



The response of violent mortality to economic crisis in Russia

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Abstract. From 1992 to 1994 life expectancy for Russian males dropped from 62.0 to 57.6 years. Female life expectancy dropped from 73.8 years to 71.2 years. This drop in life expectancy coincided in time with the introduction of painful economic reforms in Russia, leading to a rapid decrease in real wages and pensions, nearly complete loss of personal savings, and a tremendous increase in the poverty rate. This article examines the temporary changes in mortality for violent causes of death during the crisis period with a special emphasis on age-specific and gender-specific differences in the response to economic crisis.

Keywords: Mortality, Russia, Economic crisis, Violent mortality, Life expectancy, Injuries, Homicide, Suicide, Alcohol poisoning

Introduction

At the beginning of 1992, the Russian government started an economic experiment known as ‘shock therapy’. Abolition of price control in a highly monopolized economy resulted in soaring consumer prices, a rapid decrease in real wages and pensions, a nearly complete loss of personal savings, and a tremendous increase in the poverty rate. These adverse changes were followed by an unprecedented upsurge in mortality which has no parallel in modern history: female life expectancy dropped by 3 years and male life expectancy by more than 5 years within a three-year period (Vishnevsky 1998; Notzon et al. 1998).

The main causes of death that contributed to this mortality upsurge were diseases of the circulatory system and external/violent causes of death (Notzon et al. 1998). Under violent causes of death we consider the ‘external causes of accidents, injury and poisoning’ category as it is classified by the International Classification of Diseases (9th revision) on the basis of the external nature of the factor causing death. The term *violent causes* was applied to the group of external causes of death in previous studies of Russian mortality (Shkolnikov et al. 1996a, 1996b), and we adopt this convention in our study for the sake of simplicity. So we do not discuss here the appropriateness

of placing accidental poisoning by alcohol in this category but merely follow classification of the World Health Organization.

In this study, we analyze official statistical data for total mortality in 5-year age groups for the period 1991–1998, focusing on the crisis period (1992–1994).

Economic experiments and mortality changes in Russia

Russian mortality dynamics for the last 20 years demonstrate very strong dependence on political and economic decisions made by the government. In 1985 Gorbachev introduced the so-called ‘anti-alcohol campaign’. This campaign involved placing governmental restrictions on supply and sale of alcohol. Immediately after these measures, the life expectancy of males started to increase and reached its highest level in 1987, increasing by two years since the beginning of the anti-alcohol campaign (Leon et al. 1997). For industrialized parts of Russia, this effect was even more significant. These anti-alcohol actions, however, were not very popular and caused very strong social tensions that resulted in the quick termination of the anti-alcohol campaign by 1988. By that time, alcohol consumption and mortality rates have nearly returned to the previous, pre-reform, levels.

In 1992, another political decision called ‘shock therapy’ attempted to accomplish a rapid transition to market economy. The first step in this direction was a complete abolition of price control by the government. As a result, consumer prices grew 3.5 times faster than wages in 1992 (1st quarter, Goskomstat 1993) and exploded by 2500% for the entire 1992 calendar year (Klugman & Braithwaite 1998). The gross domestic product (GDP) fell more than 40 percent during 1991–1996 as a result of output collapse (EBRD 1997; Klugman & Braithwaite 1998). The number of poor households in Russia rose sharply after early 1993, reaching a record 35 percent of the population living below the official poverty line by the end of 1995 (Klugman & Braithwaite 1998; Zohoori et al. 1998). The average real earnings fell by one-half in 1992 and then stabilized around this low level (Klugman & Braithwaite 1998).

This information on population well-being during the transition period was obtained through the Russian Longitudinal Monitoring Survey (RLMS), a household survey implemented by Goskomstat (Russian State Committee on Statistics) with technical and financial assistance from the World Bank and the US Agency for International Development (Klugman & Braithwaite 1998; Zohoori et al. 1998, 1999).

Shortly after the beginning of economic reforms, Russia experienced a significant and steep rise in total age-specific mortality that resulted in the fall of

Table 1. Life expectancy at birth in Russia and other countries

Country	Year	Life expectancy at birth	
		Males	Females
Russia	1991	63.5	74.3
	1992	62.0	73.8
	1993	58.9	71.9
	1994	57.6	71.2
	1995	58.3	71.7
	1996	59.8	72.5
	1997	60.8	72.9
India	1994–1997	62.4	63.4
China	1994–1997	69.0	73.0
Tunisia	1994–1997	69.5	73.3
USA	1997	73.6	79.4

Source: Russian official statistics (Goskomstat); World Health Organization; National Center of Health Statistics.

life expectancy to 57.6 years for males and to 71.2 years for females in 1994 (see Table 1). The losses in life expectancy were more than 5 years for males and 3 years for females compared to the life expectancy in pre-crisis 1991. These decreases are beyond the peacetime experience of any industrialized country. Current life expectancy in Russia is lower than in China and even less than in some countries of Africa (see Table 1). Thus, the shock effect of ‘shock therapy’ was achieved, but no therapy was provided.

