Downloaded from jech.bmjjournals.com on 9 October 2006

The changing relation between education and life expectancy in central and eastern Europe in the 1990s

Vladimir M Shkolnikov, Evgueni M Andreev, Domantas Jasilionis, Mall Leinsalu, Olga I Antonova and Martin McKee

J. Epidemiol. Community Health 2006;60;875-881
doi:10.1136/jech.2005.044719

Updated information and services can be found at:
http://jech.bmjjournals.com/cgi/content/full/60/10/875

These include:

References This article cites 19 articles, 4 of which can be accessed free at:
http://jech.bmjjournals.com/cgi/content/full/60/10/875#BIBL

Rapid responses You can respond to this article at:
http://jech.bmjjournals.com/cgi/eletter-submit/60/10/875

Email alerting service Receive free email alerts when new articles cite this article - sign up in the box at the top right corner of the article

Topic collections Articles on similar topics can be found in the following collections

Socioeconomic Determinants of Health (858 articles)

Notes

To order reprints of this article go to:
http://www.bmjjournals.com/cgi/reprintform

To subscribe to *Journal of Epidemiology and Community Health* go to:
http://www.bmjjournals.com/subscriptions/

Downloaded from jech.bmjjournals.com on 9 October 2006

RESEARCH REPORT

The changing relation between education and life expectancy in central and eastern Europe in the 1990s

Vladimir M Shkolnikov, Evgueni M Andreev, Domantas Jasilionis, Mall Leinsalu, Olga I Antonova, Martin McKee

J Epidemiol Community Health 2006;**60**:875–881. doi: 10.1136/jech.2005.044719

See end of article for authors' affiliations

Correspondence to: Professor M McKee, ECOHOST, London School of Hygiene and Tropical Medicine, Keppel Street, London WC1E 7HT, UK; martin.mckee@lshtm.ac.uk

Accepted for publication 10 April 2006

Background: The political and social transition in central and eastern Europe has been generally associated with widening educational differences in life expectancy. However, interpretation of these findings is complicated because the size of educational categories within the population has also changed. It is therefore important to disentangle these two phenomena.
Setting: The Czech Republic, Estonia, the Russian Federation and, as a western European reference, Finland, in two periods, 1988–89 and 1998–99.
Methods: Life tables were calculated in three categories: university; secondary; and less than secondary education. Changes in life expectancy were decomposed into contributions of population composition and within-category mortality.
Results: In Finland and the Czech Republic improvements are seen in all educational groups, with only a slight widening of the educational differences. Over 80% of the total life expectancy increase is attributable to improved mortality within educational categories. In Estonia and Russia, less favourable overall trends coincide with a dramatic widening of the educational gap. A decrease in life expectancy in those with low and middle education has been compensated for, to a small degree in Russia but a greater extent in Estonia, by improvements among those with higher education and by the improved population composition. For highly educated Estonians, the gains were seen at all ages, the greatest at age $\geq$60 years. In Russia mortality increased in those $<$60 years although compensated for by improvements at older ages.
Conclusions: Russia and Estonia exhibit much less equitable transitions compared with the Czech Republic. Analyses of trends in health inequalities should capture the changing population composition. In Russia and Estonia an improved educational structure prevented an even greater decline in life expectancy. The highly educated Estonians can potentially catalyse a wider health progress.

Socioeconomic differences in mortality have been the subject of longstanding research in western countries, illustrated by the Black Report in the United Kingdom, published in 1980.[1] Since then, the volume of research in these countries increased considerably, exemplified by important research projects such as the Whitehall study of British civil servants.[2]

In contrast, until the end of the 1980s, there was little recognition that similar problems might afflict the former communist countries in central and eastern Europe (in which we include the countries of the former Soviet Union and the former Soviet satellites in Europe). The communist bloc was committed to an ideology that was formally egalitarian. Subsequent research using data from the 1980s has, however, showed that mortality differentials in some parts of this region during the communist period were as steep or even steeper than those in the west.[3–6] Furthermore, the increasing adult male mortality seen in many of these countries was almost entirely concentrated among manual workers.[7 8] In Russia, a short term improvement in mortality in the second half of the 1980s saw the greatest gains among the most highly educated.[5]

The years that followed the political transition in 1989 brought mixed fortunes to the people of this region, with overall life expectancy improving in some countries but worsening in others. The limited available information shows a diversity in the extent to which inequalities have changed within countries. Thus, Blazek and Dzúrová[9] found only a moderate increase in educational differentials in mortality between 1980 and 1995 in the Czech Republic; further analyses using the 1999 census confirmed an absence of a substantial increase in educational differences in the Czech Republic in the post-transition period. In contrast, in Hungary[10] there was a threefold difference in mortality between those with the lowest level of education compared with the highest in 1999, an increase from the twofold difference in 1989. However, to illustrate the multifaceted nature of inequality, while among Hungarian women educational differences in mortality also widened it was to a much lesser degree.[10]

In Estonia too, the difference in mortality among those with different levels of education widened further between 1989 and 2000.[11] Our own calculations of the corresponding changes in Lithuania, based on data from Statistics Lithuania, showed a similar pattern between 1989 and 2000–01 (data not shown).

