Uncovering unusual mortality differentials in Russia and Kazakhstan

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Research on global mortality has exhaustively documented a Russian mortality paradox—the phenomenon of populations of Slavic descent in experiencing higher adult mortality despite higher socioeconomic status. This study exploits Kazakhstan’s relatively heterogeneous population and geographic diversity to study ethnic differences in cause-specific mortality. After controlling for contextual differences, all-cause mortality rates for Russian men remains 27% higher than for Kazakh men, and alcohol-related death rates among Russian men remain 2.5 times higher (15% and 4.1 times higher for females, respectively). Significant mortality differentials exist by ethnicity for external causes and alcohol-related causes of death. Adult mortality among Kazakhs is higher than previously found among Kyrgyz and lower than among Russians. This phenomenon suggests the existence of a continuum between ‘non-Russian’ and ‘Russian’ model mortality patterns based on degree of accord to documented patterns of alcohol consumption among Russians. Differential mortality across republics of Central Asia may improve our understanding of the Russian mortality paradox.

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Introduction

Russian mortality rates increased dramatically after the fall of the Soviet Union. While Russian life expectancy exceeded the average for countries with similar per capita national income for many years, the 1990s saw a significant loss of GDP and a rapid decrease in recorded life expectancy that only recently began to recover. Interestingly, despite experiencing similar economic shocks, non-Russian minorities in former Soviet republics on Russia’s periphery seem to have been far less susceptible to the adverse trend in mortality. Russia occupies a peculiar place in the world. Russia is part of the ”BRIC” group of countries (Brazil, Russia, India, China), which has been characterized as having great potential for economic development. However, Russia is exceptional among the BRICs for having the highest per capita GDP and educational attainment in the group—two things normally associated with greater longevity. Yet, despite improvements in the past decade, Russia continues to have lowest male life expectancy among the BRICs.\(^1\) It is also the case that Russians are a richer, more educated minority in former Soviet countries, but appear to have worse health. I discuss the case of Russians in Central Asia to illustrate some of the dynamics of this paradox.

Kazakhstan’s large and heterogeneous Russian population, sheer geographic scale, and relatively successful economic transition provide an interesting context in which to study the Russian mortality paradox. Russians account for nearly 40% of the population of Kazakhstan. This paper takes advantage of microdata with geographic identifiers in order to better account for underlying differences between the Slavic and Central Asian populations than previous studies. With these data, I additionally attempt to establish whether, due to a longer period of interaction with Russia, the mortality patterns of Kazakhs more closely resembles that of Russians than the neighboring Kyrgyz. I find evidence for the Russian Mortality Paradox in Kazakhstan, but with some illuminating characteristics.

\(^1\)According to the UN, male life expectancy during 2005–10 in the Russian Federation was 61.6 years, compared to the next-lowest, India, at 62.8 years.
The same causes of death that have been observed among Russian adult populations are also evident in Kazakhstan. The standardized mortality rates of Russian men are approximately 50 percent higher than for Kazakhs. Mortality for this group is concentrated in alcohol-related causes of death: four causes directly related to excess alcohol consumption account for nearly 10 percent of excess mortality among Russian men and nearly 20 percent among women. The mortality gap is robust to geographic and socioeconomic conditions. Results from the regression analysis confirm this finding and furthermore suggest that mortality in Kazakhstan is correlated with the concentration of Russian-speakers. The peculiar Russian pattern of mortality documented elsewhere appears to manifest most strongly among Kazakhs in Russified areas, and suggests a behavioral explanation for mortality differences across Central Asia according to the degree of Russification.

If mortality is associated with Russification, then Kazakh mortality should be higher than among the Kyrgyz (due to the historical influences of the Russian presence in Kazakhstan), but still lower than among Russians. The mortality advantage of Kazakhs over Russians should be somewhat less than for Kyrgyz in categories where alcohol-related mortality predominates. In addition, Kazakhstan’s size means I may expect to find some variation within ethnic groups based on areas that are more or less Russified.

In order to provide a theory which supports the above hypotheses, I briefly discuss the relevant history of interaction between Russia and Kazakhstan, including a comparison of the socioeconomic circumstances of Russians and Kazakhs. I document the similarity between the mortality of Russians in Kazakhstan and those in Russia, and compare their mortality to ethnic Kazakhs. I proceed to examine the causes of death where large sex or ethnic disparities are observed. In order to remove the confounding effects of geographical, behavioral, and economic differences between Russians and Kazakhs, I proceed to test the robustness of the ethnic mortality gap through regressions of all-cause and cause-specific mortality. I conclude with a discussion of greater implications of the findings and directions for future research.
1 Background and Related Literature

1.1 Background

Kazakhstan is the largest of the Central Asian republics, and shares a border with Russia in the north and China to the east (Figure 1). Russians have had a significant presence in Kazakhstan since the first half of the 19th century. Kazakhstan gradually became integrated into the Russian sphere of influence during this period (see Hopkirk 1992, 1995 and Meyer & Brysac 2006 for an engaging discussion). Nascent anti-colonial movements during the mid-19th century were suppressed as traders and immigrants moved to Russia’s interior, settling and converting land from pastoral to agricultural use. Forced settlement of the nomadic Kazakhs combined with famines during the 1920s and 1930s took an especially heavy toll on the indigenous population (Peyrouse 2008; Tynystanova 2002).

The earliest population count was conducted in 1897, at which time 82 percent of the population was Kazakh and 11 percent was Russian. The 1926 Soviet Census recorded that Kazakhs declined to 57 percent of the population and Slavic groups had grown to 31 percent. Industrialization of agriculture and mining and relocation of Soviet political exiles increased the pace of migration into Kazakhstan from other parts of the Soviet Union. The process was accelerated after 1954, as Krushchev’s “Virgin Lands” (“Tseline”) policy targeted Kazakh lands as a future center of Soviet grain production. During the years of the program, hundreds of thousands of Russian and Ukrainian migrants settled in the country, mostly dispersed around the northern capital city of Astana (known as “Tselinograd” during 1961-1991). By 1959, Kazakhs made up just 30% of the country’s population.

