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Recent Mortality Trends in Russia: Differences between Younger and Older Generations

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Abstract

This paper analyzes the most recent trends of mortality in Russia across ages, genders and regions using official statistical data for 1991-2001. During the last decade Russia experienced two mortality crises in 1992 and 1998. Life expectancy in Russia continues to decline after 1998. The most recent mortality data for year 2001 demonstrate changes in opposite direction for younger and older adult age groups: total mortality of young adults (20-30 years old) apparently starts to decline while total mortality among middle-aged and older adults continues to grow after 1998. Our findings suggest that the recent mortality trends in Russia demonstrate increasing level of violence and stress in the society. Therefore, many negative tendencies can be reversed if more attention is paid to prevention of these largely avoidable causes of death. This study was supported in part by the grant 98-52206 from the MacArthur Foundation.

Introduction

Dramatic increase of mortality in Russia after 1992 is now a well-documented phenomenon (Shkolnikov et al., 1996a; 1998; Gavrilova et al., 1997; 2000; Leon et al., 1997; Notzon et al., 1998;).

From 1992 to 1994 life expectancy of Russian males dropped from 63.8 to 57.7 years. Female life expectancy dropped from 74.4 years to 71.2 years. This decrease in life expectancy coincided in time with the introduction of painful economic experiments ('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. The main causes of death that contributed to this mortality decline were diseases of the circulatory system, accidents, poisoning and injuries, diseases of the respiratory system. After 1995 mortality in Russia demonstrated slow but stable decrease. However, in August 1998 Russia experienced another economic crisis (crash of the banking system) resulting in mass impoverishment. Shortly after this crisis mortality started to grow again and male life expectancy dropped from 61.3 in 1998 to 58.7 years in 2001, while female life expectancy dropped from 72.6 to 71.6 years during the same period. In both cases population at working ages appeared to be the most vulnerable age group while children and the elderly were not significantly affected (Notzon et al., 1998). The losses in life expectancy during 1992-94 were more than 5 years for males and 3 years for females compared to the life expectancy in pre-crisis 1991. This fall in life expectancy is beyond the peacetime experience of any industrialized country. Temporal changes of life expectancy in Russia and major political events affected mortality are shown in Figure 1.

Figure 1 About Here

This phenomenon received significant attention in a number of papers (Ellman, 1994; Notzon et al., 1998; Leon et al., 1997; Leon, Shkolnikov, 1998; Shkolnikov et al., 1996a; 1996b; 1998a; Tulchinsky, Varavikova, 1997; Walberg et al., 1998; Gavrilova et al., 1997; 2000; McKee, Shkolnikov, 2001), 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.

Increase in alcohol consumption was one of the major factors of mortality increase resulting in a rise of mortality from external causes (Ryan, 1995; Nemtsov, Shkolnikov, 1999; McKee et al., 2000; Anderson, 2001; Pridemore, 2002). Another potentially important cause of mortality increase after 1992 is psychological stress experienced by adult population during the transition period (Shapiro, 1997; Shkolnikov et al., 1998; Cornia, Pannicia, 2001). The hypothesis of deteriorating medical care and public health system as a primary cause of mortality increase after 1992 did not find support from available data (Shkolnikov et al., 1998; Anderson, 2001). However, recent loss of control over spread of socially important infectious diseases (tuberculosis, syphilis, AIDS) will have adverse effect on population health and mortality.

Despite the abundant literature on mortality in Russia, mortality trends and patterns in different age groups did not receive sufficient attention. In this study we attempted to compare temporal patterns of mortality trajectories in two age groups: young adults (20-24 years) and middle-aged adults (45-49 years) representing two generations.

Data and Methods

Data Sources

In this study we used the following data sources on Russian mortality:

(1) Official data on mortality provided by the Russian State Statistical Committee (Goskomstat), which include deaths by region, cause, sex, five-year age groups, for each single calendar year of death, together with corresponding population denominators. Population age distributions for corresponding calendar years were presented by 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. These data were obtained by the Central Research Public Health Institute (1993-2001) and the Institute for Medical Information (1981-1992) directly from Goskomstat. The advantage of this dataset is its detailed information on age-sex distribution of deaths over the period of 1981-2001. These data were collected every year over the 15-year period, so they do not contain corrections made later by the Goskomstat.

(2) Detailed mortality file from the World Health Organization Mortality Database (ICD-9). This file was used as a supplement to the official Goskomstat data, because it contains information on suicide and homicide mortality for years before 1988 (although it does not have this information for years 1983 and 1984).

The Goskomstat cause-of-death classification has been subjected to several changes over last 20 years. Changes in cause-of-death classification have been made in years 1981, 1988, 1989, and 1999. The most notable changes in cause-of-death classification occurred in 1999 when a new coding system based on ICD-10 has been introduced. Although Russian coding system is claimed to be compatible with ICD-9 (1980-98) or ICD-10 classifications, there are substantial differences between the International and Russian classifications, especially for cardiovascular diseases. The latter issue makes study of cardiovascular mortality over long period particularly difficult. To cope with this problem, we used broader groups of causes: ischaemic heart disease and cerebrovascular diseases.

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 (Anderson, Silver, 1997). Most of authors who worked with Russian mortality data admitted that recent mortality fluctuations in Russia are not artifactual and that 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 per cent of all medical certificates in 1996 (Andreev, 1999). On the other hand, mortality from unspecified causes has very huge regional variation, which requires a special investigation (Semyonova et al., 2003). Also, 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; Shkolnikov et al., 1997). The autopsies were performed on 33.2 per cent of all deaths in 1996 (Andreev, 1999).

For external 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 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 external 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 of the Russian mortality statistics is the increase in the proportion of deaths with undefined (not stated) ages during the transition period. 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.

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 temporal stability of cancer mortality in 1992-95 against the background of a dramatic increase in total mortality (Leon et al., 1997). Also, the standard rules of cause-of-death coding in the whole country 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) may be less accurate because of self-reporting bias. Nevertheless, there is every reason to believe that the quality of Russian mortality data,

although not perfect, is reasonably good for conducting demographic analyses, particularly for working age groups (Andersen, Silver, 1997).

Statistical Analyses.

The age-specific mortality rates for years 1981-2000 were calculated on the basis of official statistics (death counts and corresponding population denominators). Life expectancies for year 2001 were calculated using the Keyfitz method of life table construction (Keyfitz, 1985). Mean expected ages at death were calculated using standard method of multiple decrement life table construction (Manton, Stallard, 1984).

We used an exploratory factor analysis in order to uncover the underlying structure of fluctuations in cause-specific mortality over time. We used so-called P-technique of factor analysis when points in time (calendar years) are treated as observations for age-specific mortality rates. With this method of analysis, age-specific death rates for 11 causes of death were used as variables and studied for 1981-2001 period of time. These causes of death were selected after preliminary screening of their behavior over time. Causes of death, which do not demonstrate significant changes after 1992 (like all cancers), were not included into analysis. Also these causes of death were rather common at young age group to ensure statistical stability of results. The particular type of factor analysis we used was the principal component analysis with paramax method of rotation (FACTOR procedure in SAS statistical package).

Divergent Tendencies of Mortality Changes in Different Age Groups

In our study we attempted to answer the following research questions:

- What are the causes of mortality crisis in Russia?
- Are these causes common for different age groups of Russian population, or are they complex and age-specific?
- Can we use age-aggregated indicators of health and mortality (like age-adjusted coefficients), or should we study mortality trends in each age group separately?

It is known that the rise in mortality during the transition period in Russia was due to mortality increase in adult age groups whereas mortality of children was declining during the same period of time. On the other hand, it is often assumed that mortality of all adult groups was changing over time in a similar manner, so that mortality of adults is often analyzed using aggregate demographic indicators.

