only since 1997. In recent years, the death rates continue to decline with a different speed in males and females across all examined countries.

Time trends analysis

With regard to the concept of avoidable mortality, the results of the time trends analysis relate only to deaths under the age of 75 years for both sexes respectively 80 years for females. The male standardized death rates decline with a higher speed, especially in recent years compared to the female ones in Bulgaria, the Czech Republic, Estonia, Hungary and Poland during the observed period 1985–2005. The same can be concluded considering the avoidable mortality. Men experience a faster decline of mortality from causes of death characterized as avoidable compared to women. The different starting point in mortality between men and women might be the explanation for the increasing improvements in male death rates. Men demonstrate higher death rates in all ages and therefore they have higher potential for improvements. Any progress in living conditions and health care may lead to a greater decrease in male mortality. In addition, concerning the different age limit by analyzing female avoidable mortality, death rates calculated for ages 0–79 years decrease with the higher speed compared to the death rates computed for ages 0–74 years although the speed is still lower than observed for males. This is first evidence that different male and female age limits setting up regarding the avoidable mortality might be a reasonable idea.

Furthermore, in all examined countries, the avoidable mortality declines more rapidly than the mortality from non-avoidable causes of death between the years 1985 and 2005. While the avoidable mortality represents for both sexes on average approximately 60 % of total mortality (ages 0–74 years respectively 0–79 years) across all countries in the year 1985, death from avoidable causes of death were on average responsible for around 54 % of total mortality in the year 2005 (for more details see tables 2–4). It might be a sign for a positive development in health care and prevention or moving ahead toward a healthier lifestyle. In the light of the structure of avoidable mortality, a decrease in ischaemic heart disease contributed to the decline of overall mortality for both sexes in Bulgaria, the Czech Republic and Estonia. In Hungary, a slight increase of death from ischaemic heart disease is observed for both sexes. In Poland, mortality from ischaemic heart disease declines only in males. Females experience increases in ischaemic heart disease mortality taking both age limits into consideration. While the mortality from treatable causes of death declines in all countries, the mortality attributable to prevention increases continuously over the entire period across all countries. The changes in the structure of avoidable mortality signalize backwardness in effectiveness of prevention compared to the medical treatment.

The Czech Republic is the leader in the temporary life expectancy for both sexes slowly followed by Poland. Despite the strong recent improvements, Estonia lags far behind all other countries in the temporary life expectancy when males are considered. Regarding females, the temporary life expectancy is higher in Estonia compared to Hungary and in recent years even to Bulgaria. Differences in the temporary life expectancy calculated in years between two time points should reflect either improvement or deterioration in mortality. Between the years 1985 and 2005, only gains in the temporary life expectancy are observed. The biggest gain in the male temporary life expectancy ($e_{0–75}$) is demonstrated in the Czech Republic (3.31 years). The largest changes in the female temporary life expectancy ($e_{0–75}$) and ($e_{0–80}$) show Hungary respectively the Czech Republic. The smallest gain over the entire period is recorded in Bulgaria for both sexes. When the same age limit is set up for males and females, the female temporary life expectancy increases more slowly compared to the male life expectancy. Burcin (2008) suggests that the disproportional development in dynamics of female temporary life expectancy would reduce provided higher age limit for females. Following this suggestion, the results indeed confirm the hypothesis.

The changes in the temporary life expectancy from year to year may be hidden in the quantity summarized in the change between the years 1985 and 2005. In order to obtain a more detailed picture, the entire period was split into three sub-periods in regard to the break points described in the methods. The sub-periods enable to illustrate the deterioration in mortality after the collapse of communism in Bulgaria and especially in Estonia and large improvements undergone in recent years. Particularly the case of Estonia is worth mentioning. In Estonia, a big deterioration of life expectancy occured between the years 1989 and 1995 resulted in the loss of 3.61 years in the male temporary life expectancy and 0.54 of a year in the female temporary life expectancy respectively 0.57 of a year when higher age limit (0–79 years) is taken into consideration. On the contrary, 4.82 years gained males and 2.07 years respectively 2.62 years females as a consequence of the improved temporary life expectancy between the years 1995 and 2005. Since the changes between those two sub-periods had a contradictory effect, the resulting change of the temporary life expectancy over the entire period 1985–2005 is small. For more information see table 7.

Contribution of each age group and cause-of-death category to the change in the temporary life expectancy ($e_{0–75}$; $e_{0–80}$) were calculated using the method of decomposition. Although the limitations of looking at the changes over entire period were described above, for sake of brevity, the results are depicted and described only for the period 1985–2005. The results concerning contribution to the change in temporary life expectancy by groups of causes of death in the sub-periods can be obtained from the tables 9–11. Figures 2–4 show how different age groups and cause-of-death categories contributed to changes in the temporary life expectancy in each country between the years 1985 and 2005. There are several features common to all observed countries. The decline in infant mortality due to the improvements of the treatable conditions and non-avoidable mortality represents the major contribution to the mortality decrease in all countries. Especially Hungary and Poland are obliged to the improvement in infant mortality for the gain in the life expectancy. Furthermore, the contribution to the changes in the female temporary life expectancy is very small in all countries but mainly in Bulgaria considering the age limit less than 75 years. Due to the small contribution of preventable cause of death to the decline in mortality, the role of the health care system and prevention is for females not as visible as for males. The contribution of each different cause-of-death category to the

difference between two temporary life expectancies becomes clearer with increasing the age limit up to 80 years for females. From this point of view, the suggested extension of the age limit for females seems to be reasonable in order to detect the dynamics of mortality changes. In all countries, improvements in mortality from conditions attributable to the medical treatment made considerable positive contribution to the overall change in life expectancy. The major part of the contribution was realized in infant age. Apart from the infant age, aged 50 and above are important contributors to the decrease of conditions responsive to the medical care in all countries.

