# Research

# Alcohol consumption and increased mortality in Russian men and women: a cohort study based on the mortality of relatives

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**Objective** To examine the relations between frequency of alcohol consumption and of binge drinking and adult mortality in Russian men and women.

**Methods** Using modified indirect demographic techniques, a convenience cohort was constructed based on survey respondents' information about their close relatives. A random sample general population of the Russian Federation of 7172 respondents (response rate 61%) provided information on 10 475 male and 3129 female relatives, including age, vital status, and frequency of alcohol consumption and binge drinking. These relatives formed the cohort analysed in this report. The outcome measure was all-cause mortality after the age of 30 years.

**Findings** There was a strong linear relation between frequency of drinking and of binge drinking and all-cause mortality in men; after controlling for smoking and calendar period of birth, the relative risk of death in daily drinkers compared to occasional drinkers was 1.52 (95% confidence interval (CI) 1.33–1.75). Male binge drinkers had higher mortality than drinkers who did not binge, which persisted after adjustment for drinking frequency (adjusted relative risk 1.09, 95% CI 1.00–1.19). In women, the increased mortality was confined to a small group of those who binged at least once a month (adjusted relative risk 2.68, 95% CI 1.54–4.66).

**Conclusion** The results suggest a positive association between alcohol and mortality in the Russian Federation. There was no evidence for the protective effect of drinking seen in western populations. Alcohol appears to have contributed to the high long-term mortality rates in Russian men, but it is unlikely to be a major cause of female mortality.

**Keywords** Alcohol drinking/epidemiology/mortality; Nuclear family; Adult; Men; Women; Sex factors; Cohort studies; Cross-sectional studies; Russian Federation (*source: MeSH, NLM*).

**Mots clés** Consommation alcool/épidémiologie/mortalité; Noyau familial; Adulte; Hommes; Femmes; Facteur sexuel; Etude cohorte; Etude section efficace; Fédération de Russie (*source: MeSH, INSERM*).

**Palabras clave** Consumo de bebidas alcohólicas/epidemiología/mortalidad; Núcleo familiar; Adulto; Hombres; Mujeres; Factores sexuales; Estudios de cohortes; Estudios transversales; Federación de Rusia (*fuente: DeCS, BIREME*).

**الكلمات المفتاحية**: روسيا، تعاطي المسكرات، معدل الوفيات، وبائيات تعاطي المسكرات، معدلات الوفيات بسبب تعاطي المسكرات، الأسرة النووية، البالغون، البالغات، عوامل الجنس، دراسات أتراب، دراسات تصالبية، الاتحاد الروسي. (المصدر: رؤوس الموضوعات الطبية المكتب الإقليمي لشرق المتوسط)

## Introduction

The dramatic mortality fluctuations in the Russian Federation since the mid-1980s have attracted considerable attention (1, 2). During the societal transformation that followed the fall of communism, Russian mortality increased dramatically between 1990 and 1994 and it has been fluctuating since then. The scale of the mortality changes is striking; between 1990 and 1994 alone, the rise in mortality was equivalent to more than two million additional deaths above long-term mortality rates (3).

While it has been recognized that the causes of the mortality crisis are complex (3, 4), it has been proposed that alcohol was an important proximal cause of these changes (1, 5). Although moderate drinking has been shown to reduce mortality (6), there is evidence from the USA and Finland that a pattern of binge drinking is related to increased mortality (7–11). The hypothesised powerful role of alcohol has been attributed to the binge drinking pattern common in the Russian Federation (12–14).

It is unclear whether alcohol consumption in the Russian Federation has any beneficial effects or whether the

adverse effect of heavy drinking predominates (15). To our knowledge, there have been four individual-level studies with data on the relation between alcohol and mortality in the Russian Federation, with inconsistent results (16–19). However, these studies were relatively small, and the inconsistency of the findings could be due to the limited statistical power of the studies. Studies in the Russian Federation are urgently needed.

We have previously developed and piloted a quick and effective approach to assess risk factors for mortality in a population. It borrows from demographers' indirect methodology to estimate mortality in countries without vital statistics. Such indirect demographic methods using survey or census data, often called "Brass techniques" (20, 21), have been used to estimate mortality from information on the survival of close kin (such as spouses and parents) where conventional data are unavailable. These methods use simple information on the number of close kin and on how many of them have died. We modified this method for literate and numerate populations, and showed that the method, based on spouses and siblings, is a useful tool to study mortality and its individual level determinants in the Russian Federation (22, 23).

