

# Changes in life expectancy in Russia in the mid-1990s

Vladimir Shkolnikov, Martin McKee, David A Leon

## Summary

**Background** Between 1987 and 1994, life expectancy in Russia declined substantially. Between 1994 and 1998, this trend reversed, and mortality rates returned to those of the early 1980s. Although the decline in life expectancy has been examined previously, much less is known about the subsequent improvement in mortality rates. We used recently published cause-specific mortality data up to 1998 to clarify this issue.

**Methods** Changes in cause-specific death rates at ages 15–74 years were examined. Rates for 1998 were compared with those for 1994 (the year of lowest life expectancy) and for 1991 (the year the Soviet Union broke up).

**Findings** Death rates among children fell steadily throughout the 1990s, and those in elderly people changed little. The reduction in mortality since 1994 was mainly due to a decrease in the death rate among middle-aged adults, which had increased until 1994. Deaths among those aged 15–30 years, which rose during 1991–94, remained high. Some causes of death, such as stomach cancer and road-traffic accidents, declined throughout the 1990s, whereas others, such as breast and prostate cancers and tuberculosis, increased. The decline in mortality since 1994 was, however, mainly due to a reduction in the rate of deaths from a group of causes associated with alcohol consumption.

**Interpretation** The changing life expectancy in Russia is a consequence of a complex pattern of trends in different causes of death, some of which have their origins long in the past, and others that result from contemporary circumstances. This study provides further support for the view that alcohol has played an important part in the fluctuations in life expectancy in Russia in the 1990s, although there remains a need for a much better understanding of the factors underlying these continuing changes.

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Max Planck Institute for Demographic Research, Doberaner Str 114, 18057 Rostock, Germany (V Shkolnikov PhD); and European Centre on Health of Societies in Transition, London School of Hygiene and Tropical Medicine, London, UK (Prof M McKee MD, Prof D A Leon PhD)

**Correspondence to:** Dr Vladimir Shkolnikov (e-mail: Shkolnikov@demogr.mpg.de)

## Introduction

Life expectancy in Russia has fluctuated substantially over the past 35 years (figure 1). After remaining at a low level throughout the mid-1960s, it improved greatly after 1985, but had declined to its earlier level by the early 1990s. After 1991, when the Soviet Union broke up, the decline in life expectancy accelerated steeply, and by 1994, it had reached a level not seen since the 1950s. From 1994, however, there was a striking and largely unexpected improvement.<sup>1</sup> By 1998, this upward trend stopped at a level almost exactly the same as that in 1984.

We have previously analysed the initial phases of these fluctuations (up to 1994).<sup>2</sup> The improvement in 1985 coincided with a wide-ranging and highly effective anti-alcohol campaign started by the then General Secretary of the Soviet Communist party, Mikhail Gorbachev.<sup>3</sup> The subsequent deterioration happened with the collapse of the campaign, and the accelerated decline after 1991 took place as the Soviet Union ended and Russia began painful economic reforms. The improvement in life expectancy at birth and the subsequent deterioration between 1985 and 1994 were driven predominantly by concurrent changes in some causes of death, particularly those associated directly or indirectly with alcohol consumption.<sup>1</sup> The age-groups most affected by these mortality fluctuations were young and middle-aged adults, especially men. Smaller changes in mortality among the elderly were seen, whereas among children, death rates improved continuously after 1991.

The findings of our initial study showed that these changes in life expectancy could not be attributed to chance, or problems with either the numerator or population denominator, and suggested that alcohol might have had an important role.<sup>4</sup> That study, and others, focused mainly on the period up to 1994.<sup>5</sup> Little attention has been given to the subsequent improvement in life expectancy, the scale of which has been much greater than expected and the reasons for which remain unclear. We

