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# Hazardous Drinking in Privatized Industrial Towns of Russia

Alexi Gugushvili<sup>1\*</sup>, Aytalina Azarova<sup>2</sup>, Darja Irdam<sup>3</sup>, and Lawrence King<sup>4</sup>

<sup>1</sup> Department of Sociology and Human Geography, University of Oslo, Postboks 1096, Blindern, 0317 Oslo, Norway

<sup>2</sup> Aytalina Azarova

Department of Public Health and Primary Care, University of Cambridge, Worts Causeway Cambridge, CB1 8RN, UK

<sup>3</sup> Hall & Partners, Bankside 2, 90-100 Southwark Street, London, SE1 0SW, UK

<sup>4</sup> Department of Economics, University of Massachusetts, Crotty Hall, 412 North Pleasant Street Amherst 01002, Massachusetts, USA

\* Author for correspondence: Alexi Gugushvili

**Email:** alexi.gugushvili@sosgeo.uio.no

**ORCID identifier:** 0000-0002-3933-9111

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## **Abstract**

Hazardous drinking, defined as the consumption of homemade, unofficially made alcohol and non-beverages, is prevalent and accounts for a high proportion of alcohol-related deaths in Russia. Individual-level characteristics are important explanations of hazardous drinking, but they are unlikely to explain spatial variation in this type of alcohol consumption. Areas that attracted insufficient attention in the research of hazardous drinking are the legacy of industrialization and the speed of economic reforms mainly through the privatization policy of major enterprises in the 1990s. Applying multilevel mixed-effects logistic regressions to a unique dataset from 30 industrial towns in the European part of Russia, we find that in addition to individual-level characteristics such as gender, age, marital status, education, social isolation, labor market status, and material deprivation, the types of towns where individuals resided such as industrial structure and speed of privatization also accounted for the variance in hazardous alcohol consumption among both males and females.

## Hazardous alcohol consumption in privatized and industrial towns of Russia

Alcohol has been identified as the key mediator between the post-Soviet socio-economic transition and the unprecedented mortality crisis that Russia faced since the beginning of the 1990s<sup>1-3</sup>. Hazardous alcohol consumption in particular, both in terms of frequency of heavy drinking and in terms of the type of alcohol consumed, played a central role in causing detrimental morbidity and mortality consequences<sup>4-6</sup>, accounting, as some studies show, for more than 40 percent of deaths in men<sup>7,8</sup>.

So-called *Samogon*, homemade alcohol, and ethanol-containing liquids have long been demonstrated as one of the riskiest types of consumed alcohol<sup>9-11</sup>. The high concentration of methanol or other impurities such as amyl alcohol or other fusel oils can be lethal even at very low doses mostly due to the severe damage to the kidneys and toxic hepatitis that they cause<sup>12,13</sup>. *Samogon* is often fortified or deodorized with substances such as tobacco, sulphuric acid, gasoline, bird droppings, kerosene, burnt rubber, and even with diphenhydramine to increase the potency of alcohol, despite the obvious health risks<sup>14,15</sup>. Estimates suggest that in the 1990s and 2000s *samogon* and other unofficial types of alcohol constituted 30 to 50% of total alcohol sales in Russia<sup>13,16,17</sup>.

The consumption of non-beverage alcohol is the most concerning type of alcohol consumption in Russia. This type of alcohol includes industrial surrogates such as medical alcohol, aftershaves, antifreeze, tooth powders, glues, kerosene and brake fluid. It was easily accessible and widely consumed, primarily by men.<sup>18-20</sup> Alcohol surrogates were sold in pharmacies all over the country as medical tinctures, aftershaves (which are often produced with “edible” scents such as lemon, mint or raspberry), and herbal extracts with high alcohol content<sup>21,22</sup>.

The price of surrogates were usually much lower than the price of officially produced alcoholic beverages, which was an important factor in high prevalence of consumption of non-beverage alcohol<sup>23,24</sup>. Researchers have also identified other important predictors of hazardous alcohol consumption in Russia. For instance, it is known that unemployment and hazardous drinking formed a vicious circle as it was identified as a boosting factor for *samogon* consumption both among men and women alike, however, the effect for men appeared to be more detrimental<sup>23,26,27</sup>. Education, particularly among men, was inversely correlated with hazardous alcohol consumption<sup>28,29</sup>. Furthermore, materially poor individuals and those with

pessimistic attitudes about their financial situation were more likely to be consumers of hazardous alcohol<sup>27,30</sup>.

Individual-level characteristics are important covariates of hazardous drinking, but they are unlikely to completely explain spatial variation in hazardous alcohol consumption. The highest levels of alcohol consumption in Russia were registered in the Far East region (primarily in Chukotka Autonomous Okrug), as well as in Siberia. The north of Russia was also significantly affected by remarkably high levels of drinking<sup>31,32</sup>. It is also known that in the European part of Russia, *samogon* and strong spirits such as vodka were consumed more commonly than beer and wine<sup>33,34</sup>. Homemade wine consumption was more common in the Southern parts of Russia due to climatic conditions suitable for grapes and other fruit production<sup>33</sup>.

Alcohol was more commonly consumed in rural, rather than in urban areas; villages and small settlements had the highest rates of alcohol consumption, while people in cities and especially regional centres drank relatively less<sup>35-37</sup>. *Samogon* was normalised as an accepted part of rural culture and was widely used to facilitate social relationships<sup>19,38</sup>. It is estimated that rural residents consumed, on average, 17,3 litres of alcohol per capita per annum, of which 14,4 litres of *samogon*<sup>29</sup>. Non-beverage alcohol was also mostly consumed in the rural rather than urban areas of the country<sup>27,33</sup>.

The lack of state regulations, low prices and wide accessibility are helpful to understand why consumption levels of hazardous alcohol were high throughout the country<sup>39,40</sup>, but they cannot explain the variance in hazardous drinking across Russian towns. Some studies on hazardous drinking link such alcohol consumption practices with community-level variables. For instance, high amount of alcohol advertisement and availability of alcohol outlets which created an environment encouraging hazardous drinking in the former Soviet Union countries including in Russia<sup>41,42</sup>.