Our analysis showed that different age groups of adults often demonstrate completely different and even opposite trends of mortality changes over time. Figure 2 shows trends of female mortality from tuberculosis in two age groups – 45-49 and 80-85 years with opposite directions over time.

Figure 2 About Here

Tuberculosis mortality of older women is declining and mortality of middle-aged women is rapidly growing. Thus, conclusions made on the basis of aggregated demographic

indicators about tuberculosis mortality may be misleading. The same opposite trends for tuberculosis mortality are observed for males at ages 45-49 and 80-84 (see Figure 3).

Figure 3 About Here

Another example of opposite trends in different age groups is shown in Figure 4.

Figure 4 About Here

Here female suicide mortality at ages 20-24 and 60-64 demonstrate opposite trends: while mortality of young females is increasing over time, mortality of older women shows a declining trend.

Thus, mortality trends in Russia are different and sometimes even opposite in different age groups. Therefore, the use of aggregated mortality indicators may be misleading, and *age-specific analysis is preferable*.

Not only mortality trends may be different in different age groups, the structure of causes of death is not the same in younger and older adults. Tables 1-2 present the leading causes of death in young adult age group (20-24).

Table 1 About Here

Table 2 About Here

The data demonstrate significant structural changes between 1990 and 2001 in the leading causes of death at younger ages. They also indicate a decline in the quality of vital statistics (growing number of deaths with undefined diagnoses) in Russia. In contrast to the younger age group, there are no significant structural changes of mortality in the middle age group (45-49) – see Tables 3-4.

Table 3 About Here

Table 4 About Here

At middle ages mortality structure changed in the direction of trauma domination, but the positions of other major causes of death remained largely unchanged. On the contrary, at younger adult ages new causes of death (infectious diseases and respiratory diseases) came to the fore (Tables 1-2).

Changes in Age Patterns of Mortality

Analyses of mortality trends from all causes of death in two age groups representing young and middle-aged adults revealed the first positive sign of mortality decline in 2001 for younger age group after long period of deterioration (see Table 5). Table 5 shows principal differences in time patterns of mortality between older and younger generations.

While the peak of mortality among the older age group was observed in 1994 and never reached these values after 1998, mortality of young adults demonstrated steady increase after 1992 with mortality peak observed in 2000.

Table 5 About Here

In our previous study we suggested that mortality of young adults is more affected by infectious diseases like tuberculosis, while mortality of middle-aged adults is more affected by violent causes of death such as suicide, homicide, injuries and alcohol poisoning (Gavrilova et al., 2002). Tables 6 and 7 show changes in homicide and suicide mortality over time with trajectories similar to those observed for total mortality.

Table 6 About Here

Table 7 About Here

In addition to the above-mentioned causes of death, mortality of younger adults may be affected by chronic diseases as a result of deteriorating health.

In order to test this hypothesis, we studied changes in mean expected age at death calculated from multiple decrement life tables (Table 8). It turns out that considerable number of diseases demonstrated rapid "rejuvenation" after 1991 (shift to earlier ages at death). Particularly large drop in mean expected age at death is observed for diseases of genitourinary system, diseases of digestive system, diseases of respiratory system, diseases of endocrine system, diseases of circulatory system. However, the highest drop of mean expected age at death is observed for "symptoms, signs and ill-defined conditions" for males (from 70 to 58 years). The fact that this rapid decline is observed exclusively among males may suggest that this cause of death may be used for concealing some other causes of death, which do not look nicely in statistical reports (for example, homicide or tuberculosis). There are some indications now that the quality of Russian vital statistics is gradually deteriorating after 1991 (Semyonova et al., 2002).

Table 8 About Here

Data presented in Table 8 indicate that mean expected age at death from injuries, infectious diseases, and malignant neoplasms virtually did not change. However, for specific infectious diseases, like tuberculosis and syphilis, decrease in mean expected age at death was significant (see Table 9).

Table 9 About Here

No significant changes of mean expected age at death were found for suicide, homicide and accidental poisoning by alcohol. Most causes of death demonstrating rapid "rejuvenation" during the 1990s are related to chronic conditions suggesting decline in health of younger adults. On the other hand, mortality from traumas and poisoning has preserved its age structure.

Causes of Death Raising Major Concerns

To study the age patterns of mortality further, we analyzed in more detail those causes of death, which showed significant changes during the transition period, particularly in younger age group. Tuberculosis is one of such causes of death. When aggregate demographic indicators are used (e.g., age-adjusted death rates), it looks like tuberculosis mortality is returning to its levels observed in the 1970s and early 1980s. There is a principal difference in age patterns of mortality in 2001 compared to 1981: high mortality from tuberculosis in 1981 was observed predominantly in old age groups (after 60) whereas in 2001 it was observed predominantly among middle and young age groups (see Figure 5).

Figure 5 About Here

Note catastrophic increase in tuberculosis mortality (doubling during the last 10 years) in a very specific age group (45-55 years) among males. This phenomenon is observed for both sexes although in females this shift to younger ages (40-50 years) is even more striking (Figure 6). Thus, mortality from tuberculosis has become an increasingly important contributor to the total mortality among younger age groups.

Figure 6 About Here

Recent efforts undertaken by international organizations (World Bank in particular) and Russian government in tuberculosis prevention and control may have resulted in stabilization of tuberculosis mortality during the last 1-2 years (Figure 7). However the levels of tuberculosis mortality still remain very high and considerable proportion of young adults and children infected with tuberculosis suggests that mortality from this cause may persist in future (Shilova, 2001).

Figure 7 About Here

Another cause of death, which demonstrated rapid growth after 1991, is homicide. Levels of homicide mortality are so high that Russia occupies now the second place after South Africa for homicide mortality (Chervyakov et al., 2002). Unlike tuberculosis mortality, mortality from homicide does not demonstrate substantial shift in age profile towards younger ages. However, mortality rates from this cause of death grew up significantly both for males and females (Figures 8, 9).

Figure 8 About Here

Figure 9 About Here

Comparison of figures 8 and 9 suggest that homicide mortality among young females (20-24 years) increased more rapidly with time than among young males. This

observation is corroborated by direct analysis of time trends in male/female mortality ratio: while male/female mortality ratio did not change much in the middle age group, it rapidly declined in young age group (Figure 10). This observation suggests that young females are becoming victims of homicide more often now than 10 years earlier.

Figure 10 About Here

Suicide mortality also demonstrated some non-significant changes in age profile (Figures 11, 12).

Figure 11 About Here

Figure 12 About Here

Although mean expected age at death for this cause increased after 1991, more rapid increase of mortality at ages 20-30 resulted in "flattening" the age profile of suicide mortality for females (Figure 12). For males the age pattern of suicide mortality in 2001 is very similar to that in 1981, with additional mortality peak at age 20-24 not observed before.

Mortality from accidental poisoning by alcohol (Figures 13, 14) has very specific age pattern, which remains stable over time.

Figure 13 About Here

Figure 14 About Here

This observation is consistent with the existing hypothesis that mortality rise after 1992 was in great extent caused by return to the traditional very high levels of alcohol consumption (Zakharov, 1999; Vishnevsky, 2000).

Some researchers believe that rapid increase of total mortality after 1992 is a result of long-term trend rooted in the 1970s (Andreev, 1999). Our analyses revealed that real situation is much more complex. Some causes of death (accidental poisoning by alcohol, suicide) in 2001 demonstrate age profiles, which are very similar to those observed in 1981. On the other hand, some causes of death (like tuberculosis) demonstrate very rapid "rejuvenation" compared to 1981, which started in the mid 80s. Other causes of death (like homicide) retained their age profile but showed so significant rise of death rates that cannot be explained by simple continuation of previous trend.