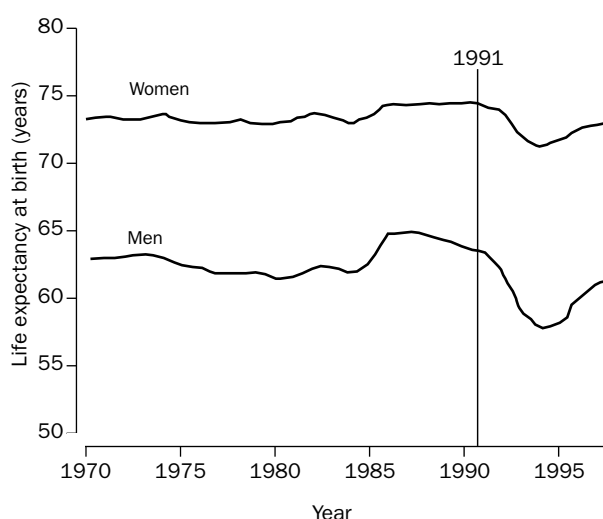


Figure 1: Trends in life expectancy at birth in Russia, 1970–98

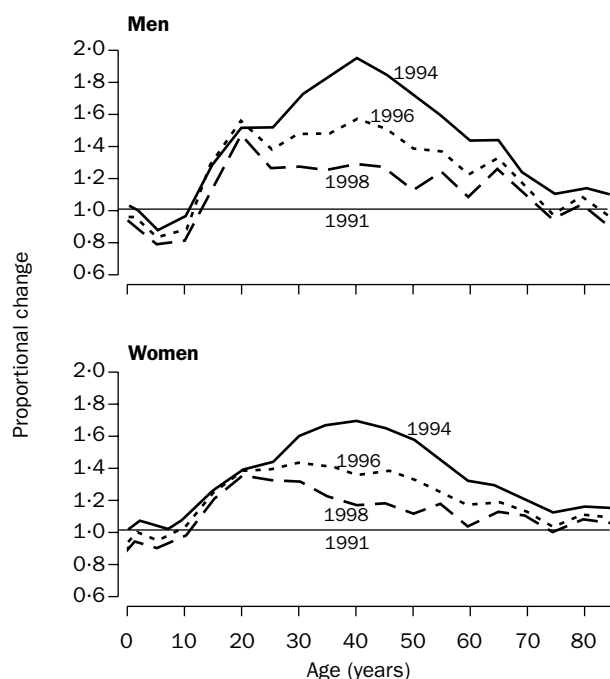


Figure 2: Proportional changes in age-specific mortality in Russia

have now used recently-published cause-specific mortality data up to and including 1998 to try to clarify this uncertainty.

## Methods

Mortality data were extracted from the reconstructed Russian mortality series published jointly by the Institut National d'Etudes Démographiques, Paris, France, and the Centre for Demography and Human Ecology, Moscow, Russia.<sup>6</sup> These data consisted of deaths by cause, sex, 5-year age group, and single calendar year of death, together with corresponding population denominators. Data were assembled from national mortality statistics collated from annual tabular returns from each of the 88 (73 before 1992) regions (oblasts and autonomous republics).

Until 1999, Russia used the Soviet system of disease classification, which contains only 175 categories. Each category corresponds to groups of items in the International Classification of Disease, ninth revision

(ICD-9). 94–98% of all deaths in Russia since the 1980s are thought to have been medically certified, the rest being certified by trained, paramedical staff (feldshers). Estimation of the Russian population by sex, age, and year is a two-step process involving estimates made by regional statistical offices (taking into account information on births and deaths), which are in turn modified on the basis of information on internal migration gathered centrally in Moscow by the Ministry of the Interior.

Our estimates of life expectancy at birth are based on original age-specific mortality rates and were calculated by the same method for the whole period; they are therefore slightly different from the officially published estimates. Mortality rates by cause for men and women in 1998 were compared with those in 1991 (the year in which the Soviet Union broke up) and with 1994 (the year of maximum all-cause mortality). For each major disease category, rates were broken down by age. For two reasons we have concentrated on deaths at ages 15–74 years. First, this is the age group in which the fluctuations in mortality were most pronounced. Second, the validity of routine cause-of-death data becomes increasingly questionable above age 74 years, as it does in all countries. Death rates were standardised to the European standard population.<sup>7</sup>

