'Avoidable' mortality: a measure of health system performance after the dissolution of Czechoslovakia

Lucia Kossarova[1]; Walter Holland[1], Elias Mossialos[1], Alistair McGuire[1]
[1]LSE Health, London School of Economics and Political Science

Contact: Lucia Kossarova: l.kossarova@lse.ac.uk

Abstract

Post-communist health care reforms and the break up of the Czech and Slovak Federal Republic have been studied from various perspectives, but little research has addressed its impact on health status and health system performance. This paper investigates the performance of the Slovak and Czech health systems after their dissolution, using 'avoidable' mortality. Age-standardized mortality rates for mortality from 'avoidable' and other causes have been calculated through indirect standardization to study trends between 1996 and 2007. Regional level data from the national statistical offices was used to study the associations of health care inputs and socioeconomic factors with regional variations in 'avoidable' mortality through panel data models.

The paper shows that 'avoidable' mortality in both countries has been continuously decreasing while mortality from other causes has increased slightly. Mortality from 'avoidable' and other causes is lower in the Czech Republic than in Slovakia. Regional variations in 'avoidable' mortality for the different causes and groups of causes are associated with socioeconomic factors but weakly with health care inputs.

Health system performance in Slovakia as measured by 'avoidable' mortality has been improving since the dissolution of the Czech and Slovak Federal Republic but still falls behind the performance of the Czech Republic. Declines in 'avoidable' mortality suggest improvements in the quality of care provided in both countries, compared to mortality from other causes where factors outside the control of the health care system may be stronger determinants. Geographical variations are better explained by socioeconomic factors than health care inputs which, however, may not be appropriate for capturing the quality and effectiveness of health care services.

In 1993, four years after the fall of the Communist regime, the Czech and Slovak Federal Republic devolved into two independent countries. A range of health care reforms and institutional changes have since been implemented in all aspects of the Slovak health care system with little understanding of how the actual system performs and the quality of care it provides to its citizens. While the effect of the break up of the Federation has been studied from numerous perspectives, only little research has been carried out on how the health of the population has evolved (Bobak & Feachem, 1992) and whether or how any changes in outcomes can be associated with changes of the health system. In this context, studying cross-country and regional variations in health outcomes could be equally important, as well

understanding factors that help to explain any variations, in order to get an insight into the potential weaknesses and strengths of the health system.

Up until 1990 the health systems of the two federations had the same structure, financed through a tax based system where all the services were provided by the state (Institute of Health Information and Statistics Czech Republic, 2006). Towards the end of 1989 both countries began to conceptualize a new health system (Hlavačka S, 2004). The new system aimed to guarantee all citizens adequate health care but also bring in the components of provider choice, competition and decentralization. Both health systems began the move away from the taxed based financed-single provider scheme with hierarchical organizational structure to a system predominantly financed through social health insurance and private provision.

Changes in the health systems between 1990-1992 were very similar in the two countries (Hlavačka S, 2004; Rokosová M, 2005); only after the dissolution of the two federations in 1993 did they slowly begin to differ. While Slovakia initially lagged behind the Czech Republic, both countries moved towards a compulsory social health insurance scheme with multiple purchasing funds, financed by individuals, employers and the state, with voluntary health insurance and out-of-pocket expenditure playing a small role. Devolution and decentralization of public health functions and administration followed, even though at a slower pace.

The initial reforms have led to the financial difficulties of insurance companies, mainly caused by the overutilization of health services under the fee-for-service schemes, inadequate risk compensation schemes, insufficient contribution levels, and inefficiencies at all levels of the system (Hlavačka S, 2004; Rokosová M, 2005).
Since 2002 Slovakia has implemented systematic reforms focused on cost-stabilization limiting the scope of benefits, increasing private spending and enactment of reform package with six new laws in 2004. The laws led to numerous adjustments in the financing, delivery and governance of the health system, redifining of the roles and relationships of all the health care actors (Hlavačka S, 2004). Overall, in Slovakia, inpatient capacities were downsized and new forms of private and public owners of health facilities have made managers more accountable. While co-payments implemented in 2003 (abolished in 2006) seemed to have decreased physician visits and drug prescriptions without limiting access to necessary care, little evidence is available whether appropriateness and high quality of the treatment has been maintained. The motivation and pay for health professionals is

unsatisfactory and overall, „there is not sufficient encouragement for health care to be delivered at the most appropriate and cost-effective level of care“ (Hlavačka, Wágner, & Riesberg). The Czech Republic has implemented no major reforms since the late 90s and the country faces the same problems that Slovakia faced before the major reforms of 2002. Reforms in the Czech Republic have only picked up again since 2008 (Kossarova & Madarovicova, 2008).

While still lower than in many other European Union countries, health expenditure as a percentage of GDP has been slowly increasing in the last decades both in Slovakia (7.1% in 2007) and the Czech Republic (6.8% of GDP in 2007)[1] (OECD, 2007). Expenditures per capita have also been increasing but the Czech Republic continues to spend more resources per capita than Slovakia. (OECD 2008 Health Data). It has been argued that at these levels of expenditure, equal and universal access has been maintained with somewhat more limited access in rural areas and for the Roma living in remote settlements (Ecohost/ Masaryk University, 2000; Hlavačka S, 2004; The World Bank, 2002). In the Czech Republic inpatient care followed by drug expenditures (32.5% and 21.2% in 2007) represent the highest share of total expenditure (Czech Institute of Statistics, 2009), while in Slovakia, drug expenditure (33.7%) followed by inpatient care (22.2%) make up the highest expenditures (Health Policy Institute, 2008). Drug expenditures have been high both because of patient demands for the most modern, and usually expensive drugs, and overprescribing by providers under the aggressive influence of pharmaceutical companies and their hidden advertising (Hlavačka, Wágner, & Riesberg, 2004). While expenditures have decreased over time, the high figures continue to provide motivation for seeking to understand prescribing patterns.

Some argue that the reforms seem to have been “implemented without significant adverse effects on the population’s health” (Hlavačka S, 2004). However, there is only little evidence that analyses trends in health outcomes and processes. A study published in 2006 compared some general trends in health indicators in the two countries between 1994 and 2004 (Institute of Health Information and Statistics Czech Republic, 2006). Crude mortality rates in the Czech Republic and Slovakia during the studied period have been quite similar. While in the Czech Republic it has been declining (from 11.4% to 10.5%), in Slovakia it has remained stable (around 9.6%). The most noticeable declines have been for neonatal mortality (halved in both

[1] According to the Health Policy Institute in Slovakia, health expenditures in 2007 represented only 5.8% of GDP

countries) and infant mortality which dropped by 4.4 percentage points (from 11.2‰ to 6.8‰) in Slovakia and by 4.2 percentage points (from 7.9‰ to 3.7‰) in the Czech Republic.

Ninety percent of overall mortality through the entire period under observation can be attributed to cardiovascular diseases, neoplasms, external causes of death, and illnesses of respiratory and digestive systems (Institute of Health Information and Statistics Czech Republic, 2006). Declining mortality is reflected in increased average life expectancy in both countries. However, while in Slovakia it has increased by 2 years for men and 1.3 years for women, in the Czech Republic it has increased by as much as 3.1 and 2.4 years respectively. Even before the break up of the two countries, the Czech Republic had higher life expectancy. Improved life expectency at birth has been influenced by improved living standards and health services, as well as the absence of any major disruptive events (e.g. regime change, revolution etc.) (Institute of Health Information and Statistics Czech Republic, 2006).

