



RESEARCH ARTICLE

Population Drinking and Gender Gap in Stroke Mortality in Russia

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Abstract

Aim: The aim of this study was to study the relationship between alcohol and the gender gradient in the death rate from stroke in Russia at the population level.

Methods: In a comparative aspect, we analyzed the dynamics of the overall level of alcohol consumption and the gender difference in the rate of mortality from stroke in the period from 1980 to 2015. The relationship between alcohol consumption and the gender difference in mortality from stroke was assessed using the Autoregressive-Integrated Moving Average (ARIMA) method.

Results: The overall level of alcohol consumption is statistically significantly associated with the gender difference in the mortality rate from stroke, while an increase in the level of alcohol consumption by 1 liter leads to an increase in the gender difference in the mortality rate by 6.1%. An assessment of the alcohol-attributable fraction showed that the alcohol was responsible for 55.3% of the gender gap in the rate of death from stroke.

Conclusions: The data obtained indicate that alcohol is the main factor in the gender gradient in the mortality rate from stroke, and changes in the availability of alcohol are the cause of sharp fluctuations in this indicator over the past five decades in Russia.

Keywords

Alcohol, Mortality, Stroke, Gender gap, Russia

Introduction

Stroke is one of the leading causes of disability and death in many countries of the world [1]. The existing regional variability in mortality from stroke in Europe is characterized by a significantly higher level of this indicator in Eastern Europe, especially among young

and middle-aged men [2]. For example, in Russia, the mortality rate from stroke among men in the 45-54 age group is ten times higher than in Germany or France [3,4]. The high East-West gradient in mortality from stroke is explained by the prevalence of such behavioral risk factors for stroke as tobacco smoking and alcohol consumption in Eastern Europe [2,5]. Alcohol consumption is a recognized risk factor for stroke [2,6]. A number of studies performed according to a case-control design, as well as prospective cohort studies, have shown a dose-dependent relationship between alcohol consumption and the risk of hemorrhagic and ischemic stroke [5-10]. It was found that daily consumption of 12 standard servings of alcohol increases the risk of ischemic stroke by 5.6 times [10].

In one of the studies, it was found that within 1 hour after drinking 1-2 standard servings of alcohol, the risk of ischemic stroke increases 2.3 times, and within 2 hours the relative risk is 1.6 [3]. Sensitive analysis using information on the frequency of alcohol consumption during the week before stroke as a control showed that drinking one standard dose of alcohol increases the risk of ischemic stroke during the next hour by 3.3 times [3]. The relative risk of hemorrhagic stroke increases linearly with increasing alcohol intake. The relationship between alcohol consumption and the risk of both types of stroke was similar for men and women, although the relative risk for women consuming less than one standard serving was slightly lower than for men. The risk within an hour after drinking alcohol was higher for spirits and lower for wine [3].

Proposed physiological mechanisms that increased the risk of stroke include the hypertensive effect of irregular heavy drinking, the increase low density lipoproteins, the increase of platelet aggregation and decrease fibrinolytic activity [5,6]. Other possible mechanisms include cerebral vasoconstriction and hyperhomocysteinemia [10].

In most economically developed countries of the world, the death rate from stroke among men is significantly higher than among women [1]. Until now, this gender paradox has not received an exhaustive explanation. The key role in explaining this phenomenon is assigned to female sex hormones, which improve the lipidemic profile, reducing the risk of stroke [3].

Available data point to alcohol as a key factor in the high mortality rate from stroke, as well as sharp fluctuations in this indicator over the past decades in Russia [7-9]. These data suggest that alcohol plays an important role in the etiology of the gender gradient in the stroke mortality rate in Russia. The aim of this study was to study the relationship between alcohol and the gender gradient in the death rate from stroke in Russia at the population level.

Materials and Methods

In a comparative aspect, we analyzed the dynamics of the general level of alcohol consumption and the gender difference in the rate of death from stroke in the period from 1980 to 2015. Standardized sex death rates from stroke per 100,000 population were used Data source - WHO Mortality Database. The total level of alcohol consumption was calculated using an indirect method using the mortality rate from acute alcohol poisoning as an indicator of alcohol problems. The relationship between

the dynamics of alcohol consumption and the gender difference in mortality from stroke was assessed using the Autoregressive-Integrated Moving Average (ARIMA) method. In order to bring the time series to a stationary form, the differentiation procedure was used [11]. The essence of the method is to transform the original series into a series of differences between its neighboring values. Statistical data processing was carried out using the software package "Statistica 12. StatSoft. "For more information, see the Time Series Analysis module.

