‘Avoidable’ mortality: a measure of health system performance in the Czech Republic and Slovakia between 1971 and 2008

Lucia Kossarova,* Walter Holland and Elias Mossialos

LSE Health, London School of Economics and Political Science, London, UK

*Corresponding author. LSE Health, London School of Economics and Political Science, Houghton Street, London, WC2A 2AE, UK. E-mail: l.kossarova@lse.ac.uk. Tel: 020 7107 5306. Fax: 020 7955 6803.

Accepted 11 July 2012

Background Post-communist health care reforms and the break-up of Czechoslovakia have been studied from various perspectives, but little research has addressed the impact on health system performance. This paper investigates the quality and performance of the Slovak and Czech health systems before and after 1989, including the year of separation in 1993, using the concept of ‘avoidable’ mortality.

Methods Age-standardized mortality rates for mortality from ‘avoidable’ and other (non-avoidable) causes have been calculated through indirect standardization to study national and regional trends between 1971 and 2008.

Results The paper shows that ‘avoidable’ mortality in both countries has been continuously decreasing while mortality from other causes has remained unchanged or increased slightly. For some ‘avoidable’ conditions, mortality rates of the two countries converge while for others divergence can be observed, with either the Czech Republic or Slovakia performing better.

Conclusion Declines in overall ‘avoidable’ mortality suggest improvements in the health system’s performance and quality of care in both countries, compared with mortality from other causes where factors outside the control of the health care system may be stronger determinants. For conditions where ‘avoidable’ mortality rates stagnate or increase, more in-depth research should be carried out to identify problems in the delivery of timely and effective prevention and treatment, and to establish steps that would reduce the numbers of unnecessary deaths.

Keywords Avoidable mortality, health system performance, Eastern Europe, Communism, Slovakia, Czech Republic

KEY MESSAGES

- The indicator of ‘avoidable’ mortality is used to measure quality and performance of health systems in two Eastern European countries before and after the fall of the Communist regime.
- Falling aggregate ‘avoidable’ mortality rates suggest improvements in health system performance since 1989 in both Czech Republic and Slovakia.
- Increasing or stagnating ‘avoidable’ mortality rates from selected individual conditions require that policy makers and health care professionals carry out systematic investigations into the different elements of health care provision to avoid unnecessary deaths.
Introduction

Slovakia and the Czech Republic became independent countries in 1993. Up until 1990, while still a federation of two countries, their health systems had the same structure and were financed through a tax-based system where all the services were provided by the state (Institute of Health Information and Statistics Czech Republic 2006). Afterwards both countries began to conceptualize a new health system which aimed to guarantee all citizens adequate health care but also bring in the components of provider choice, competition and decentralization. Their health systems began the move away from the tax-financed single provider scheme with hierarchical organizational structure to a system predominantly financed through social health insurance and private provision. While changes in the health systems between 1990 and 1992 were very similar in the two countries (Hlavacka 2004; Rokosova 2005), since the dissolution in 1993 the reforms and the speed of implementation started to increasingly differ (Bryndonva et al. 2009; Szalay et al. 2011). In terms of key indicators such as health expenditures as a percentage of gross domestic product (GDP) and life expectancy at birth, both countries have shown improvements (OECD 2011). In the 1990s the Czech Republic was spending more on its health care system (6.7% vs 5.8% in 1990), but by the end of 2000s it was the reverse (8.2% vs 9.1% in Slovakia in 2009). Life expectancy at birth for both women and men was for many years similar, but by 2009 it was higher in the Czech Republic (74.2 vs 71.3 for men and 80.5 vs 78.7 for women).

While these figures reveal some information about the changes that occurred in the two countries, they mainly reflect developments in broader country performance, not only the performance of the health care system. The effect of the regime change in 1989 and the break-up of Czechoslovakia in 1993 have been studied from numerous perspectives, including changes in the health status of the population and health outcomes (Bauer et al. 1986; Bobak et al. 1992; Ginter 1996; Bobak et al. 1997; Ginter 1998; Nemec et al. 2005; Institute of Health Information and Statistics Czech Republic 2006). However, most of this research uses standard health outcome indicators such as life expectancy at birth, infant mortality or overall mortality rates which suffer from the difficulty of attributing any improvements to health system activities directly (Smith et al. 2009). Less research (Blazek et al. 2000; Burcin et al. 2008; Burcin 2009) has been carried out evaluating the quality and performance of the Czech and Slovak health care systems post-1989 and post-1993, attempting to isolate the influence of other determinants such as socio-economic development or environmental changes. Therefore, this paper uses the indicator of ‘avoidable’ mortality, which captures premature deaths for certain conditions that are considered to be largely avoidable if timely and effective health care is provided (Holland 1988; Nolte et al. 2004) and where the role of other mortality determinants is considered to be minor. While not all deaths can be avoided, the contribution of health services may avert a substantial proportion of deaths for the 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 potentially avoidable maternal deaths (New York Academy of Medicine 1933; Holland 2009). The concept was later expanded in 1976 by Rutstein and colleagues (Rutstein et al. 1976), who suggested measuring quality of care through untimely deaths which should not occur in the presence of timely and good quality care. Only a handful of aggregate-level studies have focused on ‘avoidable’ mortality in Eastern Europe for different periods between the 1950s and 1990s, and have produced mixed results with regards to trends and rates of changes in ‘avoidable’ and non-avoidable mortality (Boys et al. 1991; Gaizauskiene et al. 1995; Nolte et al. 2002; Treurniet et al. 2004). These mixed results suggest different patterns in health care improvements in different countries, but may also be due to the application of different methods (e.g. conditions included, age limits and time periods studied). Moreover, three studies (Jozan et al. 1997; Burcin and Kucera 2008; Burcin 2009) analysed ‘avoidable’ mortality by separate conditions in both the Czech and the Slovak Republic on the regional level, and one study only in the Czech Republic at the aggregate level (Blazek and Dzurova 2000), but none have carried out a comparative analysis before and after the fall of the Communist regime and separation.