## Methods

### Subjects
We conducted a cross-sectional survey of a national sample of the Russian population, conducted in three waves in July, September, and November 2002. The data were collected in collaboration with the Levada Center, Moscow, and the New Russian Barometer survey programme (24). The population sample was selected in a multi-stage process. The whole Russian Federation was first stratified into 10 regions, and each region was further stratified into urban and rural areas. Within this framework, towns and settlements were randomly selected proportionately to population size. Within these locations, primary sampling units (locations) were randomly drawn. In each primary sampling unit, an address was randomly selected and interviewers were instructed to seek a face-to-face interview at every $n^{th}$ eligible household. At each address, the interviewer asked for a respondent matching an age-sex-education grid, and if more than one respondent was eligible, the person with the most recent birthday was selected. The questions on alcohol consumption and survival of relatives were added to an existing survey on the social and economic impact of transition. Three waves were needed to obtain the required sample size.

A total of 11 776 households containing an eligible respondent were identified. Of these, 3837 declined to be interviewed, 608 were unable to answer because of bad health or other reasons, and 159 interviews were interrupted or rejected during control, yielding an overall response rate of 61%. Response rates were similar in all three waves. The 7172 respondents were asked to provide information about their parents, eldest two siblings, and first husbands — a total of 26 709 relatives who formed the population analysed in this paper. Wives were not included as our pilot study had found that husbands underestimated wives' mortality (22). These analyses do not include the siblings from the pilot study, reported previously (23).

### Measurements
Information collected about each relative included year of birth, whether they were alive or dead, and, if applicable, year of (or age at) death. Further details including cause of death

and other details of relatives' lifestyle were sought for parents (except those who died before 1972 because it was considered that recall of behaviour from over 30 years previously would be inaccurate), siblings aged 20 years and older, and husbands. Two questions concerning alcohol consumption were asked about all relatives except mothers, for whom we judged such information would be unreliable, given the social convention of low alcohol consumption in women. First, the frequency of drinking vodka or other strong spirits; and second, the frequency of drinking more than 0.5 litre (half bottle) of vodka or strong spirits in one evening (binge drinking). Data on the consumption of other alcoholic beverages were not collected because of the predominance of vodka and spirit consumption in Russian drinking behaviour. Additional data collected on relatives included smoking (all relatives), education (siblings and husbands), frequency of contact with respondent, and marital status (siblings only). Respondents also answered questions concerning their own age, sex, socioeconomic characteristics, social and political attitudes, childhood circumstances such as lack of food, and family size.

### Statistical analyses
Since we were interested in determinants of adult mortality, only relatives who had reached 30 years of age were included in these analyses. As alcohol data were not collected on mothers, the analyses on women were therefore restricted to siblings. Fathers who died before 1972, on whom covariate data were not collected, were not included.

We calculated the Cox proportional hazard ratios (relative risks) to assess the effect of relatives' characteristics on their risk of death from all causes. The proportional hazards assumptions were fulfilled. Since we relied on survey responders' reports about their relatives, relatives with unknown vital status or age were excluded from the analyses. A total of 1884 men and 210 women were excluded because this information was missing. Data were left-censored at respondent's birth for fathers and year of marriage for husbands since time before these events should not be considered time at risk of death. Husbands who were separated or divorced from the respondent and whose vital status was unknown were right-censored at the year of separation. Since the results on different types of relatives were similar, although somewhat stronger in siblings, we analysed pooled data on different relatives and included relative type as an adjustment factor.

For drinking and other variables, we included the response "unknown" as a separate category. For drinking frequency in men, we used those who drank "occasionally, up to once a month" as the reference group (because the use of abstainers as the reference category in studies of the effects of alcohol has been criticized, as this group can contain ex-drinkers in poor health). In women, never drinkers were the reference category since this was by far the largest group. For binge drinking, we used "drinkers who never binged" as the reference category. We also used drinking and binge frequency as a linear variable excluding the unknown category, to assess the significance of linear trends. In addition, in order to investigate if binge drinking had an effect on mortality beyond that of drinking frequency, binge frequency estimates were adjusted for drinking frequency and the effect of drinking frequency on mortality was stratified by bingeing behaviour.