In Russia, a series of papers using a variety of methods suggest that educational differences in mortality have also increased during the 1990s.[5 12–14] However, until now there have been no estimates of the educational gap in mortality among the entire national population. One contribution of this paper is to fill this gap by providing new estimates for the late 1990s.

It is, however, important to recognise a potential problem affecting analysis of trends over time in inequalities between educational groups, in that the composition of the groups being compared may change. Thus, at an early stage, British researchers recognised that the social class composed of

Downloaded from jech.bmjjournals.com on 9 October 2006

unskilled workers was becoming progressively smaller as successive generations benefited from better training. The consequence was that, even if the mortality of those in each educational category was to stay the same, the overall population mortality would improve. However, if those in the upper part of the health distribution within the unskilled category benefit from training and move up into the semi-skilled category, the average level of health of those remaining behind would decline and the difference between unskilled and professional workers (the top and bottom categories) may widen. Another study showed that the hypothesis that upward mobility of healthier people moving out of parental lower classes combined with downward mobility of less healthy people moving out of parental upper classes diminishes the social class inequalities in health in Norway was false.[15]

It is therefore necessary to take account of the changing distribution of population by social group. A focus on distributional aspects helps to understand the contribution of compositional factors and category specific mortality to total mortality and permits assessment of the changes in both the nature and status of the worst off groups. This is especially relevant in central and eastern Europe, where some educational systems have achieved considerable improvements while in others have deteriorated.[16 17]

In this paper we examine what has happened to educational differences in life expectancy, looking at both the composition of educational categories and the mortality experience of those within them. We examine three countries of central and eastern Europe, as well as in a comparator country in the west. We do so by decomposing changes in total life expectancy into both group specific mortality components and compositional components and describe in these terms differences between countries.

METHODS

Selection of countries

The study examines three central and eastern European countries, the Czech Republic, Estonia, and the Russian Federation. By the beginning of the 21st century it was possible to distinguish at least four broad groupings of countries in Europe, defined in terms of both patterns of health and political history. These were the countries of western Europe, where life expectancy had, in general, increased steadily over several decades, the former communist countries of central and eastern Europe, where life expectancy had stagnated in the 1980s before beginning to increase rapidly at various points in the 1990s, although still well behind that in western Europe, the countries of the Commonwealth of Independent States (CIS), all once part of the USSR and where life expectancy has fluctuated sharply in the years since the mid-1980s but where it is still either stagnating or even deteriorating, and the three Baltic Republics that joined the European Union in 2004 and in which, until 1995, life expectancy followed a similar trajectory as in the CIS but has since been increasing rapidly. Countries were selected as exemplars of these groupings where it was possible to obtain appropriate data. The countries chosen were Russia (as an example of the CIS); the Czech Republic (a country of central and eastern Europe, now a member of the European Union); Estonia (a former Soviet republic now a member of the European Union); and Finland, a reference country in western Europe.

The Russian Federation has fared worst in the region, with a continuous decline in life expectancy, except for a brief interruption in 1995–97. The Czech Republic is the country that, together with East Germany, has made the most spectacular progress in reducing premature deaths and thus gaining life expectancy in the 1990s.[18] Estonia has experienced a less favourable evolution. Since its independence it has experienced an initial deterioration in health followed by a recovery, which began in 1995.

In 2000, life expectancy at birth in the Czech Republic was 3.2 years higher than in 1989.[19] For Finland, Estonia, and Russia the equivalent values are: +2.8 years, +0.6 years, and −4.5 years, respectively.[19] Finland was selected as it is a country that has had, historically, a high level of premature mortality, comparable to that in its then communist neighbours yet which has achieved dramatic improvements in the postwar period.

Data sources

In the central and eastern European countries, unlinked estimates of mortality by educational group were calculated, with the numerator based on information about the education of deceased, obtained from death certificates, with the denominator based on information from census records. The age groups included were determined a priori, based on data availability. In the Czech Republic, mortality by education in 1984–85, 1995–96, and 1998–99 was calculated from aggregate tables of deaths and population exposures by sex, age (ages 40+), and educational group. These tables have been reported elsewhere and were provided to us by the author.[20] In Estonia, mortality by education in 1988–89 and 1999–2000 is calculated from similar aggregate tables of deaths and population exposures for ages 30+. These data were also reported in a previous study.[11]

For Russia in 1988–89 corresponding aggregate tables are available.[5] However, the second data point proved more problematic as from 1999 registration of the social status of the deceased was stopped so it was only possible to use data for 1998. The educational composition of the Russian population in mid-1998 was estimated by interpolating between the micro-census of 1994 and the census of 2002. Tabulation of deaths by education was undertaken at Goskomstat using original death records for 1998.

