EPC Abstract

The changing relation between alcohol and life expectancy in Russia

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Short Abstract

In the 1990s a strong inverse relationship between life expectancy (LE) in Russia and mortality from alcohol poisoning was observed. This association is remarkable as this cause accounts for less than 2% of deaths each year. The most plausible explanation for this is that the annual rate of alcohol poisoning in Russia can be regarded as the best single measure of the population prevalence of hazardous drinking which is in turn associated with mortality from a wide range of causes.

This study provides the detailed analysis of the evolving relationship of LE with this mortality-based measure of heavy drinking since 1965 including the most recent period of continuous LE improvement in Russia. We examine three periods: 1965-1984 – the period of a gradual LE decline; 1984-2003 – the period of massive LE fluctuations that began with the anti-alcohol campaign; and 2003-2017 - the current period of mortality improvement. Pearson's correlation coefficients and a linear relationship between annual changes in LE and alcohol poisoning were estimated for each period.

The strongest negative correlation between changes in LE and alcohol poisonings was found in the period of sharp LE fluctuations (1984-2003) and was weaker before and after this period. In the period 2003-17, the linear model describing the relationship between changes in LE and mortality from alcohol poisonings has altered: a consistent positive LE trend emerged that was independent of alcohol poisoning. We interpret this as an indication of a new component of LE increase that is independent of hazardous drinking.

Introduction and Aims

The strong correlation between life expectancy in Russia and alcohol has been known since the mid-1990s. The first analysis on this was published in July 1994 by Nemtsov and Shkolnikov in the Russian daily newspaper “Izvestia”. Their article was accompanied by a graphical presentation showing the change in male LE and litres of pure alcohol per capita between 1981 and 1992. This showed an almost perfect negative linear relationship between these two indicators (Nemtsov and Shkolnikov, 1994). Further studies based on longer time series confirmed a strong association between alcohol on one side and total mortality and LE on the other side from the mid-1980s to the early 2000s (Shkolnikov and Nemtsov, 1997; Nemtsov, 2002; 2016; Khaltourina and Korotaev, 2015). Less attention is, however, paid to the fact that this association has recently changed.

In the present study, we aim to re-examine the link between mortality and alcohol in Russia from 1965 using the most recent available data including the period of sustained LE improvement from 2003 to 2017.

Since official government statistics on alcohol consumption in Russia are incomplete (they do not capture consumption of illegal and home-brewed alcohol and non-beverage alcohols such as medicinal tinctures) we use the level of alcohol-related mortality as a proxy for the prevalence of heavy and hazardous drinking in the Russian population.

Of all alcohol-attributable causes, acute alcohol poisoning is the one most obviously related to episodes of hazardous drinking. During the period 1965-2017 alcohol poisonings accounted for between 0.5% to 1.9% of total male aged standardized mortality rates and from 0.2% to 0.9% of the equivalent female mortality rates. In this context, alcohol poisoning constitutes only a small fraction of total mortality and changes in mortality from alcohol poisonings cannot for arithmetic reasons alone produce any substantial effect on LE. On the other hand, it is still numerically large enough to not suffer from excessive random fluctuations.

Data and Methods

Life tables for Russia for the period 1965-2017 were obtained from The Human Mortality Database (HMD). Data for 2015-17 were preliminary and obtained through personal communication with the HMD team. Age-specific mortality rates for alcohol-related causes were obtained from the Russian statistical office.

We estimated the association between the time series of the life expectancy and series of the age-standardized death rate (SDR) from acute alcohol poisoning in Russia using an OLS linear regression model of the first-order differences. These differences are stationary both in males and females.

The ordinary least squares regression model is :

$$\Delta LE_t = a + b\Delta AlcPois_t + \varepsilon_t \qquad (1),$$

where ΔLE_t is the change in LE between years *t-1* and t and $\Delta AlcPois_t$ is the corresponding change in SDR by alcohol poisonings per 100,000 person-years. In addition to the regression, we estimate the Pearson’s correlation coefficient (*r*).

We estimate the parameters *a*, *b*, and *r* for males and females and separately for the three time intervals reflecting different regimes of LE dynamics in Russia:

- 1965-1984 – the period of gradual and continuous LE decrease.

- 1984-2003 – the period of large-magnitude fluctuations that were opened by the anti-alcohol campaign of 1985.
- 2003-2017 – the current period of continuous LE increase.