This paper aims to use the indicators of ‘avoidable’ mortality to assess the performance of the Czech and Slovak health care systems before (1971–1989) and after (1990–2008) the fall of the Communist regime. We are especially interested in how the countries’ health care systems perform relative to each other in the latter period, during which Czechoslovakia split (in 1993) into two countries where each began to implement its own health policies and reforms likely to have influenced the performance of their health systems. To do so, we examine national-level mortality trends from a number of individual ‘avoidable’ causes of death in the two countries, as well as trends of all ‘avoidable’ causes together compared with mortality from all the other causes (also referred to as non-avoidable mortality). It is important to note that any observed trends in these two large groups of diseases are highly dependent on the selection of ‘avoidable’ causes of death. For the period 1996–2007, regional variations in mortality from selected ‘avoidable’ causes are also examined.

Data and methods

Mortality data classified by individual or small groups of diagnosis and age groups from 1971–2008 were obtained from the Statistical Office of the Slovak Republic and Czech Statistical Office. For both countries deaths are classified according to the 8th, 9th and 10th revisions of the International Classification of Diseases (ICD-8, ICD-9, ICD-10) between 1971–1978, 1979–1993 and 1994–2008, respectively. ‘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), which defines ‘avoidable deaths’ as ‘deaths from specific diseases (within selected age groups) for which mortality should be wholly or substantially avoidable when appropriate medical care is sought and provided in good time’. The general principle underlying the choice of each disease group applied in the EC Atlas was that each should have identifiable health care providers and effective interventions necessary to reduce mortality. The EC Atlas
A list of conditions has been widely accepted and applied in many country studies to monitor the performance of the health care system (Kunst et al. 1988; Barry 1992; Westerling et al. 1992; Alfonso Sanchez et al. 1993). The same list was also applied in another Atlas that focused on Eastern European countries including the Czech Republic and Slovakia from 1985 to 1989 (Jozan and Prokhorskas 1997). Using an extended list of conditions that other researchers have suggested without a more in-depth analysis of its applicability to the Czech and Slovak context was not considered appropriate. Furthermore, it was important to study only those conditions that have been included as ‘avoidable’ for the entire period under study.

The upper age limit was set at 64 years. While recent studies (Tobias et al. 2001; Newey et al. 2004; Nolte and McKee 2004; Korda et al. 2006; Gisbert et al. 2008; Burcin 2009) have increased the age limit to 74 years due to increased life-expectancy, setting a stricter age limit for every diagnosis should enhance the validity of mortality as an indicator of health service outcome. And notably, avoidability of a death for an older person becomes more controversial due to frequent comorbidities and cause-of-death certification increasingly questionable at older ages (Logminiene et al. 2004). In fact, recent studies have also chosen to restrict their analysis to tightened age limits (James et al. 2006).

We have selected 17 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. immunization (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. Also, it is important to note that the degree to which timely and effective health care services affect mortality from these conditions differs; for some conditions, such as hypertensive and cerebrovascular diseases or ischaemic diseases, other, non-health system factors are likely to play a much more important role than for appendicitis. Table 1 highlights the list of ‘avoidable’ conditions with the corresponding age limit.

Standardized mortality ratios and then age-standardized mortality rates (per 100 000 population) for all the ‘avoidable’ mortality causes separately have been calculated for both countries from 1971 to 2008 and all the regions from 1996 to 2007 by indirect standardization to the total ‘Czechoslovakia’ standard population (Armitage et al. 1994; Holland 1997; Kirkwood et al. 2003). Perinatal mortality has been calculated per 1000 total births (live and still births) and maternal mortality per 100 000 live births. Calculations were always confined to the appropriate age category. Perinatal mortality rates were not standardized and deaths for gender-specific conditions (e.g. malignant neoplasm of cervix uteri) were age-standardized to the female population. Also, the analysis has been combined for the two sexes since avoidability of death should not depend on gender (Holland 1997).

The regional maps show standardized mortality ratios (SMRs) representing the percentage ratio of the number of deaths observed in a particular region to the number expected from the total ‘Czechoslovakia’ standard age-specific death rate between 1996 and 2007; analysis is restricted to this period due to data availability at the regional level. The SMR for all ‘Czechoslovakia’ is equal to 100 so the SMR for a region indicates the extent to which that area differs from the ‘Czechoslovakia’ average. The perinatal SMR is the percentage ratio of the crude perinatal death rate in the area studied to the crude perinatal death rate in the reference population.