Results

On average, over the entire period under consideration, the mortality rate from stroke among men and women was 225.7 ± 35.7 and 167.9 ± 30.0 , respectively. The dynamics of the mortality rate from stroke among men and women in the period under review was subject to synchronous fluctuations, the nature of which corresponds to the pattern of fluctuations in mortality from other causes (Figure 1). The graphical data presented in Figure 2 indicate a similar dynamics of the level of alcohol consumption and the gender difference in the rate of death from stroke. The trends of these indicators during the period under review were subject to sharp fluctuations.

Alcohol consumption and gender differences in stroke mortality declined substantially in the mid-1980s; rose sharply in the first half of the 1990s; then they decreased until 1998; grew in the period from 1998 to 2003, after which they began to decline again. It should be noted that the sharp fluctuations in the gender difference in the mortality rate from stroke in the period under review were due to the greater amplitude of fluctuations in the mortality rate among men. For example, in the period from 1992 to 1994. The mortality rate

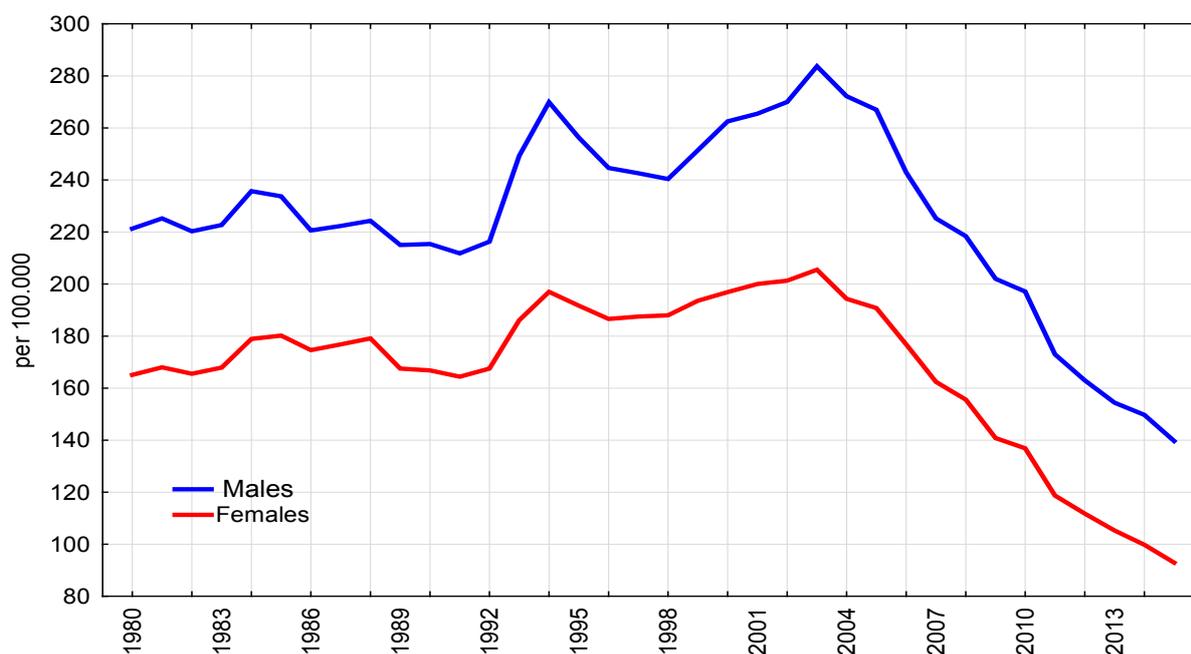


Figure 1: Gender-specific trends in stroke mortality in Russia between 1980 and 2015.