The comparative study of the Czech Republic and Slovakia (Institute of Health Information and Statistics Czech Republic, 2006) focused on monitoring the standard mortality indicators with little analysis of potential causes of any variations. While some mortality effects have been disentangled, other important causes of death have not been studied. Some reductions in mortality can be explained through improved care in hospitals linked to lower in-hospital mortality (e.g. for acute myocardial infarction in the Czech Republic) and to overall improvements in diagnostic and therapeutic methods after 1989 (Rokosová M, 2005), as for example the declines in neonatal and infant mortality. A more in depth analysis applying the concept of 'avoidable' mortality may shed more light on whether these improvements are a result of improvements in the quality of care or other social factors. Understanding whether mortality from 'avoidable' causes has been declining and the pattern for different diagnosis across regions, will provide a better picture of the population's health and the quality of the health system in the 1990s.

Measuring the performance of health systems is not an easy task since most outcome measures capture the effect of a range of factors besides the contribution of the health system, such as behavioural, genetic or environmental factors. Population health has been measured through a series of indicators including life expectancy, age-standardized mortality rates by cause, infant mortality rate, perinatal mortality, health adjusted life expectancy and disease specific survival. However, all these have

a number of limitations, as well as the difficulty of attributing any improvements to health system activities directly (Smith, Mossialos, Papanicolas, & Leatherman, 2009). A more direct measure of general health system performance is the indicator of 'avoidable' mortality or mortality amenable to medical/health care (Smith et al., 2009), where premature mortality for certain conditions can be avoided if effective and timely health care is provided. While not all deaths can be avoided, the contribution of health services can avert a substantial proportion of deaths for selected conditions.

The concept of 'avoidable' mortality was first applied in the UK and the US in the early 20th century when confidential enquiries were made into maternal deaths to discover any mistakes and take necessary action to reduce amenable deaths (Holland, 2009; New York Academy of Medicine. Committee on Public Health Relations, 1933). The concept in the broader sense with more conditions was proposed by Rutstein and colleagues in 1976 (Rutstein et al., 1976), who suggested to measure quality of care through untimely deaths which should not occur in the presence of timely and good quality care. These deaths were considered sentinel health events which should lead to detailed enquiries of why these deaths have occurred. Naturally, the authors acknowledged that the "chain of responsibility to prevent the occurrence of any unnecessary disease, disability, or untimely death may be long and complex" and therefore it may not be possible to determine who is responsible and easily take corrective action. However, these untimely deaths are likely to indicate weakness in the quality of the health care serviced provided.

Rutstein's work was followed by a series of theoretical and empirical studies (Charlton, Hartley, Silver, & Holland, 1983; Holland, 1988, 1993; Poikolainen & Eskola, 1988; Simonato, Ballard, Bellini, & Winkelmann, 1998; Tobias & Jackson, 2001). A comprehensive study by Nolte et al (2004) reviewed 72 empirical studies and grouped them in three categories. Studies that focused on *variations over time* found that mortality levels are falling and 'avoidable' mortality declines faster than mortality from other conditions, controlling for socioeconomic conditions and declines in incidence. Studies on *geographic variation* have predominantly focused on the association between geographical variation and differences in quality or quantity of health services but found little or inconsistent association. Instead socioeconomic conditions were strongly negatively associated with 'avoidable' mortality (Mackenbach, Bouvier-Colle, & Jougla, 1990) which may reflect differences in timely access to effective care. Earlier studies have looked at health expenditures

(Poikolainen & Eskola, 1988), numbers of health professionals (Kunst, Looman, & Mackenbach, 1988; Poikolainen & Eskola, 1988) , hospital beds (Kunst et al., 1988; Pampalon, 1993), as well as hospitalization rates (Pampalon, 1993) but found that associations with 'avoidable' mortality were not consistent (Nolte & McKee, 2004).

Only a handful of studies have focused on 'avoidable' mortality in Eastern Europe. These studies found that amenable mortality was falling about 1-2 percent per year between mid-1970s and mid-1980s while non-amenable mortality remained more or less stable or has even increased in Hungary, Poland and Lithuania (Gaizauskiene & Gurevicius, 1995; Nolte, Scholz, Shkolnikov, & McKee, 2002) in Nolte et al. 2004). A study that looked at changes in 'avoidable' mortality in east Germany before and after the transition in 1990 found that in both periods amenable mortality was falling faster than non-amenable mortality; however, in Poland mortality from other causes fell faster in the 90s than in the 80s but also more rapidly than 'avoidable' mortality (Nolte et al., 2002). Nolte et al (2004) noted that while East Germany was going through rapid changes after unification, in Poland health care improvements in the country were substantially slower.

One study that compared 'avoidable' mortality rates between 1979 and 1988 in Hungary with other countries, including Czechoslovakia, found that amenable mortality in the Western countries fell faster than mortality for all other causes in these two countries. In Hungary and the Czech Republic death rates from both groups of causes increased in the first part of the period studied and a decline in mortality from both types of causes could be observed from 1985; all cause mortality declined more slowly and stayed stable toward the end of the period (Bojan, Hajdu, & Belicza, 1991). Another study compared trends in 'avoidable' mortality between 1980 and 1997 in the Czech Republic and 15 countries of the EU (Treurniet, Boshuizen, & Harteloh, 2004). While the differences in trends in 'avoidable' and non-avoidable mortality before and after 1989 were not statistically significant, both 'avoidable' and non-avoidable mortality declined, with non-avoidable mortality at an increased annual rate after 1989 (from 1.8% to 2.7%) but somewhat slower than 'avoidable' mortality (from 2.1% to 2.8%). The two studies that analysed 'avoidable' mortality by separate conditions in both the Czech and the Slovak Republic including on the regional level was the Atlas of Leading and Avoidable Causes of Death in Country of Central and Eastern Europe between 1985 and 1989 (Jozan & Prokhorskas, 1997).

This paper aims to use the measure of 'avoidable' mortality to assess the quality and performance of the health system after the separation (1993) of the Czech and Slovak Federal Republic, from 1996 – 2007. The objective of this paper is to examine mortality trends from a number of 'avoidable' causes of death in the Czech Republic and Slovakia. National and regional trends of 'avoidable' mortality are reviewed in both countries from 1996-2007. These trends are also compared to mortality for other, non-amenable causes of death. Health care inputs and socioeconomic factors will be studied to see whether they can explain regional variations in mortality.

Data and methods

Mortality data for 22 regions (8 regions in Slovakia; 14 regions in the Czech Republic) classified by individual or small groups of diagnosis and age groups from 1996 – 2007 were obtained from the Statistical Office of the Slovak Republic and the Statistical Office of the Czech Republic. Deaths are classified according to the 10th revisions of the International Classification of Diseases (ICD-10) in both countries. In addition, regional data on GDP per capita, number of beds, physicians, and nurses (per 10,000 population), air pollution (tons of basic pollutants per capita) and unemployment have also been obtained from the same sources or from the Institute of Health Information and Statistics of the Czech Republic and the National Health Information Center of Slovakia. GDP per capita was adjusted to 2005 prices (OECD) and is expressed in Czech crowns.

