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Research Article

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Géraldine Duthé
Michel Guillot
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Géraldine Duthé[1]
Michel Guillot[2]
France Meslé[3]
Jacques Vallin[3]
Irina Badurashvili[4]
Mikhail Denisenko[5]
Natalia Gavrilova[6]
Karine Kuyumjyan[7]
Liudmila Torgasheva[8]

Abstract

BACKGROUND
While the health crisis in the former USSR has been well-documented in the case of Russia and other northern former Soviet republics, little is known about countries located in the southern tier of the region, i.e., the Caucasus and Central Asia.

OBJECTIVE
This paper presents new mortality information from two Caucasian countries, Georgia and Armenia. Results are compared with information from two relevant countries previously examined in the literature, Kyrgyzstan and Russia.

METHODS
Using official statistics (with adjustments when necessary), we compare adult mortality patterns in the four countries since 1979, for all causes and by cause for the recent period. For Kyrgyzstan results are presented by ethnicity, as its mortality levels have been impacted by its large Slavic population.

[1] Institut National d'Études Démographiques, France. E-Mail: geraldine.duthe@ined.fr.
[2] University of Pennsylvania, USA, and Institut National d'Études Démographiques, France.
[3] Institut National d'Études Démographiques, France.
[4] Georgian Center of Population Research, Georgia.
[5] National Research University "Higher School of Economics," Russia.
[6] University of Chicago, USA, and WHO Collaborating Centre, Department of Statistical Analysis of Population Health, Federal Research Institute for Health Organization and Informatics, Ministry of Health of the Russian Federation, Russia.
[7] National Statistical Service, Republic of Armenia.
[8] National Statistical Committee, Kyrgyz Republic.

RESULTS
Adult mortality patterns in Armenia and Georgia have been more favorable than in Russia. This appears to be due to a large extent to lower mortality from alcohol-related causes. Mortality patterns in these Caucasian republics resemble those observed in Kyrgyzstan, especially when considering the native portion of the population.

CONCLUSIONS
As far as mortality is concerned, Armenia and Georgia have weathered the collapse of the Soviet Union better than Russia. These results document a distinct southern tier pattern of adult mortality in the former Soviet Union.

CONTRIBUTION
This article enriches our understanding of the health crisis in the former Soviet Union by bringing new information from two lesser-known countries and further documenting the scale of heterogeneity in mortality experiences across this vast region.

1. Introduction

This paper presents new mortality information from two former Soviet republics of the Caucasus region, Georgia and Armenia. Results are presented in comparison with two relevant countries that have been previously examined in the literature: Kyrgyzstan, a former Soviet republic of Central Asia, and Russia. Central Asia and the Caucasus are two distinct regions, but together they form the southern tier of the former Soviet Union (Figure 1). The purpose of the comparison with Kyrgyzstan is thus to uncover potential parallels among countries of the southern tier. Russia, as the largest and most influential country of the former Soviet Union, represents another natural comparison country.

These comparisons are made within the context of the major health crisis that the former Soviet region has been undergoing in recent decades. Russia, by far the largest and most-studied former Soviet republic, has experienced health deteriorations for several decades, and progress only resumed in 2005 (Grigoriev et al. 2014). These deteriorations have been attributed mainly to cardiovascular diseases and external causes of death (Shkolnikov, Meslé, and Vallin 1996; Meslé et al. 2003; Meslé 2004). High consumption of strong alcoholic beverages among adults, especially males, has played an important role (Shkolnikov et al. 2004; Leon et al. 2007; Zaridze et al. 2009a). Baltic countries have also experienced mortality deteriorations, but impressive progress has been observed since the late 1990s, especially in Estonia (Jasilionis et al. 2011). Much less is known about former Soviet republics of the southern tier, i.e., republics of the Caucasus and Central Asia. It has been shown that adult mortality patterns in Kyrgyzstan have been more favorable than in Russia, in part because of cultural and religious differences and their impact on patterns of alcohol consumption (Guillot 2007; Guillot et al. 2013). Our paper contributes to this literature by providing new information on two republics of the Caucasus in a comparative perspective.

Figure 1: Location of Armenia, Georgia, Kyrgyzstan, and Russia

According to the United Nations (2015), life expectancy levels for both sexes combined in 2010–2015 in Armenia and Georgia reached almost 75 years, whereas it was only around 70 years in Russia and Kyrgyzstan. This advantage could be due in part to the fact that Armenia and Georgia, unlike Kyrgyzstan and, of course, Russia, do not have a substantial share of ethnic Russians in their respective populations.[9] It has indeed been previously documented that the share of ethnic Russians in a republic can to a large extent explain why some republics have higher life expectancy than others, as ethnic Russians tend to experience excess mortality wherever they reside (Dobrovolskaya 1990; Darsky and Andreev 1991; Andreev, Dobrovolskaya, and Shaburov 1992; Brainerd 1998; Guillot, Gavrilova, and Pudrovska 2011). Lower mortality in Armenia and Georgia could also be due to differences in epidemiological

