Alcohol and Homicide in Russia and the United States: A Comparative Analysis*

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ABSTRACT. Objective: The object of this study was to perform a comparative analysis of the aggregate relationship between alcohol and homicide in Russia and in the United States. The comparison was based on the magnitude of the alcohol effect, the alcohol attributable fraction (AAF), and the degree to which total consumption could account for trends in homicide. **Method:** We analyzed total and sex-specific homicide rates for the age groups 15–64 years, 15–34 years, and 35–64 years. The study period was 1959–1998 for Russia and 1950–2002 for the United States. For the United States, alcohol consumption was gauged by sales of alcohol; for Russia, estimated unrecorded consumption was included as well. The data were analyzed through autoregressive integrated moving average (ARIMA) modeling. **Results:** The results show that, for Russia as well as for the United States, a 1-L increase in consumption was associated with an increase in homicides of about 10%, although the absolute effect was markedly larger in Russia because of differences in homicide rates. The AAF estimates suggested that 73% and 57% of the homicides would be attributable to alcohol in Russia and in the United States, respectively. Most of the temporal variation in the Russian homicide rate could be accounted for by the trend in drinking, whereas the U.S. trend in total alcohol consumption had a more limited ability to predict the trend in homicides. **Conclusions:** We conclude that the role of alcohol in homicide seems to be larger in Russia than in the United States. (*J. Stud. Alcohol Drugs, 72,* 723–730, 2011)

A LARGE BODY OF RESEARCH SUGGESTS that there is a relationship between alcohol and violence, including homicide. However, in view of the great cultural variation in drunken comportment (MacAndrew and Edgerton, 1969), it seems plausible that the magnitude of this relationship would vary across countries with different drinking cultures. This relationship is also borne out by the aggregate time-series analyses that have been carried out on data for various countries. Generally, a stronger relationship has been reported for countries with an intoxication-oriented drinking pattern, compared with countries where drinking is more tempered (for a review, see Norström and Ramstedt, 2005). In this article, we widen the comparative basis by assessing the aggregate relationship between alcohol and homicide in two countries that are known for having high rates of violent deaths—Russia and the United States (Pridemore, 2001).

A hypothesis implying that this relationship is stronger in Russia than in the United States seems plausible for the following reasons. First, the reported proportion of offenders who had been drinking before the crime is higher for Russia than for the United States. For Russia, the estimates are in the 70%–80% range (Chervyakov et al., 2002; Pridemore, 2002, 2006). The corresponding estimates for the United States, however, seem to be markedly lower. According to a review by Pernanen and Brochu (1997), the most representative U.S. studies report proportions of about 50%–60%. Greenfeld (1998) and Greenfeld and Henneberg (2001) report somewhat lower figures (40%–45%), based on data from the Bureau of Justice Statistics. Second, Russia is generally considered to have a more detrimental drinking pattern than the United States. The drinking culture in Russia is characterized by episodic heavy drinking of distilled spirits (vodka), and the per capita consumption has been estimated to be one of the highest in the world (Lysova and Pridemore, 2010; Nemtsov, 2003; Norström, 2011).

The United States, on the other hand, has a somewhat lower per capita consumption; beer is the main consumed beverage. And although drinking to intoxication is fairly common in some demographic groups and states (Kerr, 2010; Naimi et al., 2003), it must be regarded as a less distinct feature of the drinking culture, compared with Russia. These differences also are reflected in the World Health Organization hazardous patterns score (which measures "the degree of hazard associated with each extra per capita liter of alcohol consumed"). It assigned Russia the highest (worst) score (i.e., 4), whereas the United States scored a 2 (Rehm et al., 2004).

Previous research

Most time-series studies with a focus on Russia have used a proxy for consumption that comprises one or several alcohol-related causes of death (e.g., alcohol poisoning; Pridemore and Chamlin, 2006; Razvodovsky, 2007), except

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for Bye (2008), who used a volume indicator. All of these studies report statistically significant relationships between alcohol and homicide. The same finding was obtained by Pridemore (2002) on the basis of ecological data comprising 78 Russian regions. With regard to beverage-specific analyses, a time-series analysis by Stickley and Razvodovsky (2011) revealed that vodka (but not beer or wine) was significantly related to homicide.