The Kazakh share of the population grew thereafter, but at a modest pace. By 1989 the Kazakhs comprised 40% of the population, and by the time of the 1999 Census had regained their status as a majority (53%). This was possible due to the repatriation of millions of
ethnic Russians, although the remaining Russian population of approximately 4 million still represents over one-fourth of the total population of the country. In 2010, the major Central Asian ethnic groups (Kazakhs, Uzbeks, Kyrgyz) together form 60 percent of the population. However, several of Kazakhstan’s sixteen top-level administrative divisions (called oblasts) are still over 40% Slavic, as are many more of the lower-level divisions called rayons (Fig 1).

1.2 Russification of Kazakhstan

Russification of Kazakhstan was significant but not complete. The adoption of a Cyrillic alphabet and the teaching of Russian made that language nearly universally spoken, while the official Soviet policy of bilingualism preserved Kazakh language teaching in schools. Russian remains a commonly spoken language many years later (at least 68% of Kazakhs speak it), and continues to be the language in which much of politics, business, and research continue to be conducted. The integration of Russian into Kazakh daily life is suggested by an Uzbek proverb, “if you want to become Russian, first become Kazakh” (Dave 2004).

Kazakhstan may be more Russified than other Central Asian states, partly as a result of the greater role in the national economy historically played by Russia and the correspondingly higher share of the population that is non-Kazakh. Still, the Slavic population in Kazakhstan is heterogeneous in its attachment to the Russian cultural mainstream. Russians in the northern and eastern parts of the country tend to identify with Russians in Siberia and the Far Eastern regions of the Russian Federation, while Russians in the south tend to be more indigenized, as indicated by the greater prevalence of Kazakh fluency among Russians (according to the Kazakh 1999 Census, more than 15% of Russians in the southern region speak Kazakh, compared to a national average of 6% and less than 1% in the Slavic strongholds of the north). Russification of urban Kazakhs is pervasive; most Kazakhs in urban areas surveyed throughout the 1980s and 1990s showed very low rates of fluency in Kazakh and little familiarity with Kazakh history (Dave 1996). Dave & Sinnott (2002) sug-
gest that recorded increases in Kazakh fluency may have been overstated and do not reflect very much meaningful displacement of Russian language in favor of Kazakh.

Compared to their Central Asian neighbors, Kazakhs have a less healthy diet and drink more alcohol (Waters & Thom 2007; Cockerham et al 2004). Policy discussions from the late 1990s highlighted increases in alcoholism by the young and women, two groups with very low rates of alcohol consumption prior to independence. Data from the WHO suggest that consumption increased by one fourth, from 8 to 10 liters of alcohol per capita per year between 1995-2000 (WHO 1999; Rehm et al. 2004). Binge drinking is alarmingly common: the number of times per year that over 220mL of vodka is consumed during a single drinking session is 25 in Kazakhstan, compared to 29 in the Russian Federation and just 11 in Kyrgyzstan (Pomerleau 2005). Further survey data finds that Kazakh men who drink consume up to 70% of their alcohol as vodka, significantly more than even Russian men in Kazakhstan (63%). For both Slavic and Kazakh women, the figure is still an impressive 45% (LSMS 1996; author’s calculations).

Anthropological literature has long suggested that some features of the nomadic steppe culture have been preserved more completely in Kazakhstan than other Central Asian states (Aristov 1896; Radlov 1989; Masanov et al 2002). The cultural influence of Islam has also tended to be moderated by the continued presence of traditional steppe culture in both Kazakhstan and Kyrgyzstan—a result of its shorter history in Central Asia, geographic and political isolation, and the suppression of Islamic identity under Communism. The weak influence of conservative Islam is especially true in Kazakhstan, where the majority identify as Muslim but also report widespread indifference to religion and ambivalence about religious practice (Edelbay 2012; Salhani 2011). Common practices in Islamic countries, such as veiling of women, never appeared in Kazakhstan; Waters & Thom (2007) suggest that this is one of several examples of cases where Kazakhs maintained more liberal attitudes, suggesting further that this openness resulted in “greater receptivity of the native population
to Slav drinking customs than in neighboring regions.” Religious attachment is stronger in Kyrgyzstan than in Kazakhstan, but still weaker than in other Central Asian republics (Tazmini 2011). In summary, the Kazakh-Russian relationship is a unique one in Central Asia—but Kyrgyzstan will serve as a useful comparison group due to its broad cultural and linguistic similarity with Kazakhstan.

1.3 The Russian Mortality Paradox in Central Asia

Russian mortality has increased in the decades since the dissolution of the Soviet Union, but its economic standing decreased as well—so, in what sense is Russian mortality in “excess”? From being an outlier in terms of high life expectancy and low income per capita in the 1960s, Russia’s position deteriorated during the later Soviet period, reaching its lowest point during 1990-2000. As Russia’s economy experienced dramatic contraction, life expectancy measures fell apace. On an income-adjusted basis, Russians in Kazakhstan during this period were solidly average in historical terms. In other words, Russians in Kazakhstan are just as healthy as those in Russia, despite Kazakhstan being a significantly poorer country. This observation masks an important deeper paradox, however: Russians in Kazakhstan are less healthy than Kazakhs. As shown in Figure 2a, age-specific mortality rates for Russians (especially males) is elevated during adult years between ages 20–59 when compared to Kazakhs. The experience of Russians in Kazakhstan mirrors the Russian Federation remarkably well during this time period.² In recent years, Russian life expectancy has improved. Yet, for those crucial years during the 1990s, it remains to be explained why Russians fared so poorly relative to the Kazakhs.

²Time series data of do not exist for Kazakhstan, but high correspondence with Russian rates since 1960 is evident in the neighboring state of Kyrgyzstan (Guillot et al 2011).
of debate over the competing roles of the decrepitating health care system (Brainerd & Cutler 2005), improvements in the vital statistics reporting system (Chen et al 1996; Anderson & Silver 1997; Andreev et al 1995; Wasserman & Värink 1998; Gavrilova et al. 2000), and the role of cohort dynamics (Avdeev et al 1998; Willikens & Scherbov 1992). These arguments have gradually given way to recognition that health behaviors are the most likely explanation for Russia’s excess mortality. These adverse health behaviors may be due to the poor preparation that the Soviet system gave individuals to self-regulate their health behaviors, combined with the end of Gorbachev’s anti-alcohol campaign and the emergence (or re-emergence) of a popular *laissez-faire* attitude towards alcohol drinking (Avdeev et al 1998; Brainerd 2010; Cockerham et al 2004).