[9] Within countries, besides the titular ethnic group, people of Slavic origin (mostly Russians but also Ukrainians and Byelorussians) are also present. This reflects a history of migration dating back to the imperial period and which intensified during the Soviet era. Conversely, after independence many Slavs who had settled in Central Asia or in the Caucasus returned to Russia or the Ukraine (Tishkov, Zayinchkovskaya, and Vitkovskaya 2005). The proportion of remaining Slavs differs from one country to another and has decreased over time. According to the 1979 Soviet census there were 3% of Slavs in Armenia, 8% in Georgia, and almost a third (29%) in Kyrgyzstan. Circa 2000 the proportions of Slavs became very low in Armenia and Georgia, and was around 14% in Kyrgyzstan. This proportion has decreased to 6%, according to the last census conducted in Kyrgyzstan in 2009.

patterns among native ethnic groups in these two republics, not only by comparison with ethnic Russians but also by comparison with native ethnic groups in Central Asia. Given the importance of alcohol consumption in explaining the health crisis in former Soviet Republics, Georgia's and Armenia's distinct alcohol culture, with more emphasis on the consumption of local wine and cognac and less emphasis on binge drinking like in the case of Russia, could explain in part Georgia's and Armenia's distinct mortality patterns (Connor 1971; Pomerleau et al. 2008). The mortality patterns presented in this paper will be discussed within the framework of these questions, which have important public health relevance for the region.

The focus of this paper is adult mortality. It has been shown that mortality fluctuations in the former Soviet Union are primarily explained by variation in mortality at adult ages. We thus focus on mortality at ages 20–59. The restriction to this age group is also motivated by data quality considerations. Incompleteness of death registration remains an issue in the Caucasus and Central Asia, but adult ages appear to be much less affected than infant or old ages[10] (Guillot 2004; Duthé et al. 2010a). We focus on all-cause as well as cause-specific mortality. Given the importance of alcohol in explaining the health crisis in the region, we pay particular attention to causes of death that are potentially related to alcohol abuse. Whenever possible, we also include ethnic-specific information in the analysis.

[10] Infant and/or old age mortality suffer from underestimation in the region, due primarily to under-registration of deaths. This under-registration has been extensively studied for infant ages (Ksenofontova 1994; Velkoff and Miller 1995; Guillot 2004; Duthé et al. 2010a), and in fact the UN uses adjusted infant and child mortality rates in their life table estimates for the Caucasian and Central Asian countries. Under-registration of deaths of the elderly, however, is still an issue. For instance, in Armenia, in order to improve the situation, an allowance has been allocated since 1996 to families for the death registration of a pensioner; its amount was increased in 2003. In Georgia in 2005 a reorganization of the civil registration system was implemented, with the establishment of an independent agency, the Georgian Civil Register, to centralize the civil registration process. If the reform improved the availability and quality of services for Georgians, the centralization of services discouraged many people in rural areas from registering events. Consequently, there were 18% fewer deaths registered in 2005 than in 2004. For the following years, mortality was clearly underestimated among old adults, especially among female ones (Duthé et al. 2010a). When looking at mortality trends, the change of administrative rules over time generates discontinuities in time series that do not reflect true trends. These issues compelled us to truncate our mortality indicator at age 60 and focus instead on adult mortality. UN estimates of life expectancy at age 60 show a ranking of countries that is similar to what we find for adult mortality, with Armenia and Georgia faring better than Russia and Kyrgyzstan. However, further research is needed to better understand patterns of old-age mortality in both the Caucasus and Central Asia.

2. Data and methods

The results presented in this paper are based on deaths and population estimates from official sources. In Armenia and Georgia the most recent censuses produced lower-than-expected population counts, likely due to underestimation of out-migration during the preceding intercensal period. In spite of these census results, official annual adult population estimates for the preceding intercensal period have not been re-estimated by national statistical offices, so in these two countries we did not use them directly. Instead, we made the following corrections. For Armenia we produced estimates for the period 2002–2011, applying the intercensal survival method used by the Human Mortality Database (HMD) team (Wilmoth et al. 2007). For each intercensal period, this method first calculates for each cohort the difference at the second census between expected population counts (based on cohort size at the first census and registered intercensal cohort deaths) and actual population counts. This difference is then redistributed uniformly across time within each cohort, generating adjusted population counts for each January 1 during the intercensal period. For Georgia, age breakdowns in the available data were not sufficiently detailed to use this method. Instead, we corrected the total annual population size (by sex) using linear interpolation between the 2003 and 2014 censuses, but preserved proportions in each age group as estimated annually by the national statistical office, which we applied to the corrected population estimates. With this procedure, annual exposure terms for mortality were adjusted downwards. Age-specific distributions of all-cause deaths for each country were based on official death tabulations. Depending on period and country, deaths were tabulated according to different classifications of causes. For Armenia and Georgia we used consistent series of deaths by cause produced for all the period, based on the official abridged ICD-10 in Armenia and on an ad hoc abridged ICD-10 in Georgia (Duthé et al. 2010b). For Kyrgyzstan and Russia no such consistent series existed over the whole period[11] and groups of causes with the same medical contents were built for each classification in use. Details about this harmonization of causes of death are provided in Annex Table 1.

