Population drinking and mortality from poisoning by substances other than alcohol in Russia

Abstract

Background: It might be the case, that the high death rate from poisoning by substances other than alcohol in Russia can be explained by misclassification of deaths attributable to acute poisoning by alcohol surrogates.

Objectives: This paper aims to test misclassification hypothesis by analyzing the relationships between the trends in alcohol consumption per capita and poisonings by substances other than alcohol in Russia between 1956 and 2005.

Methods: The ARIMA (autoregressive integrated moving average) modeling technique was used to evaluate the relationship between changes in the alcohol consumption per capita and mortality rates from poisoning by substances other than alcohol across the study period.

Results: The results of the analysis suggest that 60.8% of all male deaths from poisoning by substances other than alcohol and 58.1% female deaths in Russia could be attributed to alcohol.

Conclusions: This study does support the hypothesis that high death rate from accidental poisoning by substances other than alcohol in Russia to a significant extent is attributable to misclassification of deaths from fatal poisonings by alcohol surrogates.

Keywords: alcohol consumption, death rate, poisoning by substances other than alcohol, Russia

Abbreviations: ARIMA, autoregressive integrated moving average; AAF, alcohol-attributable fraction; SOA, substances other than alcohol

Introduction

The rate of fatal alcohol poisonings, as well as rate of deaths from poisoning by substances other than alcohol in Russia is among the highest in the world.1-3 It might be the case, that the high death rate from poisoning by substances other than alcohol in this country can be explained by misclassification of deaths attributable to acute poisoning by alcohol surrogates (industrial spirits, antiseptics, lighter fluid and medications containing alcohol). Compelling evidence suggests that the alcohol surrogates pose a risk to human health and undermine alcohol control policy measures introduced in Russia over the last decades.4-6

This paper aims to test misclassification hypothesis by analyzing the relationships between the trends in alcohol consumption per capita and poisonings by substances other than alcohol in Russia between 1956 and 2005.

Methods

Data

The data on sex-specific mortality rates from poisoning by substances other than alcohol (ICD-10 code X 40.0 – X 44.9; X 46.0 – X 49.9) per 100.000 of the population are taken from the Russian State Statistical Committee (Rosstat) reports. The total level of alcohol consumption (in litres of pure alcohol) in Russia has been estimated using the indirect method based on alcohol poisonings mortality rate.7-9

Statistical analysis

The ARIMA (autoregressive integrated moving average) modeling technique was used to evaluate the relationship between changes in the alcohol consumption per capita and mortality rates from poisoning by substances other than alcohol across the study period. This method is most commonly used to reduce the risk of spurious trend relationship.10 The first difference of log transformed time series was used to remove time trends. The final models were tested using the Ljung-Box Q statistics. In addition to the estimated effect parameter, the alcohol effect will also be expressed in terms of alcohol-attributable fraction (AAF). A time series analysis was performed using the statistical package “Statistica 12. StatSoft”

Results

Russia has experienced pronounced fluctuations in mortality from poisoning by substances other than alcohol over the past decades. The trends in mortality rates are rather similar over time series for both sexes (Figures 1) (Figure 2). Alcohol consumption per capita has shown parallel fluctuations over time. During the anti-alcohol campaign (1985-1988) the death rate from poisoning by substances other than alcohol underwent a substantial decrease, with a substantial growth in the early 1990s. This empirical evidence suggests that temporal changes in population drinking are likely to underlie these variations.
The specification of the bivariate ARIMA model and outcome of the analyses are presented in Table 1. According to the results, alcohol consumption is a statistically significant factor associated with both male and female mortality from poisoning by substances other than alcohol, implying that a 1-litre increase in per capita alcohol consumption is associated with an increase in male mortality of 7.0% and female mortality of 6.5%. Table 1 also shows the relative proportion of alcohol-attributable deaths to mortality from poisoning by substances other than alcohol by gender. The results of the analysis suggest that 60.8% of all male deaths from poisoning by substances other than alcohol and 58.1% female deaths in Russia could be attributed to alcohol.

### Table 1 Estimated effects (bivariate ARIMA model) of alcohol consumption on mortality from poisoning by other substances

| Parameter          | Model | Estim. | p  | AAF |
|--------------------|-------|--------|----|-----|
| Mortality males    | 0.1.1*| 0.07   | 0  | 60.8|
| Mortality females  | 0.1.1 | 0.065  | 0  | 58.1|

*The general form of non-seasonal ARIMA model is (p,d,q), where p, the order of the autoregressive parameter
d, the order of differencing
q, the order of the moving average parameter
Q test for residuals are satisfactory in all models

**Discussion**

The strong relationship between alcohol consumption and mortality from poisoning by substances other than alcohol may reflect the fact that a substantial proportion of deaths that are recorded as accidental poisoning by substances other than alcohol are actually attributable to poisoning by alcohol surrogates.

It must be recognized that these findings are subjected to several limitations. In particular, I relied on estimated total level of alcohol consumption across the period. However, the accuracy of assessment of actual alcohol consumption using indirect methods depends significantly on whether the level of alcohol consumption is the only factor influencing the index chosen as the indicator of alcohol-related problems. This represents an essential drawback of such methods, because many other factors influence the level of alcohol-related problems. Further, there may also have been potential problems with the mortality data, because there was a sharp increase of deaths classified as injury with undetermined intent in Russia in the post-Soviet period.

In conclusion, in this paper, I report the results of a time series analysis of the relationship between alcohol consumption per capita and mortality from poisonings by substances other than alcohol in Russia. This study does support the hypothesis that high death rate from accidental poisoning by substances other than alcohol in Russia to a significant extent is attributable to misclassification of deaths from fatal poisonings by alcohol surrogates. Further research is required to explore the mechanisms that may underline the temporal association between population drinking and mortality from poisonings by substances other than alcohol.

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**Conflict of interest**

The author declares no conflict of interest.

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