This phenomenon received significant attention in a number of papers (Ellman 1994; Gavrilova et al. 1997; Notzon et al. 1998; Leon et al. 1997; Leon & Shkolnikov 1998; Shkolnikov et al. 1996a, 1996b, 1998; Tulchinsky & Varavikova 1997; Walberg et al. 1998), which showed that diseases of the circulatory system, injuries, and diseases of the respiratory system were the major causes of death contributing to the decrease in life expectancy in Russia after 1991. The latest data available to us for 1998 demonstrate that life expectancy (61.3 years for males, 72.9 years for females) is still below its 1991 level. Thus, the Russian people have not completely recovered after the six years of ‘shock therapy’. Moreover, the most recent preliminary data for 1999 have revealed a new decrease in life expectancy (perhaps as a result of the 1998 financial crisis). A distressing feature of the recent mortality changes is the increasing mortality from some infectious diseases (e.g., tuberculosis,

sexually transmitted diseases) that were previously essentially under control (Vishnevsky 1998).

Although previous studies provided important information on the magnitude of mortality changes and on major causes of the decrease in life expectancy, these studies have not addressed changes in mortality with a more detailed cause-of-death breakdown. Also, previous research focused mainly on analyses of life expectancy or age-adjusted mortality as integral demographic indicators, while age-specific mortality trajectories were not analyzed in detail.

The purpose of this paper is to study in more detail the response of mortality from causes of death comprising the group of 'external injuries, accidents and poisoning' or, simply, 'violent mortality' to the Russian economic crisis. A special emphasis in this study is placed on the analysis of gender- and age-specific mortality trends.

Data and methods

Official data on mortality provided by Russian State Statistical Committee (Goskomstat), include deaths by cause, sex, five-year age group, for each single calendar year of death, together with corresponding population denominators. Population age distributions for years 1991–1998 were presented by the Goskomstat five-year age estimates adjusted for migration at the beginning of the year (Leon et al. 1997). The corresponding mid-year populations were calculated on the basis of two adjacent population age distributions.

The Goskomstat cause-of-death classification has not changed since 1988. Although the current classification is based on the 9th revision of the International Classification of Diseases (WHO 1977–1978), there are differences between the International and Russian classifications, especially for cardiovascular diseases. Recently Goskomstat issued a table of correspondence between the Russian classification of causes of death and the two most recent revisions (9th and 10th) of the International Classification of Diseases (WHO 1977–1978, 1992a), which was used in our study.

In this study, we analyzed violent causes of death including all accidents, injuries, and poisoning. The list of external (violent) causes of death applied in Russian statistics are presented in Table 2 together with their ICD-9 and ICD-10 codes, according to the Goskomstat table of correspondence.

The main emphasis in this study is on mortality from suicide and self-inflicted injury (ICD-9 codes E950-E959), homicide and injury purposely inflicted by other persons (ICD-9 codes E960-E969), accidental poisoning by alcohol, not elsewhere classified (ICD-9 code E860), and motor vehicle traffic accident involving collision with pedestrian (ICD-9 code E814). In-

Table 2. Causes of death in the group 'accidents, injuries and poisoning' according to three types of classification

Cause of death	Goskomstat code	ICD-9 code	ICD-10 code
Motor vehicle accidents involving occupants of the vehicle	160, 162	E8100-E8139, E8150-E8299	V400-V499
Motor vehicle traffic accidents involving collision with pedestrian	161	E8140-E8149	V010-V069, V090-V099
Other transport accidents	162, 160	E8000-E8079, E8300-E8489	V100-V399, V500-V978, V98, V99
Accidental poisoning by alcohol	163	E8600-E8609	X450-X459
Accidental poisoning by other substances, gases, and vapors	164	E8500-E8589, E8610-E8699	X400-X449, X460-X499
Complications of surgical and medical procedures	165	E8700-E8769, E8780-E8799	Y400-Y468, Y470-Y485, Y490-Y557, Y560-Y658, Y66, Y69, Y700-Y708, Y710-Y718, Y720-Y728, Y730-Y738, Y740-Y748, Y750-Y758, Y760-Y768, Y770-Y778, Y780-Y788, Y790-Y798, Y800-Y808, Y810-Y818, Y820-Y828, Y830-Y849
Accidental falls	166	E8800-E8889	W000-W199
Accidents caused by fire and flames	167	E8900-E8999	X000-X069, X080-X099
Accidental drowning and submersion	168	E9100-E9109	W650-W709, W730-W749
Accidental mechanical suffocation	169	E9110-E9159	W750-W819, W830-W849
Accidents caused by firearm missile	170	E922	W320-W349
Accident caused by electric current	171	E9250-E9259	W850-W949, W990-W999
All other accidents	172	E9000-E9094, E9160-E9219, E9239-E9249, E9260-E9499, E9700-E9789	W200-W319, W350-W459, W490-W609, W640-W649, X100-X399, X500-X549, X570-X599, Y350-Y359, Y850-Y859, Y86, Y870-Y872, Y880-Y883, Y890-Y899
Suicide and self-inflicted injury	173	E9500-E9599	X600-X849
Homicide and injury purposely inflicted by other person	174	E9600-E9699	X850-X999, Y000-Y099
Injury undetermined whether accidentally or purposely inflicted	175	E9800-E9899	Y100-Y349