'Avoidable' causes of deaths within defined age groups have been selected based on the third edition of the EC Atlas of Avoidable Mortality (Holland, 1997). The general principle underlying the choice of each disease group applied by the EC working group was that each condition should have identifiable effective interventions and health care providers. The Atlas provides the rationale for the inclusion of the different mortality causes and interventions necessary to reduce mortality. The upper age limit was set at 65 years. Setting a stricter age limit for every diagnosis compared to more recent studies on 'avoidable' mortality should enhance the validity of mortality as an indicator of health service outcome. In fact, other recent studies have also restrained their analysis to a tight age limit (James, Manuel, & Mao, 2006).

This EC Atlas list of conditions has been widely accepted and applied in many country studies to monitor the performance of the health care system. While other

studies have extended or adjusted the list of 'avoidable' causes of deaths or increased the age limit, the applicability of these lists to the Czech and Slovak context are less straightforward. It is the EC list that has also been used in the Atlas of Leading and 'Avoidable' Causes of Death in Countries of Central and Eastern Europe (1997), which looked at 'avoidable' mortality in the Czech Republic and Slovakia from 1985-89.

We have selected 15 conditions from which deaths are considered to be 'avoidable' by timely and effective health care services. 'Health care services' are defined to include primary care, hospital care and collective health services such as screening and public health programmes, e.g. immunisation (Holland, 1997). Conditions whose control depends on primary prevention or health policies which are outside the direct control of health services, such as lung cancer or motor vehicle accidents are not included in our list. Table 1 highlights the list of conditions with the corresponding age limit. Deaths that were not selected as 'avoidable' are classified as deaths from other causes.

Table 1. 'Avoidable' causes of death selected for analysis

Name of group	Age	ICD 10th revision
Tuberculosis	5-64	A15-A19, B90
Cancer of breast	25-64	C50
Malignant neoplasm of cervix uteri & Malignant neoplasm of cervix and body of uterus	15-54	C53 C54,55
Hodgkin's disease	5-64	C81
Chronic rheumatic heart disease	5-44	I05-I09
Hypertensive & cerbrovascular diseases	35-64	I10-I15; I60-I69
Ischaemic heart disease	35-64	I20-I25
All respiratory diseases	1-14	J00-J99
Asthma	5-44	J45-J46
Peptic ulcers	25-64	K25-K27
Appendicitis	5-64	K35-K38
Abdominal hernia	5-64	K40-K46
Cholelithiasis and cholecystitis	5-64	K80-K81
Maternal mortality	All	O00-O99
Perinatal mortality	<1	P00-P96
Total 'avoidable' deaths	0-64	
Total all cause mortality	0-64	All
Total mortality from other causes (non-avoidable)	0-64	

Source: Based on (Holland, 1997)

Age-standardized mortality rates (per 100,000 population) for all the 'avoidable' mortality causes separately have been calculated for both countries and all the regions by indirect standardization to the total Czech & Slovak standard population. Perinatal mortality has been calculated per 1,000 total births (live and still births) and maternal mortality per 100,000 live births. Calculations were always confined to the appropriate age category. For perinatal and maternal mortality rates were not standardized. Also, the two sexes were combined, since avoidability of death should not depend on gender (Holland, 1997) while for gender- specific conditions (e.g. malignant neoplasm of cervix uteri) deaths were age-standardized to the population of that gender.

Random effects are estimated using panel data from 1996 until 2007 to see whether health care inputs or other socioeconomic factors explain regional variations in age standardized 'avoidable' mortality rates for the selected conditions in Slovakia and the Czech Republic. Only those conditions have been analyzed where the number of deaths in one year exceeded 30 deaths throughout the period of the study. This has restricted the panel data analysis to 'avoidable' mortality from ischaemic heart disease, and cerebrovascular disease combined with hypertension. Ischaemic heart disease is usually also studied separately because it is not only medical care but other social factors that contribute to reducing mortality from the condition. The latter two conditions have been combined due to potential case transfer (coding) between hypertension and cerebrovascular disease (Holland, 1997). In addition, multiple regression analysis was carried out with residual 'avoidable' deaths grouped together (all 'avoidable' deaths excluding IHD and hypertension & cerebrovascular diseases) and mortality from other, non-avoidable, causes as the dependent variables.

The following empirical model has been used for every condition or groups of conditions:

$$AMR_{it}^{condition} = \beta_i + \beta_0 + \beta_1 GDP_{it} + \beta_2 unem_{it} + \beta_3 beds_{it} + \beta_4 docs_{it} + \beta_5 nurs_{it} + \beta_6 pol_{it} + \beta_7 time_{it} + \beta_8 country_{it} + \varepsilon_{iit}$$

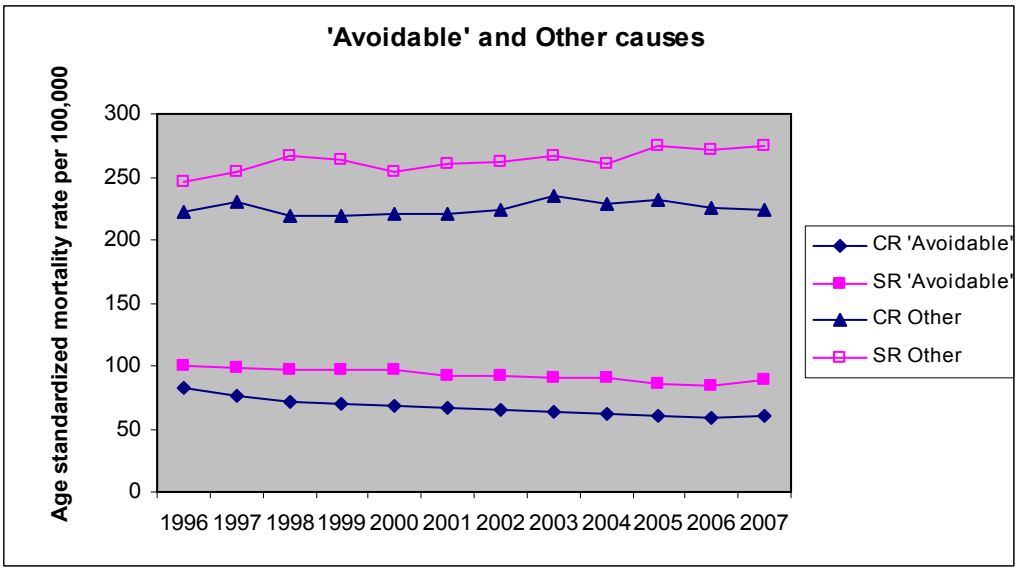
In the model, *AMR* indicates regional SMRs for individual conditions. *GDP* is per capita gross domestic product and *unem* represents regional unemployment rate, both as proxies for socioeconomic development (Mackenbach et al, 1990). *Beds* refers to the number of beds, *docs* and *nurs* to the number of doctors respectively. Health care personnel has been chosen in addition to number of beds since in Europe human

resources represent about 42% of health care expenditures and have been found to be positively associated with health outcomes (Dubois, McKee, & Nolte, 2006; World Health Organization, 2006). Also, beds may not be the best indicator of health care resource use if bed occupancy is low. *Pol* refers to the level of pollution and is a proxy of environmental factors that may be associated with regional variations in mortality levels. Time represents time dummies which are included to capture unobserved effects of changes over time. Finally, the model includes a dummy variable for *country* to capture the difference in performance between the Czech Republic and Slovakia.