One of the areas that attracted insufficient attention in research of hazardous drinking in Russia is the legacy of the Soviet industrialization which entailed building more than one thousand new cities many of which were raised as Soviet-style company towns, mono-towns, in which so called “city-forming enterprises” accounted for a large share of total employment and also provided various social services such as housing and healthcare. After the collapse of the Soviet Union, the closure of these plants threatened the entire towns with economic and social collapse and associated crisis in alcohol consumption<sup>43,44</sup>.

Transitional policies implemented by authorities in the 1990s might have also played a role. The speed of economic reforms mainly through privatization policy of major enterprises,

which varied substantially across the country and among its mono-towns, could also contribute to hazardous drinking. Some city-forming enterprises were fully privatized within one or two years, while for other far more gradual privatization strategies were adopted, incrementally reducing state capital over a number of years<sup>45,46</sup>.

Using data from the multilevel demographic cohort study – PrivMort, in this study we investigate how individual and contextual factors described above – multi- vs. mono-industrial towns (defined as having a single industrial enterprise providing employment for at least 7.5% of the total population) and slow vs. rapid privatization (where 90 or more per cent of state shares were privatized within two consecutive years) – were associated with subsequent hazardous drinking in 30 industrial towns in the European part of Russia.

The specific aim of this study was to apply the multilevel modelling approach as a method that allows us to evaluate the individual- and contextual-level covariates of hazardous drinking. We define hazardous drinking as consumption of homemade and unofficially made alcohol and non-beverages – ethanol-containing liquids not intended for human consumption.

## Results

**Consumption of hazardous alcohol** Table 1 presents the distribution of responses on the three questions on hazardous drinking, which also includes “don’t know” and “refuse to answer” options. Expectedly, drinking of all types of hazardous alcohol was higher among men than among women. Homemade alcohol was consumed more than several times a month by 11.8% of men and only by 1.9% of women. Unofficially made alcohol was consumed monthly or more often by 3.3% of men and 0.3% of women. Most individuals, 80.4% of men and 92.6% of women, have never consumed surrogates. The answer option “don’t know” is especially high for unofficially made alcohol, which suggests that many respondents were not aware if consumed alcohol was unofficially produced. Overall, our data suggest that a considerable share of Russian men engaged in hazardous alcohol consumption in the period preceding survey data collection in the first half of 2020s.

**Table 1** here

In order to analyze the variation in drinking in multivariate and multilevel settings, we created three binomial variables on hazardous alcohol consumption that take the value of 1 if individuals

drink homemade alcohol, unofficially alcohol, and surrogates often (several times a week) or sometimes (several times a month). For women, we created only one dummy variable on hazardous alcohol consumption, which takes a value of 1 if they consumed any of the three types of hazardous alcohol. The latter procedure was necessary because the share of women consuming unofficially made alcohol and surrogates was less than 0.5%, which made a meaningful analysis of its explanations unfeasible.

Figure 1 presents the mean levels of consumption of homemade, unofficially made, and surrogates in 30 towns for both genders. These results suggest that among males, there were clear differences between towns. This is especially true for homemade and unofficially made alcohol. Kirov-Chepetsk, a town in Kirov Oblast, had one of the lowest levels of hazardous alcohol consumption. It is difficult to speculate what were the causes of such a low level of drinking, but the town itself was considered to be a well-developed urban center with vibrant cultural and educational life. On the other end of the distribution, the highest levels of hazardous alcohol consumption were observed in Lakinsk and Buturlinovka. The former is a small town located in Vladimir Oblast and was populated by about 19 thousand individuals in 1989, with a declining population thereafter. The town also had a large Brewery<sup>47</sup>. Lakinsk was an outlier, especially in regard to hazardous alcohol consumption among women, as seen in Figure 1d. Buturlinovka, in turn, is located in Voronezh Oblast and was described as having an unfavorable socioeconomic situation and low indicators of the level of commercial services<sup>48</sup>. It is also the home of the Buturlinovka air base, which has been actively used by the Russian armed forces after the invasion of Ukraine in 2022.

**Figure 1** about here

**Individual-level explanations** In Table 2, three-level binomial logistic regression models for hazardous drinking with random intercepts are presented at both the settlement- and family levels. We proceed now with the description of individual-level explanations of hazardous drinking. Starting with relatives, we observed that among male respondents' first partners, when compared with fathers, had odds ratios of 3.51 ( $p < 0.001$ ), 5.65 ( $p < 0.001$ ), and 5.74 ( $p < 0.001$ ) to consume homemade alcohol unofficially made alcohol and surrogates. This might be related to the generational shift in Soviet Russia when alcohol consumption moved from the public to the private sphere and became an acceptable norm<sup>49</sup>. If before, people consumed alcohol as a collective social act, the intake of alcohol in isolation of private homes started to increase in the pre-television era and likely further contributed to hazardous drinking in Russia<sup>50</sup>. We also

observed differences in hazardous drinking between siblings, which is in line with previous scholarship on the salience of sibship size and sibship composition in drinking behavior<sup>51</sup>. Among men, age differences were particularly significant for consumption of unofficially made alcohol and surrogates. Males in the 40-49 age bracket, for instance, had odds ratios of 11.4 ( $p < 0.001$ ) and 7.83 ( $p < 0.001$ ) to engage in the latter forms of drinking when compared with the reference age category.

**Table 2** here

For women and surrogate-drinking males, marital status only marginally explained the variance in the dependent variables. Separated/divorced men had much higher odds ratios for consuming both homemade (1.69,  $p < 0.001$ ) and unofficially made (2.51,  $p < 0.001$ ) alcohol. In addition, separated/divorced (1.82,  $p < 0.05$ ) and widowed (1.52,  $p < 0.05$ ) women were more likely to drink hazardous alcohol. Individuals' educational attainment was an important explanation of alternative alcohol consumption. Males with elementary, secondary and vocational secondary educational attainment had odds ratios of 5.56 ( $p < 0.001$ ), 4.17 ( $p < 0.001$ ) and 4.15 ( $p < 0.001$ ) to consume unofficially made alcohol. Females with elementary (3.67,  $p < 0.01$ ) and secondary (3.21,  $p < 0.01$ ) education were also more likely to engage in alternative alcohol consumption. Similarly, we found that social contacts had an important effect on drinking patterns. Those males who communicated with female respondents less than once a year had odds ratios of 3.3 ( $p < 0.001$ ) and 2.7 ( $p < 0.05$ ) to drink homemade and unofficially made alcohol. For all three types of hazardous alcohol, the likelihood of drinking was especially high for those males who did not communicate with the survey respondents as they had the odds ratios of 3.18 ( $p < 0.001$ ), 4.28 ( $p < 0.001$ ), and 2.8 ( $p < 0.05$ ) for three types of alternative alcohol consumption.