### Table 1 ‘Avoidable’ causes of death selected for analysis

<table>
<thead>
<tr>
<th>Name of group</th>
<th>Age</th>
<th>ICD-8</th>
<th>ICD-9</th>
<th>ICD-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuberculosis</td>
<td>5–64</td>
<td>010–019</td>
<td>010–018</td>
<td>137</td>
</tr>
<tr>
<td>Cancer of breast</td>
<td>25–64</td>
<td>174</td>
<td>174</td>
<td>350</td>
</tr>
<tr>
<td>Malignant neoplasm of cervix uteri</td>
<td>15–64</td>
<td>180</td>
<td>180</td>
<td>C53</td>
</tr>
<tr>
<td>Malignant neoplasm of cervix uteri and body of uterus</td>
<td>15–54</td>
<td>180, 182</td>
<td>180, 179, 182</td>
<td>C53, C54, 55</td>
</tr>
<tr>
<td>Hodgkin’s disease</td>
<td>5–64</td>
<td>201</td>
<td>201</td>
<td>C81</td>
</tr>
<tr>
<td>Chronic rheumatic heart disease</td>
<td>5–44</td>
<td>393–398</td>
<td>393–398</td>
<td>105–109</td>
</tr>
<tr>
<td>Ischaemic heart disease</td>
<td>35–64</td>
<td>410–414</td>
<td>410–414</td>
<td>120–125</td>
</tr>
<tr>
<td>All respiratory diseases</td>
<td>1–14</td>
<td>460–519</td>
<td>460–519</td>
<td>100–299</td>
</tr>
<tr>
<td>Asthma</td>
<td>5–44</td>
<td>493</td>
<td>493</td>
<td>J45–J46</td>
</tr>
<tr>
<td>Peptic ulcers</td>
<td>25–64</td>
<td>531–533</td>
<td>531–533</td>
<td>K25–K27</td>
</tr>
<tr>
<td>Appendicitis</td>
<td>5–64</td>
<td>540–543</td>
<td>540–543</td>
<td>K35–K38</td>
</tr>
<tr>
<td>Abdominal hernia</td>
<td>5–64</td>
<td>550–553</td>
<td>550–553</td>
<td>K40–K46</td>
</tr>
<tr>
<td>Cholelithiasis and cholecystitis</td>
<td>5–64</td>
<td>574–575</td>
<td>574–575</td>
<td>K80–K81</td>
</tr>
<tr>
<td>Maternal mortality</td>
<td>All</td>
<td>630–678</td>
<td>630–676</td>
<td>O00–O99</td>
</tr>
<tr>
<td>Perinatal mortality</td>
<td>&lt;1 week + still births</td>
<td>760–779</td>
<td>760–779</td>
<td>P00–P96</td>
</tr>
<tr>
<td>Total ‘avoidable’ deaths</td>
<td>0–64</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Based on Holland (1997).
Overall, trends and maps for conditions with only a few deaths in the age range studied (e.g. chronic rheumatic heart disease, asthma, appendicitis, maternal deaths, etc.) should be interpreted with caution due to the small number problem. The observed results are variable and a small difference between the number of deaths which occur and the expected number based on standard age-specific rates may yield extreme SMRs (Holland 1997).

Results
Between 1971 and 2008 age-standardized mortality from ‘avoidable’ causes decreased in both the Czech Republic and Slovakia (by 62% and 39%, respectively) by more than mortality from other causes (15% and 0.7%, respectively) (Figure 1). During this period, ‘avoidable’ deaths accounted on average for 35% and 34% of total deaths in the age group of 0–64 years in the Czech Republic and Slovakia, respectively. While in 1971 ‘avoidable’ deaths accounted for as much as 41% (15586 out of 38448) and 39% (6109 out of 15797) of total deaths in these countries, respectively, in 2008 it was only 24% (6234 out of 26185) and 27% (4287 out of 15663). Throughout the entire period, mortality from other causes is higher than ‘avoidable’ mortality in both countries and Slovakia is lagging behind the Czech Republic. However, for ‘avoidable’ mortality Slovakia performs better during the initial years, then the two countries have a period with similar rates, and from the early 1990s, after the change of the regime and separation of the countries, the rates begin to diverge with Slovakia lagging behind, mainly due to higher rates of ischaemic heart disease and hypertension and cerebrovascular disease mortality.

Figure 2 shows the group of conditions for which community public health action or primary care is considered to be most important in preventing unnecessary deaths. The two countries began with different mortality rates in 1971 with starting rates also varying greatly by condition, from 0.1 deaths per 100,000 for asthma in Slovakia to 184.4 deaths per 100,000 for ischaemic heart disease in the Czech Republic (Table 2). When looking more in-depth at individual conditions, mortality from breast cancer and ischaemic heart disease appear to follow similar trends, where most of the decline in both countries occurred between 1990 and 2008, while between 1971 and 1989, there was an increase in deaths per 100,000 (Table 2). For both conditions, Slovakia performs better at first while in the second period it begins to lag behind the Czech Republic.