According to this literature, trauma from the economic crisis, or pressure relief from the removal of the Soviet system of control, may have spurred drinking. However, this fails to settle the question of why Russia and the former Soviet republics of Central Asia took such different trajectories in population health after their very similar experiences of transition. In fact, the economic crisis was if anything more severe in Central Asia than in Russia. Kazakhstan’s economy was bolstered by investment from Russia, and Russia held an effective monopsony on exports of natural resources that completely dissolved after 1989. While Kazakhstan’s economy grew starting in the late 1990s, GDP in 2001 was still below the 1989 level (Abbott 2003).

Yet, mortality did not increase in Central Asia as much as it did in Russia. The emerging explanation from projects exploring this phenomenon is that the changes in health trajectories are not due to wide swings in health status across the entire region, but due to dynamics within sub-groups of the national populations. The largest sub-group in the Central Asian countries is Russians. Adult mortality among Russians in the post-Soviet diaspora resembles the dynamics in the Russian Federation more than in the local contexts (Fig 2b), a surprising finding pointing at an explanation related to a process of cultural transmission.
Russians in the region appear to experience worse mortality than Kyrgyz (Guillot et al. 2011) and Kazakhs (Becker & Urzhumova 2004), suggesting that the same behavioral patterns appeared among Russians in Central Asia as in Russia. However, Cockerham et al. (2004) and Bougdaeva (2010) have argued that the apparent correlation of poor health behaviors with Russian ethnicity in these countries was more a function of age, sex, and occupation than of ethnicity per se. Uncertainty still exists over the interpretation of the findings to date. The lack of demographically-specific mortality data in Becker & Urzhumova’s study of Kazakhstan limits their ability to fully explain differences in mortality. In fact, Cockerham et al. found that Russian ethnicity was in fact not a significant predictor of health status in Kazakhstan after sufficiently controlling for contextual differences. Given the evidence for behavioral causes of excess mortality in the larger literature on the Russian mortality paradox, their findings suggest that Kazakhs’ and Russians’ behaviors may be similar enough within Kazakhstan so that ethnicity has no explanatory power.

I aim to resolve the apparently contradictory findings and determine the extent to which context explains the apparently higher mortality rates among Slavs. In the next section, I introduce hypotheses formed on the basis of the preceding data, and describe the data and methods used in the rest of the study.

## 2 Research design

### 2.1 Hypotheses

Based on the available evidence, I expect to find that Kazakh mortality will be in excess of Kyrgyz rates for causes related to alcohol consumption, but below the level of Russians in either country. A useful corollary—that there is in fact a “Russian norm”—is sufficiently established by the high degree of comparability between Russian mortality in Kazakhstan and in Russia. A greater share of Kazakhstan’s population is Russian, so aggregate rates
are likely to be higher. However, the point of interest is whether ethnic Kazakhs, due to a
greater degree of integration with the Russian population, also experience higher mortality
rates than ethnic Kyrgyz in Kyrgyzstan.

I also expect to find that Russified Kazakhs will have higher alcohol-related mortality
rates than non-Russified. This requires a metric of Russification, for which I propose flu-
ency with Russian language. The relevance of Russian fluency to demographic behaviors
in Kazakhstan has been previously established (Agadjanian & Dommaraju 2006). In these
studies, Kazakhs who were more comfortable speaking Russian than Kazakh tended to have
patterns of marriage and fertility behaviors that were more similar to Russians than did
other Kazakhs.

This proposition follows from the sociological theories of diffusion and social networks.
The process of diffusion or transmission of demographic behaviors became of special interest
in the 1970s as a plausible means of interpreting results from detailed studies on the timing
of fertility declines in Europe and elsewhere. Fertility change in these large scale studies
seemed to follow linguistic and ethnic vectors more closely than economic ones, which many
interpreted as supporting the application of diffusion theory to demographic analysis (Knodel
& van de Walle 1979; Lesthaeghe 1977; Cleland & Wilson 1987). The leap from transmitting
contraceptive behavior to transmitting other relevant behaviors has been made more recently
by social network theory. The availability of large scale panel microdata containing detailed
information on relationships has enabled studies that have provided evidence for the role
of social networks on the spread of behaviors such as smoking, drinking, and suicide and
outcomes such as obesity, and mental health (see a review by Smith & Christakis 2008).

Bilingualism at the micro-level enables the transfer of ideas back and forth, which ag-
gregates into macro-level differences in behaviors and outcomes based on ethnic or linguistic
similarity. While the nature of the available macrodata precludes a direct test of the role of
social networks (I have no data identifying individual Russified Kazakhs), I can produce an
ecological measure of Kazakh Russification that should be correlated with mortality.

The logic of diffusion theory is readily applicable to the case of Russians in Kazakhstan. If we consider a simplified world where behavioral norms circulate at the micro level within social networks (which themselves divide along linguistic lines), then a frontier will exist between the Russian-only circles and the Kazakh-only circles populated by those who are fluent in both languages. Although I can only identify the concentration of these groups by geography rather than linking individuals within networks, a greater concentration of Russian-speaking Kazakhs should be associated with more links between Russian-only and Kazakh-only individuals in social networks based there.

Why, in such a world, would ideas not be transmitted equally in both directions between Russians and Kazakhs? While this problem is beyond the scope of the hypotheses at hand, the anthropological evidence suggests that Russians are less receptive to external influence than are Kazakhs. Mixed households tend to adopt Russian habits (Edgar 2007) and are more likely to identify as Russian (Gorenburg 2006). For whatever reason, in this case, the transmission of messaging through social networks seems more important in the direction from Russian to Kazakh than vice versa. Thus, if we assume different starting norms of alcohol consumption among these two groups, then both the static composition of the population as well as the dynamic composition of social networks should both contribute to more prevalence of Russian norms surrounding drinking in areas where more Russians and Russian-speaking Kazakhs are located.

2.2 Methods of Analysis

To identify the main determinants of the ethnic mortality gap and how their effects may differ in Kazakhstan, I first present age-standardized, cause-specific mortality rates by sex in order to understand the main drivers of the ethnic mortality gap and how they may differ in Kazakhstan. I compare the value of $n q_x$ (the probability of dying between ages $x$ and
\(x + n\) for Slavic and Central Asian men and women, with particular attention to \(40q_{20}\) (the probability of dying between ages 20 and 60). I then compare the overall mortality rates by cause for the same groups, controlling for their differing age distributions.