For the United States, an aggregate time-series analysis by Parker and Cartmill (1998) suggested that spirits consumption was significantly and positively related to the homicide rates for Whites, whereas beer turned out to be the beverage related to homicide among non-Whites. Time-series studies of other North American countries include one by Rossow (2004), who found a positive and significant association between per capita consumption and homicide rates in Canada. For the United States, the importance of alcohol availability also has been shown by a longitudinal study of 256 American cities (Parker and Rebhun, 1995). The results of this study suggested that the density of liquor stores had a significant and positive effect on changes in homicide rates.

With regard to the role of alcohol for explaining trends in homicide rates, alcohol has been suggested as a central factor behind the large variations in violent mortality rates in Russia during the 1980s and 1990s (Leon et al., 1997; Shkolnikov et al., 2001), whereas it has received less attention in this context for the United States. However, some researchers argue that alcohol is implicated in U.S. homicide trends (e.g., the declining homicide rates of the 1990s; Parker and Cartmill, 1998).

To sum up, both Russia and the United States have high rates of violent deaths, and previous research suggests that alcohol has been implicated in both countries, although there are indications that its role may differ between them. However, the fact that different measures and analytical techniques have been used across studies makes it difficult to compare the results with a reasonable degree of precision. Against this backdrop, the aim of the present study was to perform a comparative analysis of the aggregate relationship between alcohol and homicide in Russia and in the United States. The comparison was based on three aspects of the aggregate alcohol–homicide link: (a) the magnitude of the alcohol effect (i.e., how much does the homicide rate increase in the respective countries, given a 1-liter increase in per capita consumption?), (b) the alcohol attributable fraction (AAF) for homicide (i.e., how large a fraction of the total homicide load in the respective countries is attributable to alcohol, or how much would the homicide rate decrease in the absence of alcohol?), and (c) to what degree can the trends and shifts in the homicide rates in the respective countries be accounted for by the trends in alcohol consumption? Getting such a comprehensive assessment of the role of alcohol in homicide in two countries that are similar in terms of high rates of violence but which differ in other respects will help to improve our understanding of the alcohol–violent mortality link.

Method

We used mortality data as indicators of the homicide rate. This method is considered to be more reliable than using crime data (LaFree, 1999; Pridemore, 2003). Because alcohol consumption (including heavy drinking) is less prevalent among the elderly population in both countries (Jukkala et al., 2008; Kerr et al., 2009; Pomerleau et al., 2005), the analyses were restricted to the age range 15–64 years. Another reason for restricting the age span is that the accuracy of the Russian cause of death classification is markedly poorer for older ages (Meslé, 2007).

On the basis of sex-specific data in 5-year groups, we constructed age-standardized rates for women, men, and the total population 15–64 years old, and in addition for the age groups 15–34 years and 35–64 years (by gender). The U.S. mortality data were obtained from the National Office of Vital Statistics of the United States (1950–1967) and the National Center for Health Statistics *Compressed Mortality File* (1968–1988, 1989–1998, 1999–2002). The Russian mortality data were provided by Meslé et al. (2003). These data come from a group of researchers who have reclassified the Russian mortality data (Russia used the Soviet system for classification of causes of death) according to the detailed list of ICD-9 codes; the data also were corrected for underregistration and distribution of ill-defined causes (Meslé et al., 2003).

