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DEMOGRAPHY

Assessing Data on Mortality from External Causes: Case Study of the Republic of Bashkortostan

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Abstract—The article addresses the poor quality of mortality statistics due to external causes, as figures are understated in Russia and its federal subjects. The actual death rates for homicides, suicides, and alcohol poisonings in the Republic of Bashkortostan have been reviewed based on the suggested models. According to models 1–3, on average, homicide mortality is estimated to be 1.6 times higher for males and 1.4 times higher for females compared to the officially reported data; suicide mortality rates are 1.2 times higher for both genders, while fatal accidental poisonings by alcohol are 1.8 times higher among males and 2.1 times higher among females. Model 4 predicts the gain in homicide mortality to be 3.8 and 3.2 times that for males and females, respectively, and the increase in suicide mortality to be 1.4 times higher for males and 2 times higher for females. Last but not least, mortality from fatal alcohol poisoning is predicted to be 3.0 times and 5.9 times higher than the officially reported rates. The mortality rate from the all so-called external causes is expected to increase by 1.2 times among males and by 1.4 times among females, mainly due to the increase in mortality levels in working-age groups (15–60).

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INTRODUCTION

External causes of death, along with diseases of the circulatory system and neoplasms, are the main contributors to mortality in the population of the Russian Federation. According to the International Statistical Classification of Diseases and Related Health Problems (ICD), Chapter 20, "External Causes of Morbidity and Mortality" contains the following major categories: accidents, including transport accidents; intentional self-harm (suicide); assault (homicides); and events of undetermined intent (EUIs).

Accurately determining the cause of death becomes a key factor when analyzing mortality rates nationally. In particular, this applies to the mortality rate from external causes, which, in practice, understates the actual number of homicides, suicides, and poisoning by alcohol on account of attributing the above to other external causes' codes. For example, EUIs include events when medical and legal experts are unable to make distinction between accident, self-harm, and assault with intent to kill or injure [1]. On average, in Russia, more than half of deaths in this block would most likely be related to homicides; while a considerable part would be taken by suicides and accidental poisoning by chemicals [2, 3]. As reported by Federal Research Institute for Health Organization and Informatics of Ministry of Health of the Russian Federation, the actual number of deaths from homicide among those aged 20–39 exceeds the official statistics by 41.4% for men, and by 31.8% among women; the rates in both groups double in the age range of 40–59. Deaths by suicide show an increase by over 20% for males and by nearly one-third for females [4]. In reality, fatal alcohol poisoning is estimated by A. V. Nemtsov to be 1.65 times that of the state statistics [5]. Mortality from accidents is substantially underrated, especially among seniors. Taking the latter into account, the standardized mortality rate from external causes in the entire population would increase from 211.6 deaths to 220.9 deaths per 100000 in males, and from 50.8 to 55.8 in females [6].

Note that, in Russia, homicide statistics differ, as they are published by two agencies. According to the data from Federal State Statistics Service, there were 21400 homicides in 2012 [7], whereas the Ministry of Internal Affairs of the Russian Federation reported only 17700 [8]. The reason for the discrepancy is that a forensic medical examiner is not able to report a homicide to the Ministry if no investigation has been conducted on the case [3]. The Ministry statistics also excludes involuntary manslaughter, i.e., Article 108 of the Criminal Code of the Russian Federation "Murder Committed in Excess of the Requirements of Justifiable Defense or in Excess of the Measures Needed to Detain a Person Who Has Committed a Crime"; Article 109 "Infliction of Death by Negligence"; part 4 of the Article 111 "Intentional Infliction of Grave Injury," which have involved the death of a victim by negligence.

The report on hidden crime figures published by the Research Institute of the Academy of the Office of the Prosecutor General of the Russian Federation further points out the understatement of the actual numbers of homicides given that "there were 45100 reports of homicides alone filed with law enforcement agencies and 77900 unidentified human remains in the same year. In addition, missing individuals who were not found accounted for 48500 cases." [9]. Citing the same report, homicides numbered 46200 individuals in 2009. [9]. Simultaneously, the Ministry of Internal Affairs informs that, overall, "criminal offences caused 46100 deaths" [8]; the number of murder cases (17700) in this amount may be on the low side as a consequence of overestimating the occurrences of involuntary manslaughter. Thus, according to the report by the Research Institute of the Academy of the Office of the Prosecutor General of the Russian Federation, both the Ministry of Internal Affairs and Federal State Statistics Service do indeed underestimate homicide statistics more than twice.

The proportion of EUIs in mortality due to external causes (ECs) can be viewed as a quality indicator of mortality statistics inasmuch as, aside from misuse, it reflects how accurately and exhaustively a death certificate has been filled in and whether a cause of death has been coded correctly, i.e., the management of mortality reporting and the qualification of medical personnel involved [10].

In general, the mortality statistics from external causes is an indicator of the *value of human life*. A lack of prospects and career opportunities lead to dissatisfaction with life, creating an unsafe environment, which reflects on attitudes towards one's own health and that of others [11]. The implementation of effective social, demographic, legal, anti-alcohol, and other policies would increase the value of human life and health; reduce human losses from premature and avoidable deaths. This can hardly be achieved without research in the field of population health and mortality, which is needed in order to employ a reliable dataset on true mortality levels that result from assaults, accidents, etc. [10, 12].

The present study utilizes data from the Center for Demographic Research at the New Economic School in order to calculate mortality rates not represented on the Federal State Statistics Service website or in the international databases. The rates concerned were calculated based on the figures of the Russian state statistics [13].