## Results

By 1998, overall life expectancy had recovered from the decline of the early 1990s, and had reached a level similar to that of the mid-1980s for both men and women. Variation in mortality rates in the 1990s was highly dependent on age. Each curve shown in figure 2 represents the proportional change in total mortality rates at different ages for selected years relative to rates in 1991. Death rates among children fell throughout the 1990s, and mortality in the elderly seems to have been affected little during the transition. The increase in mortality between 1991 and 1994 was confined mainly to those aged 15–74 years. At ages 30–49 years, very large proportional increases were mostly reversed by 1998; this reversal was less pronounced at ages 50–74.

Most striking was the continuing high mortality rate among those aged 15–24 years. Table 1 gives cause-specific deaths in this age band, and shows that in 1994, mortality rates among young adults were about 40% and 35% higher for men and women, respectively, than those in 1991, and remained so until 1998. Overall mortality at ages 15–24 years was driven mainly by external causes of death, which accounted for about 80% of deaths in men of this age group in 1991, 1994, and 1998. Among women of

Cause of death	Men				Women			
	1991	1994	1998	Ratio 1998/91	1991	1994	1998	Ratio 1998/91
Infectious diseases	2.70	5.15	8.00	2.96	1.60	2.20	2.80	1.75
Neoplasms	10.20	10.20	9.80	0.96	8.55	7.60	7.30	0.85
Diseases of circulatory system	8.25	12.75	14.05	1.70	4.40	5.10	4.70	1.07
Diseases of respiratory system	3.15	4.50	5.25	1.67	1.95	2.50	2.40	1.23
Diseases of digestive system	2.00	3.70	3.15	1.58	1.15	1.70	1.60	1.39
Other diseases	12.25	14.40	14.00	1.14	12.75	13.65	10.50	0.82
Ill-defined causes	3.85	7.95	9.80	2.55	1.55	2.30	2.85	1.84
External causes (accidents and violence)	177.0	247.65	232.25	1.31	38.05	55.35	57.90	1.52
Motor-vehicle accidents	48.25	45.10	37.60	0.78	11.40	13.55	13.85	1.21
Accidental poisoning by alcohol	2.70	8.70	5.30	1.96	0.25	1.35	1.00	4.00
Other accidental poisonings	5.85	10.85	20.85	3.56	2.60	3.95	5.05	1.94
Accidental falls	3.70	4.90	3.40	0.92	0.85	1.50	1.10	1.29
Accidental drownings	13.45	18.60	18.25	1.36	2.10	2.75	4.00	1.90
Suicides	29.70	49.15	52.25	1.76	6.65	9.00	8.55	1.29
Homicides	25.60	43.85	29.20	1.14	5.10	9.35	9.25	1.81
Unspecified violent death	14.40	27.35	31.90	2.22	3.60	6.60	8.15	2.26
Other accidents and violence	33.40	39.15	33.45	1.00	5.55	7.15	6.90	1.24
<b>All causes combined</b>	<b>219.45</b>	<b>306.30</b>	<b>296.25</b>	<b>1.35</b>	<b>70.15</b>	<b>90.45</b>	<b>90.15</b>	<b>1.29</b>

Table 1: Age-standardised death rates per 100 000 at age 15–24 years for selected causes of death

the same age, the contribution of external causes to all deaths increased from 54% to 64% between 1991 and 1998. For women, the increase in external causes was as high as 52%, compared with 31% for men. Deaths from accidental poisonings, unspecified (accidental or intentional) violent death, suicides, and accidental drownings were substantially higher in 1998 than in 1991 for both sexes.

Table 2 gives a broader age range than table 1 (15–74 years) and shows more specific causes of death. Total mortality rates in 1998 were 21% lower than in 1994 for men and 17% lower for women. This finding is a result of the fact that deaths from most specific causes also showed a decline in this period. The largest declines (30% or more) were seen for rheumatic heart disease, bronchitis, emphysema, and asthma in women, and accidental alcohol poisoning from homicides in men. There was also a large decline in deaths from pneumonia among men, but the death rate remained more than twice what it had been in 1991. Death rates from only four of the causes shown in table 2 increased over this period—ie, tuberculosis (particularly in women), cancer of the prostate, cancer of the female breast, and accidental drowning in women. Whatever the direction of change, however, the proportional changes in rates (1994–98) shown by each cause were strikingly similar for men and women ( $r=0.89$ ,  $p<0.0001$ ).