Another important explanation of hazardous drinking was individuals' labor market status. Compared to working males those who were made redundant or were fired from their work had significantly higher odds of hazardous drinking, especially in regard to unofficially made alcohol (OR 5.82,  $p < 0.001$ ) and surrogates (OR 3.85,  $p < 0.01$ ). In turn, females who did not work due to ill health had an odds ratio of 3.53 ( $p < 0.01$ ) to drink hazardous alcohol. The results suggest that there were long-term consequences of life-course events as long-term unemployment among males in the 1980s exhibited a statistically significant effect on all types of hazardous alcohol consumption with odds ratios of 2.20 ( $p < 0.05$ ), 4.14 ( $p < 0.01$ ) and 7.77 ( $p < 0.001$ ) to drink homemade alcohol, unofficially made alcohol and surrogates. Males who were unemployed in the 1990s (OR 1.86,  $p < 0.01$ ) and the 2000s (OR 1.98,  $p < 0.01$ ) were also more likely to drink



homemade alcohol. For females, the only significant association between long-term unemployment and hazardous drinking stemmed from the most recent decade, with an odds ratio of 5.94 ( $p < 0.001$ ).

Finally, we looked on the second variable for which information was available for three consecutive decades – individuals' material deprivation. We found an expected relationship between experiencing deprivation and consuming hazardous alcohol, but this effect was primarily manifested in the 2000s. Materially deprived males in the 2000s had odds ratios of 2.63 ( $p < 0.001$ ), 2.51 ( $p < 0.05$ ), and 7.08 ( $p < 0.001$ ) to drink homemade alcohol, unofficially made alcohol, and surrogates. In addition, males who experienced deprivation in the 1990s were also more likely to consume unofficially made alcohol (2.43,  $p < 0.01$ ). The effect of material deprivation in the 2000s was significant for females who had an odds ratio of 3.08 ( $p < 0.05$ ) to drink at least one type of hazardous alcohol.

**Intraclass correlation coefficients** We calculated two intraclass correlation coefficients (ICC) for the described three-level regressions. The first is the level-3 ICC at the town level that showed the correlation between consumption of alternative alcohol in the same town. The second is the level-2 ICC at the families-within-towns level, which showed the correlation between the consumption of alternative alcohol in the same family and town. The results suggest that, controlling for individual-level covariates, hazardous drinking among individuals was only slightly correlated within the same towns, but it was highly correlated within the same families and towns. Estimated ICCs indicated that family and town random effects composed 43%, 47%, and 56% of the total residual variance for consumption of, respectively, homemade alcohol, unofficially made alcohol and surrogates. For females, family and settlement random effects composed 47% of the total residual variance. One would expect that family-level correlation coefficients could be higher for homemade alcohol as it, by definition, implies that consumed alcohol is made within families, but our estimations showed that for males, association within the family was higher for consumption of unofficially made alcohol and surrogates.

Lastly, we compared ICC values from null models without any individual-level variables and full models with all individual-level variables, which showed that instead of decreasing, the variance in hazardous alcohol consumption among towns stayed unchanged (for homemade alcohol consumption among males) or even increased (for all other forms of hazardous drinking among males and females). This suggested that not only the descriptive results on differences between towns depicted in Figure 1 could not be explained by individual-level composition of

these towns, but also these differences were even more pronounced when individual-level characteristics were taken into account.

**Industrialization, privatization, and consumption of hazardous alcohol** In this section, we explore if the variance in hazardous drinking was also explained by the different patterns of industrialization and privatization of 30 towns in which the survey was conducted. For this purpose, in Table 3, we compared hazardous drinking between slowly- and rapidly -privatized multi-towns, and slowly- and rapidly-privatized mono-towns by fitting two-level binomial logistic regressions. In Panel 1, which accounts for individual-level characteristics, we see statistically significant differences between four considered types of towns. Individuals in rapidly privatized multi-towns had the odds ratio of 3.28 ( $p < 0.001$ ) to drink homemade alcohol when compared with slowly-privatized multi-towns, while in slowly- and rapidly-privatized mono-towns odds ratios equalled to 2.31 ( $p < 0.001$ ) and 1.76 ( $p < 0.01$ ), respectively. Furthermore, in rapidly privatized multi-towns, individuals had odds ratios of 2.23 ( $p < 0.05$ ) and 4.43 ( $p < 0.01$ ) to drink unofficially made alcohol and surrogates when compared to individuals in slowly privatized multi-towns. We also observed that females in slowly privatized mono-towns had an odds ratio of 2.33 ( $p < 0.05$ ) to consume hazardous alcohol.

**Table 3** here

To more accurately account for the possible effects on hazardous alcohol consumption related to the type of industry and the speed of privatization, it is important to include in regression models only those individuals who lived in the towns in question in the 1980s and the 1990s. For this purpose, we eliminated all individuals who immigrated to those areas after the transition had started or those who left the towns in question in the 1990s. The results for the new more conservative sample are shown in Models 5 to 8. They are substantially similar to the findings of all individuals included in the analyses. Males in rapidly-privatized multi-towns, slowly-privatized mono-towns, and rapidly-privatized mono-towns in Model 5 had odds ratios of 3.65 ( $p < .001$ ) and 2.29 ( $p < .001$ ) to drink homemade alcohol. Males in rapidly privatized multi-towns were also much more likely to drink unofficially made alcohol (OR 2.75,  $p < 0.01$ ) and surrogates (OR 7.78,  $p < 0.01$ ). In Model 8, females in rapidly privatized multi-towns and slowly privatized mono-towns, respectively, had odds ratios of 2.75 ( $p < .05$ ) and 3.19 ( $p < .01$ ) to drink hazardous alcohol.