We standardized mortality in the age range 20–59 using equal weights for each five-year age group. Thus our age-standardized mortality rate, ${}_{40}M_{20}{}^{S}$, is equal to 1/8 · $({}_{5}M_{20} + {}_{5}M_{25} + \ldots + {}_{5}M_{55})$. The advantage of this indicator is that it is directly related to ${}_{40}q_{20}$, the life-table probability that a 20-year-old will die prior to reaching age 60 in a period life table (${}_{40}q_{20} = 1- \exp\{-40 * {}_{40}M_{20}{}^{S}\}$). Our use of equal weights (1/8 or 12.5% each) in the age range 20–59 is not sensibly different from the use of the 'European'

[11] After our analyses were completed, coherent series of deaths by cause in Russia for the period 1965–2014 were made available in the Human Cause of Death Database (www.causesofdeath.org).

standard age distribution, which is rather flat in this age range, with weights varying between 10.9% and 12.7%.

We also calculated ${}_{40}M_{20}{}^{S}$ by cause, using two different groupings. The first grouping involves classic broad groups of causes: infectious diseases, neoplasms, circulatory diseases, respiratory diseases, digestive diseases, external causes, and other causes. Corresponding ICD-10 codes are given in Annex Table 1. Ill-defined causes were redistributed proportionally to the other causes within each sex and age group, thus assuming that within each age group and sex the probability that a death will be coded as ill-defined does not vary by actual cause.

The second grouping seeks to make the distinction between causes of death related to alcohol consumption vs. other causes. For this purpose we build on the results of a case-control study of adult deaths in three cities of Western Siberia (Zaridze et al. 2009a, 2009b). Causes of death identified as alcohol-related (AR) include: alcoholic and other cirrhosis, chronic alcoholism and alcohol poisoning, all the other external causes, heart diseases other than myocardial infarction, upper aero-digestive tract cancer, liver cancer, tuberculosis, pneumonia, liver and pancreatic diseases. Unlike Zaridze, we did not categorize all ill-defined causes as alcohol-related. Rather, we redistributed ill-defined causes proportionally to the other causes prior to estimating AR mortality, consistent with our first grouping. We made this choice because in the two Caucasian countries (especially Georgia), deaths from ill-defined causes tend to reflect problems with the registration system (Duthé et al. 2010a, 2010b) rather than specific problems with the coding of deaths due to alcohol abuse, as appears to be the case in Zaridze's study.[12] Obviously not all the deaths from this list of alcohol-related causes are due to alcohol, in Russia or elsewhere. The purpose of this grouping is not to estimate the amount of mortality attributable to alcohol. Rather, the purpose is to examine the extent to which differences in adult mortality between our four countries of interest can be explained by a set of causes that have been shown to be related to alcohol in Zaridze's study vs. causes that have been shown not to be strongly related to alcohol. This allows us to gain insight as to why adult mortality may vary between the four countries of interest.

[12] In Georgia the deterioration of the statistics system led to an increase in the proportion of ill-defined deaths in the registered deaths. For the period 1989–2003, official deaths counts were higher than the counts provided by the civil registration. The department of statistics corrected the under-registration (though we did not find any documentation on the correction method). This generated a high proportion of deaths of unknown cause, as all additional deaths were not attributed a cause. Whereas the group of ill-defined causes represented less than 3% of the total-cause mortality rate (${}_{40}M_{20}{}^{S}$) until 1988, this proportion had increased to around a third by 2003. It decreased after 2003, but remains high (less than 10%). In Armenia, Kyrgyzstan, and Russia, the group of ill-defined causes has accounted for less than 5% of the total-cause mortality rate (${}_{40}M_{20}{}^{S}$) since 1979.

Of the three countries of the southern tier considered in this paper, only Kyrgyzstan has a substantial Slavic population (although the proportion has diminished in recent years, from 13.6% in 1999 to 6.0% in 2009, as discussed in Footnote 1). Thus, for this country, results are disaggregated by ethnic group whenever possible. For all-cause mortality, ethnic-specific results are presented for the two-year period surrounding each available census (1978–1979, 1988–1989, 1998–1999, and 2008–2009). We present results for ethnic Kyrgyz, the largest native ethnic group in Kyrgyzstan, as well as ethnic Russians, the largest Slavic group, because these are the two ethnic groups that can be consistently followed throughout the period. Cause-specific deaths by ethnicity are only available for 1998–1999, so cause-specific mortality rates by ethnicity are presented during that two-year period only. Thanks to richer information on ethnicity during that period, we can use a more inclusive ethnic grouping for this cause-specific analysis by focusing on ethnic Slavs (Russians, Ukrainians, and Belarusians) vs. ethnic Central Asians (Kazakhs, Kyrgyz, Uzbeks, Tajiks, and Turkmens). This grouping is not substantively different from the Kyrgyz vs. Russian grouping used in the all-cause mortality approach, given the cultural similarities among ethnic groups constituting each broad group. As the results show, mortality levels using the more inclusive groupings (Slavs vs. Central Asians) are very similar to the levels for the more restrictive grouping (ethnic Russians vs. ethnic Kyrgyz). We thus use both groupings interchangeably in this paper. The more inclusive grouping is advantageous in the cause-specific analysis as it produces more robust results due to larger population size.

