Educational inequalities in avoidable mortality in Europe

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ABSTRACT

Background The magnitude of educational inequalities in mortality avoidable by medical care in 16 European populations was compared, and the contribution of inequalities in avoidable mortality to educational inequalities in life expectancy in Europe was determined.

Methods Mortality data were obtained for people aged 30–64 years. For each country, the association between level of education and avoidable mortality was measured with the use of regression-based inequality indexes. Life table analysis was used to calculate the contribution of avoidable causes of death to inequalities in life expectancy between lower and higher educated groups.

Results Educational inequalities in avoidable mortality were present in all countries of Europe and in all types of avoidable causes of death. Especially large educational inequalities were found for infectious diseases and conditions that require acute care in all countries of Europe. Inequalities were larger in Central Eastern European (CEE) and Baltic countries, followed by Northern and Western European countries, and smallest in the Southern European regions. This geographic pattern was present in almost all types of avoidable causes of death. Avoidable mortality contributed between 11 and 24% to the inequalities in Partial Life Expectancy between higher and lower educated groups. Infectious diseases and cardiorespiratory conditions were the main contributors to this difference.

Conclusions Inequalities in avoidable mortality were present in all European countries, but were especially pronounced in CEE and Baltic countries. These educational inequalities point to an important role for healthcare services in reducing inequalities in health.

INTRODUCTION

There is worldwide evidence that health status and mortality differ among socioeconomic groups, with those less educated and economically less affluent groups in society being in a more disadvantaged position.1–4 It has been suggested that these inequalities may be due, in part, to inequalities in access and quality of health services.5–7

Avoidable mortality is a concept, first introduced in 1970, to measure the performance of the healthcare system.8–10 It represents mortality from conditions amenable to medical interventions, that is deaths that should have been averted given a timely application of the current medical knowledge and technology. Levels and trends of avoidable mortality have been widely documented.11–15 Most researchers have shown that levels of avoidable mortality have substantially decreased over the past 50 years.16–22 Studies from the USA, New Zealand and Europe also observed higher levels in avoidable mortality among people disadvantaged in terms of ethnicity or socioeconomic position.15 23–29

Evidence on inequalities in avoidable mortality in Europe remains fragmentary with studies limited to particular countries and population groups. In addition, previous studies have limited comparability due to differences in the definition of avoidable mortality, study periods and age groups, and use of different socioeconomic indicators. It is of interest to learn whether there are specific causes of death for which inequalities are large in all European countries. Such causes would point to specific problems with healthcare delivery that require extra attention throughout Europe. In addition, country differences in avoidable mortality can indicate a possible role of specific national healthcare systems, and thus suggest priority areas for more in-depth investigations into the situation of specific countries.

The objective of the present study is to estimate the magnitude of educational inequalities in avoidable mortality in different European countries and to prepare such an overview for a wide array of avoidable causes of death. The aim is to obtain indications on the role of the healthcare system in reducing socioeconomic inequalities in health.

METHODS

Mortality data from 16 European populations (Finland, Sweden, Norway, Denmark, Belgium, Switzerland, Italy, Spain, Slovenia, Hungary, the Czech Republic, Poland, Lithuania and Estonia, table 1) were selected for this study. The data were drawn from national populations, except for Italy (data for Turin city only) and Spain (data for the Madrid and Basque regions, and Barcelona city only). Mortality data for Central and Eastern European (CEE) and Baltic countries, except Slovenia, come from cross-sectional unlinked mortality studies, in which information on socioeconomic data is derived separately from death certificates and census records. Data for other European countries came from longitudinal follow-up studies, in which socioeconomic position as determined during a census has been linked to mortality.