Results

Figure 1 illustrates the time trends in age-standardized mortality rates for Slovakia and the Czech Republic. From 1996 to 2007, age-standardized mortality from 'avoidable' causes decreased in both the Czech Republic and Slovakia (by 27% and 11% respectively) while mortality from other causes has slightly increased in both countries (by 0.2% and 12% respectively). During this period, 'avoidable' deaths accounted on average for 24% of total deaths in the age group of 0-64 years. While in 1996 'avoidable' deaths accounted for as much as 28%, in 2007 it was only 22%. Overall, mortality from 'avoidable' and other causes is higher in Slovakia throughout the entire period.

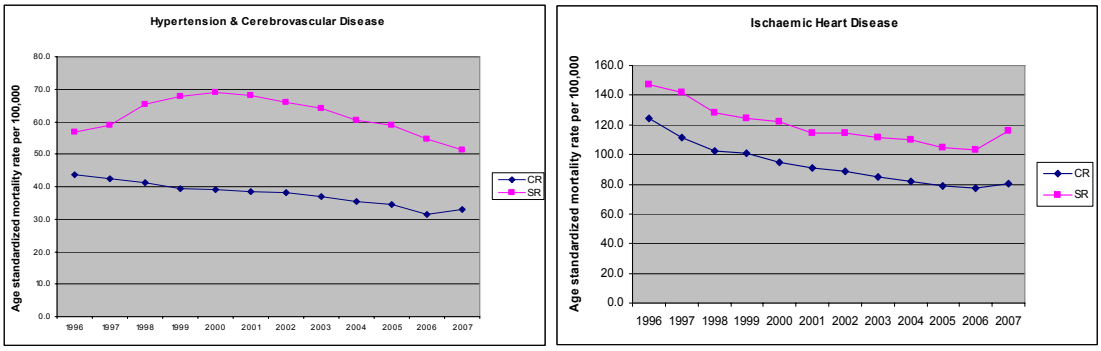
Figure 1. Mortality from 'avoidable' and other causes in the Czech Republic and Slovakia, 0-64 years



Figures 2 and 3 describe the mortality trends from selected 'avoidable' causes of death in the Czech Republic and Slovakia. It should be noted that for all conditions apart from ischaemic heart disease (IHD) and hypertensive & cerebrovascular diseases, the numbers of deaths in a year were less than 30, resulting in large annual variations. Figure 2 illustrates conditions for which community public health action or primary care are most important in preventing unnecessary deaths. The two countries often started with different mortality rates and the starting levels also varied greatly by condition, from 0.17 deaths per 100,000 for asthma to 146.8 deaths per 100,000 for ischaemic heart disease (Table 2). For some of the conditions (e.g. hypertensive & cerebrovascular disease, tuberculosis), mortality has increased in the first half of the period and then began to decline.

Mortality from hypertension & cerebrovascular disease and ischaemic heart disease has been declining in the Czech Republic annually on average by 2.1 and 0.8 percent, and 3 and 1.7 percent in Slovakia respectively. However, for peptic ulcer, mortality in the Czech Republic has declined annually on average by 0.5 percent while in Slovakia it has actually been increasing 1.5 percent. For example, for mortality for malignant neoplasm of cervix uteri and body of uterus the two countries begin to diverge in the second part of the period, compared to tuberculosis and hypertensive & cerebrovascular disease where they converge. The graphs show that for most of the conditions, the Czech Republic performs better or similarly to Slovakia.

Figure 2. Mortality from selected 'avoidable' causes where public health programmes or primary care are most important



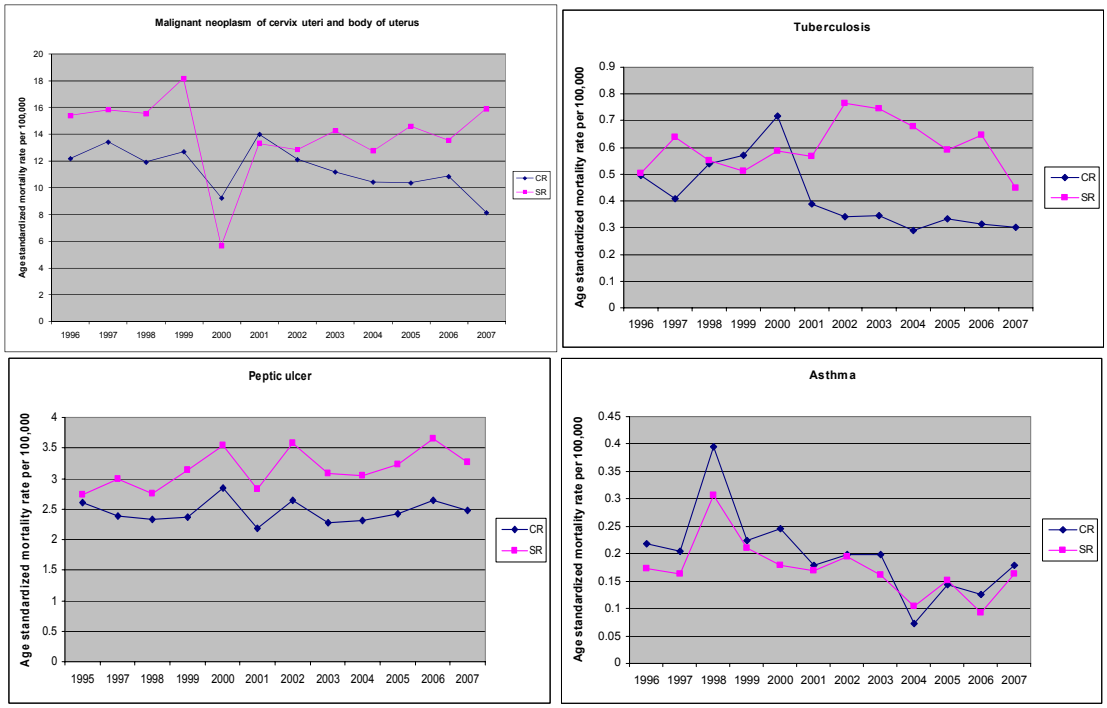
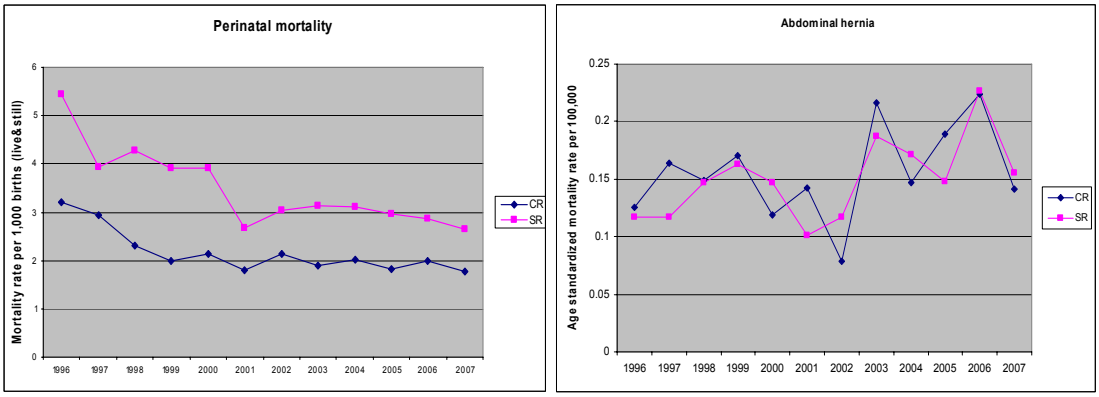
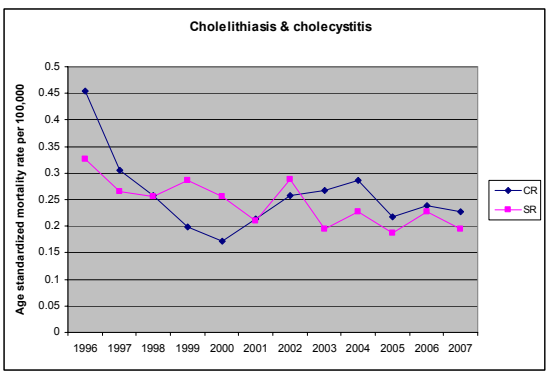