The model (1) prediction of the annual change in LE is a sum of two components: the component depending on the change in SDR for alcohol poisoning ($b\Delta AlcPois_t$) and component a expressing a constant annual change in LE that is not associated with the changes in mortality from alcohol poisoning. Hence, we can estimate how LE would evolve within each of the three time intervals if there was no independent (non-alcohol) component and all changes in LE were predicted by changes in alcohol poisonings:

$$LE_t = LE_{t_0} + b\left(AlcPois_t - AlcPois_{t_0}\right) \quad (2),$$

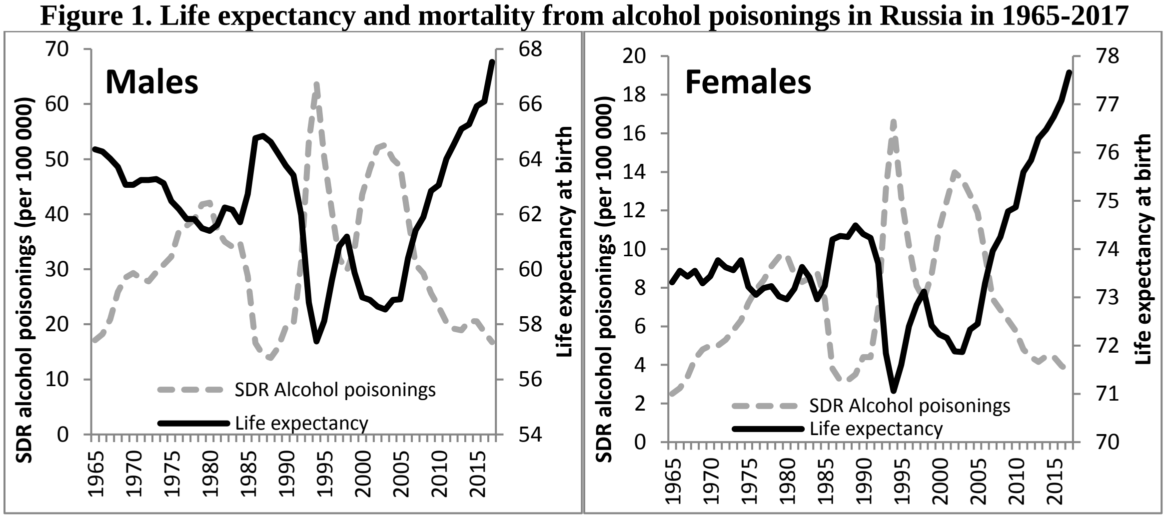
where LE_{t_0} and $AlcPois_{t_0}$ are the values of LE and SDR from alcohol poisoning in the first year of the time interval (1965, 1984 or 2003), LE_t and $AlcPois_t$are the respective values in the current year *t*.

To see to what extent our results depend upon the choice of alcohol poisoning as a proxy for the alcohol harm, we carried out a sensitivity analysis replacing alcohol poisoning by the group of alcohol-related causes that includes besides alcohol poisonings “Mental and behavioral disorders due to use of alcohol” and “Alcoholic liver disease”.

Results and Discussion

Visual inspection of the association between LE and SDR for alcohol poisoning (Figure 1) shows a remarkable mirroring of the trends. However, since the late 2000s, the sensitivity of LE to alcohol poisoning became less apparent. In particular, despite a slowdown in the decline in alcohol poisoning in 2010-15 life expectancy continued to rise without interruption.

Figure 1. Life expectancy and mortality from alcohol poisonings in Russia in 1965-2017



The relationships between changes in alcohol poisoning and LE (Equation 1) are shown numerically in Table 1. This relationship has changed over time. It was weaker before the beginning of the anti-alcohol campaign of 1985, and it has also weakened in the last decade.

Table 1. Association of annual changes in the life expectancy at birth with age-standardized death rates (per 100 000) from acute alcohol poisoning by sex and time period