The list of avoidable causes of deaths was based on the original list developed by Rutstein.9

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Specifically, diseases of infectious origin (tuberculosis [A15-19, B90], pneumonia/influenza [J10-18], and other infectious and parasitic diseases [A00-09, A20-99, B00-89, B91-99]); some types of cancer (cervix uteri [C53], testis [C62], Hodgkin B90]; pneumonia/infectious heart disease [I00-09] and asthma [J45-46]; some conditions that require acute, very dif
causes of death with strong effect of lifestyle factors, it would be
nomic inequalities in mortality from these conditions. For the
and obesity, which are known to largely determine socioeco-
ies of death have been excluded from the study.

care rather than inequalities in lifestyle factors. For that reason,
inequalities are caused by the inequalities with regards to medical
as these conditions are to a considerable extent
related to lifestyle factors such as smoking, alcohol consumption and
obesity, which are known to largely determine socioeconomic inequalities in mortality from these conditions. For the
causes of death with strong effect of lifestyle factors, it would be
very difficult to determine the extent to which the observed
inequalities are caused by the inequalities with regards to medical
care rather than inequalities in lifestyle factors. For that reason,
these causes of death have been excluded from the study.

The numbers of maternal deaths and deaths caused by pro-
tate hyperplasia were too small to be investigated separately;
these causes of death were included only in the group of total
avoidable mortality combined.

Analysis of data from longitudinal studies with about 10 years of
follow-up was performed among people aged 50–64 (at the
start of follow-up). To approximate all populations in terms of
average age at death, the analysis was performed on slightly older
age groups for all studies with cross-sectional design (35–69 years)
and for longitudinal studies with shorter follow-up period (35–69
for Madrid with a 2-year follow-up period, and 30
of follow-up was performed among people aged 30
for 5-year age group and gender. The regression model had a log
chical classi
interpreted as the risk of death at the very bottom of the
hierarchy, with 0 and 1 as the extreme values. The RII can be

tional group. This relative position is measured as the cumula-
stitution and post-secondary/tertiary education. For unlinked cross-
educational hierarchy as compared to the highest end of the

The linkage between census data and mortality registries was
achieved for more than 96% of all deceased persons in almost all
populations except Madrid (70%), the Basque region (93%) and
Barcelona (94.3%). Evaluations in Madrid and Barcelona observed no variation in this percentage according to age, sex or socioeconomic position. Therefore, estimates of relative inequalities in mortality are not likely to be biased to an important extent. In addition, estimates of the absolute mortality rates were adjusted by increasing these with correction factors (1/0.70, 1/0.93 and 1/0.945 respectively).

To estimate the mortality level per educational level, age-standardised mortality rates were computed using European population as a standard (OECD, 1995). To estimate the extent of inequalities across educational levels, Relative Indices of Inequality (RII) were computed. The RII is a regression-based measure that takes into account the distribution of the popu-
lation by educational groups. It assesses the association
between mortality rate and the relative position of each educa-
tional group. This relative position is measured as the cumula-
proportion of each educational group within the educational
classification of educational levels is used in each country. The
RII was estimated with log linear regression using the
enmod procedure of SAS. Analyses were conducted for each
population separately and combined.

Life table analysis was used to estimate the partial life expec-
tancy (PLE) between the 35th and 78th birthday (with
maximum of 65 years), for higher and lower educational groups.
The contribution of each avoidable condition to inequalities in
PLE was estimated using the cause elimination life table.

RESULTS

Inequalities in total avoidable mortality were present in all
European populations included in this study (table 2). Compared
to the educational inequalities in total mortality, inequalities in
total avoidable mortality were slightly larger in all populations