Figure 3 shows conditions for which health care services provided at the hospital level are considered to be most important in preventing unnecessary deaths. For most of the conditions mortality has been continuously declining from 1996 to 2007, while for some causes the most visible declines occurred in the first half of the period (e.g. perinatal mortality). Mortality from abdominal hernia has been increasing in both countries (1.1 percent in the Czech Republic and 2.8 percent in Slovakia annually), while mortality from perinatal mortality and cholelithiasis & cholecystitis (3.7 and 4.2 in Slovakia, and 4.3 and 3.4 in the Czech Republic respectively), have been declining steadily over the entire period. Again, for most of the conditions, the Czech Republic performs slightly better or similarly to Slovakia.

Figure 3. Mortality from 'avoidable' causes where most important interventions are provided at the hospital level





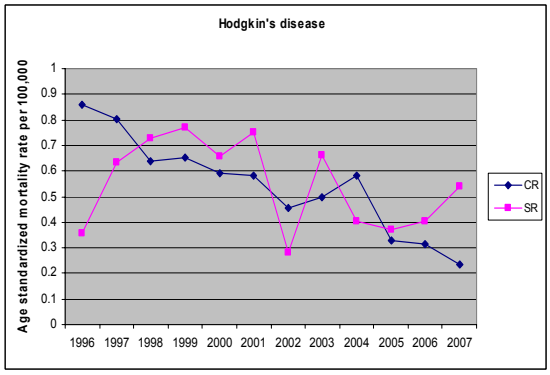


Table 2 illustrates the average proportional annual changes for mortality from different causes. The largest average annual increase can be seen for chronic rheumatic heart disease (10.4%) and decline for maternal mortality (8.3%), while the largest average annual declines in both countries were found for cholelithiasis & cholecystitis, hypertensive & cerebrovascular diseases, perinatal mortality, ischaemic heart diseases in both countries, and for malignant neoplasm of cervix uteri &body of uterus and Hodgkin's disease in the Czech Republic only. Overall, mortality from all 'avoidable' causes has been declining annually on average by 2.3% in the Czech Republic and 0.9% in Slovakia, but from other causes actually increasing by 0.02% and 1% respectively.

Table 2. Trends in 'avoidable' mortality: declines and regional distributions in the Czech Republic and Slovakia

Cause	Age	Total 'avoidable' deaths (1996-2007)	Age-standardized mortality/100,000 (1996)		Overall change in age-standardized mortality/100,000 between 1996-2007		Average % annual change		Regional SMRs		
			CR	SR	CR	SR	CR	SR	Min	Max	Median
Tuberculosis	5-64	738	0,49	0,51	-0,19	-0,06	-3,2	-1,0	0	464	88
Malignant neoplasm of cervix uteri & Malignant neoplasm of cervix and body of uterus	15-54	3507	12,17	15,39	-33,16	3,27	-2,8	0,3	40	507	189
Hodgkin's disease	5-64	841	0,85	0,36	-0,62	0,19	-6,1	4,4	0	391	94
Chronic rheumatic heart disease	5-44	134	0,19	0,06	-0,08	0,08	-3,6	10,4	0	875	0
All respiratory diseases	1-14	556	1,04	5,19	0,12	-0,89	0,9	-1,4	0	439	67
Asthma	5-44	184	0,21	0,17	-0,04	-0,01	-1,5	-0,5	0	734	0
Appendicitis	5-64	101	0,09	0,08	-0,04	-0,03	-3,8	-3,3	0	812	0
Abdominal hernia	5-64	231	0,13	0,12	0,02	0,04	1,1	2,8	0	650	80
Cholelithiasis and cholecystitis	5-64	375	0,45	0,33	-0,23	-0,13	-4,2	-3,4	0	489	88
Hypertensive & cerbrovascular diseases	35-64	33392	43,8	56,9	-10,9	-5,7	-2,1	-0,8	52	200	91
Maternal mortality*	All	91	5,2	5	-2,4	-5	-3,8	-8,3	0	1046	0
Perinatal mortality**	<1	4980	3,19	5,43	-1,41	-2,77	-3,7	-4,3	30	210	90
Cancer of breast	25-64	*to be added*									
Ischaemic heart disease	35-64	74635	124,6	146,8	-44,4	-30,4	-3,0	-1,7	50	172	99
Peptic ulcers	25-64	2762	2,6	2,7	-0,14	0,51	-0,5	1,5	21	250	95
All avoidable causes	0-64	122527	82,3	100,7	-22,28	-11,14	-2,3	-0,9	59	158	104
Other causes	0-64	387069	222,83	246	0,43	28,54	0,02	1,0	76	134	99
Total deaths	0-64	509596									
*per 100,000 live births											
**per 1,000 births (live & still)											

SMRs are based on the Czech & Slovak standard population
Source: Based on (Holland, 1997)

The table also shows the distribution of cause specific SMRs across the 22 regions in Slovakia and the Czech Republic. For most of the conditions there is significant variations from the national standard (SMR = 100). In particular, there are

substantial regional variations for tuberculosis, malignant neoplasm of cervix uteri and body of uterus, chronic rheumatic heart disease, all respiratory diseases, asthma, appendicitis, abdominal hernia, cholelithiasis & cholecystitis and maternal mortality. When looking at the regions, some of the best performing regions are Prague and the Kralovohradecky region in the Czech Republic and worse performing are Kosicky and Banskobystricky regions in Slovakia (Figure 4). *Add starting level and rate of change…….*