This descriptive analysis may strengthen the case for a behavioral interpretation of the Russian mortality paradox, but it cannot determine whether the underlying cause of the mortality gap is biological, behavioral, or ecological. Slavs and Central Asians live in very different contexts in Kazakhstan, and while the two groups tend to be equally well educated on average, this outcome masks significant regional interactions between ethnicity, education, and urban-rural residence. In order to determine the extent to which residual ethnic differences remain after accounting for these contextual differences (to the greatest degree possible), I estimate a multivariate regression model of sex-, age-, ethnicity-, and geography-specific mortality rates. I estimate a negative binomial regression model with the following basic form:\(^3\)

\[
D_{ijk} = \exp[\ln N_{ijk} + \beta_i X_i + \beta_j X_j + \sum_k (\beta_k X_k) + \varepsilon_{ijk}],
\]

Where \(D_{ijk}\) refers to the number of deaths among members of five-year age group \(i\) and ethnicity \(j\) in oblast \(k = 1\ldots16\), \(N\) refers to the person-years of exposure, and \(\varepsilon\) is a error term whose exponential is gamma-distributed. \(X\) is a dummy variable indicating membership in group \(i\), \(j\), or \(k\) and \(\beta_n\) are the coefficients of interest. I estimate these models separately by sex for three ethnic groups (Slavic, Central Asian, and other). I calculate the exposure term using data on person-years lived from the Kazakhstan 1999 Census, and \(D\) using Kazakh death certificates from 1998–99. The analytic sample is limited to 5-year age groups between 20–59.

In order to control for effects that may be captured by the ethnicity and age variables as

\(^3\)Negative binomial is selected over the Poisson model because the data fail an over-dispersion test (Cameron & Trevedi 1990).
possible, I introduce additional variables, including an urban residence dummy and education level (below secondary, secondary or technical, and incomplete college or higher).

A third model adds a Russification measure: the percent of Kazakhs fluent in Russian, specific to the same oblast and stratified by rural/urban, education level, sex, and age group. The model is intended to identify unobserved factors associated with Russification that are uncorrelated with socioeconomic phenomena, so that the lack of further contextual variables is less likely to introduce bias in the estimation of the coefficient. In order to address the linguistic diffusion hypothesis offered earlier, I construct a measure of Russification based on the level of Russian fluency among Kazakhs. Because language is not identifiable in both data sources, the measure is environmental rather than individual-level. The variable used in the regressions is the percent of Kazakhs who speak Russian in the same age, sex, education level, and geographical area (by urban/rural areas within an oblast). Russian fluency among Kazakhs ranges from 48.0–99.9% across areas, with a weighted mean of 90.6%; the standard deviation is 8.5%, and the distribution is highly negatively skewed.4

2.3 Sources of Data

The main analysis is conducted on mortality rates by age, sex, and ethnicity, which are constructed from two sources. Population counts are from the Kazakhstan 1999 Census microdata, 100 percent sample. Mortality rates used in this analysis are derived from counts of deaths from Kazakhstan’s vital statistics death registration system (covering 301,730 deaths during 1998–1999) and population counts from the Kazakhstan 1999 Census. The Census date is near the start of 1999, and therefore mortality rates are calculated using the

4While Russian fluency has been validated in some studies as a significant determinant of behavioral differences among Kazakhs (Agadjanian & Dommaraju 2006), some have argued that bilingualism itself may not be a good indicator of Russification (Anderson & Silver 1983, 1990). However, the return of Kazakh to public use during the 1990s may reduce the risk that I am capturing what Anderson & Silver term “unassimilated bilingualism.” To the extent, then, that I find a significant difference, the size of the effect may be underestimated.
average the number of deaths by cause observed in 1998 and 1999. Summary mortality rates are standardized to the European standard age distribution to increase the comparability across ethnicities by removing age structure effects. The largest increases in mortality in Kazakhstan during the 1990s appear to have been at adult ages; to narrow my focus to this group, as well as avoid reporting errors likely concentrated in the youngest and oldest age categories, my mortality analysis is limited to ages 20–59.

The rates can be constructed as low as the township level. However, in regressions, I have preferred to use rates calculated at the oblast level. The contextual variables included in the regression model are taken from the Census, as well as the Demographic and Health Survey (DHS) of 1999 and the Living Standards Measurement Study (LSMS) of 1996 and statistical yearbooks. The death certificates cannot be directly linked to Census records, and therefore only variables existing in both sources can be included in the regression, as well as those which can be linked by geography.

Ethnicity is listed in both death certificates and in the Census, but coded according to slightly different methods. Census ethnicity is self-reported, while death certificates are coded according to the nationality listed in the passport of the deceased. To reduce the possibility of mismatch between data sources, comparisons in this paper are made between all Kazakhstani Central Asians (including Kazakhs, Kyrgyz, Uzbeks, Turkmen, and Tajiks) and all Eastern Slavs (Russians, Ukraniants, and Belorussians). Educational categories are also defined differently between the Census and death certificates, so some specificity is lost in the conversion. I have opted to distinguish only between low, medium, and high education. Students in Kazakhstan are tracked into higher education after secondary school, into general or specialized/technical education tracks. Low education refers to those with completed

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5The Census was conducted February 25-March 4, 1999 (Aisagalieva 1999).
6National-level results are also presented for comparability to previous research, where they have been the only data source available.
7Interethnic marriages are uncommon in Central Asia, although more common in Kazakhstan than elsewhere. Mixed-race individuals cannot be identified in the mortality data, a potential source of bias. However, there is evidence that mixed households are more likely to identify as Russian (Gorenburg 2006).
primary schooling or below (0-6 years); medium refers to those with junior secondary (6-11 years) or senior secondary education (11-14 years), and high refers to those with partial or completed tertiary education (total 14-19 years).

3 Results and Discussion

3.1 Socioeconomic characteristics of Russians and Kazakhs

The average levels of schooling of Russians and Kazakhs differ by less than 1 year, and the college-educated share of the population does not differ dramatically (Table 1). However, the Russian population is substantially wealthier. The national poverty rate in 1996 was 35% nationally (30% in urban and 39% in rural areas), and the poverty rate by ethnicity was approximately 49% for Kazakhs and just 21% for Russians (World Bank 1996). Russian consumption per capita exceeds Kazakhs’ by approximately 30%, and to varying degrees in every part of the country.