dustrial accidents are not listed among the external causes of death in ICD-9. Goskomstat publishes statistics of industrial accidents in a separate edition. According to this statistics, there were 6,789 cases of death related to industrial accidents in 1995 in Russia. That corresponds to 2.5 percent of all violent deaths at working ages (Commission on Women, Family & Demography 1997). Information about suicide and homicide became publicly available after 1989. In Russia, a large proportion of deaths due to alcohol intoxication are coded to 'accidental poisoning by alcohol' (Russian code 163). For comparison, in the USA, most cases of alcohol related deaths are assigned to other causes (alcohol dependence syndrome, ICD-9 code 303, and nondependent use of alcohol, ICD-9 code 305.0). Only a small proportion of alcohol related deaths in the USA is coded as the 'accidental poisoning by alcohol' (ICD-9 code E860) (Notzon et al. 1998). In Russia, on the contrary, the lion share of all alcohol-related deaths is coded as accidental poisoning by alcohol. In our study, we used data on mortality from accidental poisoning by alcohol classified according to Russian official statistics (e.g. deaths with the Russian code 163). We analyzed this cause of death together with other external causes and followed in our study the classification applied by the International Classification of Diseases (accepted also by Goskomstat) that combines accidental poisoning by alcohol with other external causes.

The age-specific mortality rates that are used in this paper are the result of our calculations, based on official statistics. Age-standardized (age-adjusted) mortality rates were calculated using the direct method of age adjustment (Chiang 1978). The standard population chosen was the WHO 'new' European standard population (see WHO 1992).

Major causes of death in Russia

Cardiovascular diseases, cancer and violent causes are major causes of death of Russian mortality. Mortality from violent causes is the third major cause of deaths for females (after cancer), while for males it became the second major cause of death in 1994. The analysis of mortality trends in Russia demonstrates a considerable increase in total mortality after 1991 mostly due to an increase in violent mortality as well as in cardiovascular diseases and diseases of the respiratory system (Ellman 1994; Leon et al. 1997; Gavrilova et al. 1997; Notzon et al. 1998).

A striking feature of mortality in Russia is very high proportion of violent deaths. Mortality from accidents, injuries, and poisoning determines both previous and recent changes in the total mortality (Schkolnikov et al. 1996a, 1996b; Leon et al. 1997; Notzon et al. 1998) and is closely related to the levels

Table 3. Age-adjusted death rates for selected causes of violent mortality in Russia before and after the 'shock therapy' (per 100,000 population)

Cause of death	1991		1994	
	Male	Female	Male	Female
Suicide	47.7	11.2	76.9	13.6
Accidental poisoning by alcohol	19.4	4.2	61.2	15.8
Injury undetermined whether accidentally or purposely inflicted	22.8	5.7	60.3	14.3
Homicide	25.1	6.9	52.8	13.6
All other accidental causes	24.6	6.0	45.0	11.6
Motor vehicle traffic accidents involving collision with pedestrian	26.5	8.4	23.2	7.6
Accidental drowning and submersion	16.3	2.5	21.9	3.4
Other accidental poisoning	14.0	4.4	21.0	6.3
Motor vehicle accidents involving occupants of the vehicle	17.3	3.1	15.6	3.4
Accidents caused by mechanical suffocation	4.6	1.2	11.4	2.4
Accidental falls	7.8	3.6	11.1	3.9
Accidents caused by fire and flames	5.3	2.4	9.8	3.9
Other transport accidents	8.4	2.1	8.4	1.9

of alcohol consumption (Nemtsov 1996, 1998; Chenet et al. 1998; Nemtsov & Shkolnikov 1999).

A more detailed structure of mortality from violent causes of death is presented in Table 3, and demonstrates the significant role of social and behavioral factors in recent mortality changes.

Suicide was the main cause of violent deaths both for males and for females. Its dominating position did not change after 1992 for males but was replaced by alcohol poisoning for females in 1994. A relatively high proportion of deaths was observed for the cause 'injury undetermined whether accidentally or purposely inflicted' (Russian code 175). Wasserman and Varnik (1998) have suggested that some deaths were intentionally assigned to this code in order to conceal murder cases.

