# The effects of alcohol pricing policy on suicide rates in Russia

# Wpływ polityki cenowej wobec alkoholu na wskaźniki samobójstw w Rosji

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## Abstract

**Introduction:** There is general agreement that alcohol taxation is one of the most effective alcohol policies in reducing harmful drinking and the adverse health and social consequences associated with alcohol. The aim of this study was to examine the effect of prices of various types of alcoholic beverages on the suicide rate in Russia.

**Material and methods:** To examine the relationship between the independent variables (real retail prices of different types of alcoholic beverages) and dependent variables (suicide rates), a time series analysis (Spearman's correlation analysis, linear regression) was performed using the statistical package Statistica 12.StatSoft.

**Results:** The results of Spearman's correlation analysis suggest a strong negative relationship between the prices of all types of alcoholic beverages and suicide rates both among men and women.

**Conclusions:** This study shows an inverse relationship between the prices of alcohol and the suicide rates in Russia. These findings indicate that alcohol pricing policy is an effective population-level in-

## Streszczenie

**Wprowadzenie:** Panuje powszechna zgoda co do tego, że opodatkowanie alkoholu jest jedną z najskuteczniejszych metod polityki wobec alkoholu w ograniczaniu szkodliwego picia i negatywnych konsekwencji zdrowotnych i społecznych z tym związanych. Celem badania było przeanalizowanie, jaki wpływ mają ceny różnych napojów alkoholowych na wskaźnik samobójstw w Rosji.

**Materiał i metody:** Aby zbadać związek między zmiennymi niezależnymi (rzeczywistymi cenami detalicznymi różnych rodzajów napojów alkoholowych) a zmiennymi zależnymi (wskaźnikami samobójstw), przeprowadzono analizę szeregów czasowych (analiza korelacji Spearmana, regresja liniowa) przy użyciu pakietu statystycznego Statistica 12.StatSoft.

**Wyniki:** Wyniki analizy korelacji Spearmana sugerują silny negatywny związek między cenami wszystkich rodzajów napojów alkoholowych a wskaźnikami samobójstw – zarówno wśród mężczyzn, jak i kobiet.

**Wnioski:** Badanie pokazało odwrotną zależność między cenami alkoholu a wskaźnikami samobójstw w Rosji. Potwierdziło, że polityka cenowa wobec alkoholu jest skuteczną interwencją na poziomie popula-

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tervention also in terms of reducing suicide mortality rates in Russia.

**Keywords:** Suicides, Alcohol, Taxes, Prices, Russia

cji, skuteczną również w zmniejszaniu wskaźników umieralności z powodu samobójstw w Rosji.

**Słowa kluczowe:** samobójstwa, alkohol, podatki, ceny, Rosja

## Introduction

Suicide is a major public health problem and one of the leading causes of death in many countries [1, 2]. Alcohol is a main risk factor for attempted and committed suicide [3]. The positive association between alcohol consumption and suicidal behaviour has been well documented at the individual and population levels [4, 5]. The magnitude of this relationship varies significantly by country, gender and type of beverage [6-8].

There is general agreement that alcohol taxation is one of the most effective alcohol policies in reducing harmful drinking and the adverse health and social consequences associated with alcohol [9]. Although numerous studies have examined the relationship between alcohol taxes/prices and a wide range of alcohol-related problems [10, 11], there are only a limited number of studies specifically addressing to the impact of taxes/prices of alcoholic beverages on suicide rates. Moreover, prior studies have produced conflicting results, and the relationship between the taxes/prices of alcoholic beverages and the suicide rates remains controversial [12-14].

In particular, Son and Topyan used aggregate-level data to examine the effect of excise taxes on three types of alcoholic beverages (spirits, wine and beer) on suicide rates and found a significant inverse relationship between wine excise tax and suicide rates [12]. In another study, Markowitz *et al.* found that the increase in the excise tax on beer was associated with a reduction in the number of suicides among men but not among women [13]. In contrast, Bichmayer and Hemenway found no statistically significant relationship between beer taxes and youth suicide [14]. Inconsistencies of this kind regarding the relationship between alcohol taxes/prices and suicide rates require further investigation.