Finally, in Finland, education specific mortality in 1988–89 and 1998–99 was estimated using Statistic Finland's data in which deaths are individually linked to the census records.

Only three broad educational categories are used to minimise potential numerator-denominator bias[5 7] and to enable comparability among the four countries (only for Russia and Estonia could we use the same detailed categories). In this study, high, middle, and low educational categories correspond to: university; secondary; and less than secondary education. The categories used with the Finnish data are the same. They were used in an earlier study comparing Finland, Norway, and Russia.[13]

Statistical analysis

We applied standard life table techniques to calculate group specific life expectancies. The general algorithm for decomposition of changes in life expectancy by stepwise replacement was applied to measure both the contributions of changes in group specific mortality rates (M effects) and changes in the educational structure of the population (P effects) to the change in total life expectancy.[21] In this way we could find out if changes in life expectancy were attributable to changes in the mortality experience within educational categories (M effects) or whether they were attributable to changes in the size of the educational categories (P effects).

RESULTS

Figure 1 shows a clear contrast between Finland and the Czech Republic, on the one hand, where improvements are observed in all educational groups and only a slight widening of the gap between different educational levels takes place,

Downloaded from jech.bmjjournals.com on 9 October 2006

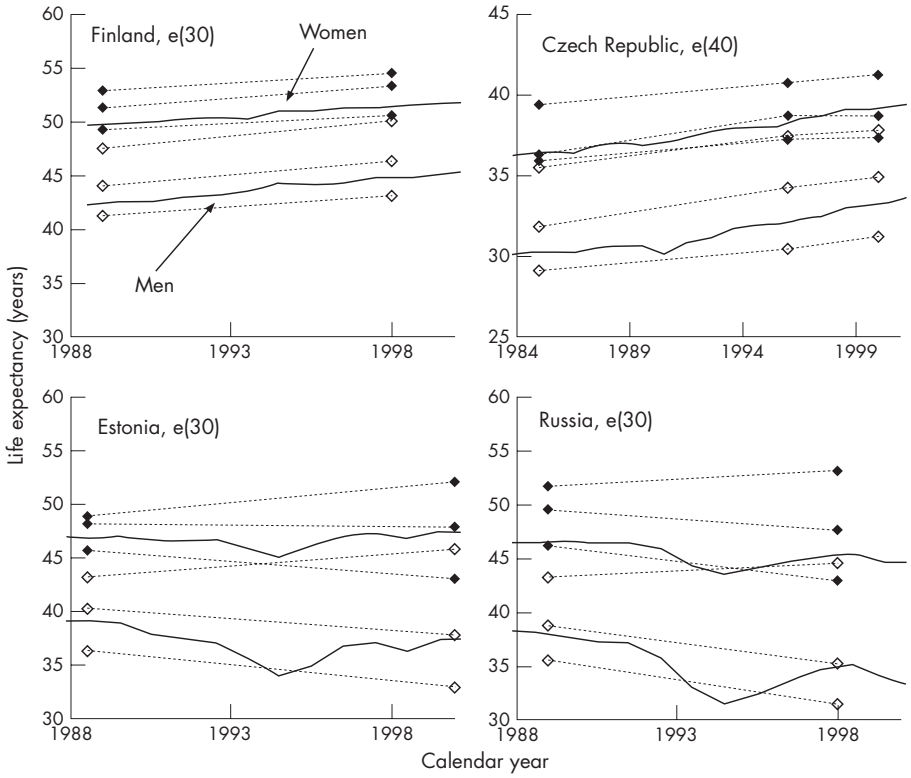

Figure 1 Annual trends in life expectancy of the total population and changes in life expectancy at ages 30 ((e(30)) and 40 (e(40)) by educational group since the late 1980s: Finland, Czech Republic, Estonia, Russia. Closed diamonds, women; open diamonds, men.

and Russia and Estonia, on the other hand, where the less favourable overall trends coincide with a dramatic widening of the gap between those with the highest and lowest education. Both the overall and the group specific changes over time are more favourable in Estonia than in Russia.