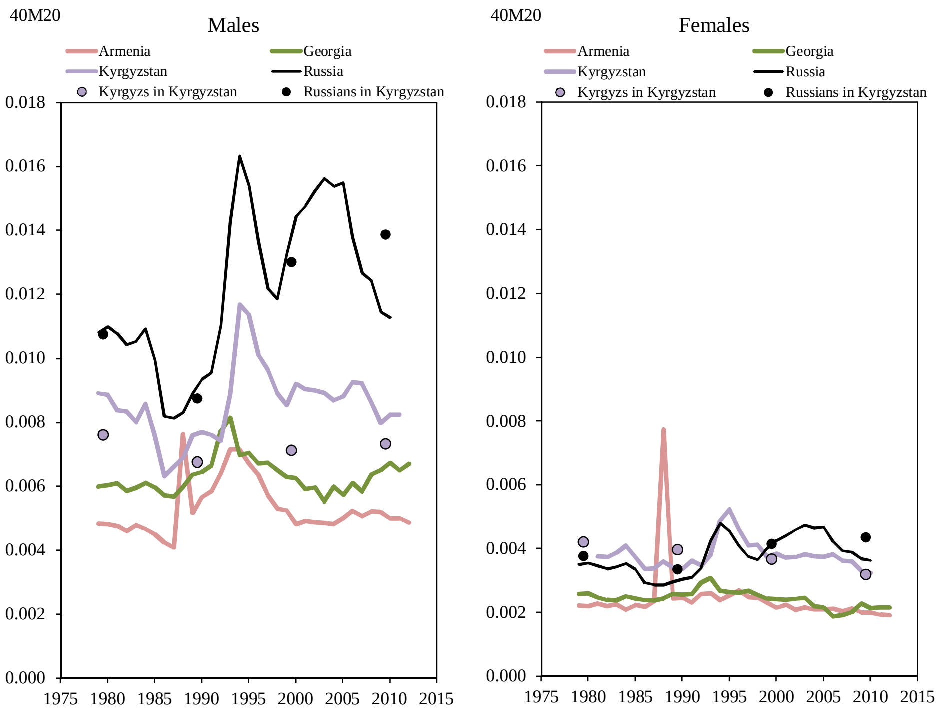
Years for which deaths and population information are available to us vary by country. Data availability is further limited when dealing with mortality by cause, ethnicity, or both at the same time, as discussed above for Kyrgyzstan. The time frame of the results presented here reflects these country-specific constraints as well as our need for cross-country comparability. All-cause mortality results start in 1979, the first year for which all-cause information by ethnicity is available for Kyrgyzstan, and end in 2010–2012 depending on country. This time frame also has the advantage of providing a long period of observation spanning both before and after the break-up of the Soviet Union. Cause-specific results (for all ethnic groups combined) are provided for 2007–2008, i.e., the most recent period for which we have detailed information by cause in all four countries. In addition, we present mortality results by cause for the 1998–1999 period, i.e., the most recent period for which we have mortality information by cause and ethnicity in Kyrgyzstan.

3. Results

3.1 All-cause mortality since 1979

Figure 2 shows trends in ${}_{40}M_{20}{}^{S}$, the age-standardized death rate at ages 20–59, in Armenia, Georgia, Kyrgyzstan, and Russia, by sex. For males, levels of adult mortality are the lowest in Armenia and Georgia. Except in 1988 when Armenia was hit by a deadly earthquake, Armenian male mortality is lower than Georgian male mortality during almost the entire period. Russia, by contrast, exhibits the highest mortality levels throughout the period. Kyrgyzstan presents levels that are significantly higher than Armenia and Georgia but lower than in Russia.

Figure 2: Age-standardized adult mortality rate at ages 20–59, Armenia, Georgia, Kyrgyzstan (national level and by ethnicity), Russia, since 1979



Source: authors' calculations based on official population and death statistics.

These results also show that the amplitude of the mortality fluctuations varies greatly by country. The fluctuations are largest in Russia, then Kyrgyzstan, then Armenia and Georgia. While all countries have experienced mortality reversals characteristic of the health crisis in the region, the scale of these reversals was significantly lower in the two countries of the Caucasus examined here. It is also notable that only Russia experienced a second major mortality reversal (starting in 1998). However, results show some mortality deterioration for Georgia since 2005.