For the United States, alcohol sales figures were used as proxy for alcohol consumption (expressed as liters of 100% alcohol per year and inhabitants 15 years and older). These data were obtained as industry statistics for the years 1950–1969 and from the Alcohol Epidemiologic Data System for the years 1970–2002 (Kerr et al., 2006). Because Russian official sales data grossly underestimate actual consumption (Nemtsov, 2000), we used an indicator that includes estimated unrecorded consumption. This is estimated on the basis of four sources: (a) alcohol sales data, (b) estimates of illegal home production (samogon) based on sales of sugar, (c) the proportion of alcohol-positive deaths because of accidents or violence (Treml, 1997), and (d) the male accident mortality rate (Norström, 2011). (The source for the alcohol indicator was Treml [1982] for the period 1959–1979, Nemtsov [2003] for the period 1980–1989, and Norström [2011] for the period 1990–1998. The estimates were converted from liters of 100% alcohol/capita into liters of 100% alcohol/capita for people ages ≥ 15 years).

The first step in the analyses was to estimate the alcohol effect on homicide on the basis of the time-series data, because these estimates provide the basis for the next two assessments. The data were analyzed using the technique for time-series analysis that has been developed by Box and

FIGURE 1. Trends in alcohol consumption (liters of 100% alcohol) per capita (age ≥ 15 years), and homicide mortality (rates per 100,000, 15–64 years)

Jenkins (1976), often referred to as autoregressive integrated moving average (ARIMA) models. The presence of strong time trends (Figure 1) in the data necessitates a filtering to achieve the stationarity required for the ARIMA modeling. In this case, a simple differencing was sufficient to remove nonstationary trends; that is, rather than using raw series, the yearly changes were analyzed. The differencing greatly reduces the risk of obtaining spurious correlations, because an omitted variable is more likely to be correlated with the explanatory variable as a result of common trends than as a result of synchronization in the yearly changes. Furthermore, the noise term, which includes explanatory variables not considered in the model, is allowed to have a temporal structure that is modeled and estimated in terms of autoregressive or moving average parameters. The model residuals should not differ from white noise; this was tested using the Box-Ljung statistics *Q*.

In keeping with most previous studies, we chose a semi-log model specification. This implies an underlying multiplicative process (i.e., that the alcohol effect is contingent on the level of other causal factors), which seems to be a reasonable assumption in this context.

The semi-log model has the following form:

$$\nabla \ln H_t = \beta \times \nabla A_t + \nabla N_t ,$$

where *H* denotes the homicide rate, *A* is per capita alcohol consumption, and *N* is the noise term. The operator ∇ signifies that the data are differenced. The parameter to be estimated is β. The percentage increase in the homicide rate that is expected to follow from a 1-liter increase in per capita alcohol consumption is obtained by computing: $(\exp(\beta) - 1) \times 100$.

Second, we estimated the AAF for homicide in the respective countries on the basis of the estimated alcohol effects. The measure is typically computed from individual-level data, but it also can be computed from aggregate estimates and is then a function of two components, the alcohol effect per liter of alcohol and the number of liters consumed. The following formula was used:

$$AF = 1 - exp(-\beta \times A),$$

where *A* is (the period average of) alcohol consumption and β is the alcohol effect parameter as estimated in a semi-log model (Norström, 1988).

Third, we assessed to what degree the trends and shifts in the homicide rates in the respective countries could be accounted for by the trends in alcohol consumption. The following formula was used:

$$Predicted\ homicide = c \times exp(\beta \times A),$$

TABLE 1. Descriptive statistics (period averages) for alcohol consumption (liters of 100% alcohol) per capita (≥15 years), and homicide mortality (rates per 100,000, 15–64 years)

Country	Alcohol consumption	Homicide rate Total	Males	Females
Russia	16.14	17.59	26.39	7.74
United States	8.98	9.94	15.86	4.15

where β is the alcohol effect as estimated in a semi-log model, and *A* is per capita alcohol consumption. The values of *c* were chosen so that the predicted rate and the observed homicide rate were equal at $t = 1$.

Results

Trends in per capita consumption and homicide mortality rates are presented in Figure 1. The rates of per capita consumption show a gradual increase until the mid-1980s for both countries. After this period, the U.S. per capita consumption began a long-term decline, whereas Russia experienced a sharp drop in consumption between 1985 and 1988 as a result of Gorbachev's anti-alcohol campaign. However, after the campaign, Russia saw a renewed increase in consumption lasting to the mid-1990s, when it dropped again.