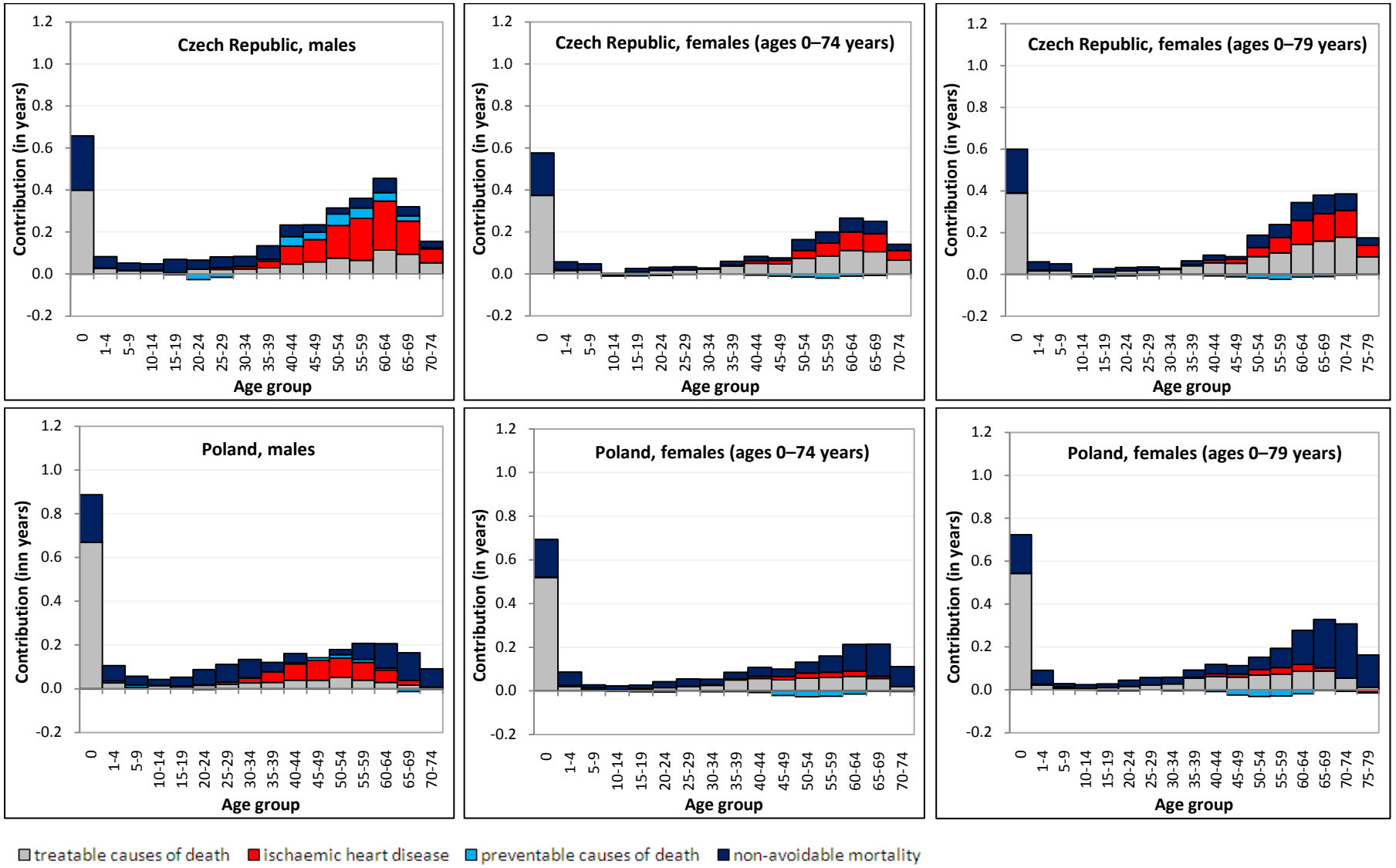
Large improvements in life expectancy at higher ages are driven by a decrease in mortality from ischaemic heart disease in the Czech Republic and Estonia for both sexes. In Poland, bigger contribution is evident only for males. Slight decline of ischaemic heart disease mortality is recorded in Hungary. In Bulgaria, improvement in mortality from ischaemic heart disease is negligible. It becomes more visible when the extended age limit for females is taken into consideration.

While the preventable conditions contribute positively to the change in life expectancy concerning males at younger ages in the majority of countries, the Czech Republic is an exception demonstrating negative contribution to the life expectancy at ages 20–29 years. This result largely reflects increasing death rates from motor vehicle accidents. On the contrary, the Czech Republic belongs to the leader in mortality decrease at higher ages whereas Hungary and Estonia experienced high increase in the preventable conditions due to excessive alcohol consumption resulting in the high number of deaths from liver cirrhosis. Taking females into account, an increase of mortality attributable to the prevention is observed at ages above 45 years in all countries. This phenomenon is closely related to the increase of smoking habits among women resulting in high mortality from lung cancer.

The decrease of deaths from conditions characterized as non-avoidable contributed to the increase of life expectancy across the age spectrum with a particular improvement in the infant stage in all countries. Only males in Bulgaria, Hungary and especially Estonia are exceptions. In those countries, an increase in non-avoidable mortality at ages 50 and above deteriorates the life expectancy between birth and age 75 years. Poland deserves an extra attention. Poland is the only country among the selected Central and Eastern European countries where the non-avoidable conditions are responsible for more than 50 % of total mortality. From this point of view, it seems that the changes in life expectancy are more likely driven by different factors than by improvements in health care system and health policy.

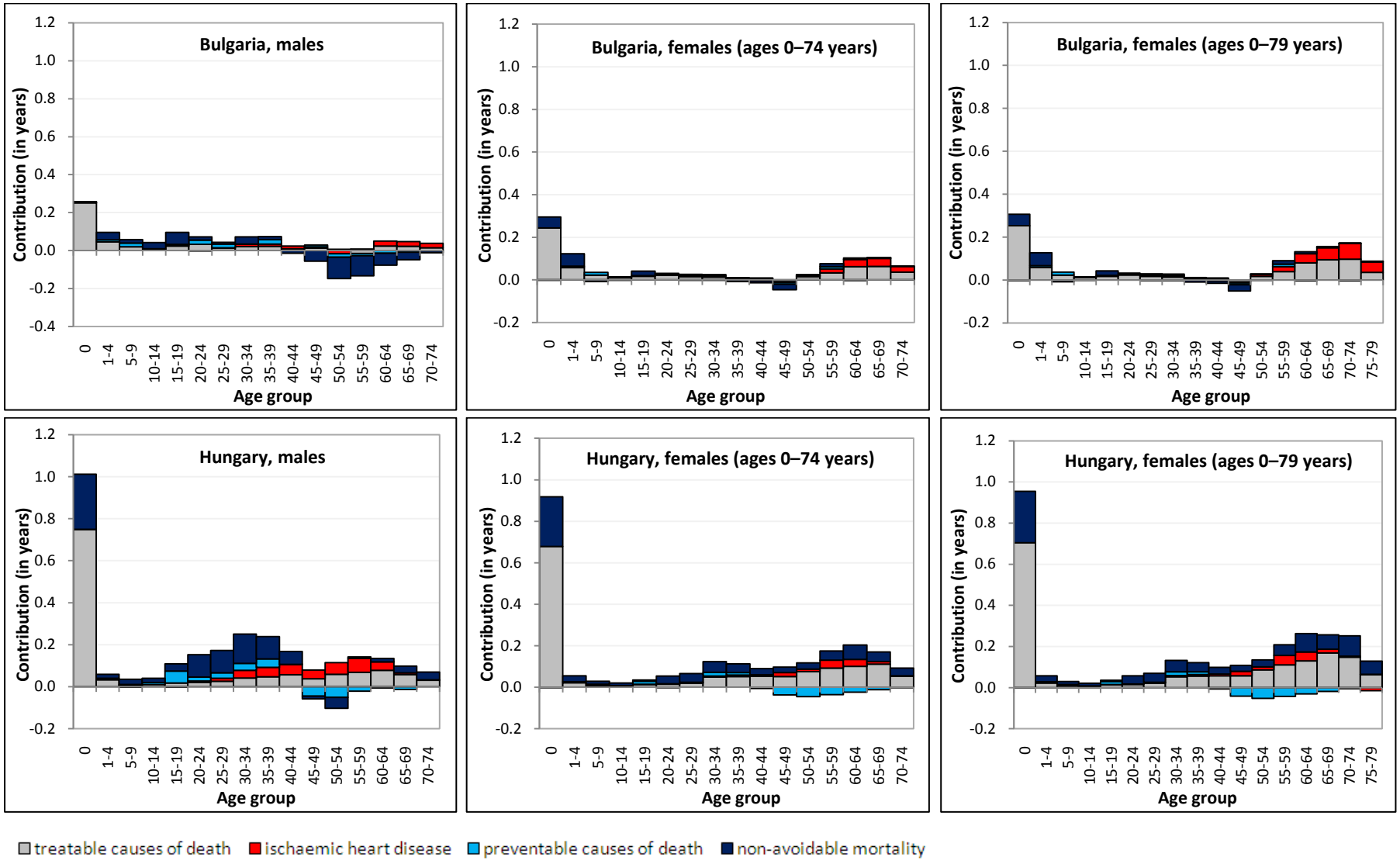
The time trends analysis confirms that the avoidable mortality decreases more rapidly compared to the mortality from non-avoidable causes of death. At the same time, conditions characterized as avoidable are sensitive to the changes in health care and prevention. For instance, the intervention by anti-alcohol campaign helped to decrease mortality from alcohol related causes of death on a short-term basis. The findings give evidence for the positive link between mortality decline and improvement in medical care. On the contrary, the health policy is not effective enough and there is still potential to progress on preventative measures in Central and Eastern Europe. Moreover, the dynamic of change in life expectancy is more visible in women when the age limit is extended up to the age of 80 years. In case of Poland, a different age limit in females does not appear to be necessary since the major contribution is attributable to the non-avoidable causes of death. With the extension of the age limit, only contributions of non-avoidable causes increase.