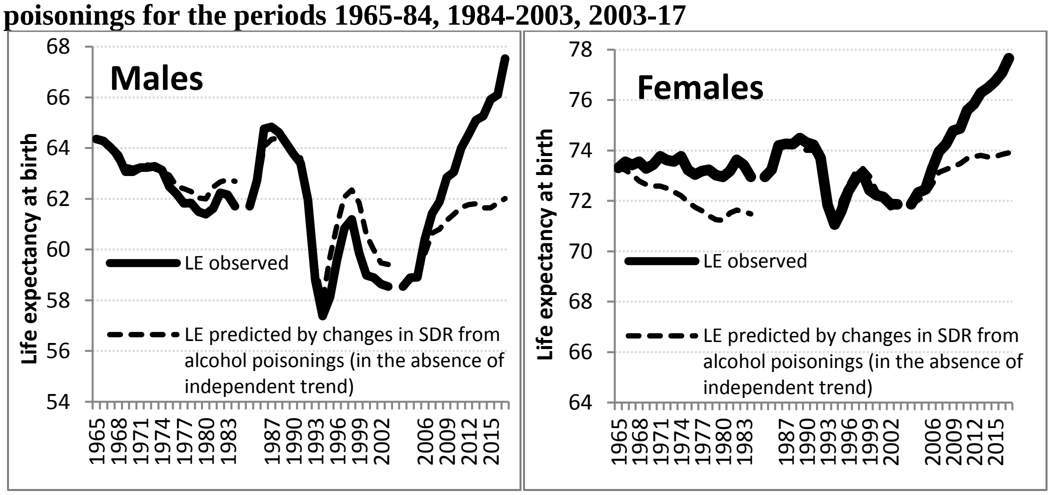
	1965-1984	1984-2003	2003-2017	1965-2017
		Males		
Intercept	-0.058 (-0.184, 0.067)	-0.046 (-0.242, 0.150)	0.395 (0.099, 0.691)	0.060 (-0.044, 0.164)
Slope	-0.094 (-0.139, -0.035)	-0.129 (-0.152, -0.107)	-0.097 (-0.173, -0.020)	-0.132 (-0.150, -0.114)
Pearson's *r*	-0.65 (*P*=0.003)	-0.95 (*P*<0.001)	-0.62 (*P*=0.02)	-0.90 (*P*<0.001)
		Females		
Intercept	0.077 (-0.066, 0.221)	-0.003 (-0.107, 0.113)	0.268 (0.112, 0.424)	0.089 (0.024, 0.154)
Slope	-0.289 (-0.551, 0.028)	-0.240 (-0.286, -0.194)	-0.205 (-0.362, -0.049)	-0.256 (-0.297, -0.215)
Pearson's *r*	-0.49 (*P*=0.03)	-0.94 (*P*<0.001)	-0.64 (*P*=0.02)	-0.87 (*P*<0.001)

Note : The 95% confidence limits of the intercept and the slope estimates and *P*-values for the Pearson correlation coefficients are given in parentheses.

The regression slopes do not change substantially across the three periods with the confidence intervals overlapping each other. Unlike the slopes, the intercepts are not the same (Table 1). In 1965-84 and 1984-2003 they are small and do not differ significantly from zero. However, in 2003-17, the LE increase in Russia is characterized by a positive and significant (*P*<0.05) intercept. It indicates that in the recent period of health improvements, Russia experienced an increase in LE that cannot be fully predicted by changes in the prevalence of hazardous alcohol drinking as indexed by alcohol poisonings. The model for 2003-17 suggests that even if alcohol poisoning stopped declining LE would continue to increase.

Figure 2 compares the observed trend in LE with that which would be observed if the only driver of LE change was alcohol as proxied by the SDR for alcohol poisoning (Equation 2). In 1965-84 and 1984-2003, the accumulated gaps by the end of the period between the real change in LE and the change predicted by alcohol poisoning are quite small : 1.0 and 0.9 years in males, and 1.4 and 0.1 in females respectively. But the same gap is much more substantial at the end of the 2003-17 period. Indeed, the intercept of the linear model suggests a 5.4 year gain in the male LE between 2003 and 2017. Another 3.5 years are produced by a reduction in alcohol poisonings. For females the annual independent increase in LE corresponds to 3.8 years of the gain by 2017 with the remaining 2.0 years attributed to alcohol.

Figure 2. Observed changes in life expectancy as compared to changes predicted by mortality from alcohol poisonings for the periods 1965-84, 1984-2003, 2003-17



The replacement by a larger group of alcohol-related causes results in slightly better predictive power of the linear models in the first and the third periods. Nevertheless, our principal findings remain the same: a significant constant term appears in the period 2003-17, markedly distinguishing this period from the earlier periods of 1965-84 and 1984-2003.

Our results suggest that in the last decades of the 20th century the pattern of mortality change was established in Russia, with changes in the levels of hazardous alcohol consumption being crucial in shaping the LE trend. However, this pattern has recently changed. Factors not associated with the prevalence of hazardous drinking have become more important for LE improvement. While alcohol still remains a major public health problem in Russia, other positive developments substantially contribute to the life expectancy rise.

The appearance of the positive LE trend independent from alcohol poisoning may be the result of the recent decrease in mortality at old ages and its growing contribution to the changes in life expectancy at birth that are unlikely to be due to changes in alcohol drinking patterns. The growing impact of mortality decline among the elderly to LE increase in Russia (largely due to reductions in cardiovascular mortality) has been described as the start of the cardiovascular revolution in Russia (Shkolnikov et al., 2013; Grigoriev et al., 2014; Timonin et al., 2017).

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