In Kyrgyzstan, mortality levels at the national level are in part the combination of large differentials for ethnic Kyrgyz vs. ethnic Russians. Figure 2 shows that for males, ethnic Russians have much higher levels of adult mortality than ethnic Kyrgyz, contributing to the high level of mortality at the national level in that republic. In fact, when focusing on the ethnic Kyrgyz only, mortality in that republic appears closer to Armenia and Georgia than it does to Russia, even though it remains somewhat higher than in these two Caucasian republics.

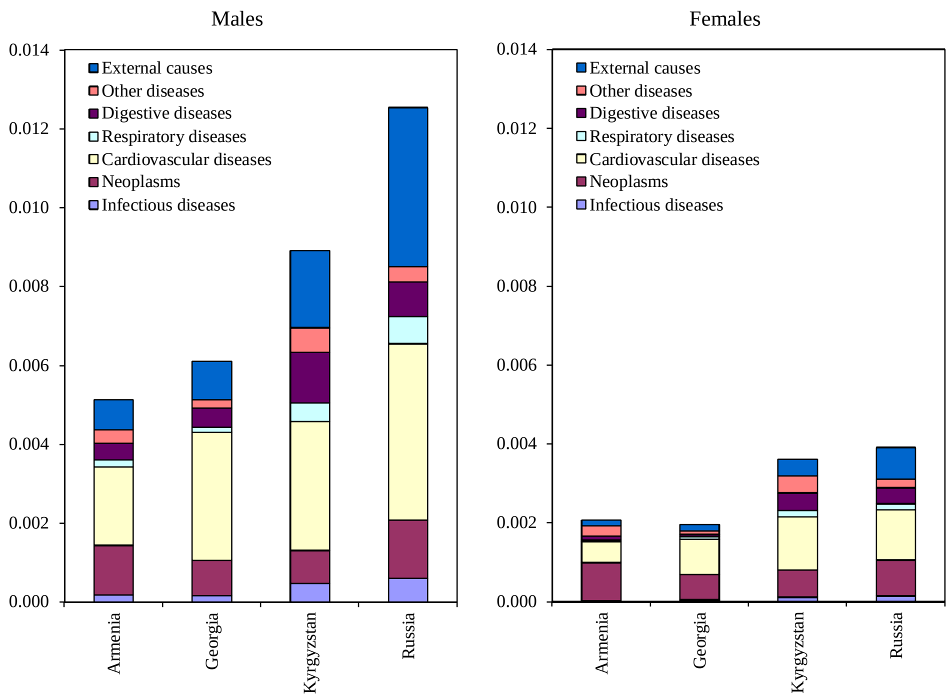
Figure 2 also shows trends in adult mortality among females. As expected, female mortality levels are much lower than those of males. As in the case of males, Armenia and Georgia consistently have the lowest mortality levels throughout the period, and experience much smaller mortality fluctuations. Kyrgyzstan and Russia both have higher mortality levels than the two Caucasian republics, but, unlike for males, Russia's levels for females are much closer to those observed in Kyrgyzstan. Due to much smaller mortality differentials between ethnic Kyrgyz and ethnic Russians, mortality levels in Kyrgyzstan do not change very much when focusing on ethnic Kyrgyz. (It is interesting to note that, unlike for males, there is a cross-over in the ethnic mortality differential during the period of study. Prior to independence, ethnic Russian females in Kyrgyzstan actually experienced an advantage in comparison with their ethnic Kyrgyz counterparts.)[13]

3.2 Cause-specific mortality, 2007–2008

As discussed above, we focus here on the 2007–2008 period, which is the most recent period for which we have detailed mortality information by cause for all four countries. Results are shown in Figure 3.

[13] Note that the all-cause adult mortality patterns presented here are similar to those produced by the United Nations (2015) for every 5-year period. This is expected, given that for these countries the United Nations, like us, does not adjust reported deaths at adult ages. The only notable difference in the results pertains to Georgian males, for whom we estimate a recent increase in adult mortality. The difference is likely due to our downward adjustment of population estimates, which we performed in light of the results of the 2014 census.

Figure 3: Age-standardized adult mortality rate at ages 20–59 in Armenia, Georgia, Kyrgyzstan, and Russia, by broad group of causes of death, 2007–2008



Source: authors' calculations based on official population and death statistics.