Figure 2: Contribution to changes in temporary life expectancy ($e_{0–75}$; $e_{0–80}$) by age group and cause-of-death category, both sexes, Czech Republic and Poland, 1985–2005



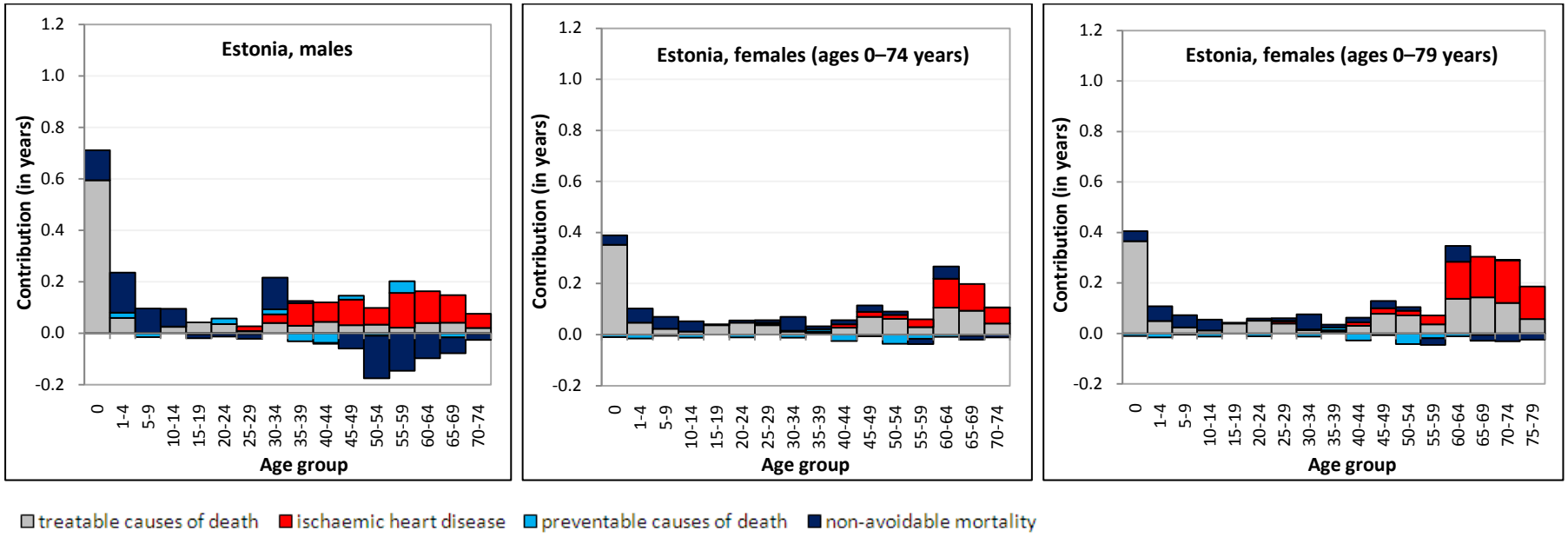
Source: WHO mortality database; authors´ calculations

Figure 3: Contribution to changes in temporary life expectancy ($e_{0–75}$; $e_{0–80}$) by age group and cause-of-death category, both sexes, Bulgaria and Hungary, 1985–2005



Source: WHO mortality database; authors´ calculations

Figure 4: Contribution to changes in temporary life expectancy ($e_{0–75}$; $e_{0–80}$) by age group and cause-of-death category, both sexes, Estonia, 1985–2005



Source: WHO mortality database; authors´ calculations

Geographical variation analysis

After the fall of communism, mortality rapidly improved in the Czech Republic compared to the other post-communist countries. Today, the Czech Republic belongs to the best performing countries in terms of mortality in the Eastern European region. For that reason, the Czech Republic was chosen as a reference country which other countries should be compared to. The aim of the geographical variation analysis is to identify causes that contribute to the remaining or even increasing differences between countries. Is the diverse health policy and dissimilar medical services responsible for the observed differences? Or there are other factors that influence the mortality and lead to disparity between countries, for instance socio-economic determinants?

Looking at the results, male life expectancies demonstrate larger differences across investigated countries. While the biggest gap in male life expectancy between countries is equal to 7.14 years, differences in female life expectancy between countries reaches at most 2.04 years respectively 2.26 years regarding different age limits. The biggest gap, not surprisingly, is observed between the Czech Republic and Estonia in the year 1995 for both sexes. At the same time as the mortality rapidly improved and the life expectancy continuously rose in the Czech Republic, Estonia was experiencing hard economic crisis resulting in a drastic deterioration of death rates.