A comparative multiregional analysis has been performed based on the standardized mortality rate (SMR) adjusted for the age and gender composition of the population. The direct method of standardization was used for the calculations; the European Standard Population was selected for adjustments. To limit the variations in parameters due to the small number of deaths due to some of the ECs, we utilized the average number of deaths and SMR as of 2011–2012. The two-year average standardized mortality rate was computed using the following formula:

$$T = \sum (D_n^i + D_{n+1}^i) \Big/ (P_n^i + P_{n+1}^i) p^i,$$

where T is the age-standardized mortality rate; D_n^i and D_{n+1}^i are the number of deaths in the years n and $n + 1$, respectively, in age group i; P_n^i and P_{n+1}^i are the mid-year population counts in the years of n and $n + 1$, respectively, in age group i; and p^i is the proportion of age group i in the standard population.

MORTALITY DUE TO EXTERNAL CAUSES IN RUSSIA AND THE WORLD

While the rate of mortality from external causes has been steadily declining in EU-27 countries since the 1980s, in Russia, those rates fluctuated. Some years saw the gap between the European Union and Russia grow, while at some points the gap reduced. The latest disparity was observed in 1998–2003, when the death rate in Russia was seven times higher than the European rate for men and four times that for women. After 2002–2003, although the gap decreased, it remains large; mortality due to ECs was five times that for men and three times that for women in 2010 (Fig. 1) [16]. Compared to other European countries, Russia shows excess mortality due to the particular external causes, e.g., suicide mortality rates by suicide were 3–4 times higher among males and 1.5–2 times higher among females. The homicide rate was ten times higher than the European levels for men and even more than ten times higher for women [14]. As a whole, Russia ranked 37th (in descending order) among the WHO's 172 Member States with a standardized rate of mortality from external causes of 103 individuals per 100000 people. Our immediate neighbors were the countries of Africa, Asia, and South America: Kenya, South African Republic, Myanmar, Pakistan, Venezuela, and Bolivia (Fig. 2) [15]. Of the age groups specified in the WHO database Health For All (HFA), the biggest differences were observed for males aged 64 and older and females aged under 64 in 2010 [16].

With that, SMRs of Russia and EU-27 had the highest ratio of up to 6.5 : 1 for males younger than 64 due to excess mortality in the working age groups, and for females aged 4 and under (Table 1).

MORTALITY DUE TO EXTERNAL CAUSES IN FEDERAL SUBJECTS OF RUSSIA

In 1990–2012, in Russia, the proportion of homicides and suicides in the total number of deaths from external causes decreased by 2.7% and 3.6%, respectively, for men and by 2.8% and 7.0% for women. However, it can hardly be seen as sufficient evidence of an upward trend, since the proportion of EUIs (where homicides and suicides are most likely to fall) grew by 12% for both genders over the same period. For example, EUI-related deaths accounted for 8.3% for both genders in 1990 and, by 2012, their proportion exceeded 20% (Fig. 3) [7]. Causes of EUIs factored in

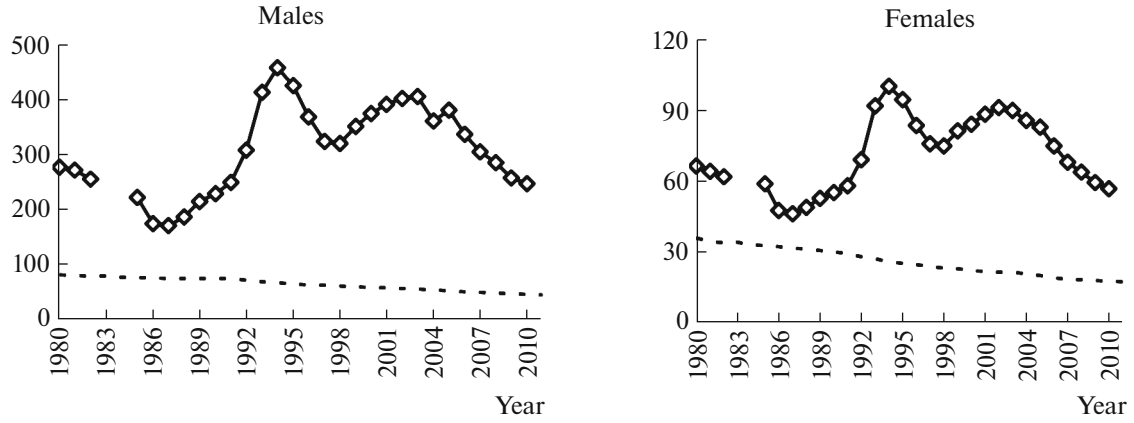

Fig. 1. Standardized mortality rate from external causes in Russia (—◇—) and in EU-27 countries (-----), 1980–2011, per 100000 people of the corresponding gender.

Fig. 2. Standardized mortality rate from external causes globally, 2012, per 100000 people of the corresponding gender □ <40, ■ 40–69, ■ 70–99, ■ >100.

when analyzing mortality due to homicides and suicides, and the upward trend is not observed inasmuch as the cumulative proportion of all three categories increases from 39% for both genders in 1990 to 45% and 41% for males and females, respectively, in 2012.

