Research Article

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Time Series Association between Suicides and Alcohol Psychoses in Belarus

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Abstract

Background: *The level of alcohol consumption and the suicide rate in the former Soviet Slavic republic Belarus are both among the highest in the world. As a predominantly spirits drinking country, Belarus is characterized by infrequent, but heavy (binge) drinking leading to high rates of acute alcohol-related problems.*

Aim: *The aim of the present study was to estimate effect of alcohol on suicide mortality rate in Belarus using aggregate-level data of suicide mortality and alcohol psychoses rates.*

Methods: *Trends in suicides and alcohol psychoses incidence rates (as a proxy for alcohol consumption) from 1979 to 2007 were analyzed employing an unconstrained polynomial distributed lags analysis in order to asses bivariate relationship between the two time series.*

Results: *According to Bureau of Forensic Medicine autopsy reports the suicide rate increased by 41.2%, and alcohol psychoses rate increased 2 times in Belarus. Alcohol in blood was found in 62% suicide victims for the whole period, with the minimum figure 49.3% in 1988 and maximum 68.5% in 1981. Alcohol-related suicides were more affected by the restriction of alcohol availability during the anti-alcohol campaign: between 1984 and 1986 the number of BAC-positive suicide cases drop by 54.2%, while number of BAC-negative suicides decreased by 7.1%. The results of distributed lags analysis indicated statistically significant relationship between alcohol psychoses rate and a number of BAC-positive suicides.*

Conclusion: *The results of present study indicate that a restrictive alcohol policy can be considered as an effective measure of suicide prevention in countries where rates of both alcohol consumption and suicide are high.*

Keywords: Suicide, Alcohol psychoses, Time series analysis, Belarus.

Introduction

Suicide is one of the leading external causes of death worldwide [1-3]. It is well recognized that both acute and chronic alcohol use are among the major behaviorally modifiable factors that are associated with suicidal behavior [4-7]. Acute alcohol intoxication may trigger self-destructive behavior by provoking depressive thoughts, decreasing self-control, and constricting cognition which impairs the generation of effective coping strategy to avoid psychological distress [8-10]. In his rigorous review of studies of acute alcohol use and suicidal behavior published over a 10 year period (1991-2001) Cherpitel et al. has found a wide range of alcohol-positive cases for both completed suicide (10-69%) and suicide attempts (10-73%) [11]. Several case-control studies at the individual level have shown a high prevalence of alcohol abuse and dependence among suicide victims [12,13]. Recent retrospective psychological autopsy study has reported that 68% of male and 29% of female who committed suicide met criteria for alcohol abuse or dependence [13]. The strong support for a direct link between alcohol and suicide comes from aggregate-level data. Both longitudinal and cross-sectional aggregate-level studies usually report a significant and positive association between alcohol consumption and suicide [14-17].

High suicide rate in the former Soviet Republics and its profound fluctuation over the past decades have attracted considerable interest [18-21]. Most authors agree that the role of alcohol is a crucial in understanding this phenomenon [16,22-24]. This hypothesis is based on the positive association between trends of alcohol consumption per capita and suicide rate [17,18,24]. Several researchers have focused on the role of drinking culture as a possible explanation of the extremely high suicide rate in the former Soviet Slavic republics [16,12,23]. There is suggestive evidence that binge drinking pattern, i.e. excessive consumption

of strong spirits results in quicker and deeper level of intoxication, increasing the propensity for alcohol-related suicide [25]. Several studies have addressed blood alcohol concentration (BAC) in suicide victims during the last decades in the former Soviet republics. Nemtsov has highlighted that in Russia the number of BAC-positive suicides shrank by 55%, while the number of BAC-negative suicides did not changes substantially during Gorbachev perestroika [24]. Similarly, in Estonia during the anti-alcohol campaign BAC-positive suicides decreased by 39.4%, while BAC-negative suicides increased by 3% [26].

The level of alcohol consumption and the suicide rate in the former Soviet Slavic republic Belarus are both among the highest in the world [27,28]. As a predominantly spirits drinking country, Belarus is characterized by infrequent, but heavy (binge) drinking leading to high rates of acute alcohol-related problems [28]. In line with this evidence we assume that devastating combination of higher level of alcohol consumption per capita and binge drinking of vodka results in a close association between alcohol drinking and suicide mortality at the aggregate level in Belarus.

The aim of the present study was to estimate effect of alcohol on suicide mortality rate in Belarus using aggregate-level data of suicide mortality and alcohol psychoses rates as a proxy for alcohol consumption.