Mortality from malignant neoplasm of cervix uteri and body of uterus in Slovakia improved only slightly over the entire period and somewhat more after 1989 (from 7 in 1990 to 5.1 deaths per 100,000 in 2008). On the other hand, in the Czech Republic there was a gradual and continuous decline by an overall 13% (from 7 to 6.1 deaths per 100,000) before 1989, and an additional decline of 35% (from 5.3 to 3.5 deaths per 100,000) between 1990 and 2008. In the case of tuberculosis, the most significant decline can be observed during the first period (1971–89) in both countries, with Slovakia performing worse but closing the gap by the early 1980s; between 1990 and 2008 mortality further declined by 72.5% in the Czech Republic. While mortality for peptic ulcer declined between 1971 and 1989 in both countries, after 1989 it continued to decline only in the Czech Republic, increasing in Slovakia (Figure 2 and Table 2).

Maps in Figure 3 show that for the same conditions there are important regional variations. We can observe the extent to which individual regions differ from the ‘Czechoslovakia’ standard (equal to 100). For example, for cerebrovascular and hypertensive diseases as well as malignant neoplasm of cervix uteri and body of uterus, regions in Slovakia are performing worse than those in Czech Republic. On the other hand, for asthma Slovakia performs better, even though the overall national age-standardized mortality rate is only 0.17 deaths per 100,000. The regions in the Czech Republic that show the worst performance for a number of conditions are Karlovarsky and Ustecky, while in Slovakia results differ across conditions.

Figure 4 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 throughout the entire period, while for others the most important declines occurred before 1989 (e.g. Hodgkin’s disease, chronic rheumatic heart disease, appendicitis, abdominal hernia, maternal mortality, perinatal mortality). When comparing the two countries, for some conditions Slovakia was initially performing worse (e.g. chronic rheumatic heart disease, abdominal hernia), while for others (e.g. Hodgkin’s disease, appendicitis or cholelithiasis and cholecystitis) it was the Czech Republic. Only for perinatal and respiratory disease mortality does Slovakia
perform worse continuously throughout the entire period than the Czech Republic.