Tables 1 and 2 present the data underlying these graphs, showing how, in Finland and the Czech Republic, the gap in life expectancy between those with highest and lowest education increased by 0.3 to 0.7 years depending on country and sex. In Estonia and Russia these changes reach five to six years. Russian men experienced the largest educational gap at the beginning of the period but this increased enormously, from 7.8 years in 1988–89 to 13.1 years in 1998.

Analysis of the change in mortality in different age groups (data not shown) shows that the rate of improvement in Finland and the Czech Republic does not vary much by age, although it is slightly higher at old ages. In Estonia[11] and Russia (data not shown) changes in mortality were generally more favourable at ages over 50–55 than at younger ages. Both in Estonia and Russia, mortality of men and women in the categories of middle and low education has increased at all ages under 70. In Estonia mortality among highly

Table 1 Life expectancy by educational group and educational composition of population in the 1980s and the late 1990s: men

	Life expectancies			Population weights		
Finland, ages 30+	**1988–89**	**1998–99**	**Diff**	**1988–89**	**1998–99**	**Diff**
Total	42.47	45.05	2.58	1.000	1.000	0.000
High education	47.41	50.07	2.67	0.113	0.149	0.036
Middle education	44.04	46.30	2.25	0.356	0.439	0.083
Low education	41.19	43.11	1.92	0.531	0.412	−0.119
Czech Republic, ages 40+	**1984–85**	**1999–2000**	**Diff**	**1984–85**	**1999–2000**	**Diff**
Total	30.02	32.55	2.53	1.000	1.000	0.000
High education	35.47	37.84	2.37	0.088	0.117	0.029
Middle education	31.80	34.95	3.15	0.182	0.216	0.034
Low education	29.11	31.21	2.11	0.730	0.668	−0.062
Estonia, ages 30+	**1988–89**	**1999–2000**	**Diff**	**1988–89**	**1999–2000**	**Diff**
Total	38.86	37.56	−1.29	1.000	1.000	0.000
High education	43.20	45.77	2.56	0.141	0.167	0.026
Middle education	40.25	37.80	−2.45	0.405	0.526	0.121
Low education	36.36	33.00	−3.36	0.453	0.306	−0.147
Russia, ages 30+	**1988–89**	**1998**	**Diff**	**1988–89**	**1998**	**Diff**
Total	37.86	35.41	−2.46	1.000	1.000	0.000
High education	43.30	44.50	1.20	0.141	0.178	0.037
Middle education	38.78	35.23	−3.55	0.425	0.534	0.109
Low education	35.52	31.42	−4.09	0.433	0.287	−0.146

Downloaded from jech.bmjjournals.com on 9 October 2006

Table 2 Life expectancy by educational group and educational composition of population in the 1980s and the late 1990s: women

	Life expectancies			Population weights		
Finland, ages 30+	**1988–89**	**1998–99**	**Diff**	**1988–89**	**1998–99**	**Diff**
Total	49.85	51.82	1.97	1.000	1.000	0.000
High education	52.80	54.46	1.66	0.093	0.142	0.049
Middle education	51.32	53.25	1.93	0.321	0.415	0.094
Low education	49.22	50.58	1.37	0.586	0.443	−0.143
Czech Republic, ages 40+	**1984–85**	**1999–2000**	**Diff**	**1984–85**	**1999–2000**	**Diff**
Total	35.91	37.70	1.79	1.000	1.000	0.000
High education	39.36	41.25	1.89	0.029	0.061	0.032
Middle education	36.30	38.68	2.38	0.127	0.242	0.115
Low education	35.84	37.33	1.49	0.844	0.697	−0.147
Estonia, ages 30+	**1988–89**	**1999–2000**	**Diff**	**1988–89**	**1999–2000**	**Diff**
Total	46.89	47.29	0.40	1.000	1.000	0.000
High education	48.91	52.05	3.15	0.124	0.173	0.048
Middle education	48.08	47.82	−0.26	0.419	0.530	0.111
Low education	45.61	43.08	−2.53	0.456	0.298	−0.159
Russia, ages 30+	**1988–89**	**1998**	**Diff**	**1988–89**	**1998**	**Diff**
Total	47.41	45.98	−1.43	1.000	1.000	0.000
High education	51.71	53.10	1.38	0.115	0.163	0.049
Middle education	49.52	47.58	−1.57	0.387	0.499	0.112
Low education	46.17	42.89	−3.52	0.498	0.338	−0.161

educated men has decreased at all ages 30+, but more significantly at ages 55+. In contrast, in Russia, mortality even among highly educated men has slightly increased at ages 30 to 59 and substantially decreased at ages 60+.