As pointed out by Pridemore (2001), the Russian and U.S. homicide rates were on approximately the same level and developed in a fairly similar pattern (basically a gradual increase) up until the 1980s. Following this period, the U.S. rates decreased and leveled out until the late 1980s and then increased during the first years of the 1990s, after which they declined for the greater part of the remaining period. For Russia, the development was once again more dramatic. First, the country experienced a sharp drop in homicide rates, coinciding with Gorbachev's anti-alcohol campaign in the mid-1980s. However, after the campaign and parallel to the extensive socioeconomic changes associated with the Russian transition, the country experienced an exceptional increase in the number of homicides. When the rates peaked in 1994, the levels were approximately three times higher than the pre-campaign rates. After the peak, the rates declined for the remaining study period.

Table 1 presents descriptive statistics (period averages) of the alcohol and mortality indicators. As can be seen, per capita consumption was almost twice as high in Russia as in the United States. A similar ratio is found for the homicide rates; for the total population and for each gender, the homicide rate is approximately 70%–90% higher in Russia than in the United States.

The outcome from the model estimations is presented in Table 2. The estimated alcohol effects for the two countries are conspicuously close to each other. For Russia as well as for the United States, a 1-L increase in consumption is associated with an increase in homicides of about 10%. It is further noted that the age- and gender-specific estimates are fairly uniform; at any rate, none of the estimates is significantly different from any of the others. All models were satisfactory with respect to residual autocorrelation. Although the relative alcohol effects are of the same magnitude for the two countries, the absolute effect will differ because of the difference in homicide rates. If we thus express the effect of a 1-L increase in absolute terms, the result is an increase by 1.48 homicides per 100,000 inhabitants age 15–64 years for Russia, whereas the corresponding figure for the United States is 0.96.

Next, we estimated the AAFs. For Russia, we obtained an estimate equal to 0.73, and for the United States the figure is 0.57. That is, about 73% of Russian homicides during the study period would be attributable to alcohol; the corresponding figure for the United States is 57%.

Finally, we turn to the predictive power of alcohol consumption in accounting for trends in homicide. Starting with the United States, Figure 2 shows that, although the pre-

TABLE 2. Estimated effects (autoregressive integrated moving average [ARIMA] models) of alcohol consumption on homicide rates in Russia and the United States. Semi-logarithmic models estimated on differenced time-series data.

Variable	United States Model[a]	Estimate	*SE*	Q^b	p^c	Russia Model[a]	Estimate	*SE*	Q^b	p^c
Total										
15–64	0,1,2	.094*	.044	1.05	.95	0,1,0	.081***	.015	3.63	.60
Males										
15–64	0,1,2	.106*	.050	1.44	.92	2,1,0	.078***	.015	0.90	.97
15–34	0,1,2	.117§	.061	1.83	.87	2,1,0	.071***	.016	1.78	.77
35–64	0,1,1	.145**	.043	4.57	.47	2,1,0	.086***	.016	1.63	.89
Females										
15–64	0,1,2	.080§	.041	2.68	.75	2,1,0	.085***	.010	2.08	.83
15–34	0,1,2	.119*	.049	0.42	.99	2,1,0	.069***	.010	0.42	.99
35–64	1,1,0	.094*	.035	6.66	.26	2,1,0	.098***	.010	3.10	.68

[a]ARIMA models are indicated by order of autoregressive parameters, order of differencing and order of moving-average parameters; [b]Box-Ljung test for residual autocorrelation, lag 5; [c]*p* values of the Box-Ljung test.
§$p < .10$; *$p < .05$; **$p < .01$; ***$p < .001$.