Figure 4. Regional variations in total 'avoidable' mortality

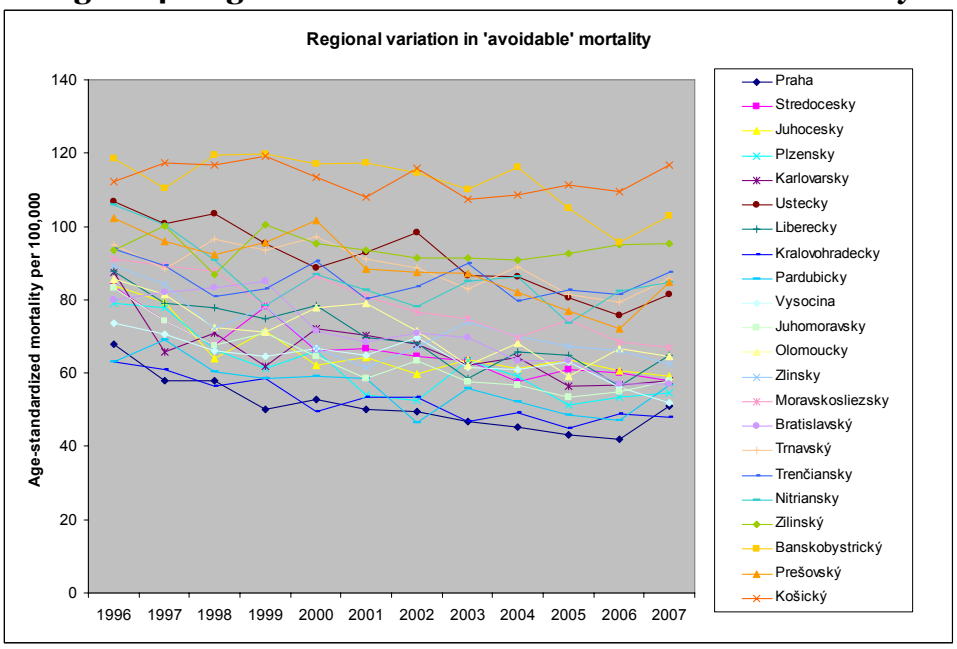


Table 3 shows the results of the random effects analysis with cerebrovascular disease & hypertension, ischaemic heart disease, residual 'avoidable' mortality and other cause mortality as the dependent variables. For all fours causes or groups of causes, GPD per capita is negatively associated with mortality rates, and significantly associated with cerebrovascular disease & hypertension, ischaemic heart disease and other cause mortality. The number of doctors per 10,000 population was significantly negatively associated with ischaemic heart disease and significantly positively associated with mortality from other causes. The number of beds per 10,000 population was significantly negatively associated with cerebrovascular disease & hypertension. The number of nurses per 10,000 was significantly positively associated with ischaemic heart disease. Unemployment was significantly positively associated with mortality from cerebrovascular disease & hypertension, as well as mortality from other causes. Levels of pollution showed a significant positive association with mortality from ischaemic heart disease, residual 'avoidable' causes

and other causes. For all causes or groups of causes, mortality in the regions of Slovakia compared to the Czech Republic was associated with higher mortality rates.

Table 4. Regression coefficients in the random effects analysis

Dependent variable	*Age-standardized mortality rate per 100,000*			
Condition(s)	Cerebrovascular disease & Hypertension	Ischaemic Heart Disease	Remaining 'avoidable' causes	Other causes
doctors	0.240	-1.034**	-0,042	0.755*
	(0.225)	(0.434)	(0.048)	(0.448)
bed	-0.397****	0,016	0,034	-0,113
	(0.105)	(0.207)	(0.022)	(0.215)
nurses	0,163	0.635*	0.020	-0,111
	(0.192)	(0.364)	(0.041)	(0.369)
lgdp/capita	-11.586***	-15.399**	-0,828	-17.188**
	(3.806)	(7.476)	(0.799)	(7.74)
unemployment	0.989****	-0.410	0,028	0.600*
	(0.189)	(0.349)	(0.041)	(0.350)
pollution	1,238	4.409**	0.658***	3.744**
	(0.988)	(1.889)	(0.208)	(1.91)
country	22.019****	27.44***	1.888**	30.117***
	(3.614)	(7.890)	(0.713)	(8.896)
constant term	183.738****	290.891****	16.234*	414.260****
	(42.184)	(83.297)	(8.874)	(86.854)
Observations	264	264	264	264
Wald chi(2)	275,1	495,13	190,87	117,8
R-squared within	0,3801	0,6788	0,3457	0,2795
R-squared between	0,8782	0,561	0,7605	0,5714
R-squared overall	0,7804	0,6016	0,597	0,5287
standard errors in parenthesis				
*p<0.1; ** p<0.05; *** p<0.01; **** p<0.001				

Discussion

The analyses of trends is consistent with the findings of many earlier studies (Charlton, Lakhani, & Aristidou, 1986; Mackenbach, Looman, Kunst, Habbema, & van der Maas, 1988; Niti & Ng, 2001; Poikolainen & Eskola, 1988; Tobias & Jackson, 2001; Treurniet et al., 2004) where 'avoidable' mortality has been falling faster than mortality from other causes, pointing towards the potential impact of medical care (Nolte & McKee, 2004). While several studies of 'avoidable' mortality in Eastern

Europe in the 1970s and 1980s found that 'avoidable' mortality declined slower than mortality from other conditions which has remained stable or even increased (Gaizauskiene & Gurevicius, 1995; Nolte et al., 2002), this cannot be confirmed in the Czech Republic and Slovakia.

In their review, Nolte et al. (2004) summarized the findings of trend analyses, especially annual changes in 'avoidable' mortality and mortality from other causes. The evidence of trends between 1950s and 1990s shows that 'avoidable' mortality was falling annually on average between 2.3% and 5% while mortality from other causes was increasing or declining by a maximum of 1%. Consistent with these findings, mortality from 'avoidable' causes has been declining annually on average by 2.3% in the Czech Republic and 0.9% in Slovakia; mortality from other causes has, however, been increasing by 0.02% and 1% respectively. The different pace of change between the studies is likely due to, in part, to differences in the selection of causes of death considered amenable to medical care (Nolte & McKee, 2004). An earlier study (Treurniet et al., 2004) which looked at trends from 1980 – 1997 in Europe and included Czech Republic found that mortality from 'avoidable' causes declined on average by 2.1% and 2.8% annually between 1980-1989 and 1989-1997 respectively, a rate somewhat higher than the one found in this study. This difference could be explained by different causes included in the list of 'avoidable' causes or by the fact that more improvements in the medical care system have occurred in the first decade after the change of the Communist regime in 1989 than since 1996 for the conditions studied.