[Table 1 here: descriptive statistics by sex, ethnicity, region]

Turning from income to mortality, the Slavic mortality disadvantage becomes apparent, as does the very large mortality disadvantage of males overall. In Kazakhstan overall, males are more than twice as likely to die between ages 20 and 60 as are females. For Slavs specifically, the ratio is close to two and a half. Russian males on average have 26 percent higher chance of dying between ages 20 and 60 than Kazakhs, compared to just 9 percent for Russian females. The results for urban areas compliment the results for income. Russians in urban areas have comparable incomes to Kazakhs, and the gap between Russian mortality and Kazakh is relatively high. In rural areas, both Russian and Kazakh mortality is generally better. It may be the case that the income advantage of Russians in rural areas explains some of the improvement in relative mortality. I explore this explanation in the regression models.
As with consumption, the aggregate trends conceal important differences across regions. Russians experience uniformly higher rates of adult mortality than Kazakhs except in one case: rural Russians in Kazakhstan’s southern oblasts have the greatest probability of survival between age 20-60 among all Kazakhs or Russians anywhere in the country. The Russian population in the south is smaller, and I hypothesize that the smaller concentration of Russians is associated with a reduction in the causes of death which explain the excess mortality among Russians. The next subsection will investigate these causes.

### 3.2 Cause of death analysis

Before proceeding to examine the role of contextual factors in explaining the mortality gap, it is useful to determine the causes of death which account for the difference. I will refer frequently to Kyrgyzstan as a comparison case (citing findings from Guillot et al. 2011), where causes of death related to Russian patterns of alcohol consumption accounted for 80-85% of the mortality gap between ethnic Russians and Kyrgyz in 1998-99. Given the cultural differences between Kazakhs and Kyrgyz, I expect a smaller difference between Russians and Kazakhs in the age-standardized death rates compared to previous results for Kyrgyz, and that alcohol-related causes account for less of the gap in Russian-Kazakh mortality than was the case for Russian-Kyrgyz mortality in Kyrgyzstan.

Cause-specific mortality rates are age-standardized according to the WHO European age standard distribution and separately specified by sex (Table 2). The gap in Kazakhstan between Slavic and Central Asian mortality for males is approximately 446 deaths per 100,000 population; for females, it is 64 per 100,000. Slavic male mortality is 44% higher than for Central Asians; female rates are only 15% higher by comparison. The mortality gap between Russians and Kyrgyz is nearly twice as high for males and approximately equal for females. In

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8The European model age distribution is chosen to increase comparability with published estimates for Kyrgyzstan (Guillot 2011a). I tested the sensitivity of the estimates to use of a uniform age distribution and the results were not affected.
Kazakhstan, the greatest share of difference (45% for males and 78% for females) is accounted for by external causes of death, which includes accidental and intentional harm from car accidents, poisoning, machinery, falls, and suicide and homicide. For males, other causes that explain a significant amount of the gap are circulatory diseases (19.2%), neoplasms (10.6%), and infectious diseases (9.7%).

[Table 2 here]

I present two ways of examining the role of alcohol in mortality using cause-of-death data. The first is by examining causes of death directly attributable to drinking, such as cirrhosis, alcohol psychosis, and alcohol poisoning. The second is to examine differences in causes of death where a majority of deaths may not be due to alcoholism, but where the vast majority of alcohol-related deaths accrue.

Mortality from alcohol poisoning, psychosis, and directly related causes is 5 times greater for Russian males than for Kazakhs. This compares to 14 times greater alcohol mortality in Kyrgyzstan, attributable to the fact that Kyrgyz men have far fewer alcohol-related deaths than Kyrgyzstani Russian men, and also to the fact that alcohol mortality among Russian males in Kyrgyzstan is in fact higher (83.0 deaths per 100,000) than among the same population in Kazakhstan (51.1 per 100,000). The lower rate among Russians in Kazakhstan may be due to unobserved factors, but it is striking anyway given the overall high degree of similarity between Russians in the two countries. Alcohol poisoning alone accounts for 7 percent of the total male mortality gap by ethnicity in Kazakhstan: consistent with the theory, this is lower than the ratio for Russians to Kyrgyz, 12 percent.

The story is similar for females, although Central Asian females have dramatically lower levels of alcohol-related deaths than Central Asian males: the ratio of male to female deaths for these causes is approximately 6:1 in Kazakhstan and 8.5:1 in Kyrgyzstan. Since I would expect the rate of these deaths to be highly correlated with the level of consumption, and also with the particular habits of binge-spirits alcohol consumption identified in Russia, this
evidence supports the qualitative observation that Kyrgyz society has absorbed less influence from Russian lifestyles than have the Kazakhs.

There are other causes besides those directly related to alcoholism that account for significant parts of the mortality gap. In particular, circulatory diseases might be an exception to the rule identified above, as Russian men have significantly higher death rates from myocardial infarction, ischemic heart disease, and related conditions that may have underlying behavioral causes, especially given that the rates among Russian women are comparable or lower than for Central Asians (Zaridze et al. 2009a, b). Tuberculosis (TB) is another notable condition, explaining 9-10 percent of the ethnic gap for males. TB infection in the Russian population has been linked to incarceration (Bobrik et al 2005), which is unsurprising if incarceration is a consequence of violence related to alcohol (Gavriloa et al 2005).

The Russian mortality paradox applies to both sexes, but the gap between Russian and Central Asian men has tended to be greater than the ethnic gap between women (Guillot et al. 2011). The results in Kazakhstan are consistent with this pattern. Female mortality for all groups is around one-third to one-half the male level, and female mortality directly attributable to alcohol is closer to one-fourth the male level in both countries for Russians, while lower still for Central Asians. Immediately, it is evident that alcohol plays a significant role here, although through a somewhat different profile of causes by sex. External causes are an even greater share of the mortality gap for females than for males, at fully 78.2%, partly explained by the very low rates of violent death (except suicides) among Central Asian women. Infectious disease mortality is lower among Russian females than their Kazakh counterparts, contrary to the findings for males. This is likely driven by the fact that tuberculosis, an important source of excess infectious disease mortality for Russian males, is lower among Russian women. Men may be more likely to have conflicts erupt in violence and end with arrest, which would explain why the effect is not found for women. Cancer mortality is higher for Russian females; however, upper digestive tract cancers that can result
from chronic alcoholism do not account for the difference.