The study design means that the data are clustered, with one respondent potentially giving information on up to four

relatives. As this may influence standard error estimates, the adjusted analyses were repeated with robust sandwich estimates (25) to calculate standard errors. The resulting confidence intervals (not shown) were virtually identical to those presented in the tables for men, and with minimal changes only for women. Results of the conventional analyses are therefore reported. In addition, characteristics of the respondent may influence reporting and hence results. Respondent sex, education, and drinking behaviour were examined in relation to reported relatives' mortality and drinking behaviour. There was no evidence that these features were distorting the results and so results of the simpler models are reported.

## Results

Alcohol data were available for 10 475 male and 3129 female relatives with 3852 and 441 deaths reported, respectively (Table 1). Cardiovascular disease was the most common reported cause of death. There were, as expected, notable differences in drinking patterns between men and women. Only 14% of men never drank and 41% were occasional and 6% daily drinkers. The prevalence of weekly or more frequent binge drinking (among male drinkers) was 13%. Among women, 54% never drank and only 5% drank several times a month or more; 17% of female drinkers were reported as ever binge drinking. Over 50% of the male population was described as regular smokers, compared to 5% of women.

In men, there was a strong association between frequency of drinking vodka or spirits and mortality (Table 2). Compared with occasional drinkers, the hazard ratio for death in never drinkers was 0.70 (95% confidence interval (CI): 0.62–0.77) increasing to 1.95 (95% CI 1.71–2.23) in daily drinkers. Among male drinkers, there was a strong association between the frequency of binge drinking and mortality; the hazard ratio for men who binged weekly compared with drinkers who never binged was 2.05 (95% CI 1.84–2.29). Adjustment for drinking frequency and then smoking, relative type, and decade of birth reduced the effect size to 1.27 (95% CI 1.10–1.48). Further adjustment was possible only in subgroups of male relatives: for education (husbands and siblings), marital status, and contact with respondent (siblings only). However, adjusting for these additional variables did not alter the estimates.

In women, small numbers meant that the frequency groups were combined, but there was an increased risk of mortality in women who drank several times a month or more (Table 3). There was no significant difference in mortality between women who never drank and occasional drinkers. Binge drinking increased mortality risk in women drinkers with the hazard ratio larger than in men. Adjustment for smoking reduced the mortality risk in women who drank regularly; the adjusted relative risk associated with bingeing among drinkers was 1.70 (95% CI 1.03–2.82). As in men, further adjustment did not reduce the estimates. Further analyses by group of cause of death (as reported by the respondents) found that the effect in women was caused by violent or alcohol-related deaths (not shown).

In order to account for residual confounding by inaccurate estimates of smoking, adjusted analyses were repeated restricted to never smokers. Effect sizes for drinking were similar to the adjusted results in Table 2 and Table 3 and for bingeing were larger. Among men who had never smoked the adjusted linear drinking and bingeing variables were 1.16 (95% CI 1.10 –1.22) and 1.25 (95% CI 1.09–1.43),

**Table 1. Descriptive data on male and female relatives**

| | Men | Women |
|---|---|---|
| Number | 10475 | 3129 |
| Relation to informant | | |
| Father | 4456 (42.5)[a] | |
| Sibling | 3087 (29.5) | 3129 (100) |
| Husband | 2932 (28.0) | |
| Alive | | |
| Yes | 6623 (63.2) | 2688 (86.0) |
| No | 3852 (36.8) | 441 (14.0) |
| Year of birth | n=10475 | n=3129 |
| Pre-1921 | 1223 (11.7) | 137 (4.4) |
| 1921–30 | 1709 (16.3) | 470 (15.0) |
| 1931–40 | 2165 (20.7) | 625 (20.0) |
| 1941–50 | 1828 (17.5) | 523 (16.7) |
| 1951–60 | 2175 (20.8) | 718 (23.0) |
| After 1960 | 1375 (13.1) | 656 (21.0) |
| Drinking frequency | n=10475 | n=3129 |
| Never | 1472 (14.1) | 1674 (53.5) |
| Occasional, up to once a month | 4288 (40.9) | 1080 (34.5) |
| Several times a month | 1614 (15.4) | |
| Weekly/more often | 1990 (19.0) | 170 (5.4)[b] |
| Daily | 619 (5.9) | |
| Don't know | 492 (4.7) | 205 (6.6) |
| Frequency of bingeing | n=8509 | n=1250 |
| Never | 2704 (31.8) | 841 (67.3) |
| Occasional | 2428 (28.5) | |
| Several times a month | 942 (11.1) | 216 (17.3)[c] |
| Weekly/more often | 1070 (12.6) | |
| Don't know | 1365 (16.0) | 193 (15.4) |
| Cause of death | n=3852 | n=441 |
| Cardiovascular disease | 1511 (39.2) | 165 (37.4) |
| Cancer | 721 (18.7) | 99 (22.5) |
| Accident /alcohol | 598 (15.5) | 37 (8.4) |
| Other illnesses | 912 (23.7) | 129 (29.3) |
| Don't know | 110 (2.9) | 11 (2.5) |