Data quality

The rapid and sharp changes in mortality experienced by Russia in recent decades have generated some concerns about the quality of Russian vital

statistics. Most of authors who worked with Russian mortality data admitted that recent mortality fluctuations in Russia are not artifactual and population estimates and death counts are accurate enough to ensure correct statistical analyses (Notzon et al. 1998; Leon et al. 1997; Bennett et al. 1998; Andreev 1999). Wasserman and Varnik (1998) conducted a study of the reliability of statistics on violent death and suicide in the republics of the former USSR. They concluded that mortality data were reliable for Russia, Ukraine, and Belarus. The completeness of death reporting in Russia is rather high except for the North Caucasus Republics and the Republic of Tuva (Andreev 1999). Unspecified diagnoses ('senility without mention of psychosis' or 'symptoms and other unspecified conditions') which often serve as a measure of quality for cause-of-death statistics, comprised only 4.4 percent of all medical certificates in 1996 (Andreev 1999). On the other hand, the quality of cause-of-death coding is not always high (Notzon et al. 1998; Andreev 1999), and the last audit of the accuracy in reporting causes of death was conducted in Russia only in 1982 (see Shkolnikov et al. 1996a). The autopsies were performed on 33.2 percent of all deaths in 1996 (Andreev 1999).

For violent causes, the main concern is the increase in mortality from 'injuries undetermined whether accidentally or purposely inflicted', (Russian code 175) or simply 'undetermined injuries'. This term could be used to conceal some cases of homicide and suicide in order to avoid criminal investigation (Wasserman & Varnik 1998). Male mortality from this cause increased dramatically after the 'shock therapy' in 1992 reaching its maximum in 1994. We found that in Moscow, with its relatively high proportion of unregistered migrants, homeless, and refugees, the 'undetermined injuries' for males exceeded any other cause of violent mortality in 1994. Thus, while the population estimates and death counts are reasonably accurate, the quality of death coding is less satisfactory. This deficiency can bias the estimates of violent mortality and lead to mortality underestimation for some causes (especially for homicide and suicide deaths which may be assigned to 'undetermined injuries').

Another problem is the increase in the proportion of deaths with undefined (not stated) ages during the crisis. Although the contribution of such deaths is not substantial for total mortality (0.25% in 1991 and 1.19% in 1994 for males), it is much higher for mortality from violent deaths (0.73% in 1991 and 2.59% in 1994 for males). The latter fact can affect the proper estimation of demographic indicators dependent on age distribution. Recently the proportion of deaths with undefined age has slowly begun to decline.

Despite the problems listed above, most researchers studying mortality in Russia admit that the quality of Russian vital statistics is good enough, with nearly 94% of all deaths being medically certified (Leon et al. 1997;

Notzon et al. 1998; Wasserman & Varnik 1998; Andreev 1999). One of the arguments supporting the acceptable quality of Russian statistics is the temporal stability of cancer mortality in 1992–1995 against the background of a dramatic increase in total mortality (Leon et al. 1997). Also, the standard rules of cause-of-death coding in Russia ensure comparability of regional cause-specific mortality statistics. The mandatory internal passport system ensures a low level of age misreporting in death certificates, although age information in census data (denominators) is less accurate. Thus, there is every reason to believe that the quality of Russian mortality data, although not perfect, is reasonably good for conducting demographic analyses.

Mortality patterns in Russia after the ‘shock therapy’

Temporary changes in life expectancy after 1991 demonstrate a two-stage pattern. In the first stage, when response to the sharp changes in life style and living standards was acute, mortality rapidly increased to a peak in 1994. In the second stage, mortality gradually decreased although it did not reach the initial pre-crisis levels.

Mortality from diseases of the circulatory system and violent deaths demonstrated very strong response to economic crisis, while mortality from neoplasms did not change during this period (Leon et al. 1997; Shkolnikov et al. 1998). The secular stability of mortality from neoplasms could be expected from the nature of these diseases (long-term multistage process) and also indicates that the fluctuations in other causes of death are not caused by errors in population estimates (denominator problem) (Leon et al. 1997). During the health crisis, mortality from violent deaths moved from the third to the second place for males, replacing mortality from neoplasms, while for women violent causes remained the third major cause of death.

Changes in mortality from violent causes of death

Mortality from violent causes started to increase rapidly in 1992 and reached its maximum values in 1994. The only exception was mortality from transport accidents, including traffic accidents (Russian codes 160–162, see Table 2).

The most dramatic increase in violent mortality is observed for mortality from accidental poisoning by alcohol (see Table 3). This cause of death became more common in 1994 than homicide and traffic accidents. Mortality from alcohol poisoning also shows the most rapid decrease after 1994. Mortality from homicide follows similar temporary pattern as mortality from alcohol poisoning. This pattern implies some relation between these two

causes of death. At the same time, homicide mortality demonstrates a slower decline after 1994 compared to the mortality from alcohol poisoning which suggests an additional, non-alcohol component in this type of violent death. Suicide mortality increased dramatically after 1992 and continued to be the main cause of violent death for males in Russia. After 1994, this cause of death demonstrated a slow but steady decline in mortality.

Violent causes of death demonstrating a similar temporary pattern (increase after 1992, peak in 1994, and subsequent decrease) are: accidental falls (Russian code 166), accidents caused by fire and flames (code 167), accidental drowning and submersion (code 168, peak in 1995), accidental mechanical suffocation (code 169), accidents caused by firearm missile (code 170, peak in 1993) and all other accidents (code 172, peak in 1995). However, the contribution of these causes to the total violent mortality is not particularly high.