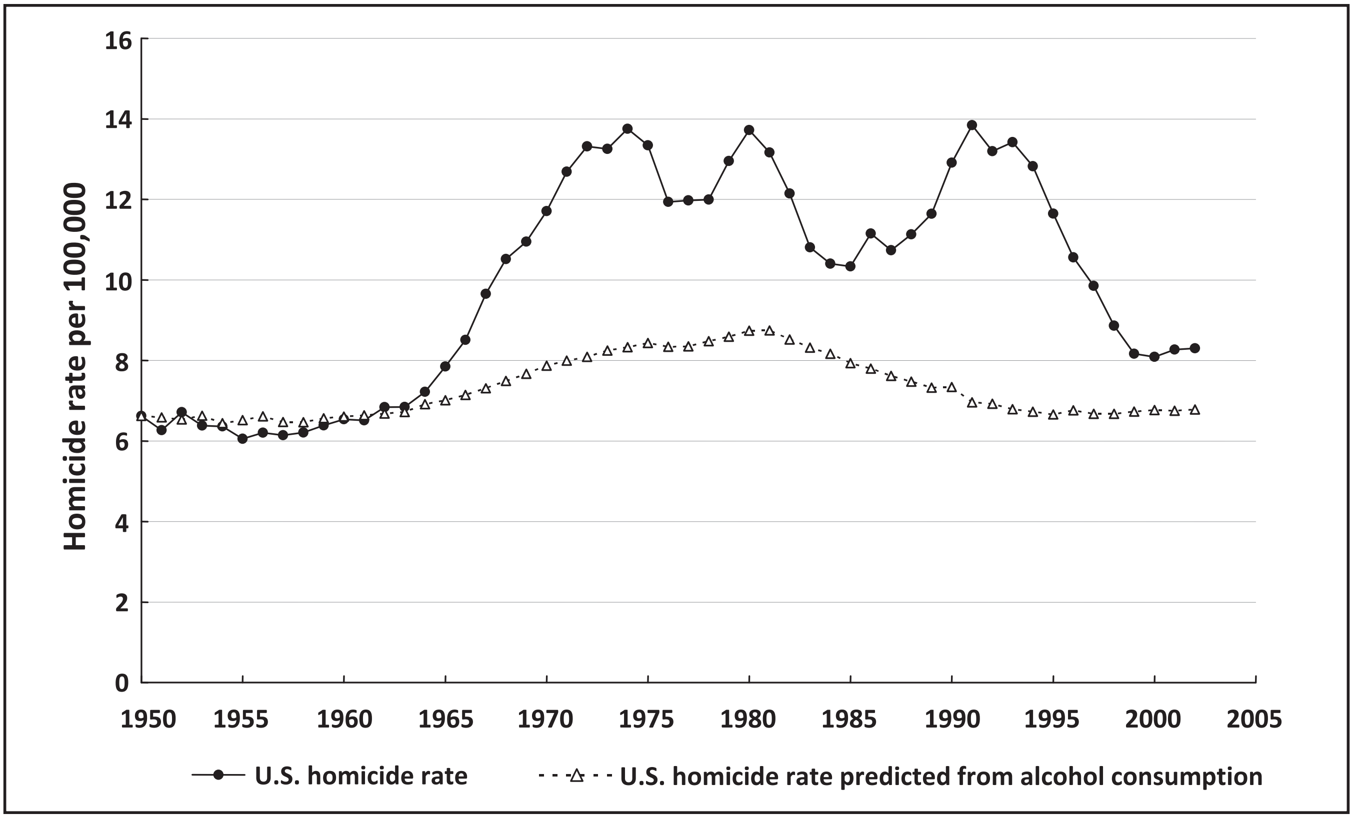

FIGURE 2. Observed and predicted homicide rates in the United States (rates per 100,000, 15–64 years)

FIGURE 3. Observed and predicted homicide rates in Russia (rates per 100,000, 15–64 years)

dicted rate mimics the main feature of the observed rate reasonably well, only about 40% of the doubling in homicides is accounted for. Turning to the outcome for Russia (Figure 3), we note a closer match between predicted and observed trends in homicide. The difference between Russia and the United States in the relative importance of population drinking for the trajectory in homicides is reflected by the fact that 88% of the variance in the Russian homicide rate is accounted for by the predicted homicide series, whereas the corresponding figure for the United States is 54%.