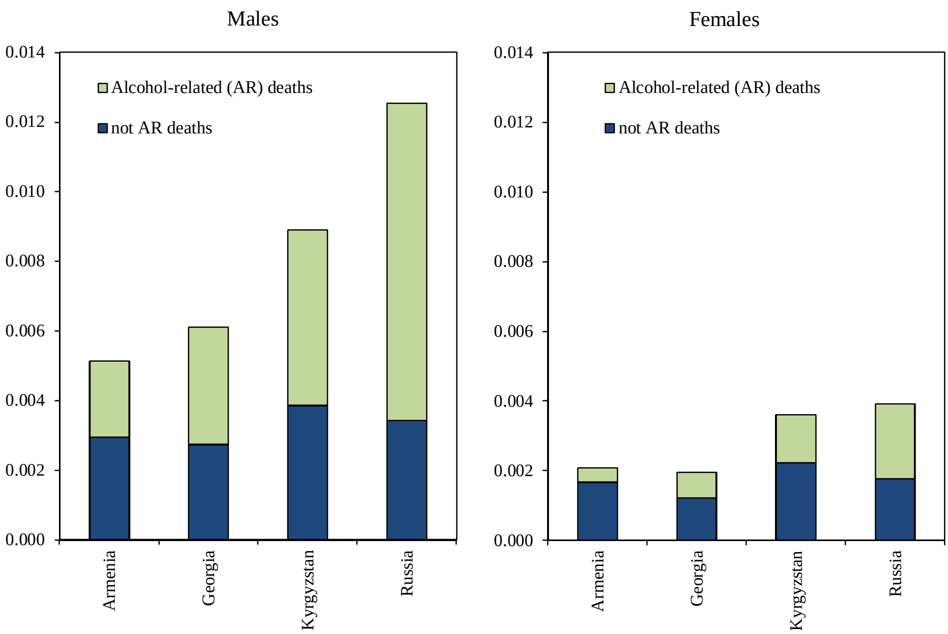
We saw earlier that adult males in Georgia vs. Armenia have similar levels of all-cause mortality. This similarity is reflected overall in their cause-of-death structure. One difference is that adult males in Georgia have higher mortality from cardio-vascular diseases, but this higher mortality is counter-balanced by lower mortality from neoplasms. Rates from the other groups of causes are similar. Kyrgyzstan (all ethnic groups combined) has significantly higher all-cause mortality than Armenia and Georgia, and this higher mortality is explained primarily by higher mortality from external causes and digestive diseases. We also observe somewhat higher mortality from infectious diseases. Adult males in Russia exhibit the highest level of mortality, and this is explained by higher mortality from cardiovascular diseases, external causes, and neoplasms.

Like in the case of males, females in Georgia vs. Armenia have similar levels of all-cause mortality. This is the result of a combination of higher mortality from cardio-vascular diseases and lower mortality from neoplasms in Georgia. Females in Kyrgyzstan have higher overall mortality than their counterparts in Armenia and Georgia, and this is explained primarily by higher mortality from cardiovascular diseases, as well as higher mortality from external causes. Adult females in Russia have mortality levels that are slightly higher than in Kyrgyzstan. This is explained by higher mortality from external causes and from neoplasms.

Figure 4 shows results for alcohol-related mortality, following the modified version of Zaridze's classification discussed earlier. For males, when making the distinction between alcohol-related causes vs. other causes, we find higher alcohol-related mortality in Georgia vs. Armenia, but slightly lower mortality from other causes. Most strikingly, Kyrgyzstan's and Russia's higher mortality levels (relative to the two Caucasian republics) appear to be almost entirely explained by alcohol-related causes. The higher the level of all-cause mortality in a given country, the higher the level of alcohol-related mortality. Other causes vary little across the different countries, though Kyrgyzstan has somewhat higher mortality from other causes.

The comparison of adult females in Georgia vs. Armenia offers similar features: higher mortality from alcohol-related causes in Georgia is counter-balanced by lower mortality from other causes. When comparing Russian females to their counterparts in Armenia or Georgia we also see that alcohol-related mortality explains most of the difference. In Kyrgyzstan, however, we find a situation in which their higher mortality (in comparison with Armenia and Georgia) is explained by higher mortality from both alcohol-related causes and other causes, but other causes appear to be playing the largest role. As a result, even though females in Kyrgyzstan have a level of all-cause mortality that is similar to Russia, their cause distributions are significantly different, with lower alcohol-related mortality in Kyrgyzstan vs. Russia.

Figure 4: Age-standardized adult mortality rate at ages 20–59 in Armenia, Georgia, Kyrgyzstan, and Russia, alcohol-related causes vs. other causes, 2007–2008