Regarding male mortality, much of the improvements observed in the Czech Republic were due to decline in deaths from conditions characterized as non-avoidable. Non-avoidable mortality contributed on average to the differences between the Czech Republic and Estonia with approximately 60 % and even 80 % contribution is observed when the Czech Republic and Poland are compared. Decrease in mortality from conditions amenable to medical care made substantial positive contribution to the differences in life expectancy between the Czech Republic and Bulgaria, especially in the years 1995 and 2005 and between the Czech Republic and Hungary. While the treatable causes of death contributed 58 % to the change in male life expectancy between the Czech Republic and Bulgaria in the year 1995, the contribution reduced to the 46 % in the year 2005. A similar pattern is observed when the Czech Republic and Hungary are compared. Almost 36 % of the change in male life expectancy between the Czech Republic and Hungary was attributable to the medical care in the year 1985. During the examined period, the share of the conditions characterized as treatable declined and in the year 2005, the share is only 17 %. It seems that the effectiveness of health care was higher in the Czech Republic compared to Bulgaria and Hungary at the beginning of the observation, but the difference reduces over time. Taking into account the age structure of the contributions, much of the observed differences were due to infant mortality. Improving the health services especially in maternal care and care for newborns reduced the gap in life expectancy between countries. The positive contribution of treatable conditions to the differences in life expectancy between the Czech Republic and Bulgaria are counterbalanced by negative contribution of ischaemic heart disease. Contribution of ischaemic heart disease to the differences in life expectancy across Central and Eastern European countries is very small. Compared to Bulgaria and Poland, the mortality is higher in the Czech Republic. Regarding ischaemic heart disease, negative contribution to the differences between the Czech Republic and Bulgaria and the Czech Republic and Poland was observed mainly during the communist regime. After the fall of communism, differences started to reduce. In the year 2005, any difference was found between the Czech Republic and Poland when ischaemic heart disease is considered. Preventable conditions made more significant contribution to the differences in life

expectancy only when the Czech Republic is compared to Hungary. Negative contribution to the changes in life expectancy is observed at ages 15–24 years mainly due to excess of death from traffic accidents in the Czech Republic. On the contrary, reflecting the increasing death rates from alcohol-related causes of death in Hungary, causes of death attributable to the prevention made a positive contribution at ages above 35 years to the differences found between those countries.

A very similar picture is obtained analyzing the female mortality. The findings largely correspond to the results described above in male. With respect to the slightly different structure of cause-of-death category in females, treatable causes of death play more important role in women than in men. Their contribution to the overall difference in female life expectancy across countries is higher than in males but major of the contribution is made at infant age. Moreover, while the differences observing between the Czech Republic and Hungary in men attributable to the preventable causes of death were mostly due to liver cirrhosis, the gap found in women between the Czech Republic and Hungary is more likely due to lung cancer reflecting higher tobacco consumption in Hungary. Apart from that, comparable conclusions can be drawn in the investigation of female life expectancy.

However, the different age limit settings deserve more attention. The five-year higher limitation for the female temporary life expectancy appeared as reasonable in time trends analysis to detect the dynamics of changes in avoidable mortality. It is not the case when the geographical variation in avoidable mortality is analyzed. Although the differences in life expectancy between countries increase when higher age limit is taken into consideration, the structure of causes of death contributing to the changes do not help to explain health care or health policy differences between countries. The changes in life expectancy between countries are mainly driven either by non-avoidable mortality across all ages or ischaemic heart disease at higher ages. While the non-avoidable causes of death contribute positively to the changes between the Czech Republic and other Central and Eastern European countries, negative contribution of ischaemic heart disease was found especially when the Czech Republic is compared to Bulgaria and Poland. As the contribution of each category of causes of death increase proportionally with the increase in temporary life expectancy by extension of the age limit, it seems that the age limit does not matter analyzing the differences between countries.

In the geographical variation analysis, the impact of medical treatment and effectiveness of health policy were not adequately proven since the majority of differences between countries are caused by non-avoidable causes of death. It might be assumed that the differences observed between countries are driven by other factors than health care. In regard to the mortality inequalities across countries, socio-economic determinants and cultural environment play more important role and should require more investigations.

Further research / Discussion

In relation to the concept of avoidable mortality, the quality of medical care is a key term. In a simplified way, the quality care will be provided if all deaths, diseases and disability attributable to the existing medical treatment are eliminated. In this study is presumed, that avoidable causes of death should decrease more rapidly than the non-avoidable causes of death if the improvements in health care system were responsible for mortality decline. If medical care was a main contributor to the mortality decline, treatable mortality would be lower and quality services would be provided. On the

other hand, if a change in life style (decrease in tobacco and alcohol consumption, healthy diet, sufficient physical activity, etc.) was a main contributor to the mortality decline, mortality from the preventable causes of death would decline and health policy would be considered as an effective tool.

But can we really suppose that quality health care is provided and health policy is efficient, even though above described pattern is observed in data? Not necessarily. The mortality decline observed in the transition economies has been more likely due to changes in life style, the socio-economic development and knowledge diffusion rather than prevention delivered by the health care policy. The successful state health policy needs a stable political environment, sufficient financial support and interconnection to other state policies. These prerequisites are hardly fulfilled in economies transformed from a command to market structure. Therefore the role of prevention is questionable and should be more investigated. The analysis of "preventable causes of death" is still not enough.

The concept of avoidable mortality was developed as a measurement of health care quality. What does it mean "health care quality"? Under what circumstances is the provided care labeled as a high, low or just a standard quality? We are interested in the quality but are we really able to measure the quality? In the last 40 years, research revealed that we are able to measure the quality of the health care and even that the quality varies from region to region and from institution to institution (Brook et al., 2000). But is indeed the quality that we are able to measure or are the measurement more related to the efficiency of medical care?

Due to the fact that quality is multidimensional, several approaches have been developed how to measure it. Although several definitions of quality health care exist, all of them cover two elements. The first is related to technical quality, the second to the humane manners of treatment. For instance, the Institute of Medicine defines the quality of health care as a degree of health services that increase the likelihood of desired health outcomes under the current professional knowledge (Donaldson, 1999). This definition clarifies that outcome is not identical to quality. From this point of view, the measurement based on outcome does not have to be necessarily sufficient. For illustration, certain deaths were avoided due to medical treatment but resulted in disability of patient. In light of the concept of avoidable mortality, we conclude that health care quality improved since fewer deaths are registered. But does really health care quality improved when the treatment led to disability? Regarding mortality, health services progressed. Nevertheless, the question should be if the health care improved in terms of all health outcomes (death, disease and disability).

Donabedian (1966, 1980) set up three dimensions of health care quality measuring, which are broadly accepted these days; structure, process and outcomes. The structural measures represent the capacity of the health care system by geographical location, accessibility of services or number of physicians per capita. The process measures are currently known as a performance measures and are related to measuring the process of care. At the level of institution, diagnoses, management of disease, screening for disease or timelines or convenience of service are covered. The last dimension corresponds to the measures of survival, unintended effect of treatment and relief of symptoms. Outcome measures can be highly specific to disease. In addition, the patients´ self-reporting health status is also included. Since all three components interact, focus on outcome without considering process could be misleading. Despite the scientific advances in medicine, there is no evidence that it would be possible to apply total technological progress (Brook et al., 2000). The Donabedian's

concept is really extensive, but the main message remains. The quality of health care is a complex issue and variables of capacity or outcomes are not enough to capture quality of provided care. Notwithstanding, it could be worth to involve capacity variables in the model in case of developing health care system, because impact of new institutions on mortality can be substantial in comparison with developed systems focused just on quality improvement.