The mortality pattern for females demonstrates less important role of suicide in recent mortality changes as compared to males (see Table 3). For females, homicide became a relatively more important cause of violent deaths after 1992 than for males, reflecting the total increase in crime rate after the economic crisis.

Age-specific mortality from violent causes

Analysis of age-specific mortality is important for understanding what age groups are the most vulnerable to economic crisis. Pre-retirement ages (50–60 years) appears to be the most vulnerable after 1992 and demonstrate the most acute response in violent mortality (see Table 4). The retirement age in Russia is 60 years for men and 55 years for women. People of pre-retirement ages lost almost all their personal savings. Because of their age, they had no hope of creating new savings for impending retirement. This group of people is particularly at risk to lose their jobs and has the smallest chance of finding a new one. This group also experienced the highest loss in social ranking when the prestige of many previously respectable professions (physicians, scientists, teachers, etc.) vanished. At the same time, this group also demonstrated the most rapid decline in violent mortality after year 1994, compared to other age groups, probably because the peak level of mortality was particularly high in this pre-retirement group. No significant cohort effects are observed: the mortality peak occurs approximately at the same age group (50–54 years) in different calendar years, although there is some indication of slightly higher mortality for cohorts born in 1941–1945.

It is interesting to note that age-specific mortality from alcohol poisoning demonstrates a very strong response to economic crisis in middle-age groups

Table 4. Age-specific death rates (per 100,000) for selected causes of violent mortality

	Age											
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74
<i>All violent causes</i>												
Males												
1991	130	224	278	318	343	351	374	370	336	287	226	233
1992	140	261	330	386	421	460	479	491	424	355	269	248
1993	167	309	392	479	542	623	654	689	586	497	377	297
1994	168	328	416	505	587	679	732	776	683	575	442	325
1998	147	318	337	382	415	453	479	485	479	402	365	291
Females												
1991	38	38	40	45	55	67	77	83	82	80	82	98
1992	43	46	48	58	70	89	102	105	100	94	91	108
1993	50	58	62	76	98	124	142	158	145	129	116	124
1994	53	58	68	83	106	137	159	180	163	149	126	128
1998	52	64	65	68	72	86	98	106	117	102	102	108
<i>Accidental poisoning by alcohol</i>												
Males												
1991	1	4	12	23	33	42	49	49	43	30	16	6
1992	2	7	18	36	54	69	74	73	63	43	24	11
1993	4	11	26	56	85	115	126	128	107	82	45	19
1994	4	13	32	66	103	134	149	149	134	101	58	22
1998	2	9	17	27	45	58	67	69	67	52	37	16

Table 4 (continued)

	Age											
	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74
<i>Females</i>												
1991	–	–	1	2	5	8	11	13	13	9	6	2
1992	–	1	2	5	8	13	18	19	19	13	8	4
1993	1	1	3	9	17	25	32	37	36	24	14	6
1994	1	2	4	12	21	32	37	48	42	34	18	8
1998	1	2	4	5	9	12	16	19	22	16	10	5
<i>Suicide</i>												
<i>Males</i>												
1991	24	35	51	62	65	64	72	73	68	67	59	75
1992	25	43	60	74	77	79	84	98	85	80	67	69
1993	32	52	74	89	97	102	106	128	108	92	82	77
1994	35	63	84	101	107	115	117	139	116	101	96	81
1998	34	71	71	80	83	88	92	89	97	76	92	83
<i>Females</i>												
1991	7	7	7	8	9	11	14	15	16	17	20	24
1992	7	8	8	9	10	14	15	17	17	19	19	23
1993	8	8	10	11	13	15	17	20	18	20	22	25
1994	9	9	11	11	14	15	18	20	18	20	22	24
1998	8	9	9	9	11	12	14	15	15	15	18	20

Table 4 (continued)

	Age											
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74
<i>Homicide</i>												
Males												
1991	16	35	42	45	45	40	35	28	23	18	14	11
1992	22	52	61	64	64	61	59	48	38	31	20	20
1993	28	63	74	81	81	83	77	64	53	46	35	24
1994	26	61	78	82	84	88	85	75	62	48	36	25
1998	16	42	53	61	60	59	53	49	41	33	26	20
Females												
1991	5	6	8	9	11	11	10	9	8	7	6	6
1992	6	8	11	13	15	18	16	14	12	10	10	11
1993	7	11	15	17	20	23	22	21	18	14	13	13
1994	7	12	15	18	21	24	24	23	19	16	14	13
1998	7	12	13	13	14	14	15	13	14	12	11	12

observed both for males and females. This increase in mortality from alcohol poisoning occurred mainly due to mortality changes during the ages of 45–55 years.

The mortality peak for homicide is observed at younger ages compared to suicide and the total group of violent causes of death. At the same time, for males the maximum mortality from homicide shifted to older ages (45–50 years) during the crisis and then returned to younger ages (30–40 years) again during the period of recovery (see Table 4).