<table>
<thead>
<tr>
<th>Country</th>
<th>Type of data</th>
<th>Follow-up period</th>
<th>Number of person years at risk</th>
<th>Educational level (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finland</td>
<td>Longitudinal</td>
<td>1990–2000</td>
<td>2260614</td>
<td>47.2</td>
</tr>
<tr>
<td>Sweden</td>
<td>Longitudinal</td>
<td>1991–2000</td>
<td>3613738</td>
<td>37.3</td>
</tr>
<tr>
<td>Norway</td>
<td>Longitudinal</td>
<td>1990–2000</td>
<td>1666884</td>
<td>30.2</td>
</tr>
<tr>
<td>Denmark</td>
<td>Longitudinal</td>
<td>1996–2000</td>
<td>1195962</td>
<td>43.1</td>
</tr>
<tr>
<td>Belgium</td>
<td>Longitudinal</td>
<td>1991–1995</td>
<td>2234953</td>
<td>61.6</td>
</tr>
<tr>
<td>Switzerland</td>
<td>Longitudinal</td>
<td>1990–2000</td>
<td>2366317</td>
<td>28.1</td>
</tr>
<tr>
<td>Turin</td>
<td>Longitudinal</td>
<td>1991–2001</td>
<td>4147548</td>
<td>70.6</td>
</tr>
<tr>
<td>Barcelona</td>
<td>Longitudinal</td>
<td>1992–2001</td>
<td>6733310</td>
<td>68.0</td>
</tr>
<tr>
<td>Madrid region</td>
<td>Longitudinal</td>
<td>1996–1997</td>
<td>3216098</td>
<td>63.3</td>
</tr>
<tr>
<td>Basque region</td>
<td>Longitudinal</td>
<td>1996–2001</td>
<td>5426107</td>
<td>67.2</td>
</tr>
<tr>
<td>Slovenia</td>
<td>Longitudinal</td>
<td>1991–2000</td>
<td>6598967</td>
<td>45.5</td>
</tr>
<tr>
<td>Hungary</td>
<td>CS unlinked</td>
<td>1999–2002</td>
<td>17926668</td>
<td>60.4</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>CS unlinked</td>
<td>1999–2003</td>
<td>22181655</td>
<td>59.5</td>
</tr>
<tr>
<td>Poland</td>
<td>CS unlinked</td>
<td>2001–2003</td>
<td>47673756</td>
<td>53.2</td>
</tr>
<tr>
<td>Lithuania</td>
<td>CS unlinked</td>
<td>2000–2002</td>
<td>4436508</td>
<td>22.5</td>
</tr>
<tr>
<td>Estonia</td>
<td>CS unlinked</td>
<td>1998–2002</td>
<td>2950765</td>
<td>23.3</td>
</tr>
</tbody>
</table>

CS, Cross-sectional.
separately and combined. The smallest inequalities in avoidable mortality were observed in South European populations, whereas the largest inequalities were found in CEE and Baltic countries. Relative inequalities were the largest in the Czech Republic and Hungary (5.34) and the smallest in the region of Madrid (1.70). Similar to relative inequalities, larger absolute inequalities in avoidable mortality were observed in CEE and Baltic countries and smaller absolute inequalities were observed in the Spanish regions and Turin.

Large inequalities favouring more educated people in the group of infectious diseases (table 3A) were observed. For all infectious diseases combined, educational inequalities were larger in CEE and Baltic countries and were relatively large also in Denmark (RII 5.04). Nearly all countries had consistently larger inequalities in tuberculosis (TB) mortality than for other infectious diseases. Inequalities in TB mortality were the largest in CEE and Baltic countries, Norway and Denmark, where RIIIs peaked at values 10.94 and higher.

Smaller, but consistent, inequalities were found in total avoidable malignant conditions (RII for all countries combined 1.84, CI 1.75 to 1.93, table 3B). RIIIs were slightly lower in the Southern regions, except Madrid and tended to be slightly higher in CEE and Baltic countries, except Slovenia and Estonia. Relative and absolute inequalities (last not shown) were the largest for cervical cancer among women, whereas inequalities for leukaemia and acute diseases, but it fluctuated largely between countries. Finland, Turin, Hungary, the Czech Republic and Poland had larger educational inequalities in total avoidable acute conditions combined than the European average (all RIIIs above 5.00 compared to European average RII 4.50).

Differences in partial life expectancy (PLE) between high and low educational groups were the largest in CEE and Baltic countries, where it varied between 1.72 years in the Czech Republic to 5.07 years in Lithuania (table 4). Slovenia was an exception to the above, having a PLE similar to Nordic countries. The smallest difference in PLE between lower and higher educated groups was in the Basque region (62 days). Avoidable causes of death made a large contribution to these small inequalities (53%). In other countries, the contribution of avoidable causes of death to the difference in PLE was between 11% and 24%. Acute and malignant conditions generally contributed little to the difference in PLE (17% and less, except in Madrid). Cardiorespiratory and infectious diseases contributed most to the difference in PLE in all European countries. Cardiorespiratory conditions contributed the most to the difference in PLE in Nordic countries, Belgium, Turin, Barcelona and CEE countries, whereas in other countries diseases of infectious origin made the largest contribution.