Again, important regional variations for conditions where hospital care is considered to be most important can be noted (Figure 5). For example, for deaths for all respiratory diseases, two Eastern Slovak regions stand out for their particularly poor performance, and SMRs more than double the ‘Czechoslovakia’ rate. For cholelithiasis and cholecystitis, it is the Southern Slovak regions where the mortality rates are double the ‘Czechoslovakia’ rate. While there is some regional variation for appendicitis, only three western Czech regions perform much worse than the national average. Yet again it is important to note that the overall national rates for many of these conditions are already very low. Regions that show worse
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuberculosis</td>
<td>5–64</td>
<td>2,974</td>
<td>3.0</td>
<td>8.6</td>
<td>-75.6</td>
<td>-90.6</td>
<td>-72.3</td>
<td>-22.7</td>
<td>-4.0</td>
<td>-4.8</td>
<td>-3.8</td>
<td>-1.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cancer of breast</td>
<td>25–64</td>
<td>28,907</td>
<td>26.9</td>
<td>23.7</td>
<td>6.1</td>
<td>12.3</td>
<td>-37.0</td>
<td>-17.5</td>
<td>0.3</td>
<td>0.6</td>
<td>-1.9</td>
<td>-0.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malignant neoplasm of cervix uteri&lt;sup&gt;a&lt;/sup&gt;</td>
<td>15–64</td>
<td>9,056</td>
<td>8.3</td>
<td>4.3</td>
<td>-10.4</td>
<td>44.7</td>
<td>-26.9</td>
<td>-10.4</td>
<td>0.5</td>
<td>2.4</td>
<td>-1.4</td>
<td>-0.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malignant neoplasm of cervix and body of uterus&lt;sup&gt;a&lt;/sup&gt;</td>
<td>15–54</td>
<td>7,643</td>
<td>7.0</td>
<td>6.3</td>
<td>-13.1</td>
<td>-0.5</td>
<td>-34.6</td>
<td>-27.2</td>
<td>-0.7</td>
<td>-0.3</td>
<td>-1.8</td>
<td>-1.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hodgkin’s disease</td>
<td>5–64</td>
<td>3,362</td>
<td>1.9</td>
<td>1.6</td>
<td>-42.2</td>
<td>-56.6</td>
<td>-54.3</td>
<td>-26.4</td>
<td>-2.2</td>
<td>-3.0</td>
<td>-2.9</td>
<td>-1.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chronic rheumatic heart disease</td>
<td>5–44</td>
<td>2,037</td>
<td>3.6</td>
<td>5.4</td>
<td>-84.8</td>
<td>-83.4</td>
<td>-93.1</td>
<td>-62.7</td>
<td>-4.5</td>
<td>-4.4</td>
<td>-4.9</td>
<td>-3.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypertensive and cerebrovascular diseases</td>
<td>35–64</td>
<td>93,531</td>
<td>106.0</td>
<td>91.8</td>
<td>-35.7</td>
<td>-8.2</td>
<td>-43.1</td>
<td>-38.2</td>
<td>-1.9</td>
<td>-0.4</td>
<td>-2.3</td>
<td>-2.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ischaemic heart disease</td>
<td>35–64</td>
<td>213,102</td>
<td>184.4</td>
<td>157.9</td>
<td>-4.3</td>
<td>7.7</td>
<td>-58.3</td>
<td>-37.8</td>
<td>-0.2</td>
<td>0.4</td>
<td>-3.1</td>
<td>-2.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All respiratory diseases</td>
<td>1–14</td>
<td>1,322</td>
<td>4.1</td>
<td>9.1</td>
<td>-48.3</td>
<td>-48.7</td>
<td>-59.1</td>
<td>-53.5</td>
<td>-2.5</td>
<td>-2.6</td>
<td>-3.1</td>
<td>-2.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asthma</td>
<td>5–44</td>
<td>714</td>
<td>24.8</td>
<td>0.3</td>
<td>75.7</td>
<td>138.3</td>
<td>-79.1</td>
<td>-64.8</td>
<td>4.0</td>
<td>7.3</td>
<td>-4.2</td>
<td>-3.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peptic ulcers</td>
<td>25–64</td>
<td>6,927</td>
<td>4.6</td>
<td>4.7</td>
<td>-20.5</td>
<td>-35.2</td>
<td>-31.6</td>
<td>-11.9</td>
<td>1.7</td>
<td>1.8</td>
<td>-1.8</td>
<td>-1.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appendicitis</td>
<td>5–64</td>
<td>956</td>
<td>0.8</td>
<td>0.6</td>
<td>-68.8</td>
<td>-70.9</td>
<td>-60.4</td>
<td>-21.5</td>
<td>-3.6</td>
<td>-3.7</td>
<td>-3.2</td>
<td>-1.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abdominal hemia</td>
<td>5–64</td>
<td>950</td>
<td>0.7</td>
<td>1.3</td>
<td>-63.0</td>
<td>-90.1</td>
<td>-47.0</td>
<td>28.7</td>
<td>-3.3</td>
<td>-4.7</td>
<td>-2.5</td>
<td>1.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cholelithiasis and cholecystitis</td>
<td>5–64</td>
<td>3,289</td>
<td>2.0</td>
<td>1.6</td>
<td>-59.8</td>
<td>-34.1</td>
<td>-69.8</td>
<td>-78.5</td>
<td>-3.1</td>
<td>-1.8</td>
<td>-3.7</td>
<td>-4.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maternal mortality&lt;sup&gt;b&lt;/sup&gt;</td>
<td>All</td>
<td>482</td>
<td>279</td>
<td>17.5</td>
<td>18.1</td>
<td>-46.6</td>
<td>-44.7</td>
<td>-44.2</td>
<td>-2.5</td>
<td>-2.4</td>
<td>-1.6</td>
<td>-2.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perinatal mortality&lt;sup&gt;c&lt;/sup&gt;</td>
<td>&lt;1 week + still births</td>
<td>50,224</td>
<td>35.405</td>
<td>18.1</td>
<td>-54.7</td>
<td>-39.8</td>
<td>-64.2</td>
<td>-2.1</td>
<td>-3.4</td>
<td>-2.5</td>
<td>-2.5</td>
<td>-1.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All avoidable causes</td>
<td>0–64</td>
<td>420,015</td>
<td>209,160</td>
<td>173.3</td>
<td>-24.4</td>
<td>-14.6</td>
<td>-48.4</td>
<td>-29.4</td>
<td>-1.3</td>
<td>-0.8</td>
<td>-2.5</td>
<td>-1.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other causes</td>
<td>0–64</td>
<td>790,006</td>
<td>412,889</td>
<td>253.4</td>
<td>-10.8</td>
<td>5.2</td>
<td>-11.6</td>
<td>-6.5</td>
<td>0.6</td>
<td>0.3</td>
<td>-0.6</td>
<td>-0.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total deaths</td>
<td>0–64</td>
<td>1,210,021</td>
<td>622,049</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: <sup>a</sup>Overlapping due to possible variation in coding practice: in some countries cancer of cervix uteri may be included in codes 179 and 182. <sup>b</sup>per 100,000 live births. <sup>c</sup>per 1000 births (live and still).
performance for several conditions are Ustecky and Liberecky in the Czech Republic and the Eastern and Southern regions in Slovakia.

Table 2 shows the overall and annual percentage changes by condition. ‘Avoidable’ mortality in the Czech Republic declined from 173 to 131 (24%) between 1971 and 1989, and down to 67 deaths per 100 000 (48%) by 2008; in Slovakia the decline was from 162 to 138 (15%) in the period 1971–1989 and further down to 99 deaths per 100 000 (29%) by 2008. On the other hand, non-avoidable mortality in Slovakia increased by 5.2% (from 258 to 272 deaths per 100 000) before 1989 and only declined by 6.5% (from 275 in 1990 to 257 deaths per 100 000) by 2008. In the Czech Republic, non-avoidable mortality also declined by 10.8% before 1989 (from 253 to 226 deaths per 100 000) and after 1989 by 11.6% or 290 deaths per 100 000. Causes that made the largest contribution to total ‘avoidable’ mortality are ischaemic heart disease, cerebrovascular disease and hypertension, perinatal mortality and cancer of the breast.