The changes seen after 1994 need to be put in the context of the steep general increase in mortality from 1991. As shown in table 2, death rates from most causes increased during 1991–94, although the extent varied. Rates due to only four causes of death declined in this first

period immediately after the collapse of the Soviet Union: cancers of the oesophagus and stomach, cancer of the lung in men, and motor-vehicle accidents. Again, the proportional changes (1991–94) shown by each cause were very similar for men and women ( $r=0.91$ ,  $p<0.0001$ ).

Table 2 also shows that the causes of death with the largest proportional declines between 1994 and 1998 tended to be the causes that showed the largest proportional increases between 1991 and 1994. For example, accidental poisoning by alcohol showed the largest proportional increase in rates during 1991–94 and the largest proportional decline during 1994–98 of any cause in table 1. For men, the Pearson correlation between the changes in rates during 1991–94 with those in 1994–98 by cause was  $r=-0.62$  ( $p=0.001$ ), whereas for women, the correlation was  $r=-0.56$  ( $p=0.002$ ). However, the changes in mortality for 1994–98 cannot be regarded as merely a mirror image of the changes in the earlier period. Death rates due to some causes declined in both periods (cancers of the oesophagus, stomach, and lung in men, and motor vehicle accidents), whereas others increased in both periods (tuberculosis, cancers of the breast in women and of the prostate in men, and accidental drowning in women). The net effects of the changes during 1991–94 and 1994–98 are shown by the ratio of mortality in 1998 to that in 1991. For most causes of death, this ratio is greater than 1, indicating that most rate declines in 1994–98 had not been sufficient to offset the earlier increases.

Cancer showed a rather heterogeneous pattern by site. Although some sites showed little change between 1991 and 1998, death rates from cancers of the prostate and female breast were higher in 1998 than in 1991, and