Considering the fact that both the level of alcohol consumption [15] and suicide rates [16-19] in Russia are among the highest in the world, this country provides an important contextual framework for investigation the relationship between alcohol prices and the suicide rates. It would be especially interesting to explore the alcohol prices-suicide relationship against the background of the alcohol policy measures adopted by the Russian government over the past decade [20]. These policies included the introduction of stricter control on the production and sales of alcohol, and a significant increase in excise taxes on alcohol products, which led to an increase in real alcohol prices [21]. In this regard, the aim of this study was to examine the effect of prices on various types of alcoholic beverages on the suicide rate in Russia.

## Material and methods

The data on gender-specific suicide (X60-X84) rates per 100,000 of the population and retail prices of three types of alcoholic beverages (vodka, wine and beer) from 2000 to 2015 were collected from reports of the Russian State Statistical Committee (Rosstat) (http:/www.gks.ru). To examine the relationship between the independent variables (real retail prices of different types of alcoholic beverages) and dependent variables (suicide rates), a time series analysis (Spearman's correlation analysis, linear regression) was performed using the statistical package Statistica 12.StatSoft. The elasticity coefficient was derived from the following equation: $e = y'x(x/y)$, were $y$ – the suicide mortality rates and $x$ – the price of alcoholic beverages. Elasticity represents the percentage change in a dependent variable associated with a 1% increase in an independent variable (e.g. price or tax rate). For example, a price elasticity of –0.5 means that a 10% increase in price would be expected to result in a 5% decrease in the outcome of interest.

## Results

The average price of a litre of vodka increased by 6.7 times (from 84.1 to 559.2 roubles), the average price of a litre of wine increased 3 times (from 93.4 to 283.7 roubles), the average price of a litre

of beer increased 3 times (from 20.1 to 98.4 roubles) between 2000 and 2015. During the same period, the male suicide rate decreased 2.3 times (from 70.3 to 30.0 per 100,000) and female suicide rate decreased 1.9 times (from 10.6 to 5.7 per 100,000) (Figure 1).

The results of Spearman's correlation analysis suggest a strong negative relationship between the prices of all types of alcoholic beverages and suicide rates for both men and women. The magnitude of this relationship was similar for all types of alcoholic beverages. Therefore, a linear regression model was applied in further analysis. The relationship between the price of alcoholic beverages and suicide rates can be described by the linear regression equation: $y = B_0 + B_1 * x$.

The results of statistical analysis presented in the Table I suggest that a 1% increase in the price of vodka is associated with a 1.85% decrease in male, and a 2.44% decrease in female suicide rate; a 1% increase in the price of wine would translate into a 1.14% decrease in male, and a 1.45% decrease in female suicide rate; a 1% increase in the price of beer is associated with a 1.61% decrease in male, and a 2.10% decrease in female suicide rate. It appears, that the elasticity of female suicide mortality to the price of alcoholic beverages is more substantial than the elasticity of male suicide mortality.

**Table I.** The relationship between the price of different alcoholic beverages and suicide rates

| Alcoholic beverages | Male suicide rates | | Female suicide rates | |
|---|---|---|---|---|
| | *r* | *e* | *r* | *e* |
| Vodka | –0.96* | 1.85 | –0.95* | 2.44 |
| Wine | –0.95* | 1.14 | –0.94* | 1.45 |
| Beer | –0.93* | 1.64 | –0.92* | 2.10 |

*r – correlation coefficient, e – elasticity coefficient*
**p < 0.000*

## Discussion

The results of the analysis suggest that there is an inverse aggregate-level relationship between the alcohol prices and the rates of suicide mortality in Russia. These outcomes agree with prior Russian findings that a higher price for vodka was associated with a lower death rate from external causes [22]. Furthermore, the results of beverage-specific modelling indicated that suicide rates tend to be more sensitive to changes in the price of vodka than wine or beer prices. These results are consistent with the previous findings that spirits are the most significant beverage-specific predictor of suicide mortality [6]. Somewhat surprisingly, that female suicide rate is more responsive to changes in the prices of alcohol than the male suicide rate. These findings seem to contradict