Despite the common belief that the elderly is the most vulnerable part of population, there is no significant change in violent mortality for the age groups older than 70 years. There are no significant changes in mortality from suicide and alcohol poisoning for older age groups since 1992. Mortality from homicide among the elderly increased after 1990, but had not changed significantly since 1994. Similar stability of mortality at older ages against background of growing mortality at middle ages was observed for manual workers in Hungary and Bulgaria (Carlson 1989; Carlson & Tsvetarsky 1992). The position of the elderly in Russia is paradoxical: although their pensions are very small, the elderly now often support their adult children who have virtually no income because of unemployment or arrears in wages. This support provided by the elderly may result in the increase of their social status and self-esteem, thus protecting them from suicides or heavy drinking.

The mortality dynamics at younger ages (15–25 years) raises the most concern. Mortality from violent deaths in this age group increased after 1994, but in contrast to the middle age groups, it did not decline significantly after 1994. Moreover, mortality of young people from suicide and homicide (for females) remained virtually unchanged since 1994. Thus, in contrast to the common wisdom, teenagers and younger adults seem more sensitive to the Russian economic crisis than the elderly and do not cope well with the new socioeconomic realities.

Gender differences in the response to economic crisis

Suicide was the main cause of violent mortality both for males and females before the crisis (see Table 4). The relative role of suicide in the recent rise of violent mortality was higher for males compared to females. Male suicide mortality demonstrates a very rapid increase after 1992 while female mortality shows a rather small change after that time (Table 4). The age-adjusted suicide mortality rate was 1.6 times higher for males and 1.2 times higher for females in 1994 compared to 1991. The different dynamics of suicide mortality for males and females may be explained by taking into account a lower contribution of alcohol consumption to female suicides compared to

male suicides (Wasserman et al. 1998). It was estimated that the attributable fraction of alcohol consumption for female suicides in the former USSR (27%) is approximately half that for male suicides (50%) (Wasserman et al. 1998). Since alcohol consumption is considered an important factor contributing to the mortality increase in 1990s (Leon & Shkolnikov 1998), we expect a larger increase in suicide mortality for males compared to females. At the same time, it seems that alcohol is not the only explanation for the increased response in suicide mortality for males. In contrast to the mortality from alcohol poisoning, which rapidly declined after 1994, suicide mortality for males is decreasing very slowly. Additional explanation of rather weak response of female suicide to the economic crisis is care-giving function of women who often have to take care for children or old parents. These family responsibilities may protect women from committing suicide.

The age-adjusted homicide mortality rate increased two-fold by 1994 compared to 1990 for both sexes. The relative importance of homicide as a cause of violent death increased significantly for females after 1992: by 1998 homicide became as common a cause of death for females as suicide.

In 1994, age-adjusted mortality from alcohol poisoning was 3.2 times higher for males and 3.8 times higher for females compared to 1990. Thus, the immediate response to economic crisis was much the same for both sexes.

The age-specific mortality from all violent causes has a bimodal age distribution of mortality for both sexes (Table 4). The ages of the first maximum (at 50–54 years) coincide in 1994 while in 1991 and 1998 the age at first maximum for females (55–59 years) is higher compared to males (45–55 years). Mortality from alcohol poisoning demonstrates unimodal age distribution with the maximum observed at higher ages for females (Table 4). Mortality from suicide has a bimodal distribution for males (first peak at 50–54 years) and increases monotonically with age for females (Table 4). The latter pattern of age-specific suicide rates is similar to the age-specific pattern observed in Europe for both sexes (Varnik et al. 1998).

The sex-specific patterns of response and recovery are different for suicide, homicide, and alcohol poisoning. Mortality from alcohol poisoning demonstrates the most rapid response and subsequently the rapid recovery for both males and females. On the other hand, the recovery rate for suicide mortality among males and homicide mortality among females is very slow (see Table 4) Thus, suicide for males and homicide for females are the causes that raise the major concern.

Possible causes of the observed mortality crisis

Following the 'shock therapy', views on the underlying causes of the mortality crisis gradually evolved. Initially, researchers proposed multiple explanations for the observed mortality increase: poor lifestyle (alcoholism, smoking), environmental catastrophe, economic impoverishment, widening social inequality, legacy of the communist system, deterioration of the health system, and malnutrition (Feshbach 1995; Chen et al. 1996; Cockerham 1997; Notzon et al. 1998). Although poor life style, a deteriorating of health care system, and environment are important in explaining the rather high baseline mortality observed in 1991, they could not explain the mortality hike in 1992–1994.