The applicability of the concept of avoidable mortality is a disputable topic. Should this concept be applied to developed system focusing predominantly on quality improvements? Is this concept convenient for measurement of quality in health care system without data on structure, process and outcomes? The decision depends on the research question. We were interested in the contribution of health care to the changes in life expectancy over time and between countries in the region of Eastern Europe. The main aim was to detect any link between health care and mortality development. The precise question regarding the quality of health care system was not of primary interest. From this point of view, the concept of avoidable mortality provides reasonable measurement and gives basic overview about the changing situation in health sector after the collapse of communism without any specification to quantifying the development. In case of seeking for appropriate measure of quality of health care, more sophisticated methods should be used. For instance, medical records providing information on presence or absence of selected critical elements of care, on justification of surgery or other major procedures or on audits could be analyzed. In addition, patients´ hospital trajectories could be followed and treatments and recorded steps of health progression could be examined. The demand on high quality data represents the major disadvantage of such kind of investigations.

Conclusion

Until the year 1989, the countries of Central and Eastern Europe were ruled by communist dictatorship. The low expenditure on health care from the state budget, outdated medical equipment, inaccessibility of high effective drugs, excessive tobacco and alcohol consumption, unsatisfactory working conditions or contaminated environment by heavy industry contributed to the high mortality observed in the Eastern European region.

After the fall of socialism, social and economic changes started a new stage in regard to mortality in all post-communist countries. Since the health conditions had already slightly improved in the Czech Republic in the pre-transition years (1985–1989) and even the Czech Republic remained prevented from the dramatic increase in the number of deaths observed in most post-communist countries during the economic crisis, the Czech Republic is the best performing country in terms of mortality among all countries of the Central and Eastern Europe. Although the mortality development were much about homogenous in these countries when death rates are considered, the mortality patterns started to diverge during the transition from command to market economy.

In order to be able to explain the reason for the increasing divergence between all countries that behaved for several decades similarly, more attention is devoted to the investigation of mortality risk factors. In recent decades, research interest is increasingly focusing on the investigation of impact of medical care and health policy on development of mortality. The intention to measure the effects of health system and evaluate the quality of provided medical care led to the development of a theoretical concept based on the idea of avoidable mortality by Rutstein and co-workers in the USA

in the 1970s. The avoidable mortality contains causes of death attributable to the medical treatment and preventive measures that could be reduced or even eliminated when efficient and high quality health care would be provided.

In this paper, we contributed to the current international literature on avoidable mortality by exploring the impact of health care on the changes in mortality in the region of Central and Eastern Europe, specifically in Bulgaria, the Czech Republic, Estonia, Hungary and Poland using the method of decomposition by age group and cause-of-death category. As an innovation, different age limits for calculation of temporary life expectancy were set up in women.

To conclude, the results of this study are consistent with the findings in existing studies on avoidable mortality. The time trends analysis demonstrates that the mortality from causes of death characterized as avoidable decreases more rapidly compared to the non-avoidable mortality. Conditions attributable to medical treatment are sensitive to the changes in quality and efficiency of health care. The findings give evidence on the positive relationship between mortality decline and improvement in medical care. In contrast, conditions responsive to health care measures contributed negatively to the changes in the temporary life expectancy. Since the health policy and its preventive measures are not successful enough, there is still a potential for improvement in prevention in the Central and Eastern European countries. In addition, extending the age limit for avoidable mortality up to the age of 80 years in women, the contribution of improved health care to the decrease of deaths from conditions amenable to medical treatment is more visible. Reflecting the sex differences in life expectancy at birth, the higher age limit setting up for females compared to males seems to be reasonable in studies examining time trends in avoidable mortality.

The concept of avoidable mortality does not appear to be a reasonable measurement in the geographical variation analysis. Since the non-avoidable causes of death dominate among all cause-of-death categories contributing to the differences in mortality observed between countries, the impact of health care is relatively limited. Therefore, the mortality variation across countries is more likely driven by other factors than medical treatment or health policy affecting in particular by lifestyle, socio-economic factors and environmental conditions (Dzúrová, 2000). Moreover, the extension of the age limit in avoidable mortality up to age of 80 years in women does not change the results. Considering the geographical variation in mortality, different age limit setting up for males and females does not seem to be necessary.

In conclusion, the relationship between health care improvements and mortality decline was found. However, the findings do not quantify the improvements in health sector. They only give an impression that changes of health care occurred during the transition in the Central and Eastern European countries. It might be sign for higher efficiency of the health care but the question related to the quality remains unanswered. To be able to measure and evaluate the quality of health care, more sophisticated methods demanding specific data on health would be needed. This idea could serve as base for further research.

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Table 1: List of causes of death considered as avoidable used in the study

Cause of death	International Classification of Diseases	
	ICD-9	ICD-10
Causes responsive to medical care (treatable causes of death)		
Intestinal infections	001-009	A00-A09
Tuberculosis	010-018, 137	A15-A19, B90
Other infectious (diphteria, tetanus, poliomyelitis, osteomyelitis)	032, 037, 045, 730	A36, A35, A80, M86
Whooping cough	033	A37
Septicaemia	038	A40-A41
Measles	055	B05
Malignant neoplasm of colon and rectum	153-154	C18-C21
Malignant neoplasm of skin	173	C44
Malignant neoplasm of breast	174	C50
Malignant neoplasm of cervix uteri	180	C53
Malignant neoplasm of cervix uteri and body of the uterus	179, 182	C54, C55
Malignant neoplasm of testis	186	C62
Hodgkin´s disease	201	C81
Leukaemia	204-208	C91-C95
Disease of the thyroid	240-246	E00-E07
Diabetes mellitus	250	E10-E14
Epilepsy	345	G40-G41
Chronic rheumatic heart disease	393-398	I05-I09
Hypertensive disease	401-405	I10-I13, I15
Cerebrovascular disease	430-438	I60-I69
All respiratory diseases (excluding pneumonia & influenza)	460-479, 488-519	J00-J09, J20-J99
Influenza	487	J10-J11
Pneumonia	480-486	J12-J18
Peptic ulcer	531-533	K25-K27
Appendicitis	540-543	K35-K38
Abdominal hernia	550-553	K40-K46
Cholelithiasis & cholecystitis	574-575.1	K80-K81
Nephritis and nephrosis	580-589	N00-N07, N17-N19, N25-N27
Begin prostatic hyperplasia	600	N40
Maternal deaths	630-676	O00-O99
Congenital cardiovascular anomalies	745-747	Q20-Q28
Perinatal deaths, all causes excluding stillbirths	760-779	P00-P96
Misadventures to patients during surgical and medical care	E870-E876, E878-E879	Y60-Y69, Y83-Y84
Ischaemic heart disease		
Ischaemic heart disease	410-414	I20-I25
Causes responsive to health policy (preventable causes of death)		
Malignant neoplasm of trachea, bronchus, and lung	162	C33-C34
Cirrhosis of liver	571	K70, K73-K74
Motor vehicle accidents	E810-E825	V02-V04, V09, V12-V14, V20-V79, V82-V87, V89