Temporal changes in the educational structure of the population reflect replacement of older cohorts with lower levels of education by younger cohorts with better education. This process is driven by increasing access to and uptake of secondary and higher levels of education and (to a lesser extent) by differential migration and mortality. Although the educational composition of the population has shifted upwards in all of the countries studied, these improvements were somewhat greater in Estonia and Russia compared with Finland and, especially, to the Czech Republic (tables 1 and 2).

Figure 2 illustrates the differential changes among Russian men. Thus, there are fewer men with the least education but, of those remaining in this category, life expectancy has declined. In contrast, those with the highest level of education have increased as a proportion of the population and their life expectancy has improved. The net effect is a pronounced widening in the life expectancy gap between the two categories.

In figure 2, the bold horizontal line corresponds to the life expectancy of the whole population. Population weights of groups at age 30+ were adjusted to ensure that the weighted sum of group specific life expectancies equals the total life expectancy. The method used has been described in detail elsewhere.[22 23]

Turning to educational composition by age in Estonia[11] and Russia (analysis not shown here), the increase in the share of people with middle and high education and the corresponding decrease in those with low education is greater at ages 45–60 than at younger ages. This reflects the expansion of education in the USSR in the 1950s and 1960s.[17]

Table 3 quantifies impacts of changes in mortality in the three educational groups (M effects) and the compositional change (P effect) on total life expectancy. The method used

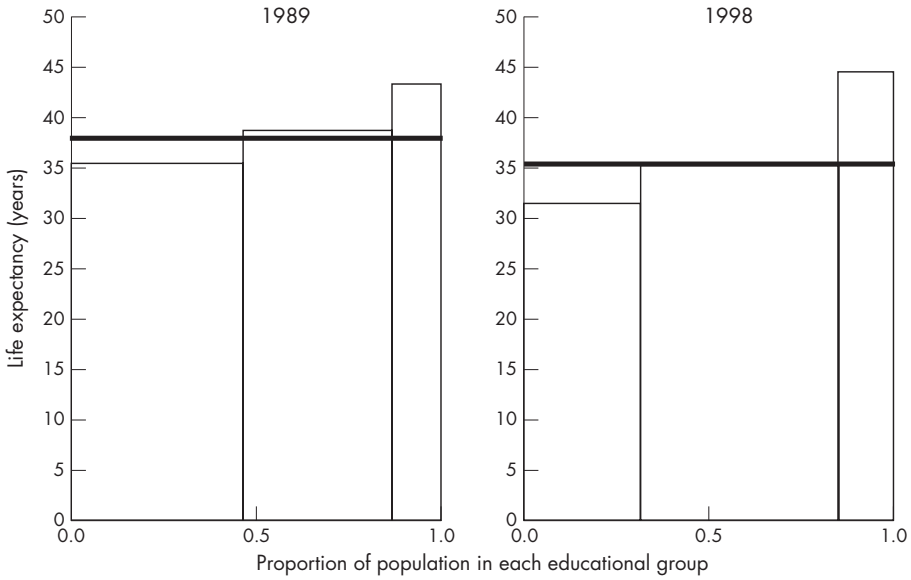

Figure 2 Population weights and life expectancies at age 30 for the three educational groups for Russian men in 1989 and 1998.

Downloaded from jech.bmjjournals.com on 9 October 2006

Table 3 Contributions of changes in mortality in the three educational groups (M effects) and of changes in the population educational structure (P effects) to the change in total life expectancy

		M effects			P effect
	Total change	High education	Middle education	Low education	
Men					
Finland, e(30), 1988–89–1998–99	2.58	0.20	0.52	1.38	0.48
Czech Republic, e(40), 1984–85–1999–2000	2.52	0.17	0.49	1.58	0.28
Estonia, e(30), 1988–89–1999–2000	−1.29	0.18	−1.09	−1.35	0.96
Russia, e(30), 1988–89–1998	−2.46	−0.01	−1.54	−1.70	0.79
Women					
Finland, e(30), 1988–89–1998–99	1.97	0.09	0.30	1.26	0.31
Czech Republic, e(40), 1984–85–1999–2000	1.79	0.04	0.36	1.26	0.13
Estonia, e(30), 1988–89–1999–2000	0.40	0.17	−0.25	−0.21	0.70
Russia, e(30), 1988–89–1998	−1.43	0.05	−0.54	−1.60	0.65

for decomposition[21] is based on the simple principle that mortality rate at every age is a population weighted sum of the mortality rates in the three educational groups. The mathematical basis of life expectancy means that the impact on life expectancy of a given proportional change in one or other group specific death rate is greater if its initial level is higher or if the population weight of that group is higher, or both.