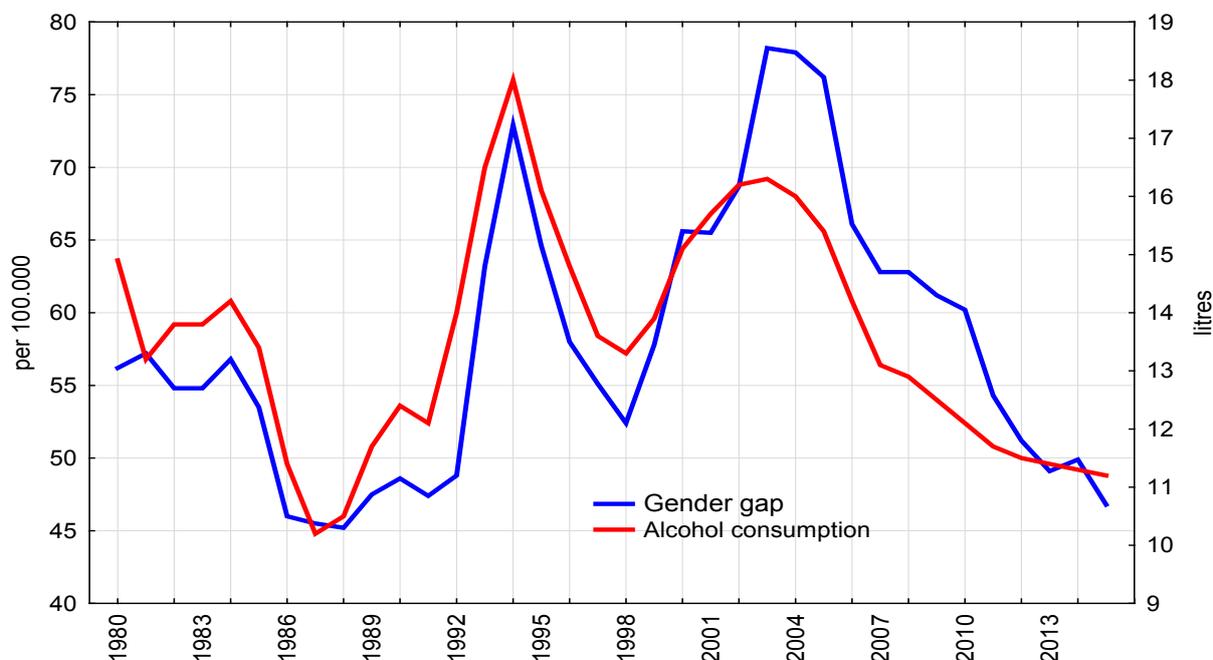


Figure 2: Trends in alcohol consumption and gender gap in stroke mortality in Russia between 1980 and 2015.

among men and women increased by 24.8% and 17.6%, respectively, and in the period from 1998 to 2003. This indicator among men and women increased by 18.0% and 9.3%, respectively.

Spearman's correlation analysis revealed a positive, statistically significant relationship between the level of alcohol consumption and the gender difference in the mortality rate from stroke ($r = 0.82$; $p < 0.000$). Visual analysis of the graphical data (Figure 2) indicates that the studied time series are not stationary, since they have a pronounced trend. Therefore, the next step was to remove the non-stationary component using the differentiation method.

Cross-correlation analysis of the transformed time series showed that there is a close relationship between the dynamics of the general level of alcohol consumption and the gender difference in the rate of death from stroke at zero lag ($r = 0.76$; $SE = 0.143$). According to the results of the assessment using the ARIMA method, the overall level of alcohol consumption is statistically significantly associated with the gender difference in the mortality rate from stroke, while an increase in the level of alcohol consumption by 1 liter leads to an increase in the gender difference in the rate of mortality from stroke by 6.4%. An assessment of the alcoholic fraction showed that alcohol was responsible for 58% of the gender difference in stroke mortality.

Discussion

An analysis of the official statistics showed that in Russia, as in other countries, the death rate from stroke among men is significantly higher than among women. It was also found that over the past decades, the gender gradient in the mortality rate from stroke has been subject to significant fluctuations. It is obvious

that fluctuations in the gender gradient in the mortality rate from stroke were associated with changes in the degree of influence of behavioral risk factors. The most likely candidate for the role of such a factor is alcohol, the prevalence of consumption of which among men is much higher than among women [12]. Furthermore, the high alcohol-attributable fraction of gender gap in stroke mortality could be attributable to the irregular heavy drinking of vodka, the prevalence of which in Russia significantly prevails among men [4].

The key role of alcohol in the etiology of the gender gradient in stroke mortality is supported by the fact that sharp fluctuations in this indicator correlate well with changes in the level of alcohol availability. For example, the decline in the level of alcohol availability during the 1985-1988 anti-alcohol campaign was accompanied by a decrease in the gender difference in the mortality rate from stroke, while an increase in the level of alcohol availability in the first half of the 1990s associated with a sharp increase in this indicator [4]. In addition, the decrease in the gender difference in the mortality rate from stroke in the last years of the period under review correlates with the adoption of a number of legislative measures that strengthened control over the alcohol market and reduced the availability of alcohol [12].

Thus, the results of this study indicate the existence of a close relationship between alcohol and the gender difference in the rate of death from stroke in Russia at the population level. The data obtained indirectly confirm the working hypothesis, according to which alcohol is one of the main factors in the gender gradient in the rate of death from stroke, and changes in the availability of alcohol are the reason for sharp fluctuations in this indicator over the past decades in Russia.

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