The standardized mortality rate from EUI has risen by eight times among males and seven times among females in the last half-century [10] and reached 44 individuals per 100000 people for males and 10 individuals per 100000 people for females in 2012. In the Republic of Bashkortostan, the death rate due to EUIs constituted 54 individuals among males and 11 individuals among females per 100000 people in 2011–2012. Bashkortostan occupied the 33rd position in descending order of SMRs among 83 subjects of Russia in both male and female ratings. Significant differences were observed between federal subjects. Sakhalin oblast rated first with SMR values of 198 and 41 individuals per 100000 people for males and females, respectively. The top three also included Ryazan and Magadan oblasts for males (122 individuals and 106 individuals per 100000 people, respectively); and the Republic of Tyva and Ryazan oblast among females (28 individuals each per 100000 people). Republics of the North Caucasus, such as Ingushetia, Dagestan,

Table 1. Standardized mortality rates from external causes of death in Russia and EU-27 in 2010, age- and gender-specific, per 100000 people

Age group, yrs	Russia	EU-27	Russia	EU-27
	Males		Females	
All ages	246	46	57	18
0–4	30	5	22	4
5–19	45	10	19	4
0–64	228	35	51	11
65 and above	393	136	106	80

Source: [15].

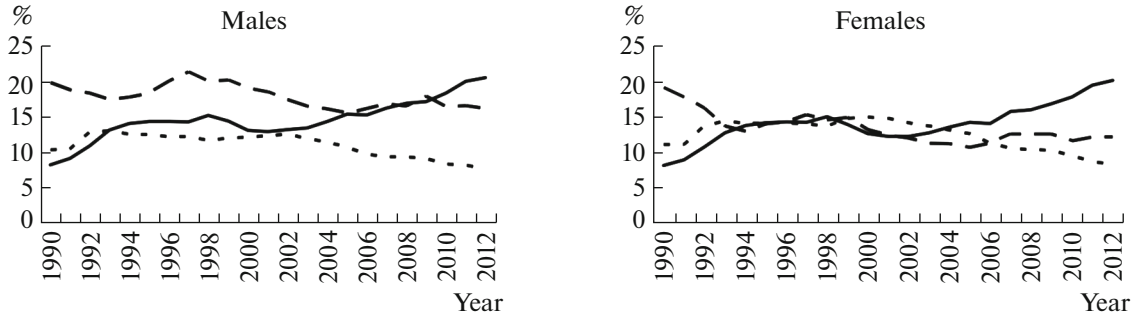

Fig. 3. Proportions of: EUI (—); homicides (-----); and suicides (– – –) in the total number of external causes' deaths in Russia in 1990–2012.

Adygea, and Kabardino-Balkaria were at the other extreme: 2, 5, 6, and 7 men per 100 000 people, respectively; and the same Republics in a slightly different order for women: 0 in both Ingushetia and Dagestan, 1 in both Adygea and Kabardino-Balkaria per 100 000 people. Penza oblast held the fifth best SMR, that is 9 and 2 individuals per 100 000 people among males and females, respectively.

ASSESSING THE EVENT OF UNDETERMINED INTENT MORTALITY DATA IN THE REPUBLIC OF BASHKORTOSTAN USING THE ANALOG METHOD

In order to utilize the method, we must select a federal subject where the standardized mortality rate from EUIs is lower than in the Republic of Bashkortostan and the SMR from all external causes and from "Other External Causes of Accidental Injury" are approximately equal. As an additional criterion for selecting the reference region, we used similar values of death rates that result from Unknown Causes of Mortality (code 244 by Shortlist of the ICD) and Other Symptoms and Ill-Defined Causes (code 245 by Shortlist of the ICD) of Chapter 18 "Symptoms, Signs, and Abnormal Clinical and Laboratory Findings Not Classified Elsewhere" (below, "Symptoms, Signs, ..."). The preliminary analysis determined Penza oblast to be the optimal region for comparison (Table 2).

Table 2 reveals that high mortality rates from EUI are not characteristic of the Republic of Bashkortostan only, but are experienced nationally; with that, the rates of deaths attributed to the entire section of "External causes of mortality" in both subject approximately equal to those across the country.

Below are the absolute numbers of deaths that occurred from external causes and events of undetermined intent in the Republic of Bashkortostan and Penza oblast (Table 3). EUI deaths account for 20.9% of the external causes among men in the Republic of Bashkortostan, 5.5 times that of Penza oblast (3.8%). The proportion of EUIs for women is six times (21.3%) in the Republic of Bashkortostan that of Penza oblast (3,4%).

As already mentioned, the EUI category covers events where no sufficient information is available to distinguish between accidents, self-harm, and assaults. These cases of death do occur due to objective reasons; however, the large spread of mortality levels from those events may cause researchers' doubt about the validity of coding deaths in federal subjects of Russia.

We accept the hypothesis that, in Penza oblast, we observe an allowed limit of mortality rate due to EUIs that is much lower than the rate in both the Republic of Bashkortostan and, on average, in Russia in 2011–2012. Below, we consider the structure of EUIs and establish other categories of ECs that might be hidden in the block. Figure 4 [13] shows two models of allocating deaths within ECs for the Republic of Bashkortostan and Penza oblast.

Table 4 presents the yields of standardized mortality rates. In the models, EUI-related death rates in Bashkortostan are equated to the analogous rates in Penza oblast; the remaining difference is distributed between other categories of external causes.

The first model assumes that the understated deaths from EC could be categorized as an EUI; hence, the most significant gain in mortality occurs in the categories of accidental poisoning by alcohol and suffocations, the SMRs of which are almost three times those in Penza oblast. However, in this model, high SMRs for suicides for both genders, assaults for men, and accidental drowning for women remain unchanged at 1.5 times higher than those in Penza oblast. The second model prorates the excess deaths from EUI to the selected categories of EC.