Interestingly, physical manifestations of chronic alcohol abuse such as upper digestive tract cancers and liver cirrhosis are not dramatically higher among Russians. This is consistent with the findings from studies of alcohol abuse that it is not only a high volume of alcohol that can adversely affect health, but also the manner in which it is consumed. Binge drinking can result in increased mortality from external causes without signs of chronic alcoholism, and data from Russia show that such sporadic bouts of heavy drinking are normal (Shkolnikov & Nemtsov 1994) and associated with higher mortality risk (Brainerd & Cutler 2005; Denisova 2009). Overall, it is psychological and circumstantial factors associated with sporadic, heavy drinking—overdose, violence, and accidents relating to alcohol consumption—where the disparity between Kazakhs and Russians is greatest.

Deaths directly attributable to chronic and acute alcohol consumption (four causes out of a list of 200) account for 9% of the male mortality gap, and excess mortality among Russians to causes “strongly related to alcohol consumption” (Zaridze et al. 2009a) accounts for fully 90%. For females, direct causes account for 20% of the gap and direct plus indirect causes account for 85%.

Comparing the Kazakhstan results with those for Kyrgyzstan, directly alcohol-attributable deaths account for a larger share of the gap between Russians and Central Asians in Kyrgyzstan (15% for males and 37% for females), reflecting greater alcohol-related mortality for both Kazakhs (compared to Kyrgyz) and Kyrgyzstani Russians (compared to Kazakhstani Russians). Ethnic Kazakhs have significantly greater alcohol related mortality than other Central Asians. Kazakh mortality for males and females is higher overall, but would be closer to parity if the levels of alcohol related deaths were identical.

Kazakhs appear to be situated squarely in between Russians on the one hand and Kyrgyz on the other, consistent with the behavioral hypothesis. This evidence points to the Russian mortality paradox as a continuum, along which closer affinity to Russian customs (related
to some degree to eating and drinking habits) result in mortality patterns approaching the
Russian standard. In this typology, Kazakhs may be the missing link between non-Russian
Central Asian and Russian populations, illustrating some properties of each.

The next section will test the robustness of these associations in a multivariate regression
of mortality on ethnicity and a set of demographic and socioeconomic variables.

3.3 Multivariate regression

Thus far, the analysis has focused on behavioral similarities between Russians and other
Central Asians, and how that should lead to a mortality gradient between Russians, Kazakhs,
and Kyrgyz. The comparison of cause of death data above addresses differences in age
structure, but not the possibility that the mortality gap is driven by the differences in
the environments in which Slavs and Central Asians live. Kazakhstan is an idea choice to
test the influence of geography and economic context because—unlike Kyrgyzstan—there
is a significant rural population of Russians dispersed across the country as well as a large
number of urban and Russified Central Asians.

From the death rates dataset, I constructed an analytic sample of deaths by age, ethnicity,
sex, and geography (urban/rural and oblast). I excluded non-Slavic and non-Asian ethnicities
and ages below 20 or over 59. Since these data are geographically specific, I can include
contextual variables that exist in only one dataset or external sources, as long as they can
be linked by geography.

To begin, I compared age-standardized adult all-cause mortality rates (40 M20) according
to my linguistic Russification measure. The results are shown in Figure 3. The figures
are constructed by plotting the values of 40 M20 against the percent of the Kazakhs in the
local area (by urban/rural residence within the oblast or oblast-level city) who speak fluent
Russian.

[Figure 3 here]
Linear regression lines are fit separately by ethnicity and sex. The figures suggest that mortality is highest among Russian males living in the most Russified areas, and a weak positive association between Russification and mortality for Kazakh males. The apparent result for Russian females is no association, and at first glance a weak negative correlation for Kazakh females.

This first cut examination of the Russification hypothesis provides some evidence of an effect; further modeling may provide useful insight. The key regression results are presented in Table 3. Models 1 through 3 test the robustness of the Russian ethnic mortality disadvantage, and models 3 and 4 test the effect of Russian fluency at the local (oblast by urban/rural residence) level. Model 4 includes Kazakhs only.

[Table 3 here]

The first model, with only age group and oblast controlled, estimates a mortality ratio of 1.45 for Slavic to Asian males, and 1.17 for females (agreeing closely with the descriptive analysis). Accounting for differences between urban and rural areas and by education level reduces the ratio to 1.27 for males and leaves the results for females virtually unchanged. Residential patterns and educational differences between the two groups explains approximately half of the excess mortality of Slavic males, and little to none of the gap for females. The gap of approximately one fourth higher mortality among Russian men remains unexplained.

The unit of the Russian fluency variable is a standard deviation (approximately 8 percentage points). The Russification variable is likely standing in as a proxy for unobserved behavioral differences between Kazakhs in areas where Russian is more or less widely spoken. As such, it should have little effect on the Russian coefficient, even if it affects the Russian population. Independently, living in a Russified area is a significant predictor of increased mortality. In unit terms, a percentage point increase in the local area level of Russian fluency among Kazakhs is associated with an increase in the mortality hazard by 2 percentage points. The mortality gap for females is smaller to begin with, and more difficult to explain—the
available contextual variables explain very little of the raw Slavic coefficient. The Russification variable is significant and positive, although the effect for women is less than one half the size as the effect for men. The effect on Kazakh women is insignificant, suggesting that Russian women are worse off in highly Russified areas, but not Kazakh women. This effect has not been previously observed, and it remains to be determined what pattern of social interaction could explain this finding. One possibility compatible with the social networking theory is that there is less movement in the frontiers between Russians and Kazakh women compared to Russians with Kazakh men, and that interactions between Kazakh men and Kazakh women are more likely to be conducted in Kazakh language. Tabulations from the 1999 Census (not shown) confirm that the rates of Russian fluency among Kazakhs is lower among women than among men.

I am also interested in confirming the ethnic differential in cause-specific mortality rates. I use the same approach as in model 2 of Table 3, for main categories of causes of death and for alcohol-related causes. I report the results of the first two models for each sex in Table 4.