The hypothesis that the increase in alcohol consumption is a major cause of the observed mortality upsurge in 1992–1994 has received significant attention (Ryan 1995; Leon et al. 1997; Notzon et al. 1998; Leon & Shkolnikov 1998). The rise in alcohol consumption undoubtedly contributed to the rapid increase in mortality from violent causes of death (Nemtsov & Shkolnikov 1999). Some authors considered increase in the alcohol consumption after the end of anti-alcohol campaign as one of the major causes of the mortality upsurge in 1992–1994 (Leon et al. 1997; Notzon et al. 1998; Leon & Shkolnikov 1998). On one hand, these conclusions proved to be correct (see Table 4). On the other hand, the increase in mortality during 1992–94 was not a simple return to the situation that occurred before the anti-alcohol campaign. Shkolnikov et al. (1996) has demonstrated that the increase in life expectancy in 1985–1988 (during anti-alcohol campaign) was achieved mostly due to a decrease in violent deaths (especially for males), while the recent decrease in life expectancy (1992–1994) included substantial cardiovascular component. Shkolnikov et al. (1998) present data indicating that the mortality of the Russian population in the early 1990s has changed for the worse instead of simply returning to the previous high levels of mortality.

It is interesting to compare alcohol-related mortality in Russia with data on alcohol consumption obtained from the Russian Longitudinal Monitoring Survey, RLMS (Zohoori et al. 1998, 1999). According to the survey data, the mean daily amount of alcohol consumption for adult males increased by August of 1993 with a 38 percent increase over the 1992 level, but did not change significantly until November 1998. For females, the mean daily amount of alcohol consumption gradually increased reaching maximum in August 1993 with subsequent gradual decrease to the initial values by 1998. Thus, the patterns of alcohol consumption in 1992–1998 obtained by the survey are not consistent with the patterns of alcohol-related mortality (rapid increase with peak in 1994 and rapid decrease afterwards). We believe that RLMS data reflect alcohol consumption among the 'normal' resident population,

but it is unlikely that this survey covered marginal groups of the population: homeless, institutionalized persons or heavy alcoholics who could not be interviewed in a regular way. These marginal groups may be responsible for almost 50% of total alcohol consumption (Nemtsov & Shkolnikov 1999) and seems responsible for the majority of alcohol-related deaths. Also, the estimates of annual alcohol consumption based on RLMS data were almost three times lower than other three independent estimates based on the official statistics (Nemtsov & Shkolnikov 1999; Nemtsov 2000) suggesting that RLMS did not cover marginal groups of the population with heavy alcohol consumption. This may be particularly true for women who normally do not drink much (and RLMS data suggest this fact), but demonstrated the same pattern of alcohol-related mortality as men. Thus, the increase in female mortality from alcohol poisoning most likely was caused by the deaths among women-alcoholics from marginal groups of population.

While the role of alcohol consumption in the increase of mortality from accidental poisoning by alcohol is quite clear, its role in the increase of mortality from suicide is not so certain. The statistical data provided by Goskomstat contain information on the number of deaths that occurred in a state of alcohol intoxication (per each cause of death and by sex). Although Nemtsov & Shkolnikov (1998) consider these statistical data as highly incomplete, we believe that they might reveal at least a tendency in the percentage of alcohol-related deaths. The analysis of changes in alcohol-related deaths for suicide mortality during the period 1991–1998 does not reveal any substantial increase in the percentage of suicides that occurred in the state of alcohol intoxication in 1993–1994. These data may indicate the existence of different underlying mechanisms behind the increase in suicide mortality and mortality from alcohol poisoning.

Mortality from suicide demonstrates virtually no changes during 1989–1991 period (before the ‘shock therapy’) following by a sharp increase during the crisis, most likely as a result of psychological stress and disadaptation. After 1994, the suicide mortality demonstrates slow decline indicating gradual adaptation of Russian population to the new social and economic environment.

Homicide mortality initially followed the same pattern as mortality from alcohol poisoning suggesting the same underlying factor in both causes of death. The slower decline of homicide mortality after 1994 compared to mortality from alcohol poisoning suggests an increasing influence of other factors (except alcohol) in homicide mortality. This may be related to the higher proportion of homicide deaths at younger ages (20–30 years) which may be of non-alcohol nature, reflecting growing crime rate after 1993 (Martynov et al. 1993).

Recently, researchers have begun to pay more attention to the role of stress as a major cause of mortality crisis (Shapiro 1997; Shkolnikov et al. 1998b; Vlassov 1999). Studies of regional mortality in Russia have showed that the mortality increase after the economic crisis was related to the pace of economic changes, crime rate, and social inequality rather than the average level of personal income or sales of alcohol (Walberg et al. 1998). Another study of regional mortality has demonstrated a strong negative influence of high divorce rate on mortality from violent causes (Becker & Hemley 1998). Kennedy et al. (1998) have studied the role of social capital in the regional differences in Russian mortality using a regression model which included a set of proxy indicators of social capital. They found strong links between age-adjusted sex-specific mortality and such proxy measures of social capital as the level of distrust in local government, disinterest in politics, crime rate, and divorce rate (Kennedy et al. 1998). These studies demonstrate that psychological stress, social disadaptation, and disintegration, and loss of social capital have played a significant role in the recent mortality increase (Kennedy et al. 1998; Shkolnikov et al. 1998; Walberg et al. 1998), while the role of such traditional economic indicators as poverty and unemployment have been far less important (Shkolnikov et al. 1998; Walberg et al. 1998; Zoohuri et al. 1998).