Factor Analysis of Mortality Trends in Different Age Groups

We may suggest that mortality from different causes of death was changing over time in a concerted way, so that many causes of death could have similar trajectories over time. To collapse the observed age- and sex-specific changes in cause-specific mortality into simpler pattern, we used a method of factor analysis that allows us to reduce the set of variables to a smaller number of factors.

We used the following factor model in our analyses:

$$z_{ct} = a_{1c}f_{1t} + a_{2c}f_{2t} + \dots + a_{nc}f_{nt}$$

where z_{ct} is standardized value (score) for mortality rate from cause c at time t .

We have selected the following causes of death for our analyses, which are relatively common among young adults and which demonstrated changes in mortality between 1991 and 2001: (1) Suicide; (2) Homicide; (3) Tuberculosis (as the main cause of death in the infectious diseases category); (4) Alcohol-related causes of death (with accidental poisoning by alcohol as a major component); (5) Diseases of digestive system; (6) Cerebrovascular diseases; (7) Diseases of respiratory system; (8) Symptoms, signs, and ill-defined conditions; (9) Diabetes as chronic disease, which requires continuous medication; (10) Ischaemic heart disease; (11) Transport accidents. Age-specific death rates for these 11 causes of death and 18 observations (points in time) were then analyzed using exploratory factor analysis. Separate analyses were conducted for males and females and two age groups: young adults (20-24) and middle-aged adults (45-49).

The results of factor analysis for young males are presented in Table 10. The first three principal components account for 89 percent of the variation in mortality over time. For further analysis we have retained 3 factors with eigenvalues greater than 1. The first factor explaining 59% of mortality variation has strong correlation with mortality from suicide, IHD, tuberculosis, diseases of respiratory system, diseases of digestive system, diabetes and cerebrovascular diseases. The second factor explaining 19% of total variation in mortality has high correlations with transport accidents and homicide. Finally, the third factor has the highest correlations with ill-defined conditions and alcohol-related diseases. Only the first and the second factors had significant correlations with total mortality. Thus, total mortality changes over time for young males are correlated mainly with mortality from suicide, IHD, tuberculosis and diseases of respiratory system.

Table 10 About Here

The results of factor analysis for young females show different pattern (Table 11). The first three principal components account for 87 percent of the variation in mortality over time. For further analysis we have retained 3 factors. Temporal variation of mortality among young females is explained by 2 major factors. The first factor explaining 58% of mortality variation has strong correlation with mortality from homicide, suicide, diabetes, IHD, transport accidents, and tuberculosis. The second factor explaining 21% of total variation in mortality has high correlations with ill-defined conditions and diseases of respiratory system. Finally, the third factor has the highest correlations with ill-defined conditions and alcohol-related diseases. Only the first and the third factors had significant correlations with total mortality with very high correlation coefficient for the 1st factor. Thus, temporal changes of mortality for young females are correlated mainly with changes of homicide and suicide mortality. Major

difference here with young male mortality is importance of homicide mortality in determining temporal variation of mortality over time for young females.

Table 11 About Here

Factor analysis applied to mortality of middle-aged males revealed simpler factor structure (Table 8). The first three principal components account for 90 percent of the variation in mortality over time. The first factor explaining 65% of mortality variation has strong correlation with mortality from cerebrovascular diseases, diseases of digestive system, homicide, IHD, diabetes, diseases of respiratory system, suicide, tuberculosis and alcohol-related diseases. The second factor explaining 15% of total variation in mortality has high correlations with ill-defined conditions, diseases of respiratory system and suicide. Finally, the third factor has the highest correlations with ill-defined conditions and alcohol-related diseases. The major difference with mortality of young males is again in homicide mortality, which has the highest correlations with the first factor for middle-aged males, while in the case of young males homicide mortality has more complex factor structure (correlated with the 2nd and the 1st factors, see Table 10). The first factor has very high correlation with total mortality ($r = 0.98$) and hence temporal dynamics of mortality for middle-aged males is correlated mainly with changes of mortality from cerebrovascular diseases, diseases of digestive system and homicide.

Table 12 About Here

In the case of factor analysis of mortality for middle-aged women (45-49), the first three principal components account for 90 percent of the total variation in mortality over time (Table 13). The first factor explaining 60% of mortality variation has strong correlations with mortality from tuberculosis, diseases of digestive system, cerebrovascular diseases, diseases of respiratory system, homicide, IHD. The second factor explaining 21% of total variation in mortality has high correlations with IHD, homicide, diabetes and alcohol-related diseases. The third factor has the highest correlations with suicide and ill-defined conditions. Middle-aged females represent an interesting case when the highest correlation with total mortality is observed for the second rather than the first factor (see Table 13). Thus, both homicide and tuberculosis are important markers of variation in total mortality over time among middle-aged females.

Table 13 About Here

Conclusion

In this study we analyzed current and past trends of mortality in Russia with emphasis on changing age-specific mortality profiles. We made an attempt to compare mortality dynamics for two different age groups of adults representing two generations: young adults (20-24 years) and middle-aged adults (45-49 years). Total mortality of young adults demonstrated steady growth over time after 1991 while total mortality in middle age group demonstrated periods of rapid growth and rapid fall. The most recent data for

2001 suggest that mortality of middle-aged adults continues its rapid growth while mortality at younger ages demonstrated the first signs of possible decline.

More detailed analyses of age and cause-specific mortality profiles revealed the shift to younger age structure for tuberculosis and many chronic diseases. On the other hand, age pattern of mortality from many external causes of death (suicide, homicide, alcohol poisoning, traumas in general) remained relatively stable over time. Factor analysis of time changes in mortality for major causes of death suggests that for young adults suicide mortality as well as tuberculosis mortality (males) and homicide mortality (females) are important markers of total mortality. Mortality of middle-aged adults is strongly correlated with homicide mortality as well as mortality from cerebrovascular diseases, diseases of digestive system (males) and tuberculosis (females).

The markers for all-cause mortality trends are very much different for different age and sex groups. The best markers do not always represent the most common causes of death. The best markers of all-cause mortality trends in young adult group (20-24) are: *Suicide* mortality for males and *Homicide* mortality for females. The best markers of all-cause mortality trends in middle-aged adult group (45-49) are *Cerebrovascular* mortality for males and *Tuberculosis* mortality for females.

This study shows that mortality trends as well as underlying factors of mortality differ across different age and sex groups. More studies in this direction are necessary to fully explore this important topic.

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Table 1. Top Five Causes of Death for Young Adults Males (20-24)

1990	2001
Injuries	Injuries
Neoplasms	Symptoms, Signs and Ill-Defined Conditions
Diseases of Circulatory System	Infectious Diseases
Symptoms, Signs and Ill-Defined Conditions	Neoplasms
Diseases of Nervous System and Sensory Organs	Diseases of Respiratory System

Table 2. Top Five Causes of Death for Young Adults Females (20-24)

1990	2001
Injuries	Injuries
Neoplasms	Neoplasms
Diseases of Circulatory System	Diseases of Circulatory System
Complications of Pregnancy and Childbearing	Symptoms, Signs and Ill-Defined Conditions
Diseases of Nervous System and Sensory Organs	Infectious Diseases

Table 3. Top Five Causes of Death for Middle-Aged Males (45-49)

1990	2001
Diseases of Circulatory System	Injuries
Injuries	Diseases of Circulatory System
Neoplasms	Neoplasms
Diseases of Respiratory System	Diseases of Respiratory System
Diseases of Digestive System	Diseases of Digestive System

Table 4. Top Five Causes of Death for Middle-Aged Females (45-49)

1990	2001
Neoplasms	Diseases of Circulatory System
Diseases of Circulatory System	Injuries
Injuries	Neoplasms
Diseases of Digestive System	Diseases of Digestive System
Diseases of Respiratory System	Diseases of Respiratory System

Table 5. Mortality trends for young and middle-aged adults in Russia. All causes of death.