Note: age limit 0–74 years for most of the causes;
exceptions in age limit: intestinal infections, whooping cough (0–14 years);
measles, all respiratory diseases excluding pneumonia/influenza (1–14 years);
malignant neoplasm of cervix uteri and body of the uterus, leukaemia (0–44 years);
diabetes mellitus (0–49 years);
maternal deaths, perinatal deaths excluding stillbirths, motor vehicle accidents (all ages)

Source: Nolte et al., 2002; Newey et al., 2004

Table 2: Standardized death rates (European standard population; per 100 000) by sex and cause-of-death category (ages 0–74 years), males, selected Central and Eastern European countries, 1985–2005 (selected years)

Country	Category of causes of death										
	Treatable causes of death		Ischaemic heart disease		Preventable causes of death		Avoidable mortality		Non-avoidable mortality		Total mortality
	Intensity	Share*) (%)	Intensity	Share*) (%)	Intensity	Share*) (%)	Intensity	Share**) (%)	Intensity	Share**) (%)	Intensity
Bulgaria											
1985	255.7	51.7	150.0	30.3	89.4	18.1	495.0	60.2	327.3	39.8	822.4
1989	239.7	50.0	145.2	30.3	94.3	19.7	479.3	58.1	345.1	41.9	824.3
1995	248.0	47.9	168.4	32.5	101.7	19.6	518.1	58.4	369.6	41.6	887.7
2005	226.9	50.9	126.2	28.3	92.9	20.8	446.1	54.7	369.4	45.3	815.5
Czech Republic											
1985	205.9	35.5	249.5	43.0	125.4	21.6	580.8	62.7	344.9	37.3	925.7
1989	193.3	34.5	237.7	42.4	129.3	23.1	560.3	62.7	332.9	37.3	893.3
1995	151.5	32.8	195.8	42.4	114.4	24.8	461.7	59.2	318.8	40.8	780.5
2005	107.7	35.0	103.2	33.5	97.1	31.5	308.0	52.5	279.2	47.5	587.1
Estonia											
1985	239.3	36.1	317.2	47.8	107.1	16.1	663.6	62.1	405.9	37.9	1069.5
1989	206.1	33.4	281.1	45.6	129.5	21.0	616.7	62.8	365.8	37.2	982.5
1995	268.1	36.5	319.2	43.5	147.1	20.0	734.3	55.5	588.3	44.5	1322.6
2005	174.0	36.6	191.9	40.4	109.1	23.0	475.0	49.9	476.5	50.1	951.5
Hungary											
1985	245.3	39.6	212.1	34.2	162.7	26.2	620.2	58.8	434.7	41.2	1054.9
1989	231.3	36.7	206.9	32.9	191.4	30.4	629.6	59.2	434.3	40.8	1063.9
1995	207.0	31.6	208.9	31.8	240.1	36.6	655.9	60.5	427.7	39.5	1083.6
2005	152.6	30.5	178.5	35.6	169.8	33.9	501.0	57.2	374.7	42.8	875.7
Poland											
1985	167.0	39.6	138.7	32.9	116.4	27.6	422.0	45.0	516.4	55.0	938.4
1989	154.4	35.5	151.5	34.8	129.4	29.7	435.3	46.6	499.2	53.4	934.4
1995	143.8	35.5	127.8	31.5	133.9	33.0	405.5	45.3	489.0	54.7	894.4
2005	120.1	36.5	93.5	28.4	115.3	35.1	328.8	45.5	393.1	54.5	722.0

Note: *) Share of avoidable mortality.

**) Share of total mortality (ages 0–74 years).

Source: WHO mortality database; authors´ calculations

Table 3: Standardized death rates (European standard population; per 100 000) by sex and cause-of-death category (ages 0–74 years), females, selected Central and Eastern European countries, 1985–2005 (selected years)

Country	Category of causes of death										
	Treatable causes of death		Ischaemic heart disease		Preventable causes of death		Avoidable mortality		Non-avoidable mortality		Total mortality
	Intensity	Share*) (%)	Intensity	Share*) (%)	Intensity	Share*) (%)	Intensity	Share**) (%)	Intensity	Share**) (%)	Intensity
Bulgaria											
1985	195.9	70.5	63.4	22.8	18.4	6.6	277.7	62.4	167.6	37.6	445.4
1989	181.9	69.6	60.2	23.1	19.2	7.3	261.3	60.4	171.0	39.6	432.3
1995	174.4	68.1	62.3	24.3	19.4	7.6	256.0	60.0	171.0	40.0	427.0
2005	152.6	72.1	42.0	19.9	17.0	8.0	211.6	56.2	164.8	43.8	376.3
Czech Republic											
1985	160.1	60.5	84.4	31.9	20.2	7.6	264.8	59.7	178.7	40.3	443.5
1989	143.3	57.0	85.3	33.9	22.9	9.1	251.5	59.2	173.7	40.8	425.2
1995	117.5	55.2	71.7	33.7	23.5	11.1	212.7	57.3	158.5	42.7	371.2
2005	79.1	55.5	36.6	25.7	26.9	18.8	142.7	51.3	135.2	48.7	277.8
Estonia											
1985	166.2	56.4	109.7	37.2	19.0	6.4	294.9	65.5	155.2	34.5	450.1
1989	156.4	54.2	106.7	37.0	25.5	8.8	288.6	65.1	154.8	34.9	443.5
1995	163.4	55.5	104.0	35.3	27.0	9.2	294.4	61.9	181.1	38.1	475.5
2005	98.6	54.8	54.1	30.1	27.2	15.1	179.9	54.9	147.8	45.1	327.7
Hungary											
1985	195.2	62.2	77.7	24.8	40.7	13.0	313.6	60.4	205.4	39.6	519.0
1989	173.9	57.1	77.5	25.5	53.0	17.4	304.5	60.4	199.8	39.6	504.3
1995	151.5	51.7	75.3	25.7	66.0	22.5	292.8	62.0	179.7	38.0	472.4
2005	104.1	46.8	65.0	29.3	63.1	23.9	222.3	59.1	154.1	40.9	376.4
Poland											
1985	141.3	71.5	36.2	18.3	20.2	10.2	197.6	45.2	239.7	54.8	437.4
1989	129.2	66.8	41.5	21.5	22.6	11.7	193.4	46.0	227.4	54.0	420.8
1995	117.4	65.0	37.7	20.9	25.5	14.1	180.6	47.4	200.7	52.6	381.3
2005	86.9	61.0	27.2	19.1	28.3	19.9	142.3	48.9	148.8	51.1	291.2

Note: *) Share of avoidable mortality.