In the first case, we observe an increase in SMR due to accidental alcohol poisoning from 11 to 30 individuals among males and from 2 to 5 individuals among females per 100 000 people of the corresponding gender; due to accidental suffocations from 4 to 12 individuals for males and from 1 to 3 individuals for females. In addition, men gain in mortality due to accidental exposure to smoke, fire and flames (from 5

Table 2. Standardized mortality rates from a variety of causes in the Russian Federation, Penza oblast, and the Republic of Bashkortostan; gender specific, 2011–2012 average, per 100000 people of the corresponding gender

Cause of death	Males					Females				
	Russian Federation	Penza obl.	Republic of Bashkortostan	min	max	Russian Federation	Penza obl.	Republic of Bashkortostan	min	max
Chapter "External causes of morbidity and mortality"	215	231	254	50 (Chechen Rep.)	545 (Rep. of Tyva	52	48	53	13 (Chechen Rep.)	212 (Rep. of Tyva)
Event of undetermined intent	44	9	54	2 (Rep. of Ingushetia)	198 (Sakhalin obl.)	10	2	11	0 (Reps. of Dagestan, Ingushetia)	41 (Sakhalin obl.)
Other external causes of accidental injury	22	19	21	3 (Chechen Rep.)	89 (Samara obl.)	5	4	5	1 (Chechen Rep.)	22 (Samara obl.)
Chapter "Symptoms, Signs, ..."										
Unknown cause of mortality	44	40	40	0 (Khabarovsk krai)	156 (Nizhni Novgorod obl.)	12	8	16	0 (Khabarovsk krai, Orenburg obl.)	93 (Chukotka Aut. Okrug)
Other Symptoms and Ill-Defined Causes	1	0	0	0 (50 subjects)	17 (Rep. of Ingushetia)	0	0	0	0 (67 subjects)	11 (Chechen Rep.)

Source: calculated based on [13].

Table 3. Absolute number of deaths from all causes, external causes, and events of undetermined intent; proportion of external causes in the total number of deaths, proportion of events of undetermined intent in the total number of externally caused deaths in the Republic of Bashkortostan, Penza oblast, and Russian Federation, 2011–2012 average

Cause of death	Republic of Bashkortostan		Penza oblast		Russian Federation	
	Males	Females	Males	Females	Males	Females
All causes	29042	24973	10671	10075	987374	928654
External causes	5055	1242	1597	435	151324	45242
Events of undetermined intent	1056	264	61	15	30752	8968
Proportion of external causes in total number of deaths, %	17.4	5.0	15.0	4.3	15.3	4.9
Proportion of events of undetermined intent in external causes, %	20.9	21.3	3.8	3.4	20.3	19.8

Source: calculated based on [13].

to 12), and falls (from 7 to 15). Women demonstrate an increase in deaths resulting from accidental falls, i.e., from 2 to 3 individuals per 100000 females.

The second scenario considerably increases the already high level of death rates by suicide from 73 to 89 males and from 10 to 12 females per 100000 people of the corresponding gender in the Republic of Bashkortostan. SMR for homicides rises from 17 to 21 individuals among men and from 5 to 6 among women; SMR for transport accidents increases from 37 to 45 for males and from 11 to 14 for females (Table 4).

In 2011, Russia improved the mortality reporting subdividing the EUI block. Instead of tabulating a cause under the single category Event of Undetermined Intent, 13 categories of such injuries were introduced. Differences in SMRs from EUI between the two federal subjects are shown in Table 5.

As follows from Table 5, the Republic of Bashkortostan exhibits mortality rates for both genders in a multifold fashion in EUI categories such as Other Poisoning (storage for the dark figure of accidental poisoning by narcotics and alcohol, and suicides); Hanging, Strangulation, and Suffocation (storage for suicides); Contact with Sharp and Blunt Objects (storage for homicides); Falling, Jumping, or Being Pushed from a High Place (storage for suicides) [4]. The above supports the reasoning that cases of the homicides,