Year	Young (20-24) age group		Middle-aged (45-49) age group	
	Males	Females	Males	Females
1981	325.07	70.61	1327.02	398.95
1982	302.02	66.23	1248.08	372.83
1990	259.91	71.44	1169.53	377.16
1991	272.47	74.09	1160.57	378.78
1992	317.47	84.06	1346.71	420.11
1993	372.89	96.90	1769.77	533.61
1994	400.59	100.07	2066.67	613.14
1995	428.17	103.79	1925.56	575.07
1996	412.68	98.59	1697.87	510.37
1997	384.48	99.41	1464.20	455.60
1998	402.73	100.61	1429.90	436.13
1999	447.58	112.36	1606.51	479.41
2000	495.83	114.38	1750.63	504.56
2001	438.48	113.47	1821.62	528.04

* Peak values are highlighted in bold.

Table 6. Mortality trends for young and middle-aged adults in Russia. Homicide.

Year	Young (20-24) age group		Middle-aged (45-49) age group	
	Males	Females	Males	Females
1981	25.26	5.57	28.50	11.77
1982	24.84	5.88	24.55	12.13
1990	33.46	5.86	30.97	9.16
1991	35.44	5.74	35.44	10.23
1992	51.57	7.66	58.53	16.41
1993	63.08	10.62	76.75	22.34
1994	61.39	11.51	85.07	23.45
1995	57.76	11.89	80.00	23.03
1996	50.71	11.52	64.47	19.44
1997	43.65	10.82	56.56	15.91
1998	42.26	11.70	53.07	14.90
1999	45.22	13.10	62.71	17.15
2000	45.99	12.92	71.39	18.34
2001	46.91	13.41	76.12	19.43

* Peak values are highlighted in bold.

Table 7. Mortality trends for young and middle-aged adults in Russia.
Suicide.

Year	Young (20-24) age group		Middle-aged (45-49) age group	
	Males	Females	Males	Females
1981	49.38	7.81	105.27	20.53
1982	52.50	7.35	103.27	19.48
1990	34.02	6.80	76.52	14.84
1991	35.20	7.25	72.04	13.63
1992	42.58	7.77	83.60	15.09
1993	52.17	9.73	106.13	17.01
1994	63.36	11.11	117.39	17.54
1995	71.27	10.83	115.12	17.23
1996	72.56	10.54	108.38	15.48
1997	71.80	10.33	98.39	14.53
1998	70.65	9.17	92.37	13.58
1999	75.70	10.63	103.73	15.45
2000	79.98	10.33	104.05	13.49
2001	82.71	11.27	105.70	13.49

* Peak values are highlighted in bold.

**Table 8. Groups of Causes of Death.
Mean Expected Age at Death in 1991 and 2001**

Cause of Death	Males		Females	
	1991	2001	1991	2001
Infectious Diseases	45.4	44.0	38.3	41.0
Malignant Neoplasms	64.5	63.8	66.7	66.3
All Injuries	42.5	42.7	50.4	48.5
Dis. Circulatory System	71.1	67.3	78.4	76.6
Cerebrovascular Diseases	73.1	70.7	78.3	77.4
Dis. of Endocrine System	58.2	53.3	65.6	63.5
Dis. of Digestive System	62.7	56.1	69.6	64.0
Dis. of Respiratory System	65.4	59.4	69.2	64.3
Dis. of Nervous System	39.8	40.1	42.7	43.9
Mental Disorders	46.1	50.4	57.2	62.1
Dis. Genitourinary System	67.5	60.6	62.9	61.9
Symptoms, Signs and Ill-Defined Conditions	70.0	58.4	82.0	79.5

* Causes of death, for which mean expected age at death dropped by 1 year or more, are highlighted in bold.

**Table 9. Selected Causes of Death
Mean Expected Age at Death in 1991 and 2001**

Cause of Death	Males		Females	
	1991	2001	1991	2001
Tuberculosis	52.00	46.9	56.8	46.9
Syphilis	28.9	9.8	48.2	8.6
Ischaemic Heart Disease	70.0	66.9	78.6	76.8
Pneumonia	44.1	49.6	45.9	51.3
Diabetes mellitus	62.1	57.1	67.5	65.7
Accidental poisoning by alcohol	47.7	47.0	51.5	51.7
Drug dependence	39.2	28.5	67.6	31.6
Transport accidents	40.0	38.3	48.1	44.2
Suicide	42.8	47.1	51.8	56.8
Homicide	41.0	39.0	46.5	46.0
Injury undetermined	44.4	44.5	50.1	52.8
Alcohol-related diseases	47.4	48.3	52.0	51.8

* Causes of death, for which mean expected age at death dropped by 1 year or more, are highlighted in bold.

Table 10. Young Males
Factor analysis of young (20-24) male mortality in Russia, 1981-2001

Factor	Eigenvalue	Difference	Proportion	Cumulative proportion
1	6.529540	4.451275	0.5936	0.5936
2	2.078265	0.922784	0.1889	0.7825
3	1.155481	0.575841	0.1050	0.8876
4	0.579640	0.269472	0.0527	0.9403
5	0.310168	0.174333	0.0282	0.9685
6	0.135835	0.033978	0.0123	0.9808
7	0.101857	0.056724	0.0093	0.9901
8	0.045133	0.009814	0.0041	0.9942
9	0.035319	0.016631	0.0032	0.9974
10	0.018688	0.008612	0.0017	0.9991

Factor structure after rotation (correlations for the first 3 factors)

Cause of death	Factor1	Factor2	Factor3
Tuberculosis	0.93358	0.14934	-0.08048
Diseases of Respiratory system	0.92829	0.09089	0.29965
Suicide	0.96392	0.29171	0.15987
Diseases of Digestive system	0.89951	0.13259	0.40288
Ischaemic Heart Disease	0.93814	0.46607	0.15232
Diabetes	0.89506	0.52038	-0.17083
Cerebrovascular Diseases	0.77070	0.54587	-0.39700
Transport accidents	0.02697	0.87657	-0.21580
Homicide	0.65343	0.86835	-0.07097
Symptoms, Signs and Ill-defined cond.	-0.14479	-0.46056	0.85159
Alcohol-related Diseases	0.48626	0.28940	0.69976
Correlation coefficient with total mortality	0.89	0.57	0.19

Correlation coefficients higher than 0.7 are highlighted in bold.