Discussion

In this study, we performed a comparative analysis of Russia and the United States with respect to the aggregate relationship between alcohol and homicide. Our findings suggest that the relative effect of a change in total consumption is of approximately the same magnitude in the two countries. The estimate (indicating an approximate 10% increase in homicides, given a 1-liter increase in consumption) accords well with that reported by Bye (2008) in a previous analysis of Russian data. The estimate also is on a par with what has been found for other countries that are characterized by a relatively detrimental drinking pattern, as indicated by high drinking pattern scores (e.g., the Nordic countries; Rossow, 2001). However, the higher homicide rate in Russia means that the absolute effect (i.e., the additional number of homicides per liter of alcohol) is appreciably higher in that country than in the United States. Similarly, the higher consumption level in Russia implies that the AAF derived from the aggregate findings was higher in Russia than in the United States. These estimates suggested that about three quarters of the Russian and a good half of the U.S. homicides would be because of alcohol. These estimates accord quite well with those based on individual-level data on the reported proportion of offenders who had been drinking before the crime. As noted in the introduction, these proportions were in the range of 70%–80% for Russia and 50%–60% for the United States.

In our assessment of the predictive power of the alcohol factor, most of the temporal variation in the Russian homicide rate could be accounted for by the trend in drinking. However, the gap during the 1990s between the predicted rate and the observed homicide rate indicates that there is room for other factors. Existent research suggests that some of the increase in the homicide rate during this period was because of the rapid political (Pridemore and Kim, 2006) and socioeconomic change (Pridemore and Kim, 2007). The economic crisis also may have had an indirect impact by spurring heavy episodic drinking (Rojas et al., 2008). However, the main explanation for the increase in drinking seems to be a confluence of various factors, including decreasing relative prices of alcohol, an increased supply of legally as well as illegally produced alcohol, and an inefficient tax collection system (Reitan, 2000).

The U.S. trend in total alcohol consumption had a more limited ability to predict the trend in homicides. Obviously, most of the large bump spanning the period 1965–1995 seems to be because of factors other than alcohol. Changing demographic composition, growth of the illicit drug market, and the subsequent increase and diffusion in the access to handguns have been suggested as important factors in this context (Blumstein et al., 2000).

With regard to the limitations of the study, the most important one is probably the alcohol indicator for Russia. As mentioned earlier, the Russian alcohol indicator includes estimated unrecorded consumption that is partly based on a violent death indicator. One concern is that this would give rise to a definitional correlation between the alcohol indicator and the outcome (i.e., homicide). However, it is not the rate of violent deaths per se that is used in the estimation of the alcohol indicator, but rather the proportion of alcohol-positive deaths in that rate. Furthermore, it is worth noting that several previous studies have used the alcohol indicator for Russia and yielded plausible estimates. These studies include those by Norström (2006), who focused on all-cause mortality; Ramstedt (2007), who looked at cirrhosis mortality; Landberg (2008), who studied suicide; and Landberg (2010), who investigated fatal nonintentional injuries.

Nevertheless, it seems likely that the consumption proxy for Russia is more contaminated with measurement errors than is the proxy for the United States. It is well known that measurement errors in the explanatory variable induce a downward bias in estimates of the variable's effect on an outcome (Greene, 2002). This in turn implies that the risk of underestimating the impact of population drinking on homicide may well be larger in the analysis of the Russian data. It also should be noted that the computations of the attributable fractions imply that the estimated alcohol effect is extrapolated over the entire range and should hence be interpreted with some caution, although the risk seems less in the context of a comparison, as in the present case.

Bearing these cautions in mind, our overall conclusion is that alcohol plays a significant role in homicides in Russia as well as in the United States. The difference is that in Russia alcohol seems to be the primary factor driving homicide, whereas in the United States factors other than alcohol (e.g., violence related to the illicit drug market) also have an important role. This difference is reflected in the fact that the proportion of homicides attributable to alcohol was larger in Russia, as was the predictive power of total consumption in explaining trends and shifts in the homicide rate.

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