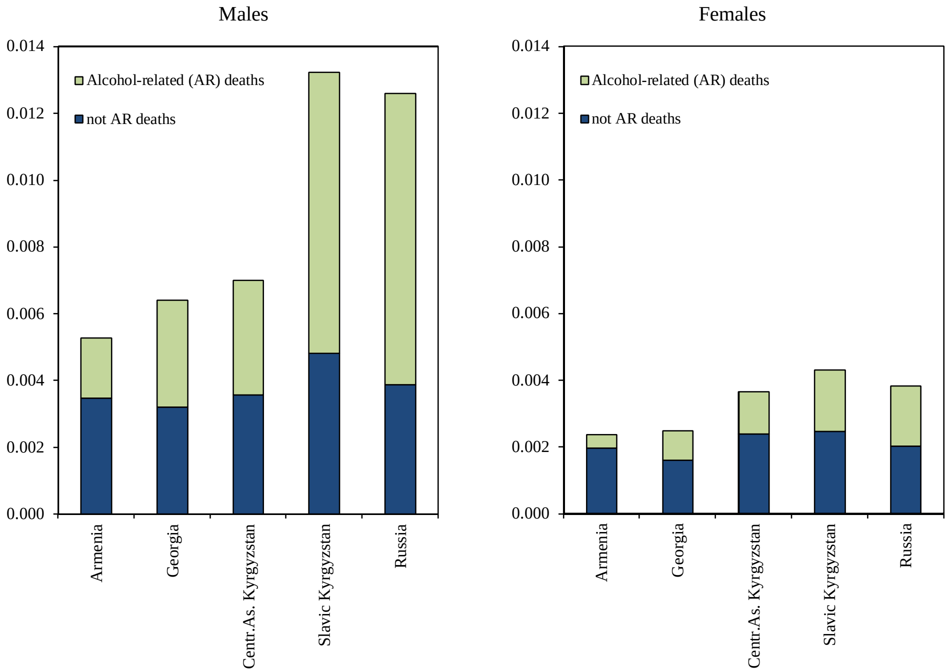


Source: authors' calculations based on official population and death statistics.

3.3 Alcohol-related mortality in 1998–1999, with ethnic-specific information for Kyrgyzstan

As discussed earlier, national-level mortality patterns in Kyrgyzstan are affected by the fact that unlike Armenia and Georgia, it has a significant ethnic Russian population, which brings its national-level mortality rates up, closer to the levels observed in Russia. In order to increase comparability with the two Caucasian republics, which do not have a significant Russian, or Slavic, population, here we make a distinction between mortality among Central Asians vs. Slavs living in Kyrgyzstan. We focus on the period 1998–1999 for this comparison, given the data availability issues discussed earlier, and we focus on the contrast between alcohol-related causes vs. other causes. Results are shown in Figure 5.

Figure 5: Age-standardized adult mortality rate at ages 20–59 in Armenia, Georgia, Kyrgyzstan (by ethnicity), and Russia, alcohol-related causes vs. other causes, 1998–1999



Source: authors' calculations based on official population and death statistics.

For males, the breakdown by ethnicity in Kyrgyzstan shows that ethnic Central Asians in Kyrgyzstan resemble their counterparts in the Caucasus much more than their counterparts in Russia, not only in terms of mortality levels but also in terms of causes of death. Their level of alcohol-related mortality is much lower than in Russia, reaching levels that are on a par with those observed in Georgia. Slavs in Kyrgyzstan, however, exhibit mortality patterns that are almost identical to those observed in Russia, with much higher levels of alcohol-related mortality than their Central Asian counterparts or their counterparts in Armenia and Georgia.

For females, ethnic Central Asians in Kyrgyzstan have lower alcohol-related mortality than their Slavic counterparts in Kyrgyzstan or their counterparts in Russia, which brings them closer to the patterns observed in Georgia. However, they have significantly higher levels of mortality from other causes, which brings their mortality closer to the levels observed in Russia.

4. Discussion

These results show that as far as their adult mortality levels are concerned, Armenia and Georgia have weathered the collapse of the Soviet Union much better than Russia. In many ways, mortality patterns in these two Caucasian republics resemble those observed in Kyrgyzstan, especially when considering the non-Slavic portion of Kyrgyzstan's population. These results document a distinct southern tier pattern of adult mortality in the former Soviet Union, with lower mortality than in Russia, especially among males, and smaller mortality increases following the break-up of the Soviet Union. These more favorable mortality patterns occur even though these countries have been poorer than Russia, and have in many ways been more severely hit by the post-Soviet economic crisis. It is interesting to note that Russian provinces bordering the Caucasus and Central Asia also appear to have more favorable mortality patterns, suggesting that this southern tier pattern may operate on a geographical continuum (Walberg et al. 1998; Vallin et al. 2005).

Alcohol-related causes appear to play an important role in the causes of death explaining these more favorable patterns, especially among males. Mortality from alcohol-related causes is lower in Armenia and Georgia than in Russia, contributing to their lower overall mortality levels. Here also, patterns are similar to those observed in Kyrgyzstan when focusing on the non-Slavic portion of the population. In Kyrgyzstan, lower levels of alcohol-related mortality have been attributed in part to the role played by Islam and its prohibition of alcohol. The new results presented in this paper suggest that Armenia and Georgia may also have been protected to some extent by their distinct and perhaps less harmful drinking practices.

Further research is needed to examine whether the country similarities documented in this paper hold once additional countries of the southern tier are included in the analysis, including other Central Asian republics as well as Azerbaijan in the Caucasus. It should be also noted that the parallels established here pertain to adult mortality only. When examining child mortality patterns the three countries of the southern tier examined here all have higher child mortality than Russia (with Kyrgyzstan having the highest level), which is more in line with expectations, given each country's level of economic development. Nonetheless, the southern tier mortality pattern discussed in this paper may be characterized as a situation in which cultural factors, to the extent that they shape adult health behaviors such as alcohol consumption, may largely trump macro-economic factors in generating specific adult mortality patterns in the region.