Lastly, to find out how the specific levels of hazardous drinking varied among the considered four types of towns, we also calculated predictive margins after fitting two-level

mixed-effects logistic regressions for three types of hazardous alcohol consumption. The derived results in Figure 2 indicate that controlling for individual-level explanations, the highest levels of hazardous alcohol consumption, particularly of homemade and unofficially made alcohol, were observed in rapidly privatized multi-towns, while the lowest incidents of hazardous drinking were observed in slowly privatized multi-towns. For males, these differences were statistically significant only for homemade alcohol consumption, while for women consumption of hazardous alcohol was somewhat higher in slowly- and rapidly-privatized mono-towns than in slowly-privatized multi-towns. The results suggested that hazardous alcohol consumption was indeed associated with industrial structure and speed of privatization of towns in which the ProvMort survey was conducted.

**Figure 2** here

## **Discussion**

In this study, we investigated the individual- and contextual-level explanations of hazardous alcohol consumption in 30 slowly- and rapidly privatized industrial towns in Russia. One of the main strengths of this study is that, unlike the conventional surveys on hazardous alcohol consumption, we were able to account for individuals who were deceased, among other reasons, due to hazardous alcohol consumption. Our estimates for the sample of respondents' relatives suggest that about 12%, 3%, and 2% of males consumed, respectively, homemade alcohol, unofficially made alcohol, and surrogates at least several times a month up until the period when the survey was conducted. Among females, the consumption of homemade alcohol a few times a month was around 2%, while only a small fraction of women drank unofficially made alcohol and surrogates. Descriptive statistics also suggested that the differences in hazardous alcohol consumption between towns are significant among males, especially for homemade and unofficially made alcohol. We first speculated that one of the reasons why we observed the differences in hazardous alcohol consumption between survey towns could be that they diverged from each other by their socio-demographic and socioeconomic composition.

The analyses of individual-level variables indicate that the consumption of hazardous alcohol was highest among males aged 40-49, males and females with elementary and secondary education, and men and women who were separated or divorced. It might be the case that homemade alcohol was perceived as less dangerous by low-educated individuals than official cheap alcohol as it was "homemade" and hence perceived to be more "natural." We also

revealed that hazardous drinking was higher among those males who lost their jobs, retired early, and did not work, those women who did not work due to ill health, and those males and females who had experienced spells of long-term unemployment and material deprivation in the 1980s to 2000s. These findings corroborate the previous scholarship. Material deprivation increased hazardous drinking as non-beverage alcohol was significantly cheaper<sup>52,53</sup>. Financial strain, especially among the elderly, might result in them producing and selling *samogon* as a means of diversifying their income, which increases the accessibility of samogon and reduces its market price due to the increased supply<sup>54,55</sup>. In addition, we found that hazardous alcohol consumption was higher among those males and females who rarely communicated with their relatives. The latter could be both the cause and the effect of hazardous drinking, as people who consume hazardous alcohol might be shunned by or seek voluntary isolation from their relatives.

Nonetheless, despite revealing significant effects of individual-level variables on hazardous drinking, our estimations suggest that the composition of towns did not account for the reduction of variance in hazardous alcohol consumption between these territorial units. Controlling for individual-level explanations, we tested how macro-level characteristics were associated with alcohol consumption in towns where our data were collected. Using two-level mixed-effects logistic regressions, we found that when compared with slowly-privatized multi-industrial towns, the consumption of homemade alcohol was significantly higher among males in rapidly-privatized multi-industrial towns as well as in slowly privatized mono-industrial towns, while consumption of unofficially made alcohol and surrogates among males was also higher in rapidly-privatized multi-industrial towns. For females, we showed that consumption of hazardous alcohol was highest in rapidly privatized multi-towns and slowly privatized mono-towns. These findings overall corroborated previous evidence linking rapid privatization policies with the worsening health and well-being outcomes during the post-communist transition<sup>44,56</sup>.

The results of our analyses can have some policy implications. Despite some recent policy initiatives in the direction of tighter control of alcohol<sup>57</sup>, in Russia hazardous drinking has been largely perceived as an individual problem, and the state has rarely offered community-level solutions providing help of narcologists to individuals instead<sup>41</sup>. Since the situation with hazardous drinking exceeds individuals by spurring into a mass problem, there is a need for more effective policy measures to address this issue. Affecting the problems of unemployment and material deprivation by means of economic progress could potentially reduce hazardous alcohol consumption. Educational campaigns on potential harmful consequences of hazardous alcohol consumption and more restrictive regulations of alcohol market in Russia might reduce hazardous drinking. Arguments have been advanced in previous studies that policies restricting

the availability and low prices of unofficial alcohol need to be made priority in Russia and in the broader Eastern European region<sup>24,58,59</sup>. On the town level, since our study showed that hazardous drinking was higher in multi-industrial towns which experienced rapid privatization as well as in some mono-industrial towns, more careful consideration of social consequences of economic policies could be important for prevention of the socio-economic problems and associated hazardous alcohol consumption. Investing more in local infrastructure and redistributive policies could also have a significant impact on hazardous drinking<sup>60</sup>.

The complex approach to the data collection employed by the PrivMort project has at least three important limitations. First, the data were collected in the European part of Russia, which despite hosting 80 per cent of Russia's total population, still is culturally and economically different from the rest of the country. Second, questionnaires aimed at finding out about past events and behaviours can result in recall bias. The survey administrators have tried to account for this by introducing auxiliary discussions with the respondents about major events and occurrences, what could help them remember the past more clearly. Third, since some of the most socio-economically disadvantaged people are often excluded from surveys due to their inability to participate, our sample might have omitted the heaviest drinkers, whose relatives were also more likely to consume hazardous alcohol. Finally, more research is needed to understand how hazardous drinking develops through time in connection to various individual and town-level characteristics. The Russian invasion of Ukraine could be an important event to explore in terms of its implications for hazardous alcohol consumption, especially in industrial towns located close to the Ukrainian border.