In Finland and the Czech Republic, the contributions to overall life expectancy of decreasing mortality within educational groups are similar: 2.1 and 2.24 years respectively among men and 1.65 and 1.66 years respectively among women, in all cases with the highest contribution from the low education group. The residual changes are attributable to the improvement in the educational level of the population. In Estonia and Russia the situation is very different, with increased mortality among those with low and middle level education driving down life expectancy, among men by 2.24 and 3.25 years respectively. This is counterbalanced substantially by the improved educational composition in these populations. For men, P effects in Estonia and Russia constitute +0.9 and +0.8 years of life, respectively. For women, they are +0.7 years in both countries.

It is important to note that these are direct effects and disregard the influence of differential mortality on the educational structure of the population (whereby those with lower levels of education are less likely to survive into old age). It is only possible to estimate approximately the impact of differential mortality on P and M effects as only aggregated mortality by education is known for the overall group of ages 70+. However a sensitivity analysis suggests that P effects would diminish by no more than 0.1–0.2 years, while M effects would increase by the same amount if this effect could be taken into account.

In Estonia, an additional positive contribution is made by improving mortality among the best educated. In Russia, however, changes in mortality among the best educated are smaller and have little impact on life expectancy (negative for men and positive for women). This is largely because any improvements in mortality among educated Russians are concentrated among those aged 60+, who make up a small share of the population with high education.

DISCUSSION

Data limitations

Before interpreting these findings, it is first necessary to consider possible limitations. Education data in three of the countries were obtained from both death certificates and census records, whereas in Finland it was from the census only. The phenomenon of posthumous promotion is well recognised, although this is primarily described in relation to occupation or socioeconomic status.[24] There is some evidence of overstating education in both censuses and death certificates in Russia.[25] However, we have no reason to believe that possible numerator-denominator bias will have changed over the short time period studied. Standard measures based on completion of educational stages were used, although of course it is not possible to say that each category has precisely the same meaning in each country, in terms of equipping a person with the resources to participate subsequently in society, something that is also affected by, for example, economic, and employment context. None the less, this approach is the only one possible in international comparisons and is established as a standard method. We reduce potential bias further by looking at trends in education specific mortality indicators rather than making direct intercountry comparisons of mortality in educational groups. In the countries concerned, all of which have robust systems for collecting vital statistics, we have no reason to believe that there has been any change in the completeness or validity of data recording in the time period under study. Finally, given the extensive fluctuations in mortality that have been seen in the 1990s in Russia and Estonia, it would have been desirable to have studied intervening years. However, the need to use census data for the denominator clearly makes this impossible.

Interpretation

Turning to the findings, it is, of course, well known that education is an important determinant of health, acting in many ways. Better educated people are more likely to earn higher incomes, they have more opportunities to make healthier choices in life, for example in terms of diet or smoking. Their occupations are less likely to entail risks to their safety and they are less likely to live in areas where they are exposed to danger. They are likely to have more control over their lives.[26] Thus, in all developed countries where the relevant statistics are available, an inverse correlation between mortality and education has been seen.

The transition in central and eastern Europe was generally more favourable for those with the greatest educational resources.[27] This study reports an emerging divide between the two pairs of countries studied, with a simultaneous reduction in mortality among all educational groups in Finland and Czech Republic and a striking widening of the educational gap in Russia and Estonia. The newly calculated estimates of mortality by educational group in Russia in 1998 show a particularly worrying pattern. While in Estonia the continuous progress experienced since 1995 suggests scope for improvement of the situation for disadvantaged groups, there are so far no grounds for optimism in Russia.

Downloaded from jech.bmjjournals.com on 9 October 2006

What this paper adds

- Although much has been published on the changing educational gap in health in central and eastern Europe since the political changes, so far no one has looked at the consequences of changes in the size of educational categories, with somewhat fewer people now in the lowest educational category.
- Decomposing of life expectancies shows that, in Russia and Estonia, gains have been concentrated among those with higher education, while the situation of others has deteriorated.
- In the absence of improvements in education on the populations of Russia and Estonia, contemporary life expectancy would be even worse than it is.

Policy implications

Investment in education holds the potential to make a contribution to better health in the countries of the former Soviet Union but it will not be enough.

In both post-Soviet countries the very high mortality among the least well educated calls for urgent action. The future pattern of mortality in Russia and Estonia will depend on their ability to recognise the scale of the problem that they face and to provide opportunities for better health to all groups in their populations.

The best educated people in Estonia and the Czech Republic have been better able to resist the adverse effects of negative aspects of transition and to take advantage of the opportunities now available to them in ways that allow them to respond to emerging challenges. For example, earlier analysis of age and cause of death patterns of mortality among people with high education in the Czech Republic and Estonia suggest that they were able to benefit more from the introduction of advanced technologies in diagnosis and treatment of cardiovascular disease and cancers.[11 20] Gains among highly educated Estonians suggests that this group could potentially play a vanguard part in catalysing future health improvement. This, however, depends on whether their improvements can be transferred downwards by means of more equitable health policies and stronger social protection measures. More immediately, however, given the important contribution of alcohol to the overall level of mortality in Russia and Estonia, further research should examine the plausible differential impact of this risk factor on different educational groups.