During the period before 1989, the largest average annual increase in avoidable mortality can be seen for asthma in both countries (4% and 7.3% in the Czech Republic and Slovakia, respectively), and the largest decline for chronic rheumatic heart disease (4.5%) in the Czech Republic and tuberculosis in Slovakia (4.8%). After 1989 the largest average annual increase
can be observed for peptic ulcers (1.8%) and abdominal hernia (1.5%) both in Slovakia; annual decline is largest for chronic rheumatic heart disease (4.9%) in the Czech Republic and cholelithiasis and cholecystitis (4.1%) in Slovakia. The largest overall percentage reductions in the Czech Republic during 1971–1989 as well as during 1990–2008 were made for chronic rheumatic heart disease (85% and 93%, respectively). The largest overall percentage reduction in Slovakia during 1971–1989 was made for tuberculosis (91%); during 1990–2008 it was for cholelithiasis and cholecystitis (79%).

Overall, mortality from all ‘avoidable’ causes has been declining annually on average faster after 1989, at 2.5% in the Czech Republic and 1.5% in Slovakia compared with only 1.3% and 0.8%, respectively, before 1989. This compares with smaller improvements for non-avoidable mortality, which has also been declining annually on average faster in the post-Communist period but overall less rapidly than ‘avoidable’ mortality. In the Czech Republic it declined annually on average by 0.6% both before and after 1989, while in Slovakia it actually increased annually by 0.3% before 1989 and afterwards declined by 0.3%.

Discussion

The results show an encouraging, declining pattern for most of the ‘avoidable’ conditions, especially since 1989, suggesting improvements in the performance of both health care systems.
since the fall of the Communist regime. The analyses of trends is consistent with the findings of earlier studies (Charlton et al. 1986; Mackenbach et al. 1988; Poikolainen et al. 1988; Niti et al. 2001; Tobias and Jackson 2001; Treurniet et al. 2004; Burcin and Kucera 2008) where ‘avoidable’ mortality has been falling faster than mortality from other causes, pointing towards the potential positive impact of medical care (Nolte and McKee 2004). While several studies of ‘avoidable’ mortality in Eastern Europe in the 1970s and 1980s found that ‘avoidable’ mortality declined more slowly than mortality from other conditions, which has remained stable or even increased (Gaizauskiene and Gurevicius 1995; Nolte et al. 2002), this cannot be confirmed in the Czech Republic and Slovakia between 1971 and 2008.

Overall, a divergence in total ‘avoidable’ mortality rates of the two countries (Figure 1) is apparent since the change of the regime in 1989 and the separation in 1993, when Slovakia began to lag behind the Czech Republic, pointing towards potential deterioration in the performance of its health care system. In particular, Slovakia has mainly fallen behind due to its higher mortality rates for ischaemic heart disease and hypertension and cerebrovascular disease, which make the largest contribution to ‘avoidable’ mortality but are also largely preventable with effective and timely prevention and primary care. For non-avoidable conditions, on the other hand, Slovakia was lagging behind the Czech Republic throughout the entire period under study. This gap can be explained by...
socio-economic, environmental and life-style differences between the two countries. Since non-health system factors such as socio-economic changes, environment or life-style influence both ‘avoidable’ and non-avoidable conditions, any improvements or changes in ‘avoidable’ mortality are likely to be explained by changes in the provision of timely and effective care (Korda and Butler 2006).

When studying the individual ‘avoidable’ mortality causes, however, we also find that in a number of cases the two countries converge and Slovakia performs better than the Czech Republic. Analysis of individual conditions provides a more in-depth understanding of how the respective health systems perform in specific areas. In the group of conditions where public health programmes or primary care are considered to be most important, results across the conditions vary significantly. It is especially important to study those conditions where mortality rates have been stagnant or the decline slowed down after 1989 (e.g. peptic ulcer or malignant neoplasm of cervix uteri and body of uterus in Slovakia). These findings should raise questions about the medical care that is being provided for these conditions, what improvements can be made to prevent unnecessary deaths and whether other, non-medical care determinants such as socio-economic, environmental or lifestyle need to be addressed instead.

For peptic ulcer, for example, mortality rates in both countries had declined between 1971 and 1989, but since 1990 they have increased in Slovakia (from 2.7 to 3.6 per 100 000) and in the Czech Republic they hover around an average of 2.7 deaths per 100 000. The initial declines may be explained by improvements in prevention, and diagnostic and therapeutic advancements since the 1970s, as well as better and timely surgical interventions (Vecchia et al. 1993; Tesar et al. 2002). Yet the lack of further decline is a reason for concern; a more in-depth understanding of health services provided for this condition is required. However, other risk factors may also need to be considered, including the consumption of alcohol and cigarettes (Holland 1997). In 2002 both the Czech Republic and Slovakia had levels of alcohol consumption amongst the highest in European countries, and the proportion of unrecorded consumption of alcohol was also high (Popova et al. 2007). In addition, a significant proportion of the population smokes (Eurostat 2004). Alcohol and smoking may therefore be some of the additional key factors explaining the observed trends apart from weaknesses in health service provision.