## Methods

**Dataset** The analysis is based on the PrivMort data – a multi-disciplinary project investigating the post-communist morbidity and mortality crisis using a multilevel convenience cohort study. Between mid-September 2014 and March 2015, the PrivMort project conducted surveys in 30 towns in the European part of Russia, illustrated in Figure 3, excluding the regions of the North Caucasus. The latter regions have dietary and alcohol consumption habits very different from the rest of Russia due to their cultural and religious traditions. The PrivMort project initially collected basic economic, demographic, and enterprise-level data on all settlements with 5,000-100,000 inhabitants. A set of 30 towns was selected from the pool of 539, using propensity score matching<sup>46</sup>. Propensity scores were calculated based on the pre-transition demographic and

socio-economic conditions in the settlements. To identify the health consequences of economic transformations, ten mono-industrial towns with rapid privatization were matched to ten mono-industrial towns without rapid privatization. Additionally, a group of five multi-industrial towns (where employment is distributed proportionally among several industrial enterprises) was selected closely matching an additional five mono-industrial towns.

Ethics approval for this study was obtained from the University of Cambridge Department of Sociology ethics committee and ERC ethics advisers. The informed consent was acquired from each participant and data were anonymized to prevent any potential identification of individual respondents. The dataset and the Stata code for replication of this study are available via the Open Science Framework.

### **Figure 3 here**

In the selected towns the houses/apartments were randomly selected using a random walk method, and interviewers conducted face-to-face interviews in the selected households. Only one respondent was selected from each household, even in cases when more than one family shared the same house. The screening criteria for the survey ensured that each potential respondent had to be born before 1972 and had at least one family member (parents, siblings, or husbands) living in the same town for a prolonged period of time during and after the transition. This criterion ensured that a respondent had reached working age by 1991 and that the potential migration effect was taken into consideration. Overall, the sample includes 22,648 respondents. In addition to collecting information on individuals, the PrivMort acquired data on their parents', siblings', or partners' hazardous drinking. This collected information on the relatives was used to analyze the patterns of hazardous drinking and their explanations.

**Questions on hazardous alcohol consumption** For homemade alcohol consumption survey respondents were asked: “People sometimes drink homemade alcohol, that is, alcohol made by themselves or acquaintances (e.g., wine, samogon, diluted medical alcohol). Does/did your father/mother/sibling/partner ever drink such beverages? If yes, how often does/did he/she do this? For unofficially made alcohol, the following question was asked: “People sometimes drink unofficially made alcohol, that is, alcohol made in large quantities, but not registered. Does/did your father/mother/sibling/partner ever drink such beverages? If yes, how often does/did he/she do this?” Lastly, for surrogates, respondents were asked: “People sometimes drink surrogates (such as mouthwash or aftershave). Does/did your father/mother/sibling/partner

ever drink such beverages? If yes, how often does/did he/she do this?" The answer options in the described questions include "often, several times a week", "sometimes, several times a month", "occasionally, less than once a month", "used to drink that type of alcohol but quit" and "never".

**Statistical analysis** To understand the individual- and town-level covariates of hazardous alcohol consumption, we started by fitting three-level mixed-effects logistic regressions. Level 1 consisted of individuals, level 2 consisted of their families, and level 3 consisted of 30 towns in which the PrivMort survey was conducted. The Three-level mixed logistic regression with random intercepts for both families and towns accounted for the dependence between individuals in the same families and towns. We assumed that random intercepts were normally distributed. Models were estimated using the Stata 17 function "melogit".

One of the main goals of this study was to find out the source of the observed cross-town variation in the consumption of hazardous alcohol. In order to test how selected types of towns, in terms of their industrial structure and privatization speed, had different levels of hazardous drinking, we fitted two-level mixed-effects logistic regressions in which levels 1 and 2 were, respectively, individuals and their families. We fitted two-level models because differences between the types of towns were absorbed in the intercepts of three-level models. Before we moved to town-level analysis, we first tested if the variation in hazardous drinking was accounted for by individual-level variables described below.

**Individual-level variables** Following the conventional approach of research in alcohol consumption, we divided our analytical sample by gender (66.0% of individuals are males). The age of the individuals was collapsed into five categories: 40-49, 50-59, 60-69, 70-79, and 80+. The variable on education was based on elementary, secondary, vocational secondary, vocational higher, and complete academic higher education. As for marital status, females were much more likely to be widowed than males. The survey respondents were asked to report the frequency of communication between them and their relatives, including personal or via phone, internet, telegraph, or letters. Descriptive statistics in Table 4 reveal that 34.9% of men and 20.3% of women were active in the labor market. A significant proportion of individuals retired at a normal age – 34.3% of males and 64.8% of females. The PrivMort survey collected information on unemployment spells lasting for 6 months or longer in the 1980s, 1990s, and 2000s. This type of unemployment was experienced by about 1.1%, 4.6%, and 3.3% of those men who were alive in these periods. For females, the rates of long-term unemployment were lower at 0.6%,

2.5%, and 3.3% for the corresponding three decades. For the 1980s-2000s, we also had information on material deprivation experienced by individuals included in the sample. The share of respondents who experienced material deprivation increased from 4.0% of men and 4.6% of women in the 1980s to 7.2% and 7.5% in the 1990s and decreased to 3.2% and 3.4% in the 2000s.