In the Czech Republic, employment promotion policies and other measures of social protection[9] could have played a protective part by avoiding increases in psychosocial stress during the transition period, even among lower educational groups.

The importance of this study lies in the way that it has, for the first time, disaggregated the population level effects of changing educational composition and changing death rates within educational categories in this region. By doing so, it shows how the improvement in education in Estonia and Russia has ameliorated the impact of apparent educational gap in mortality on the average level, while highlighting how those with the least education have suffered greatly in this time of transition. It also provides insights that are important when seeking to interpret the changing pattern of educational inequalities, as those with the lowest level of education are forming a smaller share of the population in all countries. A full discussion of the consequences of this finding is, however, beyond the scope of this paper and would require much more detailed analyses given the complex and multi-faceted pathways between educational attainment and mortality.[28] However, on the basis of other research in Russia it is likely that the very high toll of premature mortality attributable to alcohol, and in particular to episodic heavy consumption, has played an important part,[29] as it has been shown in cross-sectional studies that there is a steep educational gradient in these causes of death[30] and death rates from these causes have increased during the time period covered by this study.

It is important to recognise that in both Russia and Estonia overall male mortality has been increasing at a time when educational attainments were improving. It is now apparent that, without these educational gains, the deterioration in health may have been even greater. However, while the best educated have obtained some protection, even the best educated in Russia have not experienced the substantial improvements seen in the west. Investment in education holds the potential to make a contribution to health in the countries of the former Soviet Union but it will not be enough.

ACKNOWLEDGEMENTS

This work has been completed as a part of the Vanguard project of the Max Planck Institute for Demographic Research in Rostock (Germany) headed by Professor James W Vaupel. We used detailed data files provided by Statistics Finland. We are grateful to Professor Tapani Valkonen (University of Helsinki) for help in achieving these data and to Professor Jitka Rychtaříková (Charles University in Prague) for providing us with her earlier tabulations. We are grateful to Dr János Sándor (University Pécs) for useful literature references and to Dr Dmitri Jdanov (Max Planck Institute for Demographic Research) for helpful discussions.

CONTRIBUTORS

VS led the project, discussed core ideas, outlined the paper, and undertook some data analysis. EA undertook the main data analysis, prepared the Russian data, discussed core ideas, and commented on drafts. DJ undertook part of the data analysis, discussed ideas, and commented on drafts. ML prepared the Estonian data, discussed core ideas, and commented on drafts. OA undertook key work to prepare the Russian data, discussed core ideas, and commented on drafts. MM discussed core ideas, drafted the paper, and prepared the final manuscript.

Authors' affiliations

V M Shkolnikov, D Jasilionis, Max Planck Institute for Demographic Research, Rostock, Germany
E M Andreev, Centre of Demography and Human Ecology, Institute for Prognosis the National Economy in the Russian Academy of Sciences, Moscow, Russian Federation
M Leinsalu, Stockholm Centre on Health of Societies in Transition, University College, Sweden
O I Antonova, Federal State Statistics Service, Moscow Russian Federation
M McKee, ECOHOST, London School of Hygiene and Tropical Medicine, London, UK

Funding: none.

Competing interests: none.

Ethics approval: not required.

REFERENCES

1 **Whitehead M**. *Inequalities in health: The Black Report and the health divide*. Harmandsworth: Penguin, 1992.
2 **Marmot MG**, Shipley MJ, Rose G. Inequalities in death—specific explanations of a general pattern? *Lancet* 1984:i:1003–6.