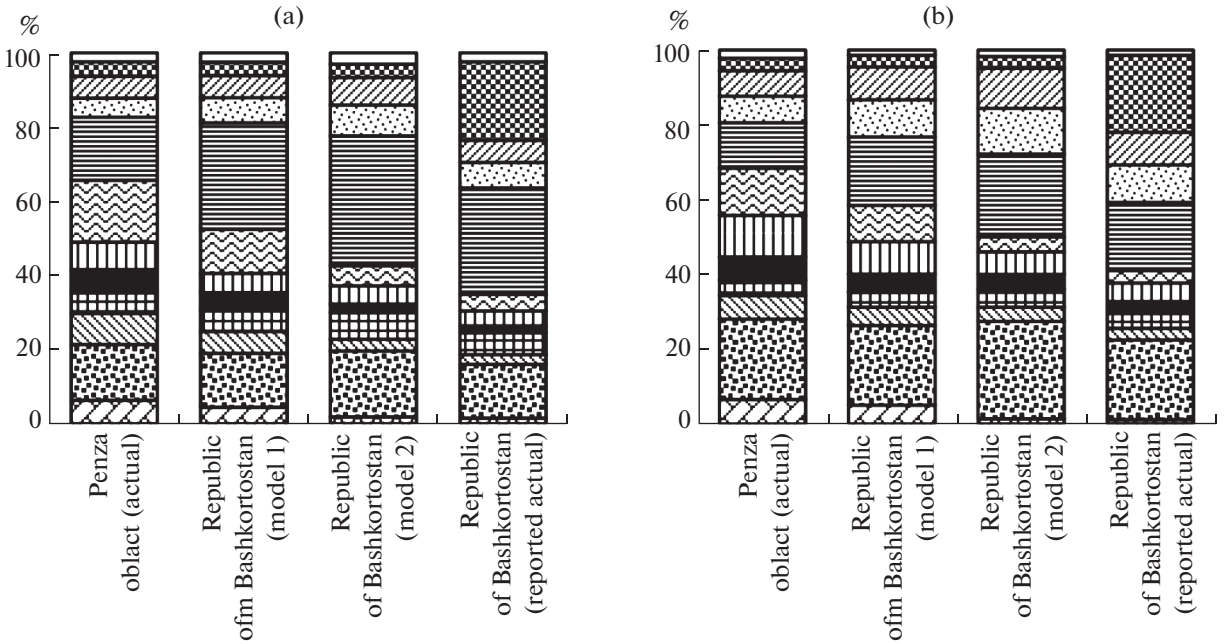

Fig. 4. Structure of mortality from external causes: (a) males; (b) females in the Republic of Bashkortostan, 2011–2012 average: ▨ suffocation; ⊡ transport accidents; ▧ falls; ⊞ drowning; ■ accidental exposures to smoke, fire, and flame; ▥ other poisonings; ⊠ alcohol poisoning; ▤ suicides; ⊡ homicides; ▨ exposure to excessive natural cold; ⊠ EUI; □ other EC.

Table 4. Standardized mortality rates from external causes in Russian Federation, Penza oblast, and the Republic of Bashkortostan, gender-specific, 2011–2012 average, per 100 000 people of the corresponding gender

Cause of death	Males					Females				
	Russian Federation	Penza obl.	Republic of Bashkortostan model1	Republic of Bashkortostan model2	Republic of Bashkortostan reported actual	Russian Federation	Penza obl.	Republic of Bashkortostan model 1	Republic of Bashkortostan model 2	Republic of Bashkortostan reported actual
External causes	215	231	254	254	254	52	48	53	53	53
Suffocation	7	15	12	5	4	2	3	3	1	1
Transport accidents	30	35	37	45	37	9	10	11	14	11
Falls	9	19	15	8	7	3	3	3	2	2
Drowning	10	13	15	18	15	2	2	2	3	2
Accidental exposures to smoke, fire and flames	8	14	12	6	5	2	3	3	2	2
Other poisoning	14	17	13	13	10	3	5	5	3	3
Alcohol poisoning	17	39	30	14	11	4	6	5	2	2
Suicides	35	39	73	89	73	6	6	10	12	10
Homicides	17	12	17	21	17	5	4	5	6	5
Exposure to excessive natural cold	13	14	15	19	15	3	3	5	6	5
Events of undetermined intent	44	9	9	9	54	10	2	2	2	11
Other External causes	10	5	6	8	6	2	1	1	1	1

Source: calculated based on [13].

Table 5. SMR from EUI in the Republic of Bashkortostan and Penza oblast, gender-specific, 2011–2012 average, per 100000 people of the corresponding gender

Category of the Event of Undetermined Intent	Penza oblast	Republic of Bashkortostan	Gain, times	Penza oblast	Republic of Bashkortostan	Gain, times
	males			females		
Poisoning by and exposure to drugs	0.1	0.1	1.6	0.0	0.0	–
Poisoning by and exposure to narcotics and psychodysleptics	0.1	0.3	4.2	0.0	0.0	–
Poisoning and exposure to alcohol	0.0	0.5	–	0.0	0.1	–
Other poisoning	0.1	5.9	40.8	0.0	1.6	35.7
Hanging, strangulation and suffocation	0.4	14.5	37.6	0.1	2.2	29.0
Submersion and drowning	0.1	0.8	6.5	0.0	0.2	–
Firearm discharge	0.2	0.7	4.4	0.0	0.0	–
Exposure to smoke, fire and flames	0.0	1.5	–	0.0	0.5	–
Contact with sharp and blunt objects	3.8	23.7	6.2	0.7	4.5	6.6
Falling, jumping, or being pushed from a high place	0.2	3.8	17.4	0.0	1.6	46.0
Crashing of motor vehicle	0.0	0.0	–	0.0	0.0	–
Specified and unspecified events	4.2	1.8	0.4	0.8	0.2	0.2
Other	0.0	0.3	–	0.0	0.1	–

Source: calculated based on [13].

suicides, and alcohol poisonings that occur in the Republic are hidden in the EUI block.

Thus, according to model 1, in the Republic of Bashkortostan, the actual mortality rate from alcohol poisoning is likely to rise 2.6 times for men and three times for women; 2.9 times and 4.3 times due to accidental drowning, respectively; and 2.3–2.4 times and 1.5–1.6 times due to falls and accidental exposures to fire, respectively. In model 2, the mortality rate from all categories of external causes increases by 1.2 times.

REVIEWING MORTALITY DATA OF EVENTS OF UNDETERMINED INTENT BASED ON HOW AN INCIDENT OCCURRED

Table 6 outlines the structure of homicides and suicides by the method of commitment in the population aged 20–59 in the Russian Federation. We assume the given patterns to be applicable to all age groups considering the fact that the proportion of EUI-related deaths was nearly 80% among males aged 20–59 and 70% among females in the Republic of Bashkortostan in 2011–2012. With that, it is equally important to recognize that data on prevalence methods of committing homicides and suicides would only be reliable if not influenced by mortality rates from EUI. However, we believe that the latter is obviously a factor in the distribution of methods of committing an incident (the extent of this influence requires a separate study), inasmuch as the EUI caused 24000 deaths among males aged 20–59 accounting for 71% of a total number of homicides and suicides for males in the age group, and 5000 deaths or 76% for females in 2010.