**DISCUSSION**

Educational inequalities in avoidable mortality were present in all countries of Europe and in most types of avoidable causes of death, with the exception of some avoidable malignant diseases. Especially large educational inequalities were found, in relative terms, for infectious diseases and acute conditions. Inequalities were larger in CEE and Baltic countries, followed by Northern and Western European countries and smaller in the Southern European regions. This geographic pattern was present in almost all types of avoidable diseases. Avoidable mortality inequalities contributed between 11% and 24% to the difference in PLE between high and low educated groups. Infectious diseases and cardiorespiratory conditions were the main contributors to this difference in PLE.
### Table 3  Numbers of death N, age and sex standardised mortality rates ASMR, and relative index of inequality RII for groups of avoidable conditions by country

#### A. Diseases of infectious origin

<table>
<thead>
<tr>
<th>Country</th>
<th>ASMR Lower education</th>
<th>Higher education</th>
<th>RII* 95% CI</th>
<th>Tuberculosis RII* 95% CI</th>
<th>Pneumonia/Influenza RII* 95% CI</th>
<th>Other infectious RII* 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finland</td>
<td>4053</td>
<td>24.4</td>
<td>13.1</td>
<td>4.21</td>
<td>3.65 to 4.86</td>
<td>2.73</td>
</tr>
<tr>
<td>Sweden</td>
<td>2955</td>
<td>11.5</td>
<td>6.4</td>
<td>3.17</td>
<td>2.75 to 3.66</td>
<td>4.75</td>
</tr>
<tr>
<td>Norway</td>
<td>1536</td>
<td>13.2</td>
<td>8.0</td>
<td>2.96</td>
<td>2.42 to 3.62</td>
<td>10.94</td>
</tr>
<tr>
<td>Denmark</td>
<td>1136</td>
<td>14.0</td>
<td>6.8</td>
<td>5.04</td>
<td>3.95 to 6.44</td>
<td>14.39</td>
</tr>
<tr>
<td>Belgium</td>
<td>3646</td>
<td>17.2</td>
<td>12.2</td>
<td>2.26</td>
<td>1.97 to 2.60</td>
<td>3.14</td>
</tr>
<tr>
<td>Switzerland</td>
<td>3950</td>
<td>23.4</td>
<td>14.9</td>
<td>3.77</td>
<td>3.32 to 4.28</td>
<td>7.47</td>
</tr>
<tr>
<td>Turin</td>
<td>336</td>
<td>8.3</td>
<td>4.9</td>
<td>3.84</td>
<td>3.43 to 6.05</td>
<td>6.71</td>
</tr>
<tr>
<td>Barcelona</td>
<td>1001</td>
<td>15.9</td>
<td>10.9</td>
<td>3.32</td>
<td>2.52 to 4.36</td>
<td>9.89</td>
</tr>
<tr>
<td>Madrid region</td>
<td>550</td>
<td>19.2</td>
<td>15.3</td>
<td>2.04</td>
<td>1.42 to 2.91</td>
<td>4.42</td>
</tr>
<tr>
<td>Basque region</td>
<td>965</td>
<td>23.0</td>
<td>14.7</td>
<td>4.55</td>
<td>3.42 to 6.04</td>
<td>1.98</td>
</tr>
<tr>
<td>Slovenia</td>
<td>1253</td>
<td>19.8</td>
<td>10.7</td>
<td>5.16</td>
<td>4.18 to 6.37</td>
<td>13.55</td>
</tr>
<tr>
<td>Hungary</td>
<td>2268</td>
<td>16.6</td>
<td>5.7</td>
<td>9.07</td>
<td>7.21 to 11.42</td>
<td>15.38</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>3298</td>
<td>19.4</td>
<td>8.0</td>
<td>7.62</td>
<td>6.34 to 9.16</td>
<td>24.05</td>
</tr>
<tr>
<td>Poland</td>
<td>7724</td>
<td>23.5</td>
<td>8.4</td>
<td>8.12</td>
<td>7.23 to 9.10</td>
<td>45.47</td>
</tr>
<tr>
<td>Lithuania</td>
<td>1541</td>
<td>106.4</td>
<td>20.9</td>
<td>19.05</td>
<td>14.94 to 24.30</td>
<td>38.46</td>
</tr>
<tr>
<td>Estonia</td>
<td>1378</td>
<td>98.9</td>
<td>33.4</td>
<td>6.81</td>
<td>5.44 to 8.53</td>
<td>12.97</td>
</tr>
<tr>
<td>All countries</td>
<td>37590</td>
<td>28.4</td>
<td>12.2</td>
<td>4.69</td>
<td>4.46 to 4.90</td>
<td>14.68</td>
</tr>
</tbody>
</table>