Table 11. Young Females
Factor analysis of young (20-24) female mortality in Russia, 1981-2001

Factor	Eigenvalue	Difference	Proportion	Cumulative proportion
1	6.410119	4.062020	0.5827	0.5827
2	2.348099	1.592376	0.2135	0.7962
3	0.755723	0.131293	0.0687	0.8649
4	0.624430	0.324528	0.0568	0.9217
5	0.299902	0.106754	0.0273	0.9489
6	0.193148	0.028049	0.0176	0.9665
7	0.165099	0.082439	0.0150	0.9815
8	0.082660	0.016502	0.0075	0.9890
9	0.066158	0.021136	0.0060	0.9950
10	0.045022	0.035383	0.0041	0.9991

Factor structure after rotation (correlations for the first 3 factors)

Cause of death	Factor1	Factor2	Factor3
Ichaemic Heart Disease	0.90592	-0.14675	0.18297
Suicide	0.94072	0.08660	0.42448
Homicide	0.97287	-0.07767	0.51805
Tuberculosis	0.84994	0.13785	0.37943
Diabetes	0.92364	-0.34337	0.43678
Transport accidents	0.88818	-0.33968	0.49615
Alcohol-related Diseases	0.67906	0.14198	0.49349
Symptoms, Signs and Ill-defined cond.	-0.16168	0.93720	0.00872
Diseases of Respiratory system	0.40622	0.79408	0.21126
Cerebrovascular Diseases	0.54665	-0.75818	-0.15804
Diseases of Digestive system	0.54700	0.06199	0.95414
Correlation coefficient with total mortality	0.96	-0.09	0.49

Correlation coefficients higher than 0.7 are highlighted in bold.

Table 12. Middle-Aged Males
Factor analysis of middle-aged (45-49) male mortality in Russia, 1981-2001

Factor	Eigenvalue	Difference	Proportion	Cumulative proportion
1	7.198461	5.596615	0.6544	0.6544
2	1.601846	0.501952	0.1456	0.8000
3	1.099894	0.393865	0.1000	0.9000
4	0.706029	0.513514	0.0642	0.9642
5	0.192516	0.056598	0.0175	0.9817
6	0.135918	0.108234	0.0124	0.9941
7	0.027684	0.007276	0.0025	0.9966
8	0.020407	0.011640	0.0019	0.9984
9	0.008767	0.002611	0.0008	0.9992
10	0.006155	0.003833	0.0006	0.9998

Factor structure after rotation (correlations for the first 3 factors)

Cause of death	Factor1	Factor2	Factor3
Cerebrovascular Diseases	0.99077	0.22577	0.23658
Diseases of Digestive system	0.97804	0.3058	0.16284
Tuberculosis	0.83533	0.14701	-0.09062
Homicide	0.95599	0.06049	0.46184
Diabetes	0.88680	-0.10551	0.40814
Ichaemic Heart Disease	0.92950	0.06749	0.46174
Diseases of Respiratory system	0.85391	0.63232	0.21139
Suicide	0.83871	0.67507	0.30140
Alcohol-related Diseases	0.64600	0.40981	0.48509
Symptoms, Signs and Ill-defined cond.	0.01259	0.96706	-0.01462
Transport accidents	0.21449	0.05123	0.91383
Correlation coefficient with total mortality	0.98	0.30	0.43

Correlation coefficients higher than 0.7 are highlighted in bold.

Table 13. Middle-Aged Females.
Factor analysis of middle-aged (45-49) female mortality in Russia, 1981-2001

Factor	Eigenvalue	Difference	Proportion	Cumulative proportion
1	6.620266	4.312289	0.6018	0.6018
2	2.307976	1.333035	0.2098	0.8117
3	0.974942	0.295554	0.0886	0.9003
4	0.679387	0.541794	0.0618	0.9621
5	0.137593	0.004961	0.0125	0.9746
6	0.132633	0.075764	0.0121	0.9866
7	0.056869	0.014599	0.0052	0.9918
8	0.042269	0.007893	0.0038	0.9956
9	0.034377	0.024080	0.0031	0.9988
10	0.010297	0.006905	0.0009	0.9997

Factor structure after rotation (correlations for the first 3 factors)

Cause of death	Factor1	Factor2	Factor3
Tuberculosis	0.95016	0.39305	-0.08438
Diseases of Digestive system	0.94256	0.76293	0.07497
Cerebrovascular Diseases	0.92067	0.73473	0.22246
Diseases of Respiratory system	0.85645	0.66736	0.46160
Alcohol-related Diseases	0.41764	0.82689	0.49972
Diabetes	0.65591	0.89015	-0.21826
Ichaemic Heart Disease	0.77313	0.93691	0.14994
Transport accidents	0.29014	0.65027	-0.31146
Homicide	0.79665	0.91050	0.10648
Suicide	-0.07446	0.08343	0.96152
Symptoms, Signs and Ill-defined cond.	0.17717	-0.07205	0.87851
Correlation coefficient with total mortality	0.83	0.91	0.09

Correlation coefficients higher than 0.7 are highlighted in bold.