Cause of death	Men						Women					
	Mortality rates			Mortality rate ratios			Mortality rates			Mortality rate ratios		
	1991	1994	1998	1998/94	1994/91	1998/91	1991	1994	1998	1998/94	1994/91	1998/91
<b>Infectious diseases</b>	24.1	43.8	41.7	0.95	1.82	1.73	3.9	6.9	6.2	0.90	1.77	1.59
Tuberculosis	21.6	38.0	38.2	1.01	1.76	1.77	2.2	3.6	4.3	1.19	1.64	1.92
<b>All neoplasms</b>	343.6	345.7	314.5	0.91	1.01	0.92	151.5	154.1	147.2	0.96	1.02	0.97
Aerodigestive tract	14.1	15.4	14.3	0.93	1.09	1.01	1.4	1.4	1.3	0.93	1.00	0.96
Oesophagus	13.9	13.5	11.8	0.87	0.97	0.85	2.1	1.9	1.6	0.84	0.90	0.75
Stomach	62.5	58.2	49.8	0.86	0.93	0.80	25.2	23.1	19.9	0.86	0.92	0.79
Intestine	26.4	27.8	27.0	0.97	1.05	1.02	19.1	19.6	18.9	0.96	1.03	0.99
Bronchus and lung	135.9	135.1	117.0	0.87	0.99	0.86	12.2	12.3	10.6	0.86	1.01	0.86
Breast	0.5	0.6	0.5	0.83	1.20	0.92	23.7	26.2	27.6	1.05	1.11	1.17
Uterus	..	..	..	..	..	..	15.0	15.4	14.9	0.97	1.03	0.99
Prostate	7.5	9.0	10.1	1.12	1.20	1.34	..	..	..	..	..	..
Other sites	53.9	57.3	57.3	1.00	1.06	1.06	38.4	39.4	38.5	0.98	1.03	1.00
<b>Diseases of circulatory system</b>	612.8	927.6	742.9	0.80	1.51	1.21	289.2	399.4	331.5	0.83	1.38	1.15
Rheumatic cardiomyopathies	8.7	10.3	7.0	0.68	1.18	0.81	10.5	10.9	7.4	0.68	1.04	0.71
Hypertensive disease	8.7	15.1	13.0	0.86	1.74	1.48	7.2	10.6	9.4	0.89	1.47	1.31
Ischaemic heart disease	349.1	526.9	404.4	0.77	1.51	1.16	125.0	178.3	140.5	0.79	1.43	1.12
Other heart diseases	32.3	74.7	58.1	0.78	2.31	1.80	13.1	26.5	20.2	0.76	2.02	1.54
Cerebrovascular disorders	182.6	256.9	227.5	0.89	1.41	1.25	118.1	153.4	139.8	0.91	1.30	1.18
Other	31.4	43.7	32.9	0.75	1.39	1.05	15.2	19.7	14.1	0.72	1.30	0.93
<b>Diseases of respiratory system</b>	86.0	146.8	95.5	0.65	1.71	1.11	20.7	28.5	19.1	0.67	1.38	0.92
Pneumonia	11.5	40.7	26.4	0.65	3.54	2.31	3.1	7.5	5.3	0.71	2.42	1.73
Chronic bronchitis, emphysema, asthma	50.9	71.2	50.7	0.71	1.40	1.00	12.7	14.8	10.3	0.70	1.17	0.82
<b>Diseases of digestive system</b>	45.4	75.1	61.0	0.81	1.65	1.34	19.9	31.7	25.4	0.80	1.59	1.28
Liver cirrhosis	16.8	33.1	24.8	0.75	1.97	1.48	7.4	15.6	11.5	0.74	2.11	1.55
Diabetes mellitus	5.9	8.6	7.2	0.84	1.46	1.21	8.6	12.0	10.6	0.88	1.40	1.23
<b>External causes</b>	294.1	527.7	382.8	0.73	1.79	1.30	62.3	114.9	84.0	0.73	1.84	1.35
Motor-vehicle accidents	51.8	45.9	37.1	0.81	0.89	0.72	11.8	11.5	11.0	0.96	0.97	0.93
Accidental poisoning by alcohol	26.7	83.2	39.4	0.47	3.12	1.47	5.9	21.9	9.9	0.45	3.71	1.68
Other accidental poisonings	16.8	26.0	25.2	0.97	1.55	1.51	4.1	6.4	5.5	0.86	1.56	1.34
Accidental drowning	17.3	25.1	22.0	0.88	1.45	1.27	1.9	3.1	3.3	1.06	1.63	1.74
Suicides	58.4	96.7	78.8	0.81	1.66	1.35	11.8	15.0	12.2	0.81	1.27	1.03
Homicides	31.4	66.1	45.1	0.68	2.11	1.43	8.2	17.4	12.5	0.72	2.12	1.52
Unspecified violent death	28.3	75.0	58.8	0.78	2.65	2.08	6.0	16.4	12.9	0.79	2.73	2.13
Other accidents and violence	54.9	96.6	68.7	0.71	1.76	1.25	10.9	20.5	15.1	0.74	1.88	1.38
<b>All causes combined</b>	1463.1	2181.1	1716.7	0.79	1.49	1.17	587.1	791.8	656.1	0.83	1.35	1.12

Table 2: Age-standardised death rates per 100 000 at age 15–74 years for selected causes of death

cancers of the stomach, oesophagus, and lung were lower. The other causes of death for which rates were lower in 1998 than in 1991 were rheumatic heart disease; other diseases of the circulatory system among women; chronic bronchitis, emphysema, and asthma among women; and motor-vehicle accidents.