**Table 4** here

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# Figures

Figure 1: Consumption of hazardous alcohol across 30 towns

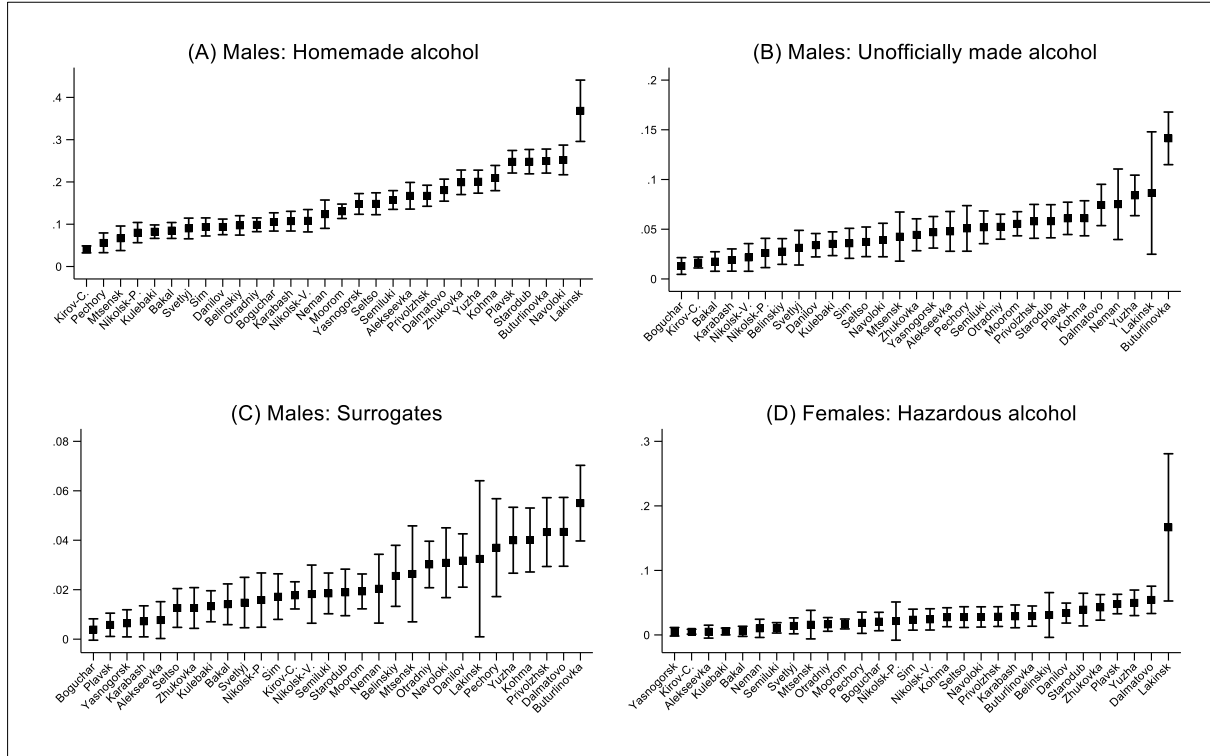
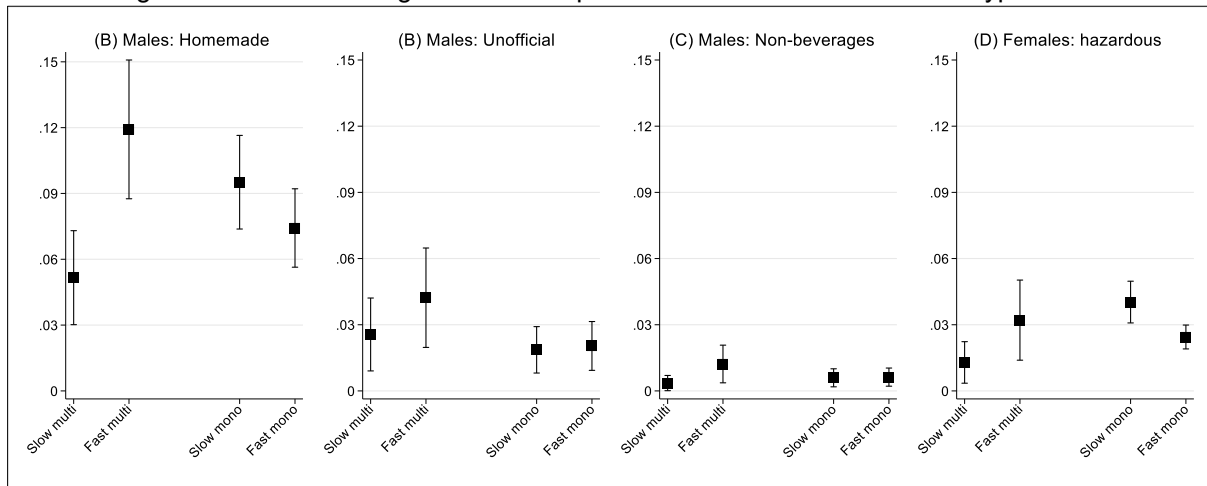
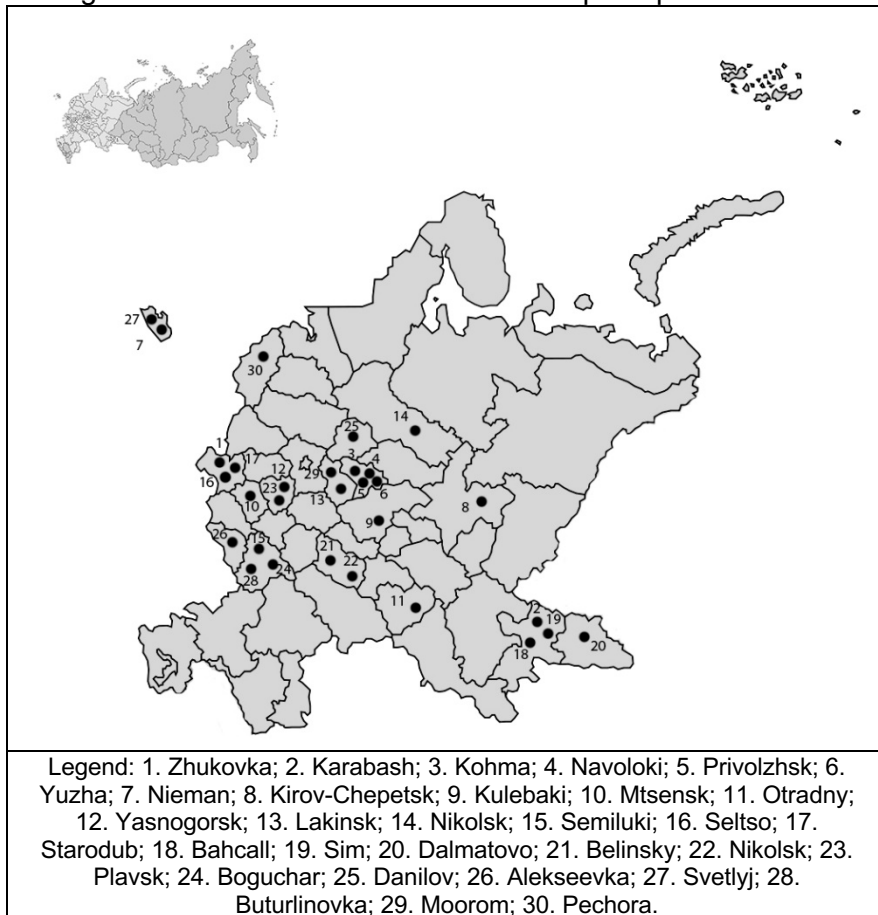


Figure 2: Predictive margins of consumption of hazardous alcohol in four types of towns



Notes: Bars represent 95% confidence intervals.