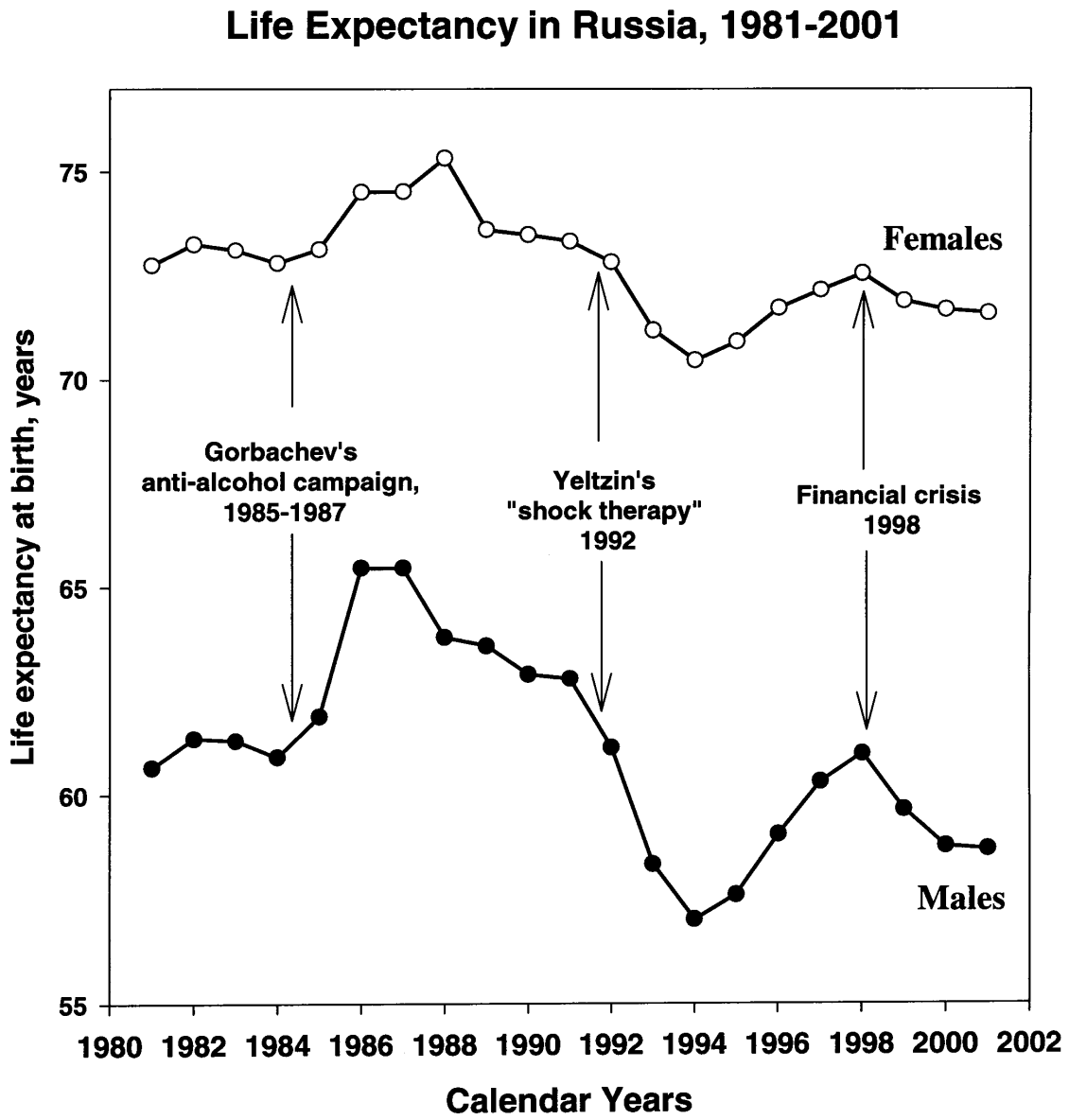


Figure 1

Opposite Trends of Tuberculosis Mortality at Ages 45-49 and 80-84 Males, Russia

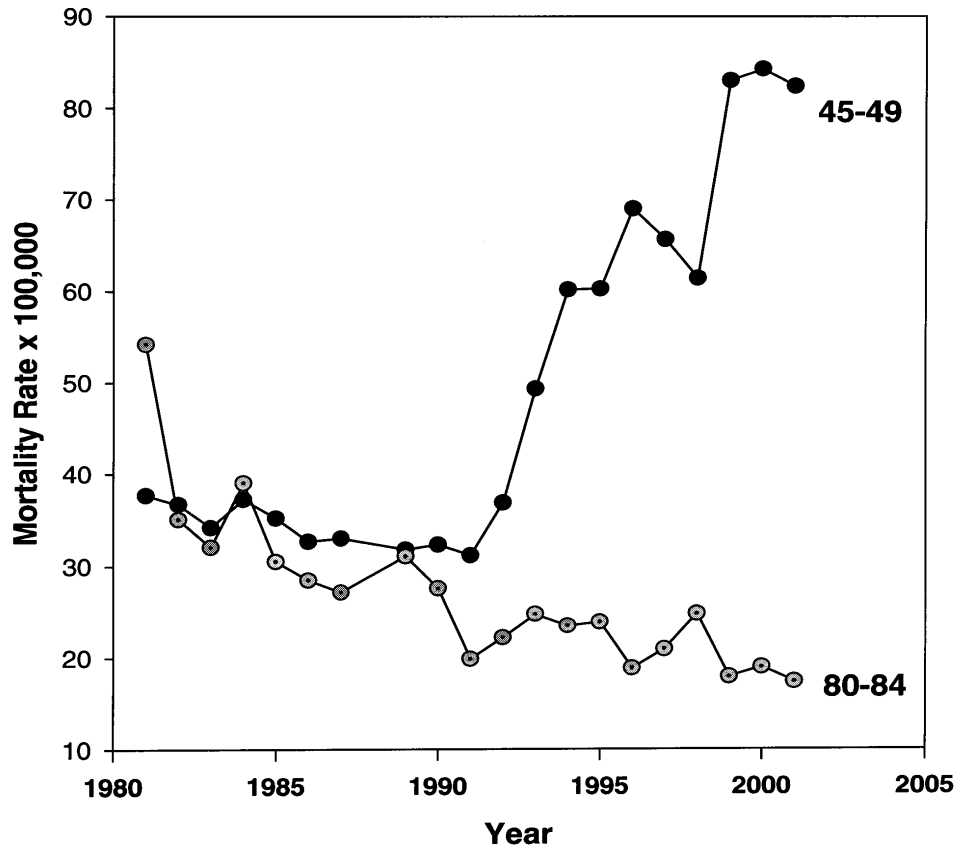


Figure 2

Opposite Trends of Tuberculosis Mortality at Ages 45-49 and 80-84 Females, Russia