Now, we evaluate the structure of EUI based on Table 6. The EUI would not only cover for homicides and suicides but also for different types of accidents. However, for calculation purposes, we assume homicides include all deaths of undetermined intent resulting from contact with sharp and blunt objects, firearm discharge, and specified and unspecified injuries. We classify all events of undetermined falls and suffocations among people aged 5 and older as suicides. We

Table 6. Structure of homicides and suicides in population aged 20–59 by the method of committing an incident in Russia, 2010

Method of committing an incident	Homicides				Suicides			
	males		females		males		females	
	number of deaths	%	number of deaths	%	number of deaths	%	number of deaths	%
Contact with sharp and blunt objects	9651	80.4	2549	77.4	666	3.1	82	2.5
Firearm discharge	1059	8.8	126	3.8	1065	5.0	18	0.5
By bodily force	406	3.4	113	3.4				
Suffocation/Hanging	399	3.3	320	9.7	18729	87.6	2588	78.6
By unspecified means	239	2.0	73	2.2	9	0.0	3	0.1
Poisoning	21	0.2	13	0.4	401	1.9	381	11.6
Pushing/Jumping from a high place	7	0.1	5	0.2	298	1.4	168	5.1
Other methods	224	1.9	94	2.9	214	1.0	53	1.6
Total	12006	100.0	3293	100.0	21382	100.0	3293	100.0

Source: [4].

classify deaths caused by exposure to smoke, fire and flame, and alcohol poisoning of undetermined intent and other poisonings among people aged 20 and older as accidental poisoning by alcohol.

In the present assumption, we proceed based on the possibility of various deaths that cancel each other out in category. On the one hand, a number of undetermined falls may be homicides; likewise, a certain number of contacts with sharp and blunt objects of undetermined intent may be suicides. On the other hand, a number of tabulated homicides and suicides might have been accidents, while a few accidental poisonings might have been suicides or accidental exposures to fire might have been homicides. Taking into account the foregoing spread, we build the third model of mortality from external causes in the Republic of Bashkortostan (Table 7, Fig. 5) [13].

The given approach in model 3 predicts the following results: among males in Bashkortostan homicides account for 48% of the EUI-related deaths, suicides for 34% of the EUI-related deaths, accidental poisoning by alcohol for 14%, and the remaining 3% of the EUI deaths are due to other external causes. The proportion of homicides, suicides, and alcohol poisonings in the EUI category for females constitute 43, 33, and

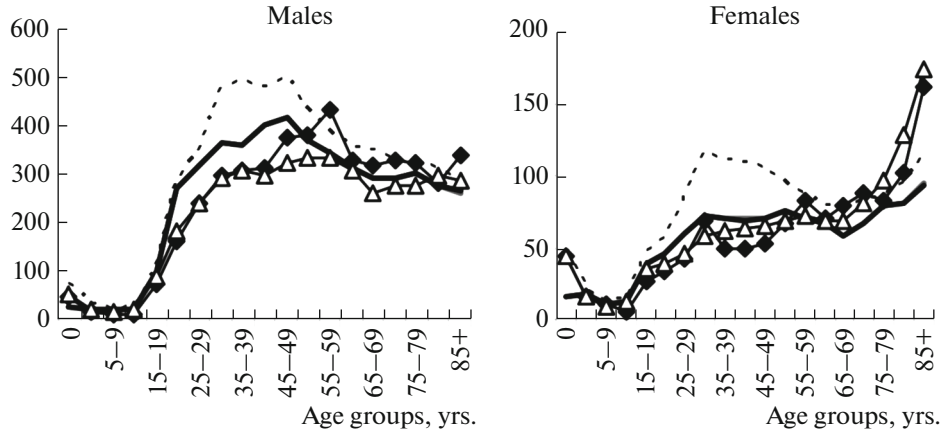

Fig. 5. Age-standardized mortality rates from external causes among males and females in the Republic of Bashkortostan, 2011–2012 average, per 100000 people of the corresponding gender: –△– Russian Federation; –◆– Penza oblast; ▬ Republic of Bashkortostan; ▬ Republic of Bashkortostan predicted (model 3); ----- Republic of Bashkortostan predicted (model 4).

Table 7. Standardized mortality rates from some of the external causes in Russian Federation, Penza oblast, and the Republic of Bashkortostan, gender-specific, 2011–2012 average, per 100000 people of the corresponding gender

Cause of death	Russian Federation		Penza oblast		Republic of Bashkortostan model 1		Republic of Bashkortostan model 2		Republic of Bashkortostan model 3		Republic of Bashkortostan model 4		Republic of Bashkortostan model reported actual	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
External causes	215	52	231	48	254	53	254	53	254	53	302	74	254	53
Accidental poisoning by alcohol	17	4	39	6	30	5	14	2	19	4	34	10	11	2
Suicides	35	6	39	6	73	10	89	12	91	13	106	19	73	10
Homicides	17	5	12	4	17	5	21	6	43	10	66	17	17	5
Events of undetermined intent	44	10	9	2	9	2	9	2	0	0	0	0	54	11
Other external causes	102	27	132	31	125	31	121	31	101	26	98	27	99	26

Source: calculated based on [13].

19%, respectively; the proportion of other external causes is being 5%.

However, even provided that the entire EUI category is distributed into assault-related deaths, i.e., 97% for men and 95% for women, the above review of homicides, suicides, and alcohol poisoning rates can hardly be asserted to reveal the upper bound of the predicted actual rates. Along with the EUI codes, deaths caused by assaults would be tabulated under Other External Causes of Accidental Injury and Unspecified Falls, as well as Unknown Causes of Mortality and Other Symptoms and Ill-Defined Causes. The given categories of causes incorporated, model 4 indeed provides the estimated upper boundary of the assault-related deaths in Bashkortostan. To build the model, death attributed to the categories of the chapter "Symptoms, Signs, ..." have been distributed among homicides, suicides, and alcohol poisonings proportionate to their age- and gender-specific shares in the EUI from model 3. Additionally, death rates from alcohol poisoning have been adjusted to include the cases coded to the categories Alcohol Cardiomyopathy and Cardiomyopathy, Unspecified from Chapter 9 "Diseases of the Circulatory System."