Figure 3: The PrivMort towns in the European part of Russia



## Tables

Table 1: Frequencies of drinking hazardous alcohol in 30 industrial towns in the European part of Russia

	Men			Women		
	Homemade alcohol	Unofficially made alcohol	Surrogates	Homemade alcohol	Unofficially made alcohol	Surrogates
Often, several times a week	3.2	1.1	0.8	0.3	0.1	0.3
Sometimes, several times a month	8.6	2.2	1.1	1.6	0.2	0.2
Occasionally, less than once a month	22.2	3.9	1.6	16.9	0.7	0.3
Used to drink that type of alcohol but quit	9.6	3.7	1.8	6.0	0.9	0.6
Never	41.7	61.6	80.4	63.0	84.0	92.6
Don't know	12.9	25.5	12.1	10.5	12.2	4.3
Refused to answer	1.9	1.7	2.3	1.8	1.9	1.9
<i>N</i>	<i>28,129</i>	<i>28,129</i>	<i>28,129</i>	<i>13,512</i>	<i>13,512</i>	<i>13,512</i>



Table 2: Odds ratios from multilevel binomial logistic regressions of hazardous drinking in Russia

	<i>Men</i>				<i>Women</i>			
	Model 1: Homemade alcohol		Model 2: Unofficially made alcohol		Model 3: Surrogates		Model 4: All hazardous alcohol	
	OR	(SE)	OR	(SE)	OR	(SE)	OR	(SE)
<i>Fixed-effects</i>								
Intercept	0.01***	(0.00)	0.00***	(0.00)	0.00***	(0.00)	0.00***	(0.00)
Deceased	2.08***	(0.25)	1.32	(0.28)	1.21	(0.32)	1.40	(0.35)
<i>Relative</i>								
1 <sup>st</sup> sibling	0.68**	(0.09)	0.43**	(0.12)	0.22***	(0.09)	0.99	(0.26)
2 <sup>nd</sup> sibling	0.77	(0.12)	0.84	(0.23)	0.53	(0.21)	0.84	(0.27)
Partner	3.51***	(0.65)	5.65***	(1.84)	5.74***	(2.29)		
<i>Age groups</i>								
40-49	2.68***	(0.64)	11.4***	(5.78)	7.83***	(4.71)	1.82	(0.98)
50-59	2.42***	(0.49)	7.30***	(3.28)	3.05*	(1.59)	2.00	(0.82)
60-69	1.68**	(0.29)	5.07***	(2.03)	3.07**	(1.33)	1.35	(0.48)
70-79	1.44*	(0.22)	2.24*	(0.82)	1.38	(0.54)	1.80	(0.56)
<i>Marital status</i>								
Single	0.45	(0.21)	0.76	(0.62)	2.47	(2.05)	0.36	(0.29)
Separated/divorced	1.69***	(0.21)	2.51***	(0.55)	1.55	(0.50)	1.82*	(0.45)
Widow/widower	1.33*	(0.18)	1.44	(0.38)	0.60	(0.25)	1.58*	(0.32)
<i>Education</i>								
Elementary	2.98***	(0.56)	5.56***	(2.33)	0.99	(0.39)	3.67**	(1.55)
Secondary	2.27***	(0.43)	4.17***	(1.74)	0.80	(0.33)	3.21**	(1.34)
Vocational secondary	2.27***	(0.42)	4.15***	(1.72)	1.17	(0.46)	1.79	(0.78)
Vocational higher	1.35	(0.25)	2.97**	(1.22)	0.61	(0.26)	1.33	(0.54)
<i>Communication</i>								
In the same household	1.07	(0.14)	1.22	(0.30)	2.29**	(0.73)	1.35	(0.37)
Once a week	1.08	(0.12)	1.10	(0.24)	1.27	(0.38)	1.24	(0.28)
Once a month	1.16	(0.16)	1.22	(0.31)	1.71	(0.59)	1.63	(0.45)
A few times a year	1.44*	(0.24)	1.71	(0.52)	1.12	(0.51)	2.12*	(0.79)
Once a year	1.89*	(0.47)	1.87	(0.81)	1.74	(1.05)	0.43	(0.48)
Less	3.64***	(0.95)	2.72*	(1.23)	2.88	(1.67)	3.73*	(2.38)
No communication	3.18***	(0.83)	4.28***	(1.74)	2.80*	(1.35)		
<i>Labor market status</i>								
Redundant/fired	1.92**	(0.47)	5.82***	(2.23)	3.85**	(1.99)	1.34	(0.80)
Ill health	0.97	(0.16)	0.96	(0.32)	1.28	(0.57)	3.53**	(1.39)
Early retirement	1.25	(0.20)	2.10**	(0.59)	2.54*	(1.03)	0.96	(0.44)
Retired	0.78*	(0.10)	1.27	(0.31)	2.12*	(0.74)	0.99	(0.27)
Other reasons	1.53*	(0.32)	4.05***	(1.34)	4.07**	(1.82)	0.97	(0.71)
<i>Long-term unemployment</i>								
Unemployed in 1980s	2.20*	(0.69)	4.14**	(1.86)	7.77***	(4.39)	2.92	(2.04)
Wasn't working in 1980s	0.61*	(0.15)	0.57	(0.26)	0.30	(0.22)	0.35	(0.20)
Unemployed in 1990s	1.86**	(0.38)	1.08	(0.39)	1.64	(0.72)	1.73	(0.75)
Wasn't working in 1990s	0.99	(0.11)	1.05	(0.22)	0.83	(0.22)	0.62	(0.16)
Wasn't alive	1.18	(0.17)	0.74	(0.21)	0.39*	(0.16)	1.21	(0.51)
Unemployed in 2000s	1.98**	(0.52)	1.64	(0.74)	1.45	(0.82)	5.94***	(3.10)
Wasn't working in 2000s	1.26	(0.16)	2.17**	(0.52)	2.33**	(0.72)	0.73	(0.20)
Wasn't alive	1.18	(0.17)	1.54	(0.40)	2.33*	(0.81)	1.35	(0.50)
<i>Material deprivation</i>								
Sometimes in 1980s	1.22	(0.25)	1.40	(0.47)	0.53	(0.26)	1.35	(0.54)
Sometimes in 1990s	1.24	(0.23)	2.43**	(0.73)	1.63	(0.65)	1.36	(0.52)
Sometimes in 2000s	2.63***	(0.67)	2.51*	(0.97)	7.08***	(3.62)	3.08*	(1.40)

