Commentary: The study by Leinsalu et al. on mortality differentials in Eastern Europe highlights the need for better data

Domantas Jasilionis, Vladimir M Shkolnikov* and Evgueni M Andreev

Among numerous studies on mortality in Eastern Europe and the former Soviet Union, only a few have addressed temporal changes in socioeconomic mortality differences. In 1998, Shkolnikov et al. reported a rapid rise in mortality differences by education between 1988–9 and 1994 in Russia. A later study by Leinsalu et al. revealed a notable widening of these differences in Estonia between 1989 and 2000. Kalediene and Petrauskiene described a very similar change in Lithuania between 1989 and 2000. Finally, a study by Shkolnikov et al. compared changes in educational differences in mortality between the Czech Republic, Estonia, Finland and Russia: it was found that during the 1990s mortality differences in the Czech Republic and Finland increased only moderately, whereas in Russia and Estonia the increase was striking.

The present study by Leinsalu continues and extends this work in two important directions. First, the study analyses changes in education-specific mortality in a larger number of Eastern European countries (Estonia, Hungary, Lithuania and Poland) and in a greater detail than before. The study demonstrates that although inequalities have increased in all the countries under study, two different patterns of mortality divergence can be distinguished. In Hungary and Poland, the reduction (or, at worst, stagnation) of mortality has been observed in all education groups. In contrast, Lithuania and Estonia have experienced mortality decreases in highly educated groups, but increasing mortality in low education groups. This finding supports the existence of a health divide between parts of the former Soviet Union, such as the Baltic countries, and the former communist countries of Central Europe.

Second, the article looks at cause-specific mortality. Even a very limited number of causes of death (seven broad groups) provide valuable insights into possible determinants of varying trends in group-specific mortality across the four countries. The study shows that external causes of death have made the major contribution to the increase in educational differences in mortality in Lithuania and Estonia. The authors suggest that alcohol is an important mediating factor behind these growing inequalities. The role of alcohol can also be identified in the analyses of some other groups of causes of death. Leinsalu et al. indicate that alcoholic cardiomyopathies account for a substantial part of the educational gap in cardiovascular mortality.

The authors’ explanation of the role of alcohol might be even more persuasive if more causes of death had been considered. Leinsalu and colleagues, probably correctly, point to a significant contribution of non-beverage illegal and surrogate alcohol consumption to the increasing educational differentials in mortality in Estonia and Lithuania. This consideration, however, could be strengthened if the effect of...
poisoning by alcohol, alcoholic psychosis and liver cirrhosis had been included in the analyses. In this regard, it is worth mentioning a recent study by Lang and colleagues which shows that surrogate and illegal alcohol that are drunk are easily obtainable in Estonia and implies that consumption of these substances might be widespread among the country’s poor. The conclusions about alcohol as one of the major determinants of mortality differentials agree with the results from a recent census-linked study on Lithuania, suggesting that alcohol-related causes are characterized by the highest relative inequalities in mortality and also produce very significant contributions to the life expectancy gap between high-education and low-education groups.

However, the use of census-unlinked cross-sectional data on differential mortality is a major methodological problem with the study by Leinsalu and colleagues and also with the most of the earlier studies on differential mortality in Eastern Europe, including our own. It is clear that self-reported information about education at census can differ systematically from the same information reported by the next of kin after the individual’s death. A recent study in Lithuania used a unique data source for the comparison between census-linked and census-unlinked estimates of differential mortality in this country in 2001–04. This study showed that the educational mortality differences are grossly overestimated due to the numerator–denominator bias. Leinsalu and colleagues are aware of this problem: they recognize that ‘some overestimation of the diverging trends between the two former Soviet republics and the two Central Eastern European countries may have occurred’, but they believe that the bias has no influence on the principal conclusions of their analysis.

However, the over-estimation of educational mortality differences in Lithuania in 2001–04 is very important. The comparison of mortality figures based on the census-linked data with those calculated by Leinsalu and colleagues for the early 2000s suggests that, for males, the mortality rate difference between the high-education and the low-education group was 1399 instead of 1742 per 100 000 and that the high-to-low mortality ratio was 2.93 instead of 3.77 (Table 1). Thus the educational difference in 2000–02 is seriously overstated by the unlinked estimates. To what extent could the widening of the educational difference since 1988–90 be misreported? The answer to this question depends on the magnitude of the overstatement of the educational mortality difference in 1988–90.