**) Share of total mortality (ages 0–74 years).

Source: WHO mortality database; authors´ calculations

Table 4: Standardized death rates (European standard population; per 100 000) by sex and cause-of-death category (ages 0–79 years), females, selected Central and Eastern European countries, 1985–2005 (selected years)

Country	Category of causes of death										
	Treatable causes of death		Ischaemic heart disease		Preventable causes of death		Avoidable mortality		Non-avoidable mortality		Total mortality
	Intensity	Share*) (%)	Intensity	Share*) (%)	Intensity	Share*) (%)	Intensity	Share**) (%)	Intensity	Share**) (%)	Intensity
Bulgaria											
1985	260.0	68.2	100.3	26.3	20.9	5.5	381.1	63.6	218.5	36.4	599.6
1989	237.1	67.8	91.5	26.2	20.8	6.0	349.4	61.5	219.2	38.5	568.6
1995	224.6	66.7	90.9	27.0	21.3	6.3	336.8	60.5	220.3	39.5	557.1
2005	204.2	71.7	61.7	21.7	18.8	6.6	284.7	59.6	215.4	43.1	500.1
Czech Republic											
1985	216.0	59.4	124.7	34.3	22.8	6.3	363.5	61.4	228.5	38.6	591.9
1989	193.5	56.5	123.2	36.0	25.8	7.5	342.5	60.8	220.4	39.2	562.9
1995	155.5	54.3	105.2	36.7	25.8	9.0	286.5	58.7	201.8	41.3	488.3
2005	108.2	54.9	59.0	29.9	29.9	15.1	197.1	53.1	173.9	46.9	371.0
Estonia											
1985	212.9	51.7	177.9	43.2	21.0	5.1	411.8	70.2	175.2	29.8	587.0
1989	201.1	51.8	159.7	41.1	27.5	7.1	388.3	68.9	175.0	31.1	563.3
1995	203.9	53.1	151.4	39.4	28.8	7.5	384.1	65.2	204.6	34.8	588.7
2005	127.2	53.3	81.7	34.3	29.5	12.4	238.4	57.6	175.4	42.4	413.8
Hungary											
1985	248.3	62.4	105.2	26.4	44.3	11.1	397.8	60.2	263.4	39.8	661.2
1989	221.9	58.0	104.1	27.2	56.7	14.8	382.7	60.3	251.8	39.7	634.5
1995	190.5	52.5	102.6	28.3	69.6	19.2	362.6	61.9	223.6	38.1	586.3
2005	135.4	46.7	97.8	33.8	56.4	19.5	289.6	60.4	189.8	39.6	479.3
Poland											
1985	168.9	71.4	44.7	18.9	22.8	9.7	236.4	41.8	329.3	58.2	565.7
1989	154.6	66.9	51.0	22.1	25.6	11.1	231.1	42.8	308.4	57.2	539.5
1995	143.8	65.5	47.3	21.6	28.3	12.9	219.3	44.6	272.7	55.4	492.0
2005	110.9	61.0	39.7	21.9	31.1	17.1	181.7	48.6	192.3	51.4	374.0

Note: *) Share of avoidable mortality.

**) Share of total mortality (ages 0–79 years).

Source: WHO mortality database; authors´ calculations

Table 5: Differences in temporary life expectancy (in years), selected Central and Eastern European countries, 1985–2005 (selected time periods)

Country	1985–1989	1989–1995	1995–2005	1985–2005
	Males (e_{0-75})			
Bulgaria	-0.09	-0.68	1.28	0.52
Czech Republic	0.41	0.98	1.93	3.31
Estonia	0.63	-3.61	4.82	1.84
Hungary	0.11	0.12	2.44	2.67
Poland	0.02	0.67	2.04	2.72
	Females (e_{0-75})			
Bulgaria	0.23	-0.07	0.73	0.89
Czech Republic	0.32	0.50	1.12	1.95
Estonia	0.02	-0.54	2.07	1.55
Hungary	0.31	0.59	1.29	2.19
Poland	0.27	0.53	1.21	2.02
	Females (e_{0-80})			
Bulgaria	0.31	-0.01	0.91	1.20
Czech Republic	0.40	0.74	1.53	2.68
Estonia	0.08	-0.57	2.62	2.12
Hungary	0.38	0.73	1.61	2.72
Poland	0.35	0.68	1.62	2.65

Source: Human Mortality Database; authors´ calculations

Table 6: Differences in temporary life expectancy between countries (in years), selected Central and Eastern European countries, 1985–2005 (selected years)

Country	1985	1989	1995	2005
	Males (e_{0-75})			
Czech Republic – Bulgaria	-0.08	0.42	2.08	2.72
Czech Republic – Estonia	2.77	2.55	7.14	4.25
Czech Republic – Hungary	2.39	2.69	3.54	3.03
Czech Republic – Poland	1.22	1.61	1.92	1.81
	Females (e_{0-75})			
Czech Republic – Bulgaria	0.46	0.55	1.12	1.51
Czech Republic – Estonia	0.70	1.00	2.04	1.09
Czech Republic – Hungary	1.59	1.60	1.51	1.34
Czech Republic – Poland	0.51	0.56	0.53	0.44
	Females (e_{0-80})			
Czech Republic – Bulgaria	0.46	0.56	1.31	1.94
Czech Republic – Estonia	0.62	0.95	2.26	1.18
Czech Republic – Hungary	1.71	1.73	1.74	1.67
Czech Republic – Poland	0.39	0.44	0.50	0.42

Source: Human Mortality Database; authors´ calculations

Table 7: Contribution to change in temporary life expectancy ($e_{0\text{-}75}$) in years by group of causes of death, selected Central and Eastern European countries, males, 1985–2005 (selected time periods)

Country	Category of causes of death				Total mortality
	Treatable mortality	Ischaemic heart disease	Preventable mortality	Non-avoidable mortality	
Bulgaria					
1985-1989	0.16	0.01	-0.07	-0.18	-0.09
1989-1995	-0.13	-0.19	-0.09	-0.28	-0.68
1995-2005	0.47	0.29	0.23	0.30	1.28
Czech Republic					
1985-1989	0.13	0.09	-0.06	0.26	0.41
1989-1995	0.45	0.34	0.19	0.00	0.98
1995-2005	0.49	0.64	0.11	0.70	1.93
Estonia					
1985-1989	0.31	0.14	-0.38	0.57	0.63
1989-1995	-0.53	-0.24	-0.12	-2.73	-3.61
1995-2005	1.27	0.85	0.49	2.21	4.82
Hungary					
1985-1989	0.29	0.06	-0.31	0.07	0.11
1989-1995	0.40	0.00	-0.48	0.21	0.12
1995-2005	0.64	0.30	0.88	0.62	2.44
Poland					
1985-1989	0.16	-0.12	-0.20	0.17	0.02
1989-1995	0.31	0.27	0.00	0.09	0.67
1995-2005	0.55	0.35	0.27	0.87	2.04

Source: WHO mortality database; authors´ calculations

Table 8: Contribution to change in temporary life expectancy ($e_{0\text{-}75}$) in years by group of causes of death, selected Central and Eastern European countries, females, 1985–2005 (selected time periods)