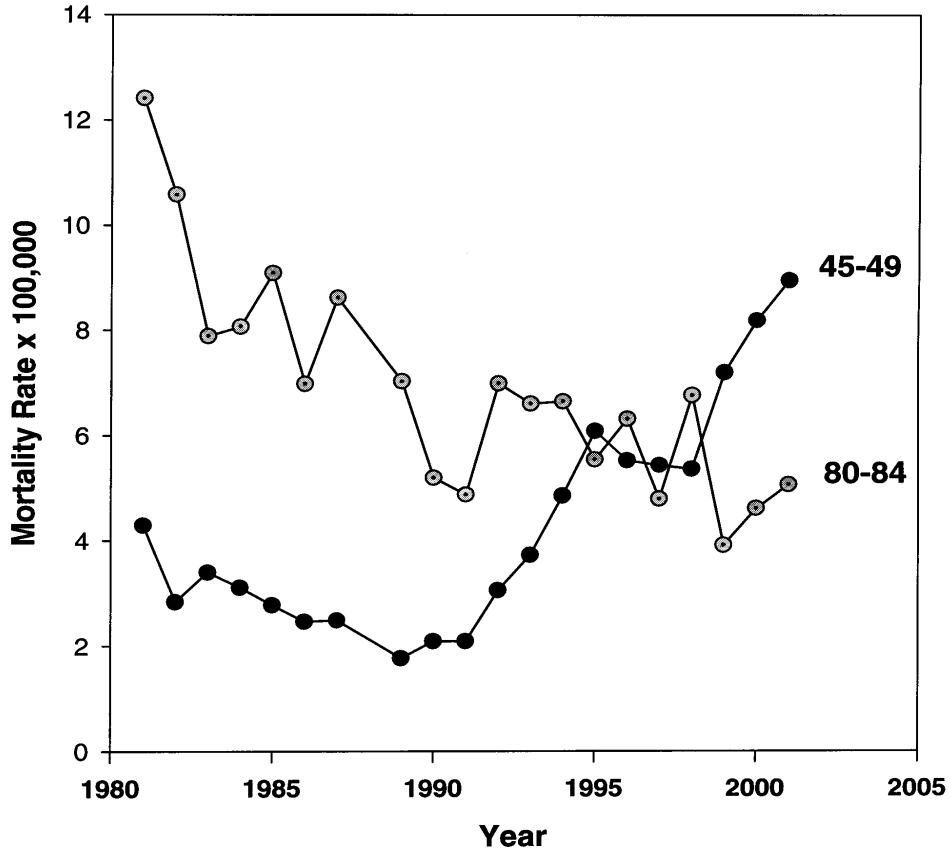


Figure 3

Opposite Trends of Suicide Mortality at Ages 20-24 and 60-64 Females, Russia

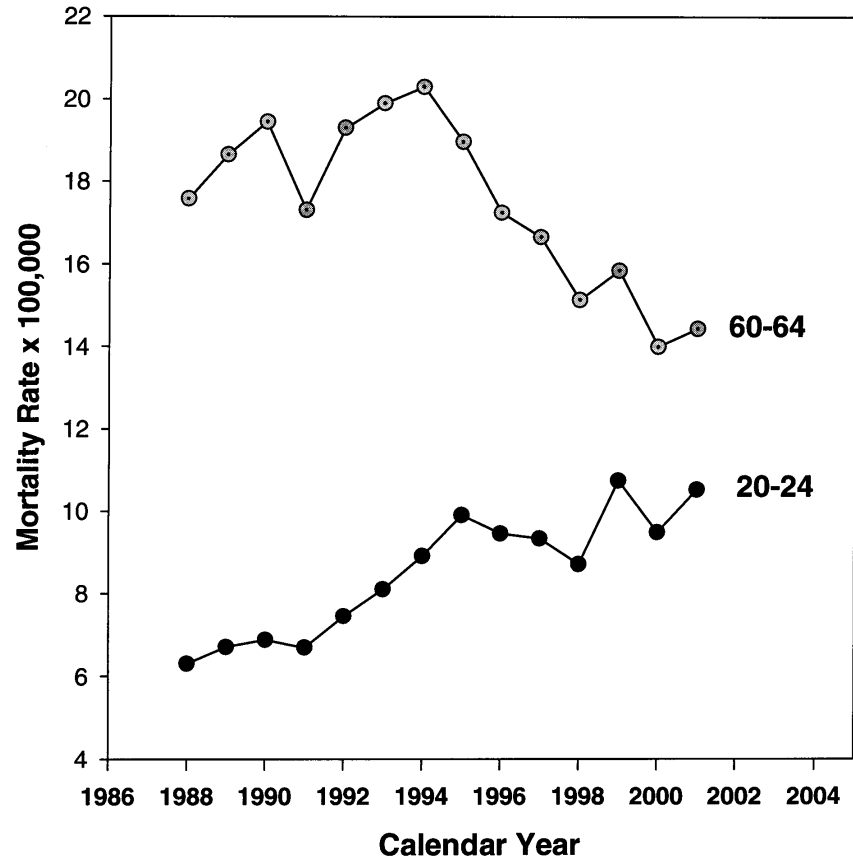


Figure 4

Mortality from Tuberculosis Russia, Males

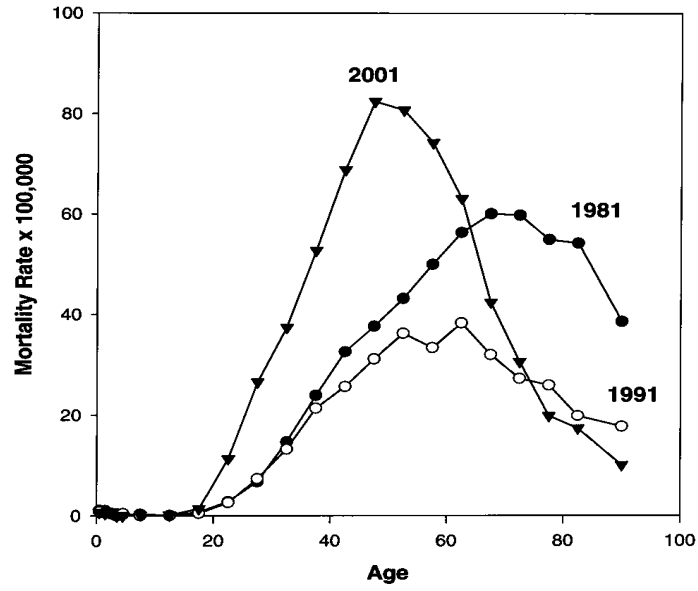


Figure 5

Mortality from Tuberculosis Russia, Females

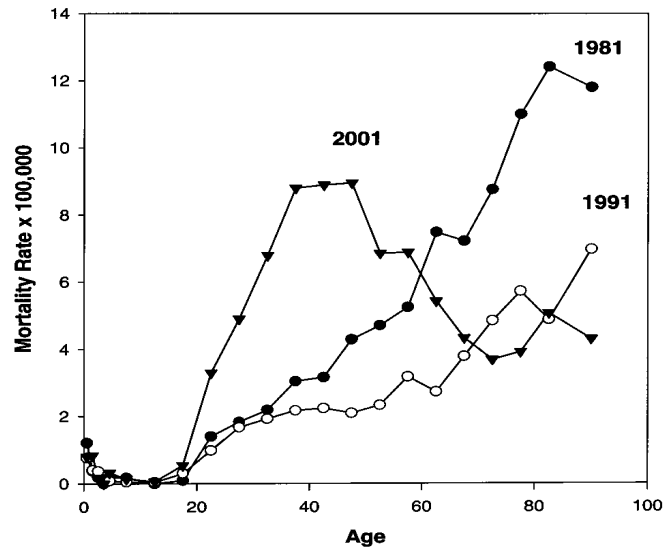


Figure 6

Trend of Mortality from Tuberculosis Males, Russia

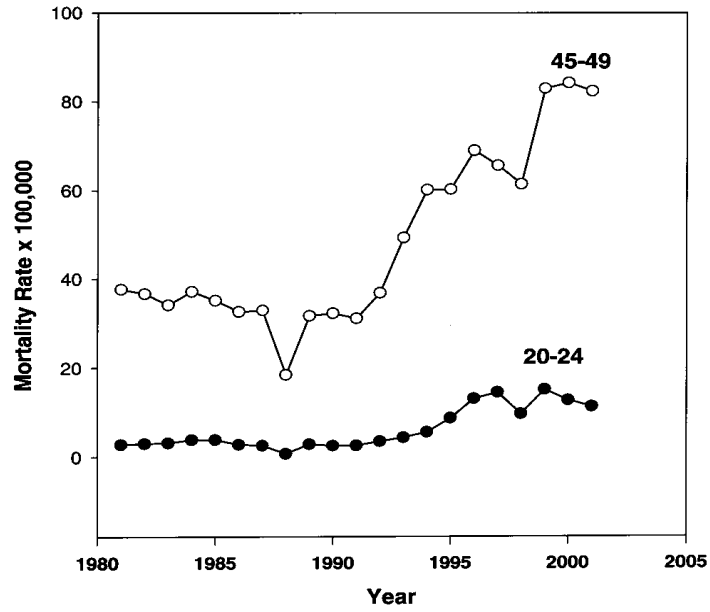


Figure 7

Homicide Mortality Russia, Males

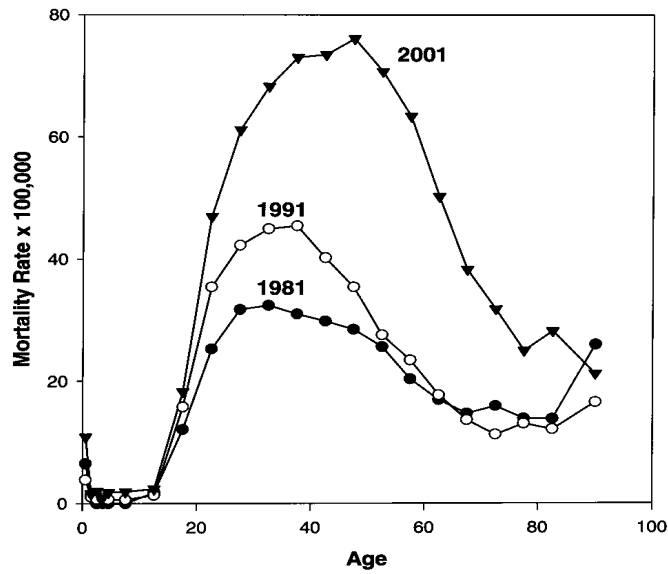


Figure 8

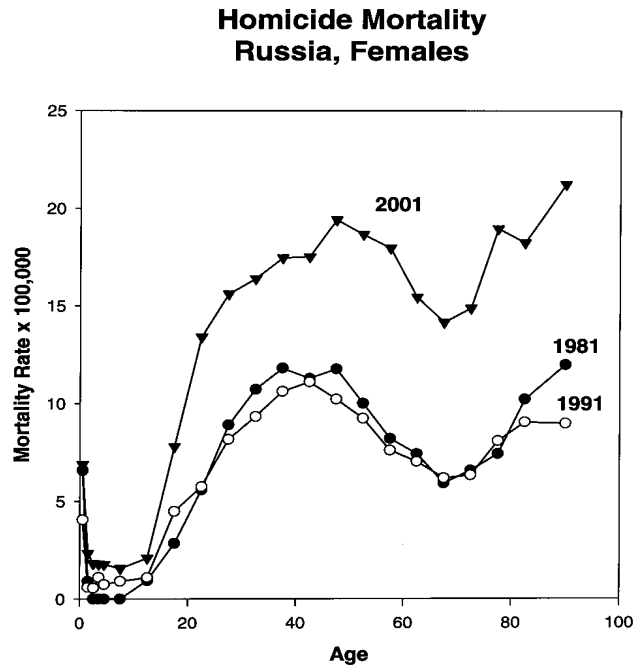


Figure 9

Male-Female Mortality Ratio from Homicide for Young (20-24) and Middle (45-49) Age Groups Russia