The relatively high mortality rates for malignant neoplasm of cervix uteri and body of uterus could be attributed mainly to deficiencies in the organization and performance of cervical screening (Vlasak et al. 1991; Potancok et al. 2004), which are also likely to explain the gap between the two countries. While both countries have had a nationwide organized screening programme since 2008, actual implementation remains an issue, especially getting the patients to show up for the visits. Even before the new legislation was passed in Slovakia, preventive gynaecological examinations were legally guaranteed but only about 20% of women took advantage of them (Hupkova 2008).

Until the early 1990s some of the main factors behind unsatisfactory results in breast cancer mortality were late diagnosis, where patients sought medical care a few years after the first symptoms appeared (Konopasek et al. 1994). Overall, the importance of wide-scale systematic education of the population, quick diagnosis with the necessary diagnostic equipment, a treatment strategy established by a multidisciplinary medical team, and respect for general onco-surgical guidelines have been stressed to avoid unnecessary deaths (Konopasek et al. 1994; Celko 1996). Improvements in both countries since the early 1990s are likely to be explained by early diagnosis, improved access to care, the introduction of new effective treatment (e.g. tamoxifen), a shift toward more favourable stage distribution, and increased breast cancer awareness as national screening programmes were not in place (Botha et al. 2003; Tyczynski et al. 2004). In addition,
changes in other risk factors such as childbearing, breastfeeding, type of diet and obesity, use of alcohol and tobacco, oral contraceptive use and hormonal replacement therapy should be taken into consideration (McPherson et al. 2000; Key et al. 2001; Tyczynski et al. 2004).

Better control of hypertension, high cholesterol and smoking, enhanced access to pharmaceuticals and improvements in secondary care have resulted in declining hypertension and cerebrovascular disease mortality (Egnerova et al. 1997; Skodova et al. 1997; Ginter 1998; Newey et al. 2004). Also, increased consumption of anti oxidants and a decline in the consumption of salt and spirits may have been important (Ginter 1995).

Better control of hypertension has also improved mortality from ischaemic heart disease (Cifkova et al. 2004).

Figure 4 Mortality from ‘avoidable’ causes where most important interventions are provided at the hospital level

Note: For respiratory diseases, interventions are equally important at the primary care and hospital level.
However, further improvements can be made as treatment of hypertension is still not sufficient; between 1985 and 2001 less than 20% of those diagnosed in the Czech Republic had their blood pressure controlled (Cifkova et al. 2004). Another study in Slovakia from 1995 to 2005 found that while mortality from diseases of the circulatory system, ischaemic heart disease and cerebrovascular disease in the age group 25–64 years has been declining, overall mortality from hypertension has doubled, largely due to the unfavourable prevalence of preventable risk factors such as untreated high blood pressure, overweight and obesity (Barakova et al. 2007), and deficiencies in the prevention and treatment of cardiovascular diseases (Jurkovicova 2005; Bada 2006). The same study suggests that only with better management of hypertension and interdisciplinary co-operation can Slovakia close the gap with the Czech Republic and other European Union countries. With respect to treatment, the number of angiograms, percutaneous coronary interventions and stenting rates have been gradually increasing in both Slovakia and the Czech Republic, but rates remain behind most Western European countries, especially in Slovakia (Cook et al. 2007). In addition, while the causes of the different developments may not be well understood.

Figure 5  Regional standardized mortality ratios from selected ‘avoidable’ causes where public hospital care is most important

Note: For respiratory diseases, interventions are equally important at the primary care and hospital level.
recognized, factors that may require further attention are lower levels of education, worse composition of diet, higher consumption of distillates and tobacco, lower levels of health care and higher proportion of the Roma population in Slovakia (Ginter 2001).

For all the conditions where hospital-level care is considered more important (e.g. Hodgkin’s disease, appendicitis, maternal and perinatal mortality, etc.), the declining mortality trends and convergence suggest improvements in the provision of timely and effective hospital care in both countries. These are encouraging trends likely to have resulted from significant improvements in the equipment of providers and available medicines since 1989, even though evidence on the changes in clinical aspects of quality is not available (Nemec and Lawson 2005).

When looking at individual conditions, substantial improvements in perinatal mortality can be attributed to developments in the quality of neonatal care in two areas: prenatal diagnosis of congenital malformations and intensive care in newborns of extremely low birth weight (Stembera et al. 2006). The overall lower neonatal hospital and human resource capacity in Slovakia (Chovancova 2008) may explain the gap between the two countries. Higher rates of perinatal mortality in the Eastern regions of Slovakia may be linked to the large presence of the Roma population, their lifestyle and attitudes to health and health care services (Ecohost/Masaryk University 2000).
A large presence of the Roma population may also explain the higher mortality rates for respiratory disease deaths for children aged 1 to 14 in the two Eastern regions. Other studies found that the most common diagnoses for hospitalized Roma infants and toddlers in Slovakia were respiratory tract infections, among others, or that Roma children had twice as many respiratory diseases as ethnic Czech children (Ecohost/Masaryk University 2000). As a result, specifically targeted prevention and treatment activities for this group may be necessary to make further reductions in mortality levels.