It should be noted that the economic crisis of 1992 gave rise to a series of structural changes in Russian society that were not limited only to the price hike and rapid population impoverishment. The Russian population struggled to survive in hard economic conditions when traditional ways of earning a living were not available and began to look for non-traditional and sometimes illegal ways of finding income. These conditions resulted in substantial increase in non-reported earnings – up to 50% of total income in 1995 (Martynov et al. 1998; estimates are made on the basis of population consumption statistics). As a result, many people were involved in tax-evading businesses and contacts with criminal elements. It is not surprising that the rate of ‘grave’ (mostly violent) crimes (a more objective indicator of crime rate than total crimes) started to increase rapidly after 1993 and still continues to grow (Martynov et al. 1998). These negative processes undoubtedly influence the levels of violent mortality. Even political factors may be related to mortality: Martynov et al. (1998) showed that regions with increased political confrontation (simultaneous voting for opposite parties by considerable parts of population) demonstrated higher levels of decline in life expectancy in 1992-1994. Thus, even such indirect indicators may be related to mortality, suggesting the complex nature of the factors that determine mortality changes in Russia.

However, the increase in violent mortality was among the earliest consequences of the economic reforms, while other negative changes (including social destabilization, growth of 'grave' crime rate, and unemployment) occurred later (Martynov et al. 1998; Zohoori et al. 1998, 1999). Population surveys demonstrated that the rapid decline in living standards did not affect mortality rates directly through mass malnutrition or starvation (Shkolnikov et al. 1998; Zohoori et al. 1999). Moreover, children and the elderly who should be more vulnerable to malnutrition and often are the first victims of economic crisis in other countries (Palloni & Hill 1997) were much less affected compared to adults. Thus, it is more likely that increasing mortality was one of the first manifestations of stress experienced by the population as a result of rapid impoverishment and changing living conditions in 1992 (Shapiro 1995; Shkolnikov et al. 1998). Loss of traditional sources of income and personal savings forced the active part of the population to change their traditional life style. In many cases, these life style changes resulted in deviant behavior, including increased alcohol consumption, suicides, and homicides. The observed two-stage dynamics of mortality in 1991–1998 (acute stage and recovery) fits the typical stress-related pattern (Braunstein & Toister 1981). After the period of initial acute response to stress (1992–1994), people adapted to the changing living conditions, found ways to make additional income, and mortality began to decline. It seems that the selection processes also played some role in the initial mortality increase: the most vulnerable groups of the population (heavy alcohol drinkers in this case) show increased mortality during the crisis periods (Palloni & Hill 1997). For example, mortality from acute poisoning by alcohol demonstrated a very rapid decrease after its initial hike that is more consistent with the selection of heavy drinkers rather than with their adaptation when a slower recovery would be expected (Nemtsov & Shkolnikov 1999). The factors that influenced mortality changes after 1993 are more complex than the simple shock of skyrocketing prices experienced in 1992 and require special analysis that is beyond the scope of this article. More studies are necessary to uncover and analyze all possible mechanisms that determine violent mortality of the Russian population.

Conclusion

The facts available in the scientific literature as well as the observed dynamics of violent mortality support the hypothesis that psychological stress played a major role in the initial increase of violent mortality after the economic reforms in Russia. Social and economic instability, loss of social capital, and an uncertain future increased the level of aggression and anxiety in Russian society which led to an increase in alcohol consumption. Males responded to

the growing economic and social instability through the increase of suicide rates, while women became more often the victims of homicide. After 1994, during the period of social adjustment both suicide and homicide mortality rates declined in almost all age groups, except teenagers and young adults.

The recent decline in mortality demonstrates the capacity of the Russian people to adapt to changes in life style and living standards. There have been no noticeable improvements in living conditions after 1994 when mortality started to decline. Moreover, after 1994 the Russian government began to withhold wages for large groups of federal workers (Zohoori et al. 1998). Surprisingly, this block in salary payments (up to 12 months) did not result in a catastrophic rise of mortality. However, this protracted exposure to economic hardship may eventually exhaust the adaptation capacity of the Russian population and lead to further mortality increase.

The data presented here are restricted to 1998 when the most recent statistics are available. Thus, we can only partially analyze the consequences of the economic and financial crisis that happened in August 1998. This new crisis resulted in further decrease in real wages, pensions, and savings of the Russian people (Mroz et al. 1999). According to the 1998 data, there has been no catastrophic increase in mortality after the August crisis, although the process of recovery decelerated. Recent information provided by Goskomstat demonstrates that life expectancy in Russia decreased in 1999 compared to 1998. What we do not know is the location of the threshold for the economic sufferings that Russian people can tolerate. It is not clear how close Russian society is to an outbreak of epidemics or massive violence triggered by some local conflict in Chechnya or elsewhere. There is a need for further research to monitor the effects of the recent economic crisis on mortality in Russia. The experience of those countries that have positive changes in mortality and life expectancy during the transition to market economy (Poland & Slovenia), is of particular interest (Brainerd 1998).

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