Since 1996 the Czech Republic has been performing better for most of the 'avoidable' causes, with similar increasing (e.g. peptic ulcer) or declining trends (e.g. ischaemic heart disease) to Slovakia's over the studied period. Convergences of 'avoidable' mortality for the two countries can be noted for some conditions, in particular for hypertension & cerebrovascular disease or perinatal mortality. For asthma and abdominal hernia, for example, the mortality trends in the two countries between 1996-2007 were almost identical, possibly suggesting that the medical care provided for these conditions has been very similar. While it is difficult to compare overall changes in 'avoidable' mortality across studies due reasons mentioned earlier, studying individual causes of deaths makes comparisons across earlier studies possible and more useful conclusions can be provided. For example, when comparing mortality rates in 1996 to those between 1985-87 found in Czechoslovakia in an earlier study (BOYS ET AL, 1991) for appendicitis (0.28 per 100,000) and

hypertensive and cerebrovascular disease (82.18 per 100,000), the results show that there has been a substantial declines in deaths for these conditions during the period up to 1996 (see mortality rates in 1996 in Table 2) and it continued to decline after 1996 as well. DISCUSS.

However, mortality from peptic ulcer in Czechoslovakia does not seem to have declined since 1985-87 (2.68 per 100,000), with the rate being almost the same as in 1996 (2.6 and 2.7 in the Czech Republic and Slovakia respectively in 1996). Furthermore, since 1996 it has been declining only slightly (-0.5% in the Czech Republic) or increasing (1.5% in Slovakia). These results should raise questions about the type of care that is being provided for this condition to understand whether improved health care services can contribute towards reductions in mortality levels or other, non-medical care factors need to be addressed. For peptic ulcer, for example, the interventions that have contributed to reductions in mortality are anti-ulcer drugs and surgery for complications, and should be considered together with levels of alcohol consumption and smoking (Table 5).

Table 5. Example of interventions for some conditions

Cause	Intervention	Provider	Other factors
Appendicitis	Case detection Surgery	Hospital* Primary care	Coding error – acute abdominal pain with no positive diagnosis
Abdominal hernia	Case detection Surgery prior to complications	Hospital* Primary care	Coding error – acute abdominal pain with no positive diagnosis Incidence of strangulated abdominal hernia
Hodgkin's disease	Case detection Chemotherapy Radiation therapy	Hospital* Primary care Pathology services	Social class Radiation therapy services may not be available in each small area. Excess mortality may reflect non referral or delayed referral of cases to regional treatment centres.
Hypertensive & cerebrovascular diseases	Case detection Antihypertensive medication treatment of complications of cerebrovascular disease	Primary care* Hospital	Coding error - ischaematic heart disease Lack of screening/case finding Social factors Non-compliance with treatment Nutrition Weight Smoking (cerebrovascular disease) Malignant hypertension
Ischaemic heart disease	Primary prevention	Primary care* Hospital Health education	Coding error Social factors
Peptic ulcer	Anti-ulcer drug Surgery for complications	Primary care* Hospital	Alcohol Smoking

Source: HOLLAND
* Most important provider(s)

Next paragraphs will further discuss:

- Mortality trends from other individual causes, especially where declines in mortality trends have slowed down or are actually increasing and explore potential reasons why; relate findings to information about the health system changes in the Czech Republic and Slovakia
- Large regional variations for specific cause of mortality – these should "provide warning signals of potential shortcomings in health care

delivery"(Holland, 1986) and should prompt further enquiries as to why these deaths occurred

- A detailed understanding of causes specific interventions at each level of the health system are essential for indicators of 'avoidable' mortality to ensure action since designing an indicator to measure health system performance and collect information without an appropriate follow up is futile (Kossarova et al., 2009 forthcoming).

The results of the panel data analysis confirms the findings of many earlier studies that health care inputs are only weakly or inconsistently associated with variations in mortality and instead socioeconomic factors show more consistent associations (Mackenbach et al., 1999). The lack of or weak associations with health care inputs are not really surprising, because any relationship between quantity and quality are likely to be inexact (Nolte et al., 2004; Poikolainen & Eskola, 1988 ETC.....), especially in Eastern European countries with lower overall health care expenditures but excessive numbers of beds and health care personnel do not necessarily reflect the quality of care provided. However, Mackenbach and colleagues (1990) found that weak associations between mortality and health care inputs do not mean that 'avoidable' mortality is an invalid indicators of the effectiveness of health services, mainly because crude variables which are not specific to the aspects of health care delivery are being utilized and because levels of supply may reflect allocation decisions based on observed mortality, which may not be only an indicator of outcome but also of need (Mackenbach et al., 1990; Humblet et al., 1987). Therefore, variables which better capture how supply is organized and whether it conforms to quality standards should be included in the analysis (Nolte et al., 2004).

The significant negative associations with socioeconomic variables suggest that factors associated with access to timely and effective care should be explored. An interesting finding of this study is the significant positive association of pollution, a proxy for environmental factors, with all the causes of mortality except hypertension & cerebrovascular disease.....ELABORATE....

- Regional variations in deaths from IHD have been shown to be associated with differences in prevalence of smoking, obesity, hypertension and physical inactivity (see James et al. 2006; 21,22) and income status, employment and education (IHD – 21,22,17,25)

- Evidence of declining case-fatality rates suggest the impact of medical interventions (Nolte & McKee, 2004)

Discuss other potential determinants of changes in 'avoidable' mortality, not included in the panel data analysis:

- Changes in incidence (Treurniet 99, Bauer et al 1986) --- there can be spontaneous incidence differences and variations in incidence caused by shortcomings in preventive care
- Severity at presentation – health services have partly a role here
- Behavioral – smoking, diet, alcohol
- Adherence
- Medical technology/pharmaceuticals
- Treatment complications or comorbidity (13,14 in James et al. 2004)
- Access and utilization
- Coding and data quality
- Differences in the structure of the health care system, differences in screening, diagnostics and treatment - perhaps not so much in the Czech Republic and Slovakia

Discuss problems with the measure discussed by number of earlier studies and summarized by Nolte et al. (2004):

- Interpretation of trends over time with caution (importance of changing incidence)
- Selection of 'avoidable' conditions and attribution to health outcomes
- Changing concept of avoidability
- Contribution of 'avoidable' conditions to overall mortality
- Focus on mortality and negative consequences of medical care

Health system performance in Slovakia as measured by 'avoidable' mortality has been improving since 1996 but still falls behind the performance of the Czech Republic. Declines in 'avoidable' mortality suggest improvements in the quality of care provided since the fall of the Communism and the separation of the two countries, compared to mortality from other causes where factors outside the control of the health care system may dominate. However, strong associations of all cause

mortality, both 'avoidable' and mortality from other causes, with socio-economic development suggests that access problems or life-style factors should be studied to understand regional variations. The paper confirms earlier findings that using health care inputs as a proxy for the quality of care provided is also not appropriate in Slovakia and the Czech Republic, and more refined variables to capture the quality of care provided should should be considered.

The fact that the results of the regression have showed weak and inconsistent relationships with health care inputs, does not mean that the indicator cannot be used to assess the quality of the health care system. Instead, it is important to understand that the measure of 'avoidable' mortality is meant to point towards weaknesses or failures of the health system which require further investigation; it should not be used as an absolute measure of health care quality (Kossarova et al. 2009) but as a tool to provide insights into the performance of the health system (James et al., 2006). ELABORATE THIS PARAGRAPH…..