[a] Figures in parentheses are percentages.
[b] Several times per month or more frequent.
[c] Occasionally or more often.

respectively, and in women who never smoked the linear drinking variable was 1.19 (95% CI 0.98–1.44) and the effect of bingeing was 1.87 (95% CI 1.07–3.27).

Table 4 examines the contribution of drinking frequency to the mortality risk in drinkers stratifying by bingeing behaviour. Never drinkers were used as a reference point for both sexes. In men, increasing mortality with increasing drinking frequency was observed in drinkers who were reported as never bingeing, with a similar increase seen in bingers. A statistical test for interaction between binge and drinking frequency was not significant (P=0.29). In women the increased mortality risk was limited to women who binged but, because of small numbers, the formal test for interaction was not significant (P=0.26). Interestingly, of 21 deaths in women who drank several times a month, 18 were among binge drinkers; 12 of these 18 deaths were reported as being caused by violence or were alcohol-related, giving a relative risk of 30.4 for external causes of deaths.

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## Discussion

This study — the largest individual-level study of alcohol and mortality in the Russian Federation to date — found strong and robust positive associations between frequency of drinking and of binge drinking and all-cause mortality in men and women. In men the associations were linear; there was no suggestion of the U- or J-shaped association usually seen in western populations.

The design of this study offers great advantages in terms of time and expense, but several potential limitations need to be considered. Firstly, a formal validation study of the indirect methodology in this context has not been undertaken; however, there is good evidence to suggest that the methodology provides good estimates of overall mortality and temporal changes in mortality (22), and that the approach is sufficiently sensitive to study differences in mortality between socioeconomic subgroups within populations (23) and the temporal trends in such differences (Murphy et al., manuscript under review 2005).

In terms of studying the effect of alcohol, the methodology has not been formally validated. It is possible that respondents were more likely to overestimate alcohol consumption in dead relatives, which would account for the associations observed. However, the fact that the reported alcohol consumption in relatives is similar to other reports in the Russian population suggests that this method should give reliable estimates of the association between drinking and mortality. In men we were able to examine the associations between alcohol and mortality within different groups of relatives. The associations were stronger in siblings but the pattern of results was similar. Since reports on husband drinking could be expected to be the most reliable, a similar pattern of associations in all relatives argues for the validity of our findings. We are aware of the potential for inaccurate reporting of alcohol consumption which led us to exclude all mothers and fathers who died before 1972.

Secondly, the questionnaire asked about alcohol consumption of the relative without specifying time period, and replies may refer to drinking habits immediately preceding death. Changes in alcohol consumption behaviour before death may therefore influence the results, but one would expect that this type of misclassification would tend to underestimate the underlying relative risks.

Thirdly, mortality of fathers was underestimated in the data set since alcohol consumption was not obtained for fathers who died before 1972, while those in the same birth cohort and still alive were included. We assessed the effect of this potential bias by analysing only fathers born after 1941; the results were similar to, but marginally stronger than, those in all fathers. Deaths at younger ages are more likely to be caused by alcohol; this indicates that the effects are, if anything, underestimated in the full data set.

Finally, frequent contact with siblings was associated with higher reported mortality in siblings. This observation is probably due to increased contact with sick relatives and to under-reporting of mortality in siblings with less contact. However, adjustment for the frequency of contact did not alter the results materially. When analyses were restricted to siblings in more frequent contact, the associations between drinking and mortality were similar in men and stronger in women.