Material and Methods

Data

The data on suicide used in the article were based on autopsy reports from Bureau of Forensic Medicine. The most researchers admit that vital statistics in the former USSR republics is reliable enough [29]. All violent deaths are subjected to forensic autopsies, which include (BAC) inspection and histological examination of organs. The cause-of-death classification has been subjected to several changes over the last decades. In 1989-2001 the Ministry of Statistics used coding scheme based on ICD-9. In 2002 a new coding system based on ICD-10 has been introduced. Belarussian coding system is claimed to be compatible with ICD-9 and ICD-10. For example code 173 (1989-2001) "suicide and self-inflicted injury" corresponds with ICD-9 code E 950.0-E 959.9 and code 249 (since 2002) corresponds with ICD-10 code X 60.0-X 84.9.

In present study we used the alcohol psychoses incidence rate as a proxy for the aggregate level of alcohol consumption. We specified the number of persons, witches were admitted for the treatment as incidence of alcohol psychoses: (ICD-10: F 10). The data on alcohol psychoses incidence rate (per 100.000 of the population) are taken from the Ministry of Statistics of Belarus annual reports for the years from 1979 to 2007.

Statistical analysis

The statistical analysis was performed using the package "Statistica". It is generally agreed that bivariate correlations between the two raw time-series are spurious due to common sources of trends and autocorrelation [30]. Therefore in order to reduce the risk of obtaining a spurious relation between two variables that have common trends, the trends should be removed by means of a differencing procedure: $\Delta x_t = x_t - x_{t-1}$. This means analyzing annual changes rather than raw data. The process of removing systematic variation within time series prior to the examination of potential causal relationships is referred to as "prewhitening" [31]. A further step entails the inspection of the cross-correlation function in order to estimate the association between the two prewhitened time series. We used an unconstrained polynomial distributed lags analysis to estimate the relationship between the time series alcohol psychoses incidence (independent variable) and stroke mortality (dependent variable) rates in this paper.

Results

In all 64,162 suicide and 59,489 fatal alcohol poisoning cases were examined with respect to the autopsy reports between 1979 and 2007. According to Bureau of Forensic Medicine autopsy reports the suicide rate increased by 41.2% (from 17.7 to 25 per 100.000 of residents), and alcohol psycoses rate increased 2 times (from 38.0 to 75.7 per 100.000 of residents) in Belarus between 1979 and 2007. The number of BAC-positive suicide cases increased by 47.7% (from 10.7 to 15.8 per 100.000 of residents) and number of BAC-negative suicides increased by 31.4% (from 7 to 9.2 per 100.000 of residents) (Figure 1). Alcohol in blood was found in 62% suicide victims for the whole period, with the minimum figure 49.3% in 1988 and maximum 68.5% in 1981.

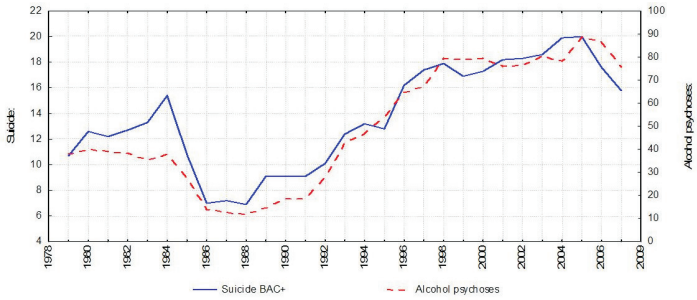

Figure 1: Trends in BAC-positive suicides and alcohol psychoses rates in Belarus from 1979 to 2007.

A comparative analysis show that trend in BAC-positive suicides tends to fluctuated across time series to a much greater extent that the BAC-negative suicides (Figure 2).

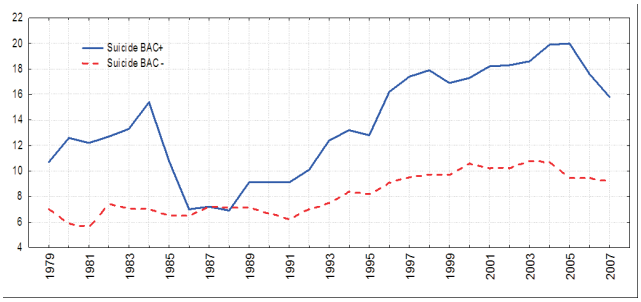

Figure 1: Trends in BAC-positive and BAC-negative suicides in Belarus from 1979 to 2007.

Alcohol-related suicides were more affected by the restriction of alcohol availability during the anti-alcohol campaign: between

1984 and 1986 the number of BAC-positive suicide cases drop by 54.2% (from 15.4 to 7.0 per 100.000 of residents), while number of BAC-negative suicides decreased by 7.1% (from 7 to 6.5 per 100.000 of residents). Further, the upward trend in BAC-positive suicides in 1990s was greater than trend in BAC-negative suicides: from 1989 to 1998 the number of BAC-positive suicides increased by 96.7% (from 9.1 to 17.9 per 100.000 of residents), while the number of BAC-negative suicides increased by 36.6% (from 7.1 to 9.7 per 100.000 of residents).