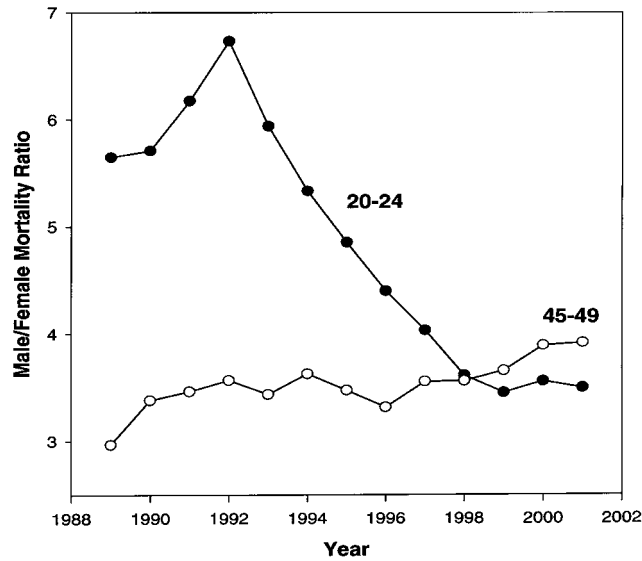


Figure 10

Mortality from Suicide Russia, Males

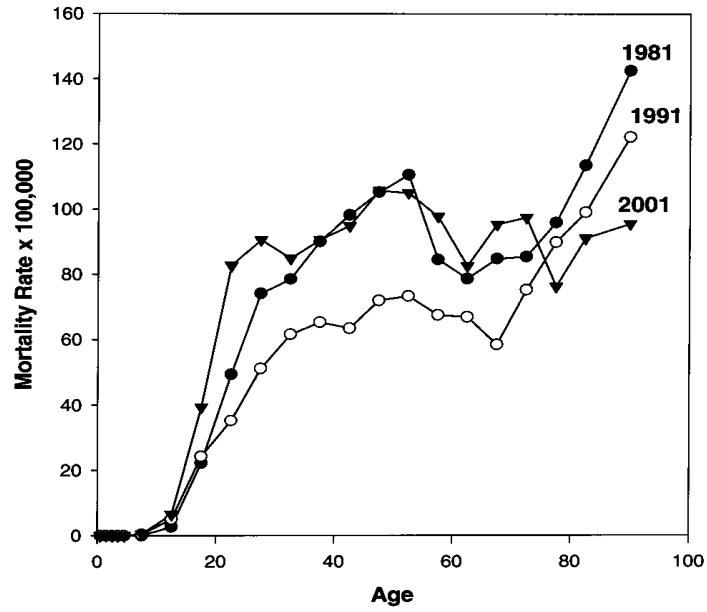


Figure 11

Suicide Mortality Russia, Females

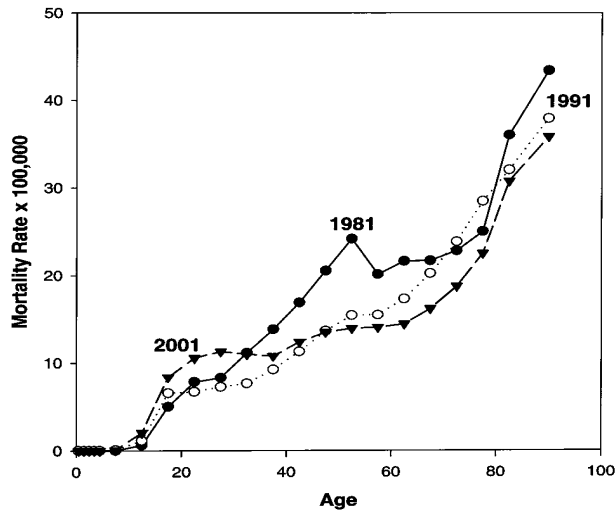


Figure 12

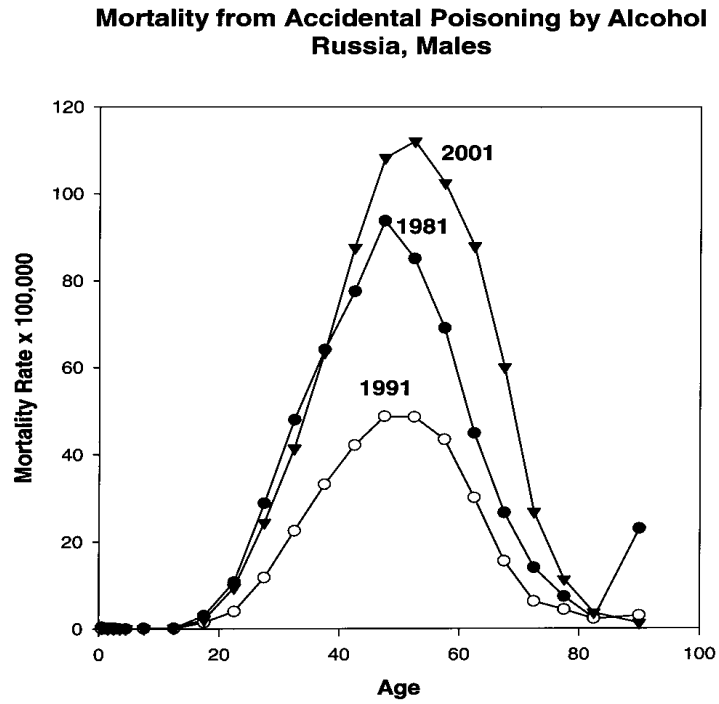


Figure 13

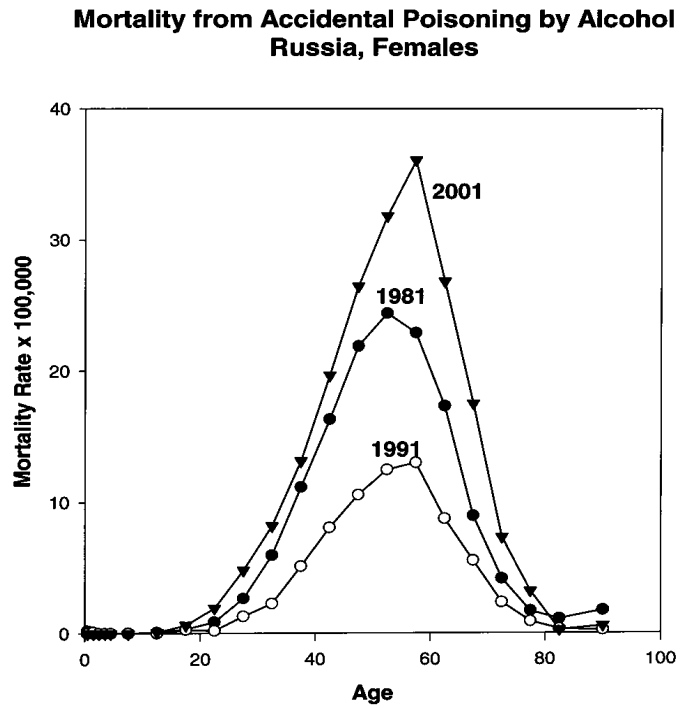


Figure 14