Thus, as determined in model 4, the actual homicide rate among males could amount to 66 individuals per 100000 people as opposed to 17 individuals sourced from the official statistical data, i.e., the rate increases by 3.8 times for males and by 3.2 times for females (17 individuals as opposed to 5 individuals per

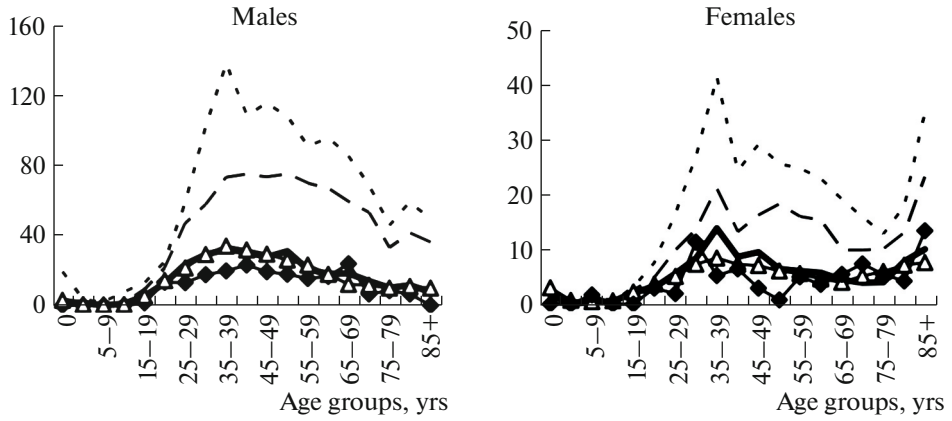

Fig. 6. Age-standardized mortality rates for homicides among males and females in Republic of Bashkortostan, 2011–2012 average, per 100000 people of the corresponding gender: –△– Russian Federation; –◆– Penza oblast; ▬ Republic of Bashkortostan; – –– Republic of Bashkortostan predicted (model 3); ----- Republic of Bashkortostan predicted (model 4).

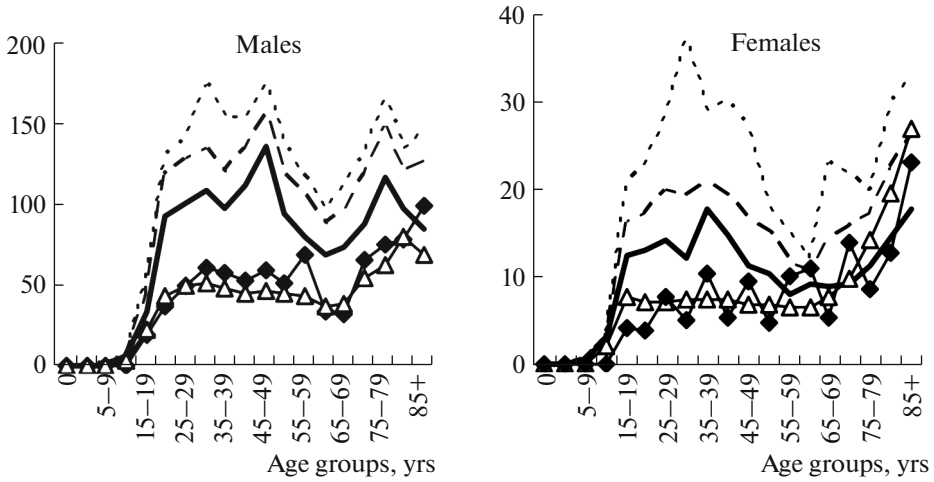

Fig. 7. Age-standardized mortality rates for suicides among males and females in Republic of Bashkortostan, 2011–2012 average, per 100000 people of the corresponding gender, calculated based on [13]: –△– Russian Federation; –◆– Penza oblast; ▬ Republic of Bashkortostan; – – – Republic of Bashkortostan predicted (model 3); ----- Republic of Bashkortostan predicted (model 4).

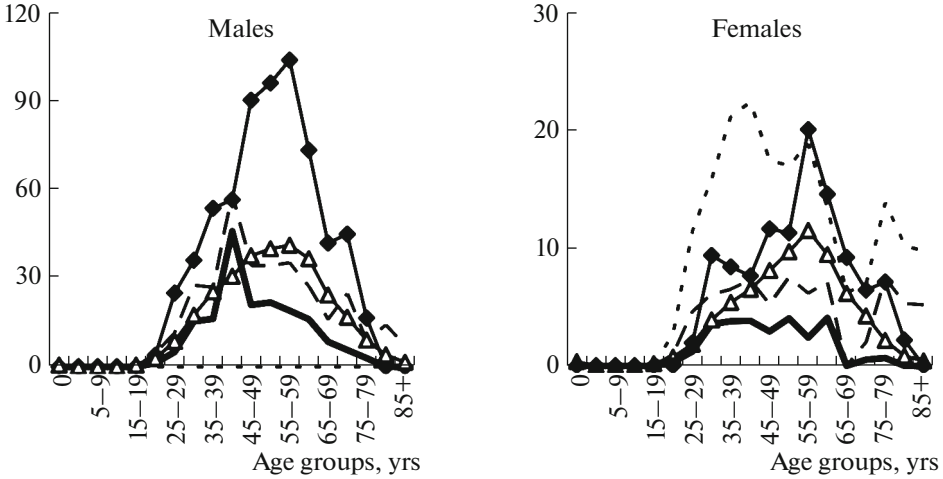

Fig. 8. Age-standardized mortality rates from alcohol poisonings among males and females in the Republic of Bashkortostan, 2011–2012 average, per 100000 people of the corresponding gender: –△– Russian Federation; –◆– Penza oblast; ▬ Republic of Bashkortostan; ––– Republic of Bashkortostan predicted (model 3); ----- Republic of Bashkortostan predicted (model 4).