The graphical evidence (Figure 1) suggests quite a strong association between BAC-positive suicides and alcohol psychoses trends. The two time trends fluctuated over the period: dropped sharply in 1984-1988, began to increase in 1988, dramatically jumped from 1991 to 1998. In 1999 there was a slight decrease in the rates and from 2000 it again began to rise until 2004, than started to decrease in the last years.

The Spearman's correlation analysis suggests the strong positive relation between alcohol psychoses rate and a number of BAC-positive (r=0.93; p=0.000), and BAC-negative suicides (r=0.79; p=0.000). As can be seen from Figures 1 there is linear trend in the time series. This trend was removed by means of first-order differencing procedure. After pre-whitening the cross-correlations between alcohol psychoses incidence and suicide mortality time series were inspected. The outcome indicated statistically significant cross-correlation between alcohol psychoses rate and a number of BAC-positive suicides (r=0,70; SE=0,20) at zero lag. At the same time, there is no relation between alcohol psychoses and BAC-negative suicide rates (r=0,16; SE=0,20). So, positive correlation between these variables was spurious. The results of the distributed lags analysis also suggest that the estimated effects of alcohol psychoses rate (as a proxy for alcohol consumption) on BAC-positive suicides are clearly statistically significant at lag zero (Table 1).

Lags	Regressn Coeff	Standard Error	t	p
0	0,19	0,04	4,50	0,000
1	-0,01	0,04	-0,37	0,710
2	-0,01	0,04	-0,4	0,689
3	-0,01	0,04	-0,27	0,789

Table 1: The results of distributed lags analysis.

Discussion

The findings from the present study indicates that alcohol drinking and BAC-positive suicide mortality rates are positive related phenomena in Belarus: Gorbachev's anti-alcohol campaign 1985-1988 was associated with a rapid reduction in the level of alcohol consumption and the number of BAC-positive suicides, while increasing alcohol consumption in the transitional period has been linked to increase in suicide mortality rate.

The results from the time series analysis suggest positive relationship between alcohol psycoses (as a proxy for alcohol consumption) and suicide rates at zero lag. In this case the independent variable is directly influencing the dependent variable and there is no evidence of a lagged relationship between the two time series. This may support the point that binge drinking, which results in a quicker and deeper intoxication is a risk factor for auto aggressive behaviour, especially in people predisposed to suicide. This research evidence is consistent with the findings from previous studies highlighted that the relationship between alcohol and suicide was stronger for consumption of distilled spirits (vodka) relative to total level of alcohol consumption. It was shown that a 1% increase in vodka consumption per capita would result in a 0.57% increase in suicide rate among males and 0.24% increase in suicide rate among females [25].

There is a suggestion that the decrease in suicide rate in the former Soviet republics in the mid-1980s could have been related to the political and social liberalization during the period known as "perestroika", which gave rise to social optimism and new hope [32]. However, the results of present study indicate that the number of BAC-positive suicides shrank by 54.2%, while the number of BAC-negative suicides did not change substantially during Gorbachev's perestroika. This fact in conjunction with the coincident trends between the alcohol psychoses rate and the number of BAC-positive deaths from suicide in the mid-1980s indicate that a restriction of alcohol availability can be considered as an effective measure of suicide mortality prevention.

Several scholars have argue that psychosocial distress resulting from the "shock therapy" economic reform and sudden collapse of the Soviet paternalist system was the main determinant of the suicide mortality crisis in the former Soviet republics in the 1990s [33,34]. Nevertheless, the fact that the number of BAC-suicides dramatically jumped in the 1990s strongly supports an alcohol related hypothesis and suggests that rather that playing major causal role; psychosocial distress may represent a confounding variable. It seems plausible that the psychosocial distress resulting from the reforms were the main causes of increased demand for alcohol at this time. This demand was met by factors that increased supply. Following the repeal of state alcohol monopoly in 1992, Belarusian's alcohol market became fragmented, including many private producers and importers operating without a license or registration. The country was practically flooded by a wave of homemade, counterfeit, and imported alcohol of low quality. In the second half of the 1990s, the overall level of alcohol consumption grew to 14-14.5 litres per capita, the highest rate in the country's history [35]. The negative outcomes of increase of alcohol consumption during this period included a sharp rise in alcohol-related mortality. After an introduction of measures against illegal alcohol production, import, and sale in 1998, the overall level of alcohol consumption began to diminish [35-38].

Conclusion

This study replicates previous findings that suggested a close link between alcohol and suicide at the aggregate level. The outcome of this study also support the hypothesis that suicide and alcohol closely connected in culture with prevailing intoxication-oriented

drinking pattern and adds to growing body of evidence that a substantial proportion of suicides in Belarus are due to acute effect of binge drinking. The results of present study, as well as findings from other settings indicate that a restrictive alcohol policy can be considered as an effective measure of suicide prevention in countries where rates of both alcohol consumption and suicide are high.

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