#### B. Selected malignant conditions

<table>
<thead>
<tr>
<th>Country</th>
<th>ASMR Lower education</th>
<th>Higher education</th>
<th>RII* 95% CI</th>
<th>Cervical cancer RII* 95% CI</th>
<th>Leukaemia and Hodgkin’s disease RII* 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finland</td>
<td>1584</td>
<td>8.3</td>
<td>6.5</td>
<td>1.66</td>
<td>1.35 to 2.05</td>
</tr>
<tr>
<td>Sweden</td>
<td>2751</td>
<td>8.5</td>
<td>7.4</td>
<td>1.39</td>
<td>1.21 to 1.60</td>
</tr>
<tr>
<td>Norway</td>
<td>1461</td>
<td>11.6</td>
<td>8.3</td>
<td>1.70</td>
<td>1.39 to 2.09</td>
</tr>
<tr>
<td>Denmark</td>
<td>1130</td>
<td>11.1</td>
<td>8.8</td>
<td>1.44</td>
<td>1.15 to 1.81</td>
</tr>
<tr>
<td>Belgium</td>
<td>2351</td>
<td>10.9</td>
<td>9.7</td>
<td>1.40</td>
<td>1.19 to 1.66</td>
</tr>
<tr>
<td>Switzerland</td>
<td>2048</td>
<td>10.1</td>
<td>8.3</td>
<td>1.47</td>
<td>1.23 to 1.75</td>
</tr>
<tr>
<td>Turin</td>
<td>397</td>
<td>9.0</td>
<td>8.5</td>
<td>1.25</td>
<td>0.84 to 1.85</td>
</tr>
<tr>
<td>Barcelona</td>
<td>690</td>
<td>9.6</td>
<td>9.1</td>
<td>1.23</td>
<td>0.90 to 1.68</td>
</tr>
<tr>
<td>Madrid region</td>
<td>316</td>
<td>11.0</td>
<td>7.9</td>
<td>1.26</td>
<td>1.28 to 3.31</td>
</tr>
<tr>
<td>Basque region</td>
<td>307</td>
<td>6.0</td>
<td>5.4</td>
<td>1.56</td>
<td>0.90 to 2.70</td>
</tr>
<tr>
<td>Slovenia</td>
<td>965</td>
<td>12.6</td>
<td>10.7</td>
<td>1.31</td>
<td>1.03 to 1.67</td>
</tr>
<tr>
<td>Hungary</td>
<td>3112</td>
<td>19.2</td>
<td>13.9</td>
<td>2.01</td>
<td>1.72 to 2.36</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>3239</td>
<td>17.0</td>
<td>11.8</td>
<td>2.24</td>
<td>1.91 to 2.62</td>
</tr>
<tr>
<td>Poland</td>
<td>7532</td>
<td>19.2</td>
<td>12.8</td>
<td>2.83</td>
<td>2.57 to 3.13</td>
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<tr>
<td>Lithuania</td>
<td>919</td>
<td>33.0</td>
<td>17.7</td>
<td>3.29</td>
<td>2.48 to 4.37</td>
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<tr>
<td>Estonia</td>
<td>440</td>
<td>16.5</td>
<td>14.8</td>
<td>1.61</td>
<td>1.11 to 2.32</td>
</tr>
<tr>
<td>All countries</td>
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<td>10.1</td>
<td>1.84</td>
<td>1.75 to 1.93</td>
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</tbody>
</table>