100000) in the Republic of Bashkortostan. If we consider the same model for suicides, the rate could be 1.4 times that of officially reported among men and could double for women. The death rate from accidental poisoning by alcohol may increase 3 times the official statistics for men (34 as opposed to 11 individuals per 100000 men) and nearly 6 times for women (10 as opposed to 1.7 individuals per 100000 women).

It is worth noting that the mortality rate from external causes remains unchanged in the first three models, since homicides and suicides are in fact manipulated into a hidden crime figure by being transferred to the EUI category within External Causes of Morbidity and Mortality (in Fig. 6 [13] the line of age-standardized mortality rate from external causes coincides with the values from model 3). Model 4 considers the cases of deaths attributed to chapters "Symptoms, Signs, ..." and "Diseases of the Circulatory System" and implies an increase in mortality from external causes from 254 to 302 individuals per 100000 people for men and from 53 to 74 individuals per 100000 people for women in the Republic of Bashkortostan; that is, the mortality from external causes is 1.2 times that for males and 1.4 times that for females in the given model.

Figs. 6–8 [13] show the age-standardized mortality rates from the selected categories of external causes. The so-called "hump of injury-related mortality" becomes even more pronounced in models 3 and 4.

Table 8. Standardized mortality rates from selected external causes in the Republic of Bashkortostan (Republic of Bashkortostan), age- and gender-specific, 2011–2012 average, per 100000 people of the corresponding gender

Cause of death	Age group, yrs	Males Republic of Bashkortostan			Females Republic of Bashkortostan		
		model 3	model 4	reported actual	model 3	model 4	reported actual
External causes	0–14	21	29	21	13	18	13
	15–59	326	391	326	63	91	63
	60+	296	338	296	69	84	69
Accidental poisoning by alcohol	0–14	0	0	0	0	0	0
	15–59	26	46	16	5	14	2
	60+	20	34	9	4	10	1
Suicides	0–14	2	3	2	1	1	1
	15–59	118	138	95	17	25	13
	60+	108	121	83	15	20	10
Homicides	0–14	1	5	1	1	1	0
	15–59	55	84	24	13	22	7
	60+	55	76	15	13	20	5

Source: calculated based on [13].

In model 4, assault-related deaths are further centered in the working-age population following the redistribution of deaths coded to unknown causes and other ill-defined causes' categories of the chapter "Symptoms, Signs, ...," as well as deaths from Alcohol Cardiomyopathy or Cardiomyopathy, Unspecified in the chapter "Diseases of the Circulatory System." The model shows an increase in mortality from external causes by 64 individuals among males and by 27 individuals among females in the age group 15–59 over the SMR figures reported by the Republic of Bashkortostan. After all, the mortality rate amounts to 391 males and 91 females per 100000 people of the corresponding gender (Table 8). In the given age group, the number of deaths from alcohol poisoning grows by 30 individuals for men and by 12 individuals for women; and the number of suicides increases by 43 and 13 individuals among males and females, respectively.

Most of the gain in mortality is estimated to fall on homicide deaths in the age groups of 15–59 and aged 60 and above. Here, the numbers rise by 61 individuals among males and 15 individuals among females per 100000 people. The growth in mortality rates due to alcohol poisoning in the ages of 60 and older for both genders should not be overlooked either, as well as an increase in the homicide-related deaths among males under the age of 15.

CONCLUSIONS

The paper attempted to determine the actual mortality rates resulting from homicides, suicides, poisoning by alcohol, and from the entire section "External Causes of Death" in the Republic of Bashkortostan. The first three models of mortality were built based on redistribution of deaths coded to the category of EUIs in the chapter "External Causes of Death" (models 1–3). The fourth model was built following the redistribution of deaths coded to such categories as Other External Causes of Accidental Injury and Unspecified Falls, as well as coded to some of the categories of the sections "Symptoms, Signs, ..." and "Diseases of the Circulatory System." *As a result, according to models 1–3, the homicide death rate is estimated on average to be 1.6 and 1.4 times that officially reported for males and females, respectively; suicide mortality rate estimates on average 1.2 times that for both genders; and the number of deaths from accidental poisoning by alcohol might on average exceed the officially reported rates for men by 1.8 times and that for women by 2.1 times*. Model 4 estimates the gain in homicide mortality to be 3.8 and 3.2 times that for males and females, respectively; the suicide mortality to be 1.4 times higher for men and 2 times higher for women; and death rates from accidental poisoning by alcohol to exceed the official statistics 3 and 5.9 times higher, respectively. The mortality rate that results from all external causes increases by 1.2 times among males and 1.4 times among females, mainly due to the rise in mortality in working-age groups (15–60).

Importantly, whereas the obtained figures should be considered an estimate, we believe they might better reflect facts on the ground than the official statistics.

Thus, the poor quality of the available mortality statistics is evinced by the large number of deaths being misallocated to the category Events of Undetermined Intent in Chapter 20 "External Causes of Morbidity

and Mortality" and to Unknown Causes of Mortality in Chapter 18 "Symptoms, Signs, ..." This leads to inadequate approaches in social policies and prevents social issues that must be properly addressed on a national scale.

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