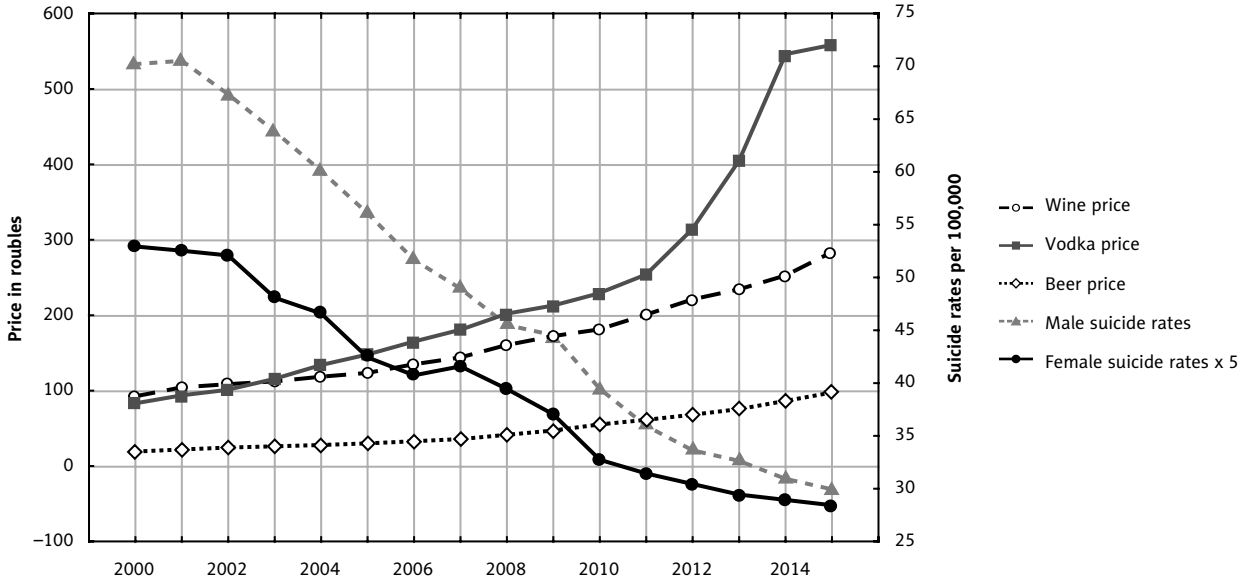


**Figure 1.** The retail prices of three types of alcoholic beverages (wine, vodka and beer) and gender-specific suicide rates between 2000 and 2015

the well-established fact that alcohol-related suicide is mainly a male phenomenon [3]. There is no convincing explanation for this obvious paradox.

This study has several limitations which should be addressed. It must be admitted, that multiple socio-structural factors may independently affect suicide rates. There is suggestive evidence that recent improvement in suicide mortality in Russia might be attributed, at least partially, to a significant increase in population incomes [22]. In addition, it might be the case that the effect of the alcohol pricing policy was outperformed by the effects of other alcohol policy measures that have been implemented in Russia over the past decade [23]. Therefore, in order to reduce the risk of spurious relationship, other alcohol policies should be considered when assessing the impact of alcohol prices on suicide rates.

Further, there may also have been potential problems with the suicide mortality data used. The rapid improvement in suicide mortality in Russia over the past decade has raised concern about the quality of statistic on violent mortality in this country. Some researchers argue that, since suicide mortality is considered as an indicator of psychosocial distress, there are manipulations taking place with the suicide mortality statistic in Russia [24]. There is suggestive evidence that statistical manipulations disproportionately affected the mortality rates of female suicides [24].

Finally, the use of simple correlation in the analysis of time series may lead to spurious correlations, which can be avoided by using *the autoregressive integrated moving average* (ARIMA) analytical modelling techniques, which however requires around 50 time points [8].

In conclusion, this study shows an inverse relationship between the prices of alcohol and the suicide rates in Russia. These findings indicate that alcohol pricing policy is a population-level intervention also effective in reducing suicide mortality rates in Russia. The Russian government should consider the complementary effects of other alcohol control policies, including a reduction in the availability of alcohol, in order to reduce suicide rates.

**Conflict of interest/Konflikt interesów**

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**Ethics/Etyka**

The work described in this article has been carried out in accordance with the Code of Ethics of the World Medical Association (Declaration of Helsinki) on medical research involving human subjects, EU Directive (210/63/EU) on protection of animals used for scientific purposes, Uniform Requirements for manuscripts submitted to biomedical journals and the ethical principles defined in the Farmington Consensus of 1997.

Treści przedstawione w pracy są zgodne z zasadami Deklaracji Helsińskiej odnoszącymi się do badań z udziałem ludzi, dyrektywami UE dotyczącymi ochrony zwierząt używanych do celów naukowych, ujednoliconymi wymaganiami dla czasopism biomedycznych oraz z zasadami etycznymi określonymi w Porozumieniu z Farmington w 1997 roku.

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