While the three countries of the southern tier examined here all have lower adult mortality than Russia, significant differences remain among them. Lower adult mortality in Armenia and Georgia (in comparison to Kyrgyzstan) is explained in part by lower mortality from infectious and respiratory causes. Compounded with the fact that infant mortality is lower in the two Caucasian republics, these patterns suggest that Armenia and Georgia may be more advanced in the epidemiological transition than Kyrgyzstan.

It is also important to acknowledge that although the southern tier countries studied here have experienced more favorable adult mortality patterns than Russia, they have not experienced any progress in recent decades, especially for males. Their current adult mortality levels are similar to those observed in the late 1970s, and a worrisome increase is detected among Georgian males. These trends need to be acknowledged and addressed by local governments.

5. Acknowledgments

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Appendix

Table 1: Correspondence between broad groups of causes, coding practices, and ICD-10 codes in Armenia, Georgia, Kyrgyzstan, and Russia for 1998–99 and 2007–08

	Armenia		Georgia	
	Official Abridged ICD-10 (1998-1999[a] & 2007-2008)	Correspondence in detailed ICD-10	Abridged ICD-10[b] (1998-1999 & 2007-2008)	Correspondence in detailed ICD-10
Infectious diseases	1–48	A00-B99	1–52	A00–B99
Neoplasms	49–81	C00–D48	53–83	C00–D48
Cardiovascular diseases	104–125	I00–I99	105–120	I00–I99
Respiratory system diseases	126–140	J00–J98	121–133	J00–J98
Digestive system diseases	141–155	K00–K92	143–147	K00–K92
Other diseases	82–103, 156–199	D50–H95, L00–Q89	84–104, 148–179	D50–H95, L00–Q89
External causes	214–229	V01–Y89	181–197	V01–Y89
Alcohol-related group	9–14, 38, 47, 49–50, 58, 88–89, 110, 113–116, 126–132, 136–140, 149–150, 154, 214–229	A15–A19, B15–B19, B90, C00–C15, C32, F10, I20, I23–I51, J00–J22, J30–J39, J60–J98, K70, K74, K85–K86, V01–Y89	9–14, 34, 51,53–54, 62, 91–92, 111, 113–115, 121–126, 129–133, 141–142, 146, 182–197	A15–A19, B15–B19, B90, C00–C15, C32, F10, I20, I24–I51, J00–J22, J30–J39, J60–J98, K70, K74, K85–K86, V01–Y89
Ill-defined	200–202	R00–R99	180–181,999	R00–R99
Total all causes	1–229	A00–R99, V01–Y89	1–197, 999	A00–R99, V01–Y89

(a) In Armenia, for all the period, consistent series of deaths by cause have been proposed by Duthé et al. (2010b) according to the last official classification (abridged ICD–10).
(b) In Georgia, for all the period, consistent series of deaths by cause have been proposed by Duthé et al. (2010b) according to an ad hoc abridged ICD–10 (the detailed ICD–10 is the current official classification in use in Georgia).

Table 1: (Continued)

	Kyrgyzstan		Russia		
	Official classif. based on ICD9 (1998–1999)	Correspondence in detailed ICD–10 (available in 2007–2008)	Official classif. based on ICD9 (1998)	Official classif. based on ICD–10 (1999 & 2007–2008)	Correspondence in detailed ICD–10
Infectious diseases	1–44, 206	A00–B99	1–44	1–55	A00–B99
Neoplasms	45–67	C00–D48	45–67	56–89	C00–D48
Cardiovascular diseases	84–97, 100–102, 196–205	I00–I99	84–102	115–147	I00–I99
Respiratory system diseases	103–114	J00–J98	103–114	148–164	J00–J98
Digestive system diseases	115–127	K00–K93	115–127	165–179	K00–K93
Other diseases	68–83, 128–157, 207–208	D50–H95, L00–Q89	68–83,128–157	90–114,180–225	D50–H95, L00–Q89
External causes	160–175	V01–Y89	160–175	239–256,272–274	V01–Y89
Alcohol-related group	9–13, 30, 43, 45, 46, 52, 73, 75, 92–97, 103–107, 110–114, 122–123, 126, 160–175	A15–A19, B15–B19, B90, C00–C15, C32, F10, I20, I24–I51, J00–J22, J30–J39, J47, J60–J99, K70, K74, K85–K86, V01– Y89	9–13, 30, 43, 45, 46, 52, 73, 75, 92–97, 103–107, 110–114, 122–123, 126, 160–175	9–15, 41–43, 54, 56, 57, 65, 97, 98, 125–132, 148, 150–155, 160–164, 173, 174, 178, 239–256, 272–274	A15–A19, B15–B19, B90, C00–C15, C32, F10, I20, I24–I51, J00–J01, J02.8–J22, J30–J39, J60–J99, K70, K74, K85–K86, V01–Y89
Ill-defined	158–59	R00–R99	158–159	226–228	R00–R99
Total all causes	1–97, 100–175, 196–209	A00–R99,V01–Y89	999	999	A00–R99, V01–Y89