	<i>Men</i>				<i>Women</i>			
	Model 1: Homemade alcohol		Model 2: Unofficially made alcohol		Model 3: Surrogates		Model 4: All hazardous alcohol	
	OR	(SE)	OR	(SE)	OR	(SE)	OR	(SE)
Random-effects								
Settlement-level variance	0.50	(0.16)	0.61	(0.23)	0.77	(0.33)	0.45	(0.20)
Family-level variance	1.97	(0.45)	2.31	(1.13)	3.38	(1.65)	2.43	(1.32)
Statistics								
ICC on settlement-level								
Null model	0.09	(0.02)	0.06	(0.02)	0.07	(0.02)	0.09	(0.03)
Full model	0.09	(0.02)	0.10	(0.03)	0.10	(0.04)	0.07	(0.03)
ICC on family-level								
Null model	0.37	(0.03)	0.40	(0.05)	0.43	(0.05)	0.43	(0.08)
Full model	0.43	(0.05)	0.47	(0.11)	0.56	(0.11)	0.47	(0.12)
BIC	7535.4		2736.0		1969.8		2058.2	
Towns	30		30		30		30	
Observations	10,711		9,164		11,107		9,049	

Notes: \*\*\*, \*\* and \* denote statistical significance at the 0.001, 0.01 and 0.05 levels, respectively.

Table 3: Odds ratios from multilevel logistic regressions of frequent behaviour in different types of towns

<i>Panel 1: All relative of interviewed individuals</i>				
	Men		Women	
	Model 1: Homemade alcohol	Model 2: Unofficially made alcohol	Model 3: Surrogates	Model 4: Alternative alcohol
Slow privatized multi-towns	1.00	1.00	1.00	1.00
Fast privatized multi-towns	3.28 (0.76)***	2.23 (0.75)*	4.43 (2.37)**	1.12 (0.50)
Slow privatized mono-towns	2.31 (0.47)***	0.69 (0.20)	1.78 (0.86)	2.33 (0.84)*
Fast privatized mono-towns	1.76 (0.35)**	0.84 (0.23)	1.81 (0.85)	1.13 (0.40)
Observations	10,711	9,164	11,107	9,049
<i>Panel 2: Only those relatives living in the analysed towns in the 1980s-1990s</i>				
	Men		Women	
	Model 5: Homemade alcohol	Model 6: Unofficially made alcohol	Model 7: Surrogates	Model 8: Alternative alcohol
Slow privatized multi-towns	1.00	1.00	1.00	1.00
Fast privatized multi-towns	3.65 (1.02)***	2.75 (1.06)**	7.78 (5.01)**	2.75 (1.40)*
Slow privatized mono-towns	2.29 (0.54)***	0.66 (0.21)	1.98 (1.10)	3.19 (1.32)**
Fast privatized mono-towns	1.55 (0.35)	0.77 (0.23)	2.17 (1.17)	1.51 (0.63)
Observations	7,840	6,574	8,067	6,464

Notes: Settlement fixed-effects included, not shown. Robust standard errors are clustered around settlements.

Table 4: Descriptive statistics of independent variables, %

<i>Variables</i>	<i>Men</i>	<i>Women</i>	<i>Variables</i>	<i>Men</i>	<i>Women</i>
Age groups			Long-term unemployment		
40-49	10.8	5.5	In the 1980s		
50-59	24	14.3	Wasn't unemployed	93.1	93.1
60-69	31.3	27.7	Unemployed	1.1	0.6
70-79	23.6	29.5	Wasn't working	5.8	6.3
80+	10.3	23.1	<i>N</i>	21,054	9,759
<i>N</i>	23,566	12,531	In the 1990s		
Education			Wasn't unemployed	69.1	63.3
Elementary	29.4	37	Unemployed	4	2.3
Secondary	17.5	16.2	Wasn't working	14.9	25
Vocational secondary	19.8	13.4	Wasn't alive	12.2	9.4
Vocational higher	23.1	24	<i>N</i>	22,104	10,503
Academic higher	10.2	9.4	In the 2000s		
<i>N</i>	23,625	12,405	Wasn't unemployed	43.5	37.1
Marital status			Unemployed	2.3	1
Single	0.9	2.8	Wasn't working	23.7	38.3
Married	44.3	47.6	Wasn't alive	30.5	23.7
Separated/divorced	7.8	12.5	<i>N</i>	23,027	11,375
Widow/widower	6.4	37.1	Material deprivation		
First partner	40.4	—	In the 1980s		
<i>N</i>	23,940	12,509	Never	96	95.4
Communication			Sometimes	4	4.6
Live in the same household			<i>N</i>	23,600	12,497
Every day	24	31.6	In the 1990s		
Once a week	29.3	29.2	Never	82.2	85.2
Once a month	16.1	14	Sometimes	6.4	7
A few times a year	7.6	5.5	Wasn't alive	11.4	7.9
Once a year	2.4	1.5	<i>N</i>	23,538	12,506
Less	2.3	1.3	In the 2000s		
No communication	3.8	—	Never	67.8	75.8
<i>N</i>	15,241	12,444	Sometimes	2.2	2.7
Labor market			Wasn't alive	30	21.5
Working	34.9	20.3	<i>In total</i>	100	100
Redundant/fired	1.7	1.6	<i>N</i>	23,420	12,521
Ill health	8.1	3.6	—	—	—
Early retirement	17	6.4	—	—	—
Retired	34.3	64.8	—	—	—
Other reasons	4.1	3.3	—	—	—
<i>N</i>	22,704	12,107	—	—	—

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**Code availability:** All analyses were conducted in Stata 17 (StataCorp, College Station, 369 TX). The code used to generate the results can be obtained through the Open Science Framework.

**Data availability:** The data used in this study can be obtained from the author or through the Open Science Framework.

**Competing Interest Statement:** The authors declare that they have no competing interests.