#### C. Selected cardiorespiratory conditions

<table>
<thead>
<tr>
<th>Country</th>
<th>ASMR Lower education</th>
<th>Higher education</th>
<th>RII* 95% CI</th>
<th>Hypertension and cerebrovascular disease RII* 95% CI</th>
<th>Chronic rheumatic heart disease RII* 95% CI</th>
<th>Asthma RII* 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finland</td>
<td>10947</td>
<td>60.1</td>
<td>40.9</td>
<td>2.40</td>
<td>2.20 to 2.60</td>
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<tr>
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<td>10683</td>
<td>34.8</td>
<td>22.1</td>
<td>2.21</td>
<td>2.06 to 2.38</td>
<td>2.14</td>
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<tr>
<td>Norway</td>
<td>6226</td>
<td>37.5</td>
<td>26.2</td>
<td>3.03</td>
<td>2.74 to 3.35</td>
<td>2.69</td>
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<td>33.0</td>
<td>2.25</td>
<td>1.97 to 2.56</td>
<td>2.08</td>
</tr>
<tr>
<td>Belgium</td>
<td>9971</td>
<td>37.8</td>
<td>26.2</td>
<td>2.21</td>
<td>2.03 to 2.41</td>
<td>2.20</td>
</tr>
<tr>
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<td>6399</td>
<td>33.0</td>
<td>24.6</td>
<td>2.59</td>
<td>2.34 to 2.86</td>
<td>2.47</td>
</tr>
<tr>
<td>Turin</td>
<td>1964</td>
<td>43.6</td>
<td>36.7</td>
<td>1.56</td>
<td>1.32 to 1.89</td>
<td>1.60</td>
</tr>
<tr>
<td>Barcelona</td>
<td>2687</td>
<td>37.4</td>
<td>31.1</td>
<td>1.64</td>
<td>1.39 to 1.93</td>
<td>1.63</td>
</tr>
<tr>
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<td>31.1</td>
<td>1.43</td>
<td>1.10 to 1.86</td>
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<tr>
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<td>26.6</td>
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<td>0.78 to 1.30</td>
<td>1.02</td>
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<td>64.7</td>
<td>3.01</td>
<td>2.75 to 3.29</td>
<td>3.07</td>
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</tbody>
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Continued
In the present data, education was available in a comparable form for a large number of countries. Advantages of this measure are that it allows for classification of individuals regardless of whether they are inside or outside of the labour force market and it largely averts reverse causation as most people acquire their education early in life. Large differences were observed between countries in the distribution of population by educational level. These differences mainly reflect true variations between countries of Europe in educational systems and attained levels of education. To cope with these differences, the present study used RII, a measure that takes educational distributions into account.

Data from CEE (except Slovenia) and Baltic countries had cross-sectional unlinked design, whereas all other European countries and Slovenia had census-linked mortality follow-up studies. In a study that compares linked and unlinked mortality estimates in Lithuania, Shkolnikov et al demonstrated that mortality inequalities based on unlinked mortality data were overestimated. However, this overestimation was rather small in the age group 50–69. Moreover, the two lowest educational levels were combined, where numerator denominator bias is most likely to occur, thus minimising possible overestimation of mortality inequalities by education in CEE and Baltic countries.

Although all data came from populations with reliable cause-of-death registries, potential influences of national diagnosing and coding practices should also be considered. For example, in Barcelona AIDS cases were coded under a different code and thus were not included in the count of avoidable deaths presented in this study. The results of the present study would be biased only to the extent that coding practices are associated with educational level within populations. The diagnosing and coding practice may have depended on the medical care received before death.

Although there are no specific indications for variations in coding according to the educational level of the deceased, such bias cannot be completely ruled out for some specific smaller causes of death. However, such bias is unlikely to explain the results for broader cause-of-death groups as analysed here.

Particular concern should be given to mortality from HIV/AIDS. In most of the available data sets, deaths from HIV/AIDS were not included when the 8th or 9th revision of the ICD was used. As a result, HIV/AIDS deaths were not registered for about the first 5 years of the 10-year study periods of Finland, Norway, Sweden and Switzerland (ie, about 1990–1995), and for most of the study periods of Belgium, Barcelona, Madrid, Turin and Slovenia (ie, early and mid-1990s). Due to exclusion of HIV/AIDS, educational inequalities in avoidable mortality that were consistently observed in most Baltic and CEE countries.