[Table 4 here]

Many of the specific causes of death show no significant difference between Russian and Kazakh rates. The exceptions are informative. For Russian women, the earlier finding of lower rates of deaths from infectious and parasitic diseases is robust. For men and women, external causes of death are much higher for Russians. After controls, Russian men are 22% more likely to die from this family of causes than Kazakh men, and Russian women 51% more likely than Kazakh women. For directly alcohol-related causes, the ethnic ratios remain robust, albeit lower than estimated by the descriptive analysis. Compared to the cause of death analysis, accounting for contextual differences reduces the ratio of Slavic to Central Asian mortality from 5 to 2.5 for men, and from 8.1 to 4.1 for women. Contextual differences account for only half of the gap and the ethnic mortality ratio remains highly
4 Conclusion

While it has been impossible to fully control for all the potential contextual variables that may be correlated with Slavic residence patterns, the Russian mortality penalty has shown itself to be robust to the major contextual differences between Kazakhs and Russians. The concentration of excess Russian mortality in causes related to alcohol abuse is consistent with prior findings, and in the hypothesized direction. Crucially, Kazakh mortality exceeds that of Kyrgyz in alcohol-related causes of death—further evidence of the role of alcohol in post-Soviet mortality contexts.

This paper is the first to study causes of death in depth for the period of the Kazakstan 1999 Census. The adult mortality of Russian men is 45% higher than for Kazakhs. Russians and Kazakhs live in different areas of the country, and live different lifestyles. Controlling for contextual differences, Russian men’s all-cause mortality remains 27% higher, and alcohol-related deaths among Russians men remain 2.5 times higher. There is no significant mortality differential between Russian and Kazakh men for most causes of death, but external causes and alcohol-related causes are large exceptions which explain the vast majority of the ethnic mortality gap. Russian women similarly have higher all-cause mortality, although only 15% higher than Kazakh women. The excess all-cause mortality of Russian women is unchanged when controls are included. Russian women have lower likelihood of dying from infectious or parasitic diseases or respiratory diseases, and much higher likelihood of dying due to external or alcohol-related causes. The alcohol-related death rate remains 4.1 times higher for Russian women relative to Kazakh women.

In the analysis, I present an original test for significantly higher mortality as a consequence of Russification. The gradient observed between Russians, Kazakhs, and Kyrgyz in
direct mortality estimation hints at closeness to Russian cultural habits as a driver of increased adult mortality. From the regression analysis, it emerges that the Russian mortality paradox may not be exclusive to Russians, but could also affect those who are substantially Russified. Living in Russified locations is associated with higher adult mortality risk for Russians and for Kazakh men (approximately 2% pt. increase in mortality rates for each 1% pt. increase in Russian fluency among Kazakhs), but Kazakh women appear to be insulated from the process that generates this association.

The gap in socioeconomic status between Kazakhs and Russians is lower than between Kyrgyz and Russians. Since the Kazakhs have greater education and consumption levels than Kyrgyz, one would expect their mortality numbers to be better overall—which they are generally, with the glaring exception being worse rates the same causes of death that happen to explain Russia’s poor adult mortality. In other words, higher socioeconomic status among Kazakhs does not necessarily translate to better health, since urban, educated Kazakhs tend to be more Russified, and fall prey to the same problems that Avdeev et al. (1998) called the “specific nature of Russian mortality.”

The results beg the larger question of why Russification should lead to worse health. There have been some suppositions about why there has been such a rapid growth in adult mortality among Russians in the former Soviet sphere, but there is as yet no scientific consensus. Diffusion and networking theories offer a potential route into understanding the transmission of the Slavic pattern of mortality to Kazakhs, but a detailed examination of these dynamics is beyond the scope of the present study. Slavs still account for a significant share of the world population, suggesting an urgency to understanding what precisely precipitated the alcohol-fueled increase in mortality in the Russian-speaking world.
References


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Libertas.


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Tables and Figures

Figure 1: Russian population of Kazakhstan, 1999

1 cm = 165 km

Note: Russian share of total population ages 0–90 by rayon (district), divided by quartile. Oblast names and boundaries shown with major cities (Almaty and Astana are oblast or province-level cities).
Source: Kazakhstan 1999 Census.
Figure 2: Comparative mortality of Russians and Kazakhs, 1999

Note: Rates shown as $nq_x$, probability of death between age $x$ to $x + n$.

<table>
<thead>
<tr>
<th></th>
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<th>South</th>
<th>West</th>
<th>North</th>
<th>East</th>
<th>All</th>
<th>Central</th>
<th>South</th>
<th>West</th>
<th>North</th>
<th>East</th>
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<td>61.4</td>
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<td>31.5</td>
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<td>175</td>
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<td>574</td>
<td>650</td>
<td>742</td>
<td>707</td>
<td>382</td>
<td>90.97</td>
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<td>87.99</td>
<td>83.84</td>
<td>98.37</td>
<td>97.18</td>
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<td>87.27</td>
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<td>$484</td>
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<td>9.3</td>
<td>8.0</td>
<td>10.7</td>
<td>12.9</td>
<td>11.7</td>
<td>8.6</td>
<td>8.9</td>
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<td>0.357</td>
<td>0.321</td>
<td>0.350</td>
<td>0.152</td>
<td>0.135</td>
<td>0.156</td>
<td>0.153</td>
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<tr>
<td><strong>Slavic</strong></td>
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<td>852</td>
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<td>17.76</td>
<td>5.95</td>
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<td>$980</td>
<td>$593</td>
<td>$1,177</td>
<td>$1,367</td>
<td>$1,020</td>
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</tr>
<tr>
<td>(1) Rural</td>
<td>0.306</td>
<td>0.287</td>
<td>0.285</td>
<td>0.337</td>
<td>0.321</td>
<td>0.340</td>
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<tr>
<td>(2) Rural</td>
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<td>0.403</td>
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<td>0.118</td>
<td>0.183</td>
<td>0.183</td>
<td>0.166</td>
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<tr>
<td><strong>Ratio (2)/(1)²</strong></td>
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<td>1.314</td>
<td>0.885</td>
<td>1.197</td>
<td>1.278</td>
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<td>0.742</td>
<td>1.014</td>
<td>1.167</td>
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¹ Figures refer to both sexes combined
² Asterisks indicate significance level: * p<0.05, ** p<0.01

Note: Alcohol consumption converted to equivalent mL per person consumed per month. Spending converted to 2012 USD. See Figure 1 for oblasts by region.
Source: LSMS (alcohol and spending); Kazakh 1999 Census (population, language, education) Kazakhstan vital statistics 1998-99 (mortality).