## Discussion

The improvement in life expectancy in Russia between 1994 and 1998 was larger than expected even a few years ago, and almost succeeded in reversing the rapid decline in life expectancy associated with the break-up of the Soviet Union. As with the earlier increase in mortality during 1991–94, the decline since 1994 showed great heterogeneity by age. Mortality of children and the elderly changed little, with most of the improvement occurring in the age group 25–60 years, largely offsetting the earlier increases in mortality. By contrast, deaths of younger people, aged 15–24 years, did not decline between 1994 and 1998 and were still 40% higher in 1998 than they were in 1991. This finding is due to high rates of accidents and violence, and (to a lesser extent) tuberculosis and cardiovascular deaths among young men.

The overall changes in mortality have been driven by changes in a range of causes of death that have shown the same general pattern during 1991–98 (ie, an increase between 1991 and 1994 and then a decrease between 1994 and 1998). The extent of these fluctuations varies substantially by cause. However, the proportional changes in mortality shown by each cause in both periods are very similar for men and women, with Pearson's correlation coefficients of about 0.9. This similarity might merely relate to the fact that the underlying determinants of the mortality fluctuations in men and women are driven by the same stresses of transition. In this way, the mortality fluctuations are not restricted to men, as sometimes portrayed, although mortality rates in absolute terms are much lower in women than in men, and indeed show a very different distribution by cause at any point.

We cannot completely exclude the possibility that such similar patterns in men and women might result from systematic changes in certification or coding of cause of death during a period of rapidly fluctuating total mortality. One example of this possibility could be the category of unspecified violent deaths, which rose especially steeply during 1991–94 and then fell sharply again. This pattern could be due to lack of resources and poor morale in the forensic service and in the police force during the first part of the transition.

The causes that showed an increase during 1991–94 followed by a decline in 1994–98 were mainly those that, at least in Russia, have been linked to heavy drinking. In some cases, the link is obvious—eg, acute alcohol poisoning and cirrhosis. Indeed, given the difficulties in measuring patterns of alcohol consumption in a population, changes in acute alcohol poisoning can be regarded as a good estimation of changes in the frequency of excessive drinking. There is also extensive evidence to link alcohol with different types of injuries<sup>8</sup> and, specifically, with homicide.<sup>9</sup> Many studies have shown a link between alcohol and suicide, but the most relevant is one from Finland. That study showed that deaths due to suicide increased as the economy improved, were not associated with either unemployment or divorce rates, but were related to changes in alcohol consumption.<sup>10</sup> The association between alcohol and respiratory disease, particularly pneumonia, is also well recognised.<sup>11,12</sup> The association with cerebrovascular disease is complex: although there is no consistent relation with ischaemic

stroke, rates of haemorrhagic stroke increase steeply with alcohol consumption.<sup>13</sup>

Cardiovascular disease is not usually associated with alcohol, but evidence from Russia and elsewhere links deaths from ischaemic heart disease with episodic (binge) drinking<sup>14</sup>—a pattern of consumption common in Russia.<sup>15</sup> Although data from studies of average weekly consumption have typically found that alcohol exerts a protective effect, cohort studies in which exposure is assessed either as the amount drunk in one sitting or by proxies such as frequent hangovers or trouble with police have consistently shown a substantially increased risk of sudden cardiac death.<sup>16</sup> Deaths due to ischaemic heart disease in countries of the former Soviet bloc are much more likely to be sudden than those elsewhere.<sup>17,18</sup> They also fluctuate by day of week, showing a weekend peak that corresponds with patterns of alcohol consumption.<sup>19</sup> Regular, moderate alcohol consumption and episodic, heavy consumption have quite different effects on lipid metabolism, clotting, and propensity to arrhythmias.<sup>20</sup>

The changes in deaths from causes associated with alcohol reflects what is known about trends in alcohol consumption. These trends have been tracked throughout the transition by the Russian Longitudinal Monitoring Survey—a household survey undertaken eight times between 1992 and 1999. Although all measures of self-reported alcohol consumption should be treated with caution, analyses of the early surveys showed that alcohol consumption rose during the early 1990s when mortality was increasing.<sup>21</sup> Subsequent surveys revealed a fall in average consumption of 19%, from 25.72 g daily to 20.54 g daily between late 1994 and late 1998.<sup>22</sup> These changes were accompanied by the observed changes in rates of acute alcohol poisoning.