Some recommendations

- Deaths could be aggregated to 5 year periods to improve the robustness where numbers of deaths were too small
- Causes should continue to be studied individually to allow for comparisons across studies and more in-depth enquiries at the different levels of the health care system
- List of conditions included in all 'avoidable' should be standardized to allow for comparisons across studies (Refer to on-going EU project); conditions which have become avoidable over time should be included but only if there is evidence to support the inclusion
- Availability of regional level data in the two countries is improving and if possible additional risk factors (e.g. smoking, alcohol, diet) and incidence should be included in further analysis of regional variations

To be added to the analysis:

- National level trends from 1970-1989; 1989-1992; 1993-1996

Bobak, M., & Feachem, R. (1992). Health status in the Czech and Slovak Federal Republic. *Health Plicy and Planning, 7*(3), 234-242.

Bojan, F., Hajdu, P., & Belicza, E. (1991). Avoidable mortality. Is it an indicator of quality of medical care in Eastern European countries? *Int J Qual Health Care, 3*(3), 191-203.

Charlton, J. R. H., Hartley, R., Silver, R., & Holland, W. (1983). Geographical variation in mortality from conditions amenable to medical intervention in England and Wales. *Lancet, 1*(8326), 691-696.

Charlton, J. R. H., Lakhani, A., & Aristidou, M. (1986). How have 'avoidable death' indices for England and Wales changed? 1974-78 compared with 1979-83. *J Public Health, 8*(4), 304-314.

Czech Institute of Statistics. (2009). *Results of the Health Accounts in the Czech Republic 2000-2007*. Prague: Czech Institute of Statistics.

Dubois, C., McKee, M., & Nolte, E. (Eds.). (2006). *Human resources for health in Europe*: European Observatory on Health Systems and Policies. Open University Press.

Ecohost/ Masaryk University. (2000). *Health needs of the Roma population in the Czech and Slovak Republics.* London: London School of Hygiene and Tropical Medicine.

Gaizauskiene, A., & Gurevicius, R. (1995). Avoidable mortality in Lithuania. *Journal of Epidemiology and Community Health, 49*, 281-284.

Health Policy Institute. (2008). *General Health Policy Framework 2008-2011*. Bratislava: Health Policy Institute.

Hlavačka, S., Wágner, R., & Riesberg, A. *HiT Summary: Slovakia*. Copenhagen: European Observatory on Health Systems and Policies WHO Regional Office for Europe.

Hlavačka, S., Wágner, R., & Riesberg, A. (2004). *Health care systems in transition: Slovakia*: WHO Regional Office for Europe on behalf of the European Observatory on Health Systems and Policies.

Hlavačka S, W. R., Riesberg A. (2004). *Health care systems in transition: Slovakia*: WHO Regional Office for Europe on behalf of the European Observatory on Health Systems and Policies.

Holland, W. (1986). The 'avoidable death' guide to Europe. *Health Policy, 6*, 115-117.

Holland, W. (2009). Measuring the quality of medical care. *Journal of Health Service Research and Policy, 14*, 183-185.

Holland, W. (Ed.). (1988). *European Community atlas of 'avoidable death'*. Commission of the European Communities Health Services Research Series No.3. Oxford: Oxford University Press.

Holland, W. (Ed.). (1993). *European Community atlas of 'avoidable death'* (2nd ed. Vol. II). Commission of the European Communities Health Services Research Series No.9. Oxford: Oxford University Press.

Holland, W. (Ed.). (1997). *European Community atlas of 'avoidable death' 1985-89*. Oxford: Oxford University Press.

Institute of Health Information and Statistics Czech Republic. (2006). *Trends in evolution of health data in the Slovak Republic and Czech Republic, 1994-2004*. Prague: Institute of Health Information and Statistics Czech Republic.

James, P. D., Manuel, D. G., & Mao, Y. (2006). Avoidable mortality across Canada from 1975 to 1999*., 6*(137).

Jozan, P., & Prokhorskas, R. (Eds.). (1997). *Atlas of leading and 'avoidable' causes of death in countries of Central and Eastern Europe*. Budapest: Hungarian CSO Publishing House.

Kossarova, L., & Madarovicova, H. (2008). Czech Republic: first steps on the path to health care reform. *Eurohealth, 14*(4).

Kunst, A. E., Looman, C. W., & Mackenbach, J. P. (1988). Medical care and regional mortality differences within the countries of the European Community. *European J Population, 4*, 223-245.

Mackenbach, J. P., Bouvier-Colle, M. H., & Jougla, E. (1990). "Avoidable" mortality and health services: a review of aggregate data studies. *Journal of Epidemiology and Community Health, 44*, 106-111.

Mackenbach, J. P., Looman, C., Kunst, A., Habbema, J., & van der Maas, P. (1988). Post-1950 mortality trends and medical care: gains in life expectancy due to declines in mortality from conditions amenable to medical interventions in the Netherlands. *Social Science Medicine, 27*, 889-894.

New York Academy of Medicine. Committee on Public Health Relations. (1933). *Maternal Mortality in New York: a study of all puerperal deaths 1930-32*. New York: The Commonwealth Fund.

Niti, M., & Ng, T. P. (2001). Temporal trends and ethnic variations in amenable mortality in Singapore 1965-1994: the impact of health care in transition. *Int J Epidemiol, 30*, 966-973.

Nolte, E., & McKee, M. (2004). *Does health care save lives? Avoidable mortality revisited*. London: The Nuffield Trust.

Nolte, E., Scholz, R., Shkolnikov, V., & McKee, M. (2002). The contribution of medical care to changing life expectancy in Germany and Poland. *Social Science Medicine, 55*, 1907-1923.

OECD. (2007). OECD Health Data 2007 (Publication.:

Pampalon, R. (1993). Avoidable mortality in Québec and its regions. *Soc Sci Med, 37*, 823-831.

Poikolainen, K., & Eskola, J. (1988). Health services resources and their relation to mortality from causes amenable to health care intervention: a cross-national study. *Int J Epidemiol, 17*, 86-89.

Rokosová M, H. P., Schreyögg J, Busse R. (2005). *Health care systems in transition: Czech Republic*: Copenhagen, WHO Regional Office for Europe on behalf of the European Observatory on Health Systems and Policies.

Rutstein, D. D., Berenberg, W., Chalmers, T. C., Child, C. G., Fishman, A. P., & Perrin, E. B. (1976). Measuring the quality of medical care. A clinical method. *N Engl J Med, 294*(11), 582-588.

Simonato, L., Ballard, T., Bellini, P., & Winkelmann, R. (1998). Avoidable mortality in Europe 1955-1994: a plea for prevention. *J Epidemiol Community Health, 52*(10), 624-630.

Smith, P. C., Mossialos, E., Papanicolas, I., & Leatherman, S. (2009). *Performance Measurement for Health System Improvement: Experiences, Challenges and Prospects*. Cambridge: Cambridge University Press.

The World Bank. (2002). *Poverty and welfare of Roma in the Slovak Republic*. Bratislava.

Tobias, M., & Jackson, G. (2001). Avoidable mortality in New Zealand, 1981-97. *Aust N Z J Public Health 25*, 12-20.

Treurniet, H. F., Boshuizen, H. C., & Harteloh, P. P. M. (2004). Avoidable mortality in Europe (1980-1997): a comparison of trends. *J Epidemiol Community Health, 58*(4), 290-295.

World Health Organization. (2006). *The World Health Report 2006: working together for health*. Geneva.