Figure 3: Standardized deaths by level of Russification

Note: Adult mortality (ages 20–59) standardized to European age standard. Observations by oblast by urban/rural residence.
Table 2: Age-standardized death rate (per 100,000) at ages 20–59 (40–M20), by sex, ethnicity, and cause of death, Kazakhstan, 1998–1999

<table>
<thead>
<tr>
<th>Cause of Death</th>
<th>Slavic Central Asian Ratio</th>
<th>Slavic Central Asian Ratio</th>
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<tr>
<td></td>
<td>(1)</td>
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<tr>
<td>All Causes</td>
<td>1.465</td>
<td>1.019</td>
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<td>Infectious and Parasitic Diseases</td>
<td>134.8</td>
<td>91.3</td>
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<td>Neoplasms</td>
<td>184.0</td>
<td>136.5</td>
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<td>Diseases of the Circulatory System</td>
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<tr>
<td>Diseases of the Respiratory System</td>
<td>66.7</td>
<td>55.8</td>
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<td>Diseases of the Digestive System</td>
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<td>232.1</td>
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<td>External Causes</td>
<td>100.4</td>
<td>72.1</td>
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<td>Directly Alcohol Related Causes¹</td>
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<td>9.9</td>
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<td>All Causes Related to Alcohol Consumption²</td>
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<td>584.6</td>
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<tr>
<td>Detailed Causes</td>
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<td></td>
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<tr>
<td>Detailed Infectious and Parasitic Diseases</td>
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<td></td>
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<tr>
<td>Tuberculosis</td>
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<tr>
<td>Other infectious and parasitic diseases</td>
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<tr>
<td>Detailed Neoplasms</td>
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<td>All Causes Related to Alcohol Consumption²</td>
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<td>584.6</td>
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<tr>
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<td>0.5</td>
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<tr>
<td>Other causes</td>
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<tr>
<td>Detailed Other Causes</td>
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<tr>
<td>Suicide</td>
<td>2.0</td>
<td>0.5</td>
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<tr>
<td>Detailed Other Causes</td>
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<tr>
<td>Suicide</td>
<td>2.0</td>
<td>0.5</td>
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<tr>
<td>Detailed Other Causes</td>
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<tr>
<td>Suicide</td>
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<td>0.5</td>
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<tr>
<td>Number of cells</td>
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</table>

¹ Directly alcohol related causes include: alcohol poisoning, alcoholic cirrhosis of the liver, alcohol psychosis, and chronic alcoholism.
² Causes indirectly related to alcohol consumption from Guillot et al. 2011 (HSE Conference Paper), Table 1.

Source: Author’s calculation based on Kazakhstan 1999 Census data and 1998-1999 vital registration data.

<table>
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<th>Variables</th>
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<th>(4)</th>
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<td>1.270***</td>
<td>1.260***</td>
<td>1.170***</td>
<td>1.167***</td>
<td>1.166***</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
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<td>1.242***</td>
<td>1.220***</td>
<td>1.130***</td>
<td>1.064***</td>
<td>1.068***</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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</tr>
<tr>
<td>High education (College or greater)</td>
<td>0.492***</td>
<td>0.465***</td>
<td>0.497***</td>
<td>0.542***</td>
<td>0.520***</td>
<td>0.561***</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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</tr>
<tr>
<td>Low education (Primary or none)</td>
<td>1.719***</td>
<td>1.793***</td>
<td>1.496***</td>
<td>1.895***</td>
<td>1.952***</td>
<td>1.568***</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Russian fluency (among Kazakhs)</td>
<td>1.167***</td>
<td>1.115***</td>
<td>1.059***</td>
<td>1.099***</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Number of cells</td>
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<td>1345</td>
<td>717</td>
<td>255</td>
<td>1272</td>
<td>1272</td>
<td>694</td>
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<td></td>
</tr>
</tbody>
</table>

* p<0.05, ** p<0.01, *** p<0.001

Note: Exponentiated coefficients; t-statistics in brackets. Model 1 controls for age and oblast; Models 2 and 3 additionally control for urban/rural residence and education. Model 4 applies to Kazakhs only.
<table>
<thead>
<tr>
<th>Cause of Death</th>
<th>Males (1)</th>
<th>Males (2)</th>
<th>Females (1)</th>
<th>Females (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Causes</td>
<td>1.448***</td>
<td>1.270***</td>
<td>1.170***</td>
<td>1.167***</td>
</tr>
<tr>
<td></td>
<td>[18.80]</td>
<td>[11.88]</td>
<td>[6.59]</td>
<td>[5.67]</td>
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<tr>
<td>Infectious and Parasitic Diseases</td>
<td>1.341*</td>
<td>0.872</td>
<td>0.555***</td>
<td>0.437***</td>
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<tr>
<td>Neoplasms</td>
<td>1.035</td>
<td>1.037</td>
<td>1.180</td>
<td>1.087</td>
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<tr>
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<td>[0.35]</td>
<td>[0.35]</td>
<td>[1.07]</td>
<td>[0.79]</td>
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<tr>
<td>Diseases of the Circulatory System</td>
<td>1.085</td>
<td>0.935</td>
<td>0.860</td>
<td>0.836</td>
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<td>[0.62]</td>
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<td>[-1.03]</td>
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<tr>
<td>Diseases of the Respiratory System</td>
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<td>1.017</td>
<td>0.717</td>
<td>0.560***</td>
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<td>Diseases of the Digestive System</td>
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<td>1.027</td>
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<td>External Causes</td>
<td>1.528***</td>
<td>1.222**</td>
<td>1.765***</td>
<td>1.510***</td>
</tr>
<tr>
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<td>[3.91]</td>
<td>[2.90]</td>
<td>[4.07]</td>
<td>[3.94]</td>
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<tr>
<td>Other Causes</td>
<td>1.177</td>
<td>0.917</td>
<td>0.873</td>
<td>0.767*</td>
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<td>[1.16]</td>
<td>[-0.84]</td>
<td>[-0.89]</td>
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<tr>
<td>Directly Alcohol-Related Causes</td>
<td>3.693***</td>
<td>2.504***</td>
<td>5.460***</td>
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<td>Indirectly Alcohol-Related Causes</td>
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<td>[2.13]</td>
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<td>[0.89]</td>
</tr>
</tbody>
</table>

* p < 0.05, ** p < 0.01, *** p < 0.001

Note: Exponentiated coefficients; t-statistics in brackets. Model 1 controls for age and oblast; Model 2 additionally controls for urban/rural residence and education.