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AIDS deaths, the total burden and the relative inequalities in total avoidable mortality, as well as in mortality from infectious diseases, may have been underestimated. This underestimation may be particularly large for southern European countries, which were severely affected by the AIDS/HIV epidemic in the 1990s. Therefore, it is of special interest to have the results for the Basque country, the only Southern population for which HIV/AIDS deaths were included. The study period for the Basque country, 1996–2001, largely reflects the situation after the introduction of HAART therapy in Spain in about 1997. Compared to Barcelona, Madrid and Turin, higher absolute rates and larger relative inequalities in infectious disease mortality were found in Basque country (table 3A). However, the effect on infectious diseases on educational inequalities in partial life expectancy was modest in the Basque country in 1996–2001 compared with the larger educational inequalities in TB mortality and prevalence of TB among people with lower socioeconomic status in many countries. Although the contribution of characteristics of the individual healthcare systems.

One of the potential explanations of educational inequalities in mortality is inequalities in incidence of the diseases. Social and geographical variations in incidence could partly contribute to the explanation of variations in mortality. Even though inequalities in incidence may be fundamental, these do not always justify the occurrence of inequalities in mortality. Death from many conditions could be prevented (eg, infectious diseases) or considerably delayed even after the condition has developed, provided that appropriate and timely treatment is applied. In addition, occurrence of some diseases can be prevented by medical intervention, for example cervical cancer, influenza and cerebrovascular disease.

### Table 4

<table>
<thead>
<tr>
<th>Region</th>
<th>PLE, lower education</th>
<th>PLE, higher education</th>
<th>Δ PLE</th>
<th>Total avoidable mortality</th>
<th>Diseases of infectious origin</th>
<th>Malignant diseases</th>
<th>Cardiorespiratory conditions</th>
<th>Acute conditions</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Δ PLE days</td>
<td>Δ PLE days %</td>
<td>Δ PLE days %</td>
<td>Δ PLE days %</td>
<td>Δ PLE days %</td>
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<td>31.95</td>
<td>33.00</td>
<td>382</td>
<td>59 15</td>
<td>21 35</td>
<td>3 5</td>
<td>28 47</td>
<td>8 13</td>
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<td>10 31</td>
<td>2 7</td>
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<td>4 11</td>
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<td>322</td>
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<td>8 17</td>
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<td>304</td>
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<td>16 42</td>
<td>4 12</td>
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<td>4 11</td>
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<td>Belgium</td>
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<td>33.50</td>
<td>197</td>
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<td>4 17</td>
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<td>2 7</td>
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<tr>
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<td>32.72</td>
<td>33.23</td>
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<td>41 22</td>
<td>22 54</td>
<td>4 11</td>
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<tr>
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<td>33.37</td>
<td>182</td>
<td>23 13</td>
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<td>32.71</td>
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<td>176</td>
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<td>1 5</td>
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<td>6 22</td>
<td>0 1</td>
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<tr>
<td>Basque region</td>
<td></td>
<td></td>
<td>82</td>
<td>33 53</td>
<td>32 99</td>
<td>3 9</td>
<td>– 3 – 8</td>
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<td>16 22</td>
<td>5 7</td>
<td>46 64</td>
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<td>32.46</td>
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<td>167 18</td>
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<td>10 6</td>
<td>125 75</td>
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<tr>
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<td>31.58</td>
<td>33.30</td>
<td>629</td>
<td>96 15</td>
<td>20 21</td>
<td>10 10</td>
<td>59 62</td>
<td>8 9</td>
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<tr>
<td>Poland</td>
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<td>33.02</td>
<td>816</td>
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<td>12 10</td>
<td>79 63</td>
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<td>357 19</td>
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<td>31.16</td>
<td>1418</td>
<td>335 24</td>
<td>165 49</td>
<td>7 2</td>
<td>152 45</td>
<td>21 6</td>
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</table>

Δ PLE, difference in PLE between the higher and lower educated groups.

% from the total mortality.

% from total avoidable mortality.

Research report
lower and high levels of education in European countries with universal coverage would be instructive in identifying other mechanisms that contribute to educational inequalities with regards to healthcare outcomes. Confidential case reviews might serve as a way to identify and correct possible deficiencies in acute care.