Due to the absence of census-linked data, it is impossible to evaluate directly the magnitude of the bias in group-specific standardized death rates for the earlier period of 1988–90. If the amount of overstatement of the educational mortality differences was the same in 1988–90 and 2000–02, then the widening of the inequality would not differ from the one estimated by Leinsalu and colleagues. If in 1988–90 the numerator–denominator bias did not exist at all, then the real increase in the high-to-low mortality ratio would have been from 1.67 to 2.80 (not from 1.67 to 3.73). This means that there was a 1.7-fold (not a 2.2-fold) increase in the relative mortality inequality between the late 1980s and the 2000s. The real increase in the educational mortality inequality must be somewhere between these two extremes.

In fact, it is possible that the magnitude of reporting bias in the late 1980s was smaller than in the early 2000s. Compared with the more recent period, in the Soviet period there is likely to have been greater discipline in reporting information to authorities (in general) and stricter adherence to rules of concerning the reporting of education and other socio-economic characteristics at death. Moreover, in the USSR educational levels were more precisely defined and uniform (across regions). Finally, there was better agreement between educational categories indicated in the census and death records compared with the situation around the 2001 census. However, while the numerator–denominator bias may have been smaller in the late 1980s compared with early 2000s, it is very likely that there was still some degree of overestimation of the educational differentials in this

### Table 1 Unlinked and linked age-standardized death rates (SDRs) per 100 000 for all causes of death among males and females aged 35–64 years: Lithuania, 1988–90, 2000–02 and 2001–04

<table>
<thead>
<tr>
<th></th>
<th>Males SDRa (Unlinked)</th>
<th>Males SDRb (Linked)</th>
<th>Females SDRa (Unlinked)</th>
<th>Females SDRb (Linked)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher</td>
<td>696</td>
<td>629</td>
<td>726</td>
<td>337</td>
</tr>
<tr>
<td>Upper secondary</td>
<td>1159</td>
<td>1312</td>
<td>1359</td>
<td>420</td>
</tr>
<tr>
<td>Lower than secondary or less</td>
<td>1508</td>
<td>2371</td>
<td>2125</td>
<td>564</td>
</tr>
<tr>
<td>Rate difference</td>
<td>812</td>
<td>1742</td>
<td>1399</td>
<td>227</td>
</tr>
<tr>
<td>Rate ratio</td>
<td>2.17</td>
<td>3.77</td>
<td>2.93</td>
<td>1.67</td>
</tr>
</tbody>
</table>

a Calculated by Leinsalu and co-authors.
b Our calculations from the census linked database for Lithuania.
earlier period. To this extent it is likely that the increase in mortality differentials was greater than the conservative estimate of 1.7 given above.

All these considerations regarding the Lithuanian data support the idea that the numerator–denominator bias cannot be entirely responsible for the growing divergence in group-specific mortality. Nevertheless, it is still questionable whether the same would remain true in other countries including Estonia or Russia. We agree with Leinsalu and colleagues, when they say that ‘the numerator–denominator bias can take various forms’ in different countries. In order to get more precise assumptions about the size and peculiarities of the bias, more country-specific studies comparing linked and unlinked estimates are needed.5

While there is certain awareness about data quality issues, we believe that the substantive conclusions by Leinsalu and colleagues are right and that their findings have important implications for future scenarios regarding mortality trends in post-communist countries. The reported results confirm that post-communist countries showing the most significant reductions in overall mortality have experienced much less significant widening in mortality inequalities over the 1990s. By the same token, more unfavourable trends in overall mortality have been observed in the countries showing gross widening of mortality inequalities. The increase in educational differentials in Estonia and Lithuania (and also in Russia) is mostly attributable to a worsening situation in the low-education groups, whereas more or less consistent recovery can be observed only among those highly educated. This suggests that the progress observed in high-education groups might not yet have spread towards lower education groups. If sustained, such tendencies have potential to impede further progress in the health of entire populations. The mortality reversal in Russia in 1998 and the recent stagnation or even increase in mortality in Lithuania may be in line with this concern.

The findings by Leinsalu and colleagues point to serious failures of health and social policies addressing inequalities in the Baltic countries. The research also suggests a need for more precise census-linked data on mortality differentials to provide better data to the public health policy makers. Unfortunately, the situation with respect to availability of data on mortality inequalities in the region remains unsatisfactory and is even worsening. In some cases such as Estonia, this is related to irrationally restrictive approaches towards privacy protection, which impedes any usage of personal data for scientific purposes.9 In other cases (e.g. of Latvia and Russia), even unlinked data in aggregated format is no longer available due to the exclusion of information on education from death certificates. If this situation remains unchanged, there is a threat that monitoring of health inequalities will become virtually impossible.

References