Country	Category of causes of death				Total mortality
	Treatable mortality	Ischaemic heart disease	Preventable mortality	Non-avoidable mortality	
Bulgaria					
1985-1989	0.22	0.03	-0.02	0.00	0.23
1989-1995	0.01	-0.04	-0.01	-0.03	-0.07
1995-2005	0.38	0.14	0.06	0.15	0.73
Czech Republic					
1985-1989	0.25	0.00	-0.03	0.10	0.32
1989-1995	0.26	0.09	-0.01	0.16	0.50
1995-2005	0.54	0.27	-0.05	0.36	1.12
Estonia					
1985-1989	0.02	0.04	-0.12	0.09	0.02
1989-1995	-0.05	-0.07	-0.02	-0.40	-0.54
1995-2005	1.03	0.40	0.00	0.65	2.07
Hungary					
1985-1989	0.33	0.02	-0.18	0.14	0.31
1989-1995	0.44	0.01	-0.14	0.28	0.59
1995-2005	0.62	0.11	0.23	0.33	1.29
Poland					
1985-1989	0.21	-0.05	-0.04	0.15	0.27
1989-1995	0.23	0.06	-0.04	0.29	0.53
1995-2005	0.60	0.11	-0.02	0.52	1.21

Source: WHO mortality database; authors´ calculations

Table 9: Contribution to change in temporary life expectancy ($e_{0\text{-}80}$) in years by group of causes of death, selected Central and Eastern European countries, females, 1985–2005 (selected time periods)

Country	Category of causes of death				Total mortality
	Treatable mortality	Ischaemic heart disease	Preventable mortality	Non-avoidable mortality	
Bulgaria					
1985-1989	0.28	0.05	-0.01	-0.01	0.31
1989-1995	0.06	-0.04	-0.01	-0.02	-0.01
1995-2005	0.44	0.24	0.06	0.16	0.91
Czech Republic					
1985-1989	0.32	0.00	-0.03	0.12	0.40
1989-1995	0.38	0.15	-0.01	0.22	0.74
1995-2005	0.70	0.44	-0.06	0.46	1.53
Estonia					
1985-1989	0.06	0.09	-0.14	0.07	0.08
1989-1995	-0.06	-0.02	-0.02	-0.47	-0.57
1995-2005	1.27	0.63	0.00	0.71	2.62
Hungary					
1985-1989	0.40	0.02	-0.21	0.17	0.38
1989-1995	0.52	0.02	-0.17	0.36	0.73
1995-2005	0.79	0.12	0.26	0.44	1.61
Poland					
1985-1989	0.25	-0.07	-0.05	0.22	0.35
1989-1995	0.25	0.07	-0.04	0.40	0.68
1995-2005	0.70	0.13	-0.03	0.81	1.62

Source: WHO mortality database; authors´ calculations

Table 10: Contribution to change in temporary life expectancy ($e_{0\text{-}75}$) between countries in years by group of causes of death, selected Central and Eastern European countries, males, 1985–2005 (selected years)

Countries combination	Category of causes of death				Total mortality
	Treatable mortality	Ischaemic heart disease	Preventable mortality	Non-avoidable mortality	
Czech Republic – Bulgaria					
1985	0.66	-0.59	-0.17	0.03	-0.08
1989	0.63	-0.51	-0.17	0.47	0.42
1995	1.21	0.01	0.11	0.75	2.08
2005	1.26	0.31	-0.03	1.18	2.72
Czech Republic – Estonia					
1985	0.68	0.42	-0.02	1.69	2.77
1989	0.49	0.37	0.31	1.38	2.55
1995	1.45	0.90	0.60	4.20	7.14
2005	0.63	0.59	0.19	2.84	4.25
Czech Republic – Hungary					
1985	0.85	-0.01	0.54	1.01	2.39
1989	0.68	0.01	0.80	1.20	2.69
1995	0.70	0.32	1.52	1.00	3.54
2005	0.53	0.62	0.77	1.11	3.03
Czech Republic – Poland					
1985	0.28	-0.46	0.02	1.39	1.22
1989	0.24	-0.26	0.16	1.47	1.61
1995	0.36	-0.23	0.35	1.44	1.92
2005	0.28	0.00	0.19	1.34	1.81

Source: WHO mortality database; authors´ calculations

Table 11: Contribution to change in temporary life expectancy (e_{0-75}) between countries in years by group of causes of death, selected Central and Eastern European countries, females, 1985–2005 (selected years)

Countries combination	Category of causes of death				Total mortality
	Treatable mortality	Ischaemic heart disease	Preventable mortality	Non-avoidable mortality	
Czech Republic – Bulgaria					
1985	0.56	-0.14	0.00	0.04	0.46
1989	0.60	-0.17	-0.01	0.13	0.55
1995	0.86	-0.04	-0.01	0.32	1.12
2005	1.02	0.08	-0.12	0.54	1.51
Czech Republic – Estonia					
1985	0.24	0.14	0.01	0.30	0.70
1989	0.48	0.10	0.11	0.31	1.00
1995	0.78	0.26	0.13	0.87	2.04
2005	0.29	0.13	0.07	0.60	1.09
Czech Republic – Hungary					
1985	0.79	0.05	0.30	0.45	1.59
1989	0.70	0.03	0.46	0.41	1.60
1995	0.52	0.10	0.60	0.29	1.51
2005	0.43	0.26	0.34	0.31	1.34
Czech Republic – Poland					
1985	0.25	-0.27	0.00	0.53	0.51
1989	0.28	-0.22	0.02	0.48	0.56
1995	0.31	-0.20	0.05	0.36	0.53
2005	0.25	-0.05	0.02	0.22	0.44

Source: WHO mortality database; authors´ calculations

Table 12: Contribution to change in temporary life expectancy (e_{0-80}) between countries in years by group of causes of death, selected Central and Eastern European countries, females, 1985–2005 (selected years)

Countries combination	Category of causes of death				Total mortality
	Treatable mortality	Ischaemic heart disease	Preventable mortality	Non-avoidable mortality	
Czech Republic – Bulgaria					
1985	0.69	-0.22	0.00	0.00	0.46
1989	0.73	-0.27	-0.02	0.13	0.56
1995	1.06	-0.09	-0.03	0.37	1.31
2005	1.35	0.08	-0.16	0.67	1.94
Czech Republic – Estonia					
1985	0.22	0.31	0.01	0.09	0.62
1989	0.47	0.23	0.12	0.13	0.95
1995	0.92	0.40	0.13	0.81	2.26
2005	0.34	0.22	0.07	0.55	1.18
Czech Republic – Hungary					
1985	0.85	-0.02	0.34	0.53	1.71
1989	0.76	-0.04	0.53	0.49	1.73
1995	0.61	0.08	0.71	0.34	1.74
2005	0.51	0.40	0.41	0.35	1.67
Czech Republic – Poland					
1985	0.07	-0.53	0.00	0.84	0.39
1989	0.13	-0.47	0.02	0.76	0.44
1995	0.25	-0.41	0.05	0.60	0.50
2005	0.25	-0.13	0.02	0.28	0.42

Source: WHO mortality database; authors´ calculations