Downloaded from jech.bmjjournals.com on 9 October 2006

3 **Lahelma E**, Valkonen T. Health and social inequities in Finland and elsewhere. *Soc Sci Med* 1990;**31**:257–65.
4 **Brajzewski C**, Ragucka E. Social class differences in rates of premature mortality among adults in the City of Wroclaw, Poland. *Am J Human Biol* 1993;**5**:461–71.
5 **Shkolnikov V**, Leon D, Adamets S, *et al*. Educational level and adult mortality in Russia: an analysis of routine data 1979 to 1994. *Soc Sci Med* 1998;**47**:357–69.
6 **Mackenbach JP**, Kunst AE, Groenhof F, *et al*. Socioeconomic inequalities in mortality among women and among men: an international study. *Am J Public Health* 1999;**89**:1800–6.
7 **Carlson E**. Concentration of rising Hungarian mortality among manual workers. *Sociol Soc Res* 1989;**73**:119–28.
8 **Carlson E**, Tsvetarsky S. Concentration of rising Bulgarian mortality among manual workers. *Sociol Soc Res* 1992;**76**:81–5.
9 **Blazek J**, Dzúrová D. The decline of mortality in the Czech Republic during the transition: a counterfactual case study. In: Cornia GA, Paniccià R, eds. *The mortality crisis in transitional economies*. Oxford: Oxford University Press, 2000:303–27.
10 **Klinger A**. Halandósági különbségek maguarországon iskolai végzttség szerint [Mortality differences by educational level in Hungary]. *Demografia* 2001;**44**:227–58.
11 **Leinsalu M**, Vågerö D, Kunst AE. Estonia 1989–2000: enormous increase in mortality differences by education. *Int J Epidemiol* 2003;**32**:1081–7.
12 **Plavinski SI**, Plavinskaya SI, Klimov AN. Social factors and increase in mortality in Russia in the 1990s: prospective cohort study. *BMJ* 2003;**326**:1240–2.
13 **Shkolnikov VM**, Deev AD, Kravdal Ø, *et al*. Educational differentials in male mortality in Russia and northern Europe. A comparison of an epidemiological cohort from Moscow and St Petersburg with the male populations of Helsinki and Oslo. *Demogr Res*, 2004;**10**.http://www.demographic-research.org.
14 **Bobak M**. Health impact of rapid social change: the example of Eastern Europe. LSE Health and Social Care. Lecture, 10 Feb 2005, London. http://www.lse.ac.uk/collections/LSEHealthAndSocialCare/eventsAndSeminars/FORMALSEMINARS/Healthimpactofrapidsocialchange.ppt.
15 **Elstad JI**. Health-related mobility, health inequalities and gradient constraint. *Eur J Public Health* 2001;**11**:135–40.
16 **Micklewright J**. *Education, inequality and transition*. Florence: Unicef, 2000.
17 **Gerber TP**, Hout MH. Educational stratification in Russia during the Soviet period. *Am J Sociol* 1995;**101**:611–60.
18 **McKee M**, Adany R, MacLehose L. Health status and trends in candidate countries. In: McKee M, MacLehose L, Nolte E, eds. *Health policy and European Union enlargement*. Buckingham: Open University Press, 2004:24–42.
19 **World Health Organisation**. *European health for all*. (Database). Copenhagen: WHO Europe, 2004;http://www.euro.who.int/hfadb.
20 **Rychtařiková J**. The case of the Czech Republic. Determinants of the recent favourable turnover in mortality. *Demogr Res*, 2004; special collection 2 (5). http://www.demographic-research.org.
21 **Andreev EM**, Shkolnikov VM, Begun AZ. Algorithm for decomposition of differences between aggregate demographic measures and its application to life expectancies, healthy life expectancies, parity-progression ratios and total fertility rates. *Demogr Res*, 2002;**7**(14). http://www.demographic-research.org.
22 **Shkolnikov V**, Valkonen T, Begun A, *et al*. Measuring inter-group inequalities in length of life. *Genus* 2001;**LVII**:33–62.
23 **Moser K**, Shkolnikov V, Leon DA. World mortality 1950–2000: divergence replaces convergence from the late 1980s. *Bull World Health Organ* 2005;**83**:202–9.
24 **Fox AJ**, Goldblatt PO, Jones DR. Social class mortality differentials: artifact, selection, or life circumstances. *J Epidemiol Community Health* 1985;**36**:69–79.
25 **Andreev E**, Dobrovolskaya V. Sotsio-kultuniye razlichiya v smertnoshi v Rosii [The socio-cultural differences in mortality in Russia]. *Zdravoohrraneniye Rossiiskoi Federatsii* 1993;**12**:18–21.
26 **Ross CE**, Mirowski J. Refining the association between education and health: the effects of quantity, credential, and selectivity. *Demography* 1999;**36**:445–60.
27 **Bobak M**, Pikhart H, Herzman C, *et al*. Socioeconomic factors, perceived control and self-reported health in Russia. A cross-sectional survey. *Soc Sci Med* 1998;**47**:269–79.
28 **Mackenbach JP**, Howden-Chapman P. New perspectives on socioeconomic inequalities in health. *Perspect Biol Med* 2003;**46**:428–44.
29 **Leon D**, Chenet L, Shkolnikov VM, *et al*. Huge variation in Russian mortality rates 1984–1994: artefact, alcohol, or what? *Lancet* 1997;**350**:383–8.
30 **Chenet L**, Leon D, McKee M, *et al*. Death from alcohol and violence in Moscow: socio-economic determinants. *Eur J Population* 1998;**14**:19–37.