Despite overall declines in mortality from external causes during 1994–98, mortality rates from violent causes in particular remained much higher in 1998 than they were in 1991. This finding is consistent with the general view that Russian society has become more violent since the collapse of the Soviet Union.<sup>5</sup> The 50% higher levels of deaths from homicide in 1998 compared with 1991 in men and women is especially worrying.

Between 1991 and 1998, deaths due to cancer of the oesophagus and stomach in men and women, and cancer of the lung in men declined, as did mortality from motor-vehicle accidents. However, mortality from tuberculosis, cancer of the female breast, prostate cancer, and accidental drowning in women increased throughout this period. The very existence of these exceptions to the general pattern provides some assurance that the dominant cause-specific pattern discussed above is not purely artefactual, especially because some of the exceptions seem to be explicable in terms of current knowledge.

The decline in stomach-cancer mortality is consistent with very long-term trends in Russia and in industrialised countries as a whole. This decrease is believed to be associated with lower rates of *Helicobacter pylori* infection in successive birth cohorts due to improvements in socioeconomic conditions in childhood.<sup>23</sup> Lung-cancer mortality has followed a path determined by changes in rates of smoking in the post-war period, and is expected to begin to rise again in the first decade of the 21st century.<sup>24</sup> The most surprising consistent decline is for mortality due to motor-vehicle accidents. This decline is particularly unusual given that mortality from all other external causes shows such major fluctuations. The reduction during 1991–94 is probably due to a rapid increase in fuel costs and the general decrease in economic activity in the first few years after the collapse of the Soviet Union. These



factors would have reduced the volume of road traffic and hence the number of deaths from motor-vehicle accidents. The decline in 1994–98 is consistent with the decline in other external causes of death, which, as discussed below, is likely to be partly a consequence of the fall in alcohol consumption.

The increase in tuberculosis has attracted more attention in the west than trends in any other disease in Russia, partly because of the threat to other countries posed by the rising number of Russian cases of multidrug-resistant disease.<sup>25</sup> The two other major disorders other than tuberculosis that increased throughout the 1990s are breast cancer in women and prostate cancer in men. These are both disorders for which mortality rates in Russia and many other eastern European countries are lower than in western countries, and both show evidence of positive socioeconomic gradients within countries.<sup>26</sup> The upward trend in these malignancies seen in Russia is shared by a range of other eastern European countries, and could be a consequence of long-term effects of changes in patterns of childbearing (for female breast cancer) and in levels of nutrition in childhood, both of which might be positively associated with later risk.<sup>27</sup>

The reason alcohol consumption fell remains poorly understood, but several other former Soviet republics have followed a similar, and in the case of the three Baltic states, almost identical trajectory.<sup>28</sup> This similarity remains despite each country's adoption of very different social and economic policies since independence, and raises wider questions about how populations react and subsequently adapt to large-scale political and economic stresses.

At the time of writing, data on mortality in 1999 have become available. These data show that mortality is increasing again. Analysis by cause is difficult because they are now coded with a new system based on ICD-10, and coding is now to be undertaken by the physician certifying death rather than, as before, by statisticians on the basis of verbatim diagnoses. There has been insufficient time to assess how the old and new systems correlate with each other, but initial work suggests some discrepancies. Nevertheless, male life expectancy has fallen to 59·9 from 61·3 in 1998, and for women to 72·4 from 72·9 in 1998. This reduction is a consequence of increases in deaths from all major causes except cancer. Although, as before, tuberculosis contributed little to overall mortality, the age-standardised mortality stands out as having increased by almost 30%. Unfortunately, the fluctuations in Russian mortality might not yet be at an end.

#### Contributors

Vladimir Shkolnikov, Martin McKee, and David Leon jointly conceived the paper and discussed the ideas underlying it. Vladimir Shkolnikov undertook the main analyses. Martin McKee and David Leon drafted the paper and contributed to the analyses. Vladimir Shkolnikov commented on and amended drafts.

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