A question is whether inequalities in avoidable mortality between countries observed in this study reflect cross-national variations with regards to healthcare systems. It is especially interesting to learn if it is inequalities in the use of healthcare services or the quality of services received that have the strongest contribution to inequalities in avoidable mortality. International overviews in socioeconomic inequalities in healthcare utilisation\(^5\)\(^4\) show that the magnitude of these inequalities varied little between countries, and any cross-national variations that existed, were not consistently related to the variations in inequalities in avoidable mortality reported here. For example, the magnitude of inequalities in mortality from hypertension or acute conditions strongly differed between Estonia, Hungary and Belgium, whereas these countries had nearly identical inequalities in specialist visits.\(^4\)\(^5\) This points to a stronger contribution of inequalities in quality of services received rather than overall utilisation patterns. The present results additionally show that the largest contributors to the educational inequalities in avoidable mortality were infectious and cardiorespiratory diseases. These diseases are largely addressed at the primary care level, which could suggest possible shortcomings particularly in the quality of primary care. Evidence suggests that well-organised primary care reduces inequalities in health outcomes and that quality of primary care in general is not lower than that of specialists.\(^4\)\(^6\) International comparative studies that would investigate differences in quality of primary care in different European countries, however, do not exist.

The geographical scope of this study is substantially broader than that of other studies because a large number of European countries were incorporated, including those in the East, for which data on socioeconomic inequalities in mortality have been poorly documented. It was observed that educational inequalities in avoidable mortality in CEE (except Slovenia) and Baltic countries are larger than in other European countries. These countries had to deal with limited financing, a lack of efficiency and poor quality of health services during the 1990s. This may partly explain the substantially smaller improvements in the mortality from avoidable causes in the East as compared to the rest of Europe.\(^3\)\(^1\)\(^2\) It is notable that the PLE of highly educated people in CEE and Baltic countries was only about 1 year shorter than the PLE of highly educated people in other European countries, whereas the difference in PLE between lower educated people in CEE/Baltic countries and other European countries was more than 3 years (table 4). This finding may indicate that the benefit achieved during the last decade in CEE/Baltic countries primarily was limited to people with higher education, whereas the life expectancy of those in lower education at best stagnated.\(^3\) Evidence also suggests that access and quality of healthcare services in these countries may play an important role in causing the observed inequalities.\(^4\)\(^6\) If true, a special priority should be given to improving access and quality of health services for those of lower education in CEE and Baltic countries.

In conclusion, educational inequalities in avoidable mortality are present in all countries of Europe. Reduction of inequalities in cardiorespiratory and infectious diseases would largely contribute to the reduction of the total avoidable mortality in Europe, especially in CEE and Baltic countries. Although socioeconomic inequalities in health are a function of a broad array of factors that go beyond the sphere of influence of healthcare policies and services, the latter may nevertheless contribute to reducing socioeconomic inequalities in mortality.

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Competing interests None.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES


What this study adds

- The present study found that inequalities in avoidable mortality among people with higher and lower levels of education are present in all European countries and for all avoidable causes of death.
- Educational inequalities were larger in Central Eastern European and Baltic countries, followed by Northern and Western European countries, and smallest in the Southern European regions.
- Avoidable mortality contributed between 11% and 24% to the inequalities in Partial Life Expectancy between higher and lower educated groups.
- Educational inequalities in avoidable mortality point to an important role of healthcare services in reducing inequalities in health.

What is already known on this subject

- Levels and trends of avoidable mortality have been widely documented.
- Previous studies observed higher levels of avoidable mortality among people disadvantaged in terms of ethnicity or socioeconomic position.
- However, evidence of inequalities in avoidable mortality in Europe remains fragmentary due to limited geographic coverage and comparability of previous studies.
Educational inequalities in avoidable mortality in Europe

Irina Stirbu, Anton E Kunst, Matthias Bopp, Mall Leinsalu, Enrique Regidor, Santiago Esnaola, Giuseppe Costa, Pekka Martikainen, Carme Borrell, Patrik Deboosere, Ramune Kalediene, Jitka Rychtarikova, Barbara Artnik and Johan P Mackenbach

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