Overall, the aggregate study of avoidable mortality can only ‘point towards weaknesses or failures of the health system which require further investigation and not as an absolute measure of health care quality’ (Kossarova et al. 2009). It is a tool to provide insights into the performance of the health system (James et al. 2006). Therefore, the next step for policy makers in both the Czech Republic and Slovakia would be to carry out in-depth systematic investigations of the underlying reasons for observed trends according to existing and sound methodologies; as well as to understand local- and central-level policies, and how services targeted at the selected condition are being delivered and co-ordinated, starting from prevention, through diagnosis and treatment and management of the disease (Kossarova et al. 2009). While for a number of conditions problems appear to be obvious and implementation is the issue (e.g. cancer of cervix), for others further research is
necessary. In the future, with regional-level data becoming increasingly available, data on the distribution of ‘avoidable’ mortality across socio-demographic and ethnic groups may be particularly useful, especially when one considers, for example, the large presence of the Roma population in some regions of Slovakia and the Czech Republic. Their health and access to care is worse than that of the general population and therefore health services need to be better targeted for this group (Ecohost/Masaryk University 2000; Koupilová 2001).

**Study limitations**

There are several limitations of using ‘avoidable’ mortality as an indicator of health system performance, many of which have been summarized in an in-depth review of the concept by Nolte et al. (2004); the most important ones will be considered below. First, death from any particular condition, even if considered ‘avoidable’, is a result of many events (Rutstein et al. 1976) and its prevention may not have been possible by the timely and effective provision of health services. For example, we have not taken into account severity of the disease at presentation to health services, which could be at a point when death cannot be averted. Severity of disease at presentation is a function of health seeking behaviour and thus partly outside the scope of health services. However, it may also reflect access to care and should therefore, at least partially, be ‘avoidable’ by accessing health services (Charlton et al. 1983; Andreev et al. 2003).
Second, incidence of the disease may affect the observed trends and has not been incorporated in the analysis. However, studies that have taken into account incidence find that regional variations remain and cannot be explained by incidence (Bauer and Charlton 1986; Treurniet et al. 1999). Also, as Charlton and colleagues stated, ‘there is no reason for more deaths to occur from conditions such as acute appendicitis or hernia in areas where the condition may be more common’ (Charlton et al. 1987). In other words, if there is higher incidence of a particular condition, the health system should adjust to the needs of the population.

Third, while the conditions have been split into those where primary care or hospital care are more important, for many of these conditions both effective and timely primary care and hospital services are necessary to prevent deaths (Holland 1997). In addition, other non-health system factors including socio-economic conditions, lifestyle, behavioural (e.g. smoking, alcohol, adherence), environmental and others should be considered. Attributing ‘avoidable’ mortality outcomes to health care services exclusively can be done for selected conditions only (e.g. appendicitis) (Nolte and McKee 2004). As non-avoidable mortality rates may also be affected by all these different non-health system factors, the gradient in ‘avoidable’ mortality is best seen relative to that in non-avoidable mortality (Korda and Butler 2006). Fourth, ‘avoidable’ mortality focuses on deaths but mortality may not always be an adequate indicator for the performance of the health system, especially for the elderly, where most of the focus is not on preventing death but on relieving pain and improving the quality of life (Holland 2007).

Fifth, some of the identified differences between the two countries may be due to differences in diagnostic patterns and habits (Reid 1962; Reid et al. 1964), death certification or coding of causes of death, even though these may not be so severe given the countries’ common past and practices. In fact, these differences could even arise within one country in different regions. Problems in assigning ICD codes may result in misclassification of deaths and changes in trends; this is more likely to occur when new ICD coding is implemented. In both countries, there was a change from ICD-8 to ICD-9 coding in 1979 and from ICD-9 to ICD-10 coding in 1994, but these do not appear to be so important in the overall analysis of trends.

It should also be noted that there are certainly causes included in the category ‘other’ or non-avoidable conditions that have become avoidable in the course of time (e.g. diabetes). However, since we were studying trends from as early as 1971 when deaths from these conditions were not yet considered to be avoidable, including them would have been incorrect. Due to the changing concept of ‘avoidability’ (Nolte and McKee 2004), it is important to revisit all the existing lists of ‘avoidable’ conditions and specify the date from which onwards a death from a particular condition has become avoidable, as has already been stressed by others (Treurniet et al. 1999). At present the ‘AMIEHS’ project (Avoidable mortality in the European Union: towards better indicators for the effectiveness of health systems) aims to develop an agreed definition of ‘avoidable’ mortality for Europe, to review the evidence of how treatment has changed and to derive a set of validated ‘avoidable’ mortality-based indicators of the effectiveness of health systems which can be used in routine surveillance systems (Kossarova et al. 2009).

Acknowledgements
We are grateful to Daniela Oslejova and Peter Heidinger from the Statistical Office of the Slovak Republic and Ondřej Kosata from the Czech Statistical Office for providing assistance during data collection. We would also like to thank Juraj Betak from GeoModel for preparing the maps in the paper. We are grateful to Alistair McGuire, Joan Costa-i-Font and anonymous reviewers for their comments.

Funding
This work was supported by funding from the London School of Economics and Political Science, London, UK.

Conflict of interest
None declared.

References


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