These potential biases are unlikely to explain our findings. The pattern of drinking in this study was similar to that previously reported for the Russian Federation (12, 14). Men drank relatively infrequently but many drinking occasions tended to be high intake episodes, whereas the frequency of any drinking and of binge drinking in women were low.

Previous studies of alcohol and mortality in the Russian Federation have produced inconsistent results. One cohort study found no relation between alcohol and mortality at all (16); another cohort study found increased mortality among frequent heavy drinkers only (17); and one cohort study found

Table 2. **Hazard ratios (HR) for alcohol consumption and all-cause mortality after the age of 30 years in men**

|  | Number | Events | HR (age adjusted) (95% CI) | Adjusted HR[a] (95% CI) | Adjusted HR[b] (95% CI) |
|---|---|---|---|---|---|
| **Drinking frequency** | | | | | |
| Never | 1472 | 443 | 0.70 (0.62–0.77) | | 0.79 (0.71–0.88) |
| Occasional | 4288 | 1454 | 1 (referent) | | 1 (referent) |
| Several times a month | 1614 | 654 | 1.39 (1.27–1.53) | | 1.26 (1.15–1.38) |
| Weekly/more often | 1990 | 878 | 1.63 (1.50–1.77) | | 1.37 (1.25–1.49) |
| Daily | 619 | 263 | 1.95 (1.71–2.23) | | 1.52 (1.33–1.75) |
| Don't know | | | 1.15 (0.98–1.36) | | 1.05 (0.87–1.26) |
| Linear variable[a] | | | 1.23 (1.20–1.25) | | 1.14 (1.11–1.16) |
| **Frequency of binge drinking (among drinkers)** | | | | | |
| Never | 2704 | 1044 | 1 (referent) | 1 (referent) | 1 (referent) |
| Occasional | 2428 | 823 | 1.19 (1.08–1.30) | 1.13 (1.03– 1.24) | 1.01 (0.92–1.11) |
| Several times a month | 942 | 386 | 1.67 (1.48–1.87) | 1.41 (1.24–1.60) | 1.24 (1.09–1.42) |
| Weekly/more often | 1070 | 477 | 2.05 (1.84–2.29) | 1.51 (1.31–1.75) | 1.27 (1.09–1.47) |
| Don't know | 1365 | 518 | 1.30 (1.17–1.44) | 1.23 (1.11–1.37) | 1.18 (1.05–1.31) |
| Linear variable[c] | | | 1.28 (1.24–1.32) | 1.19 (1.13–1.25) | 1.11 (1.06–1.17) |
| Ever versus never binge | | | 1.45 (1.34–1.57) | 1.22 (1.12–1.34) | 1.09 (1.00–1.19) |

[a] Adjusted for drinking frequency.

[b] Adjusted for relative, smoking behaviour (and drinking frequency for binge variables) and stratified by decade of birth.

[c] Hazard ratio for one category change excluding don't know category.

Table 3. **Hazard ratios (HR) for alcohol consumption and all-cause mortality after the age of 30 years in women**

|  | Number | Events | HR (age adjusted) (95% CI) | Adjusted HR[a] (95% CI) | Adjusted HR[b] (95% CI) |
|---|---|---|---|---|---|
| **Drinking frequency** |  |  |  |  |  |
| Never | 1674 | 281 | 1 (referent) |  | 1 (referent) |
| Occasional | 1080 | 118 | 1.07 (0.86–1.33) |  | 1.07 (0.86–1.33) |
| Several times a month | 170 | 23 | 1.94 (1.26–2.97) |  | 1.74 (1.09–2.77) |
| Don't know | 205 | 19 | 0.76 (0.48–1.21) |  | 0.76 (0.47–1.24) |
| Linear variable[c] |  |  | 1.21 (1.02–1.44) |  | 1.18 (0.98–1.40) |
| **Frequency of binge drinking (among drinkers)** |  |  |  |  |  |
| Never | 841 | 92 | 1 (referent) | 1 (referent) | 1 (referent) |
| Does binge | 216 | 28 | 1.94 (1.26–2.97) | 1.68 (1.03–2.73) | 1.70 (1.03–2.82) |
| Don't know | 193 | 21 | 1.09 (0.68–1.76) | 1.07 (0.66–1.72) | 1.10 (0.67–1.81) |

[a,b,c] See corresponding footnotes, Table 1.

that men drinking more than 150 g of alcohol per week had 42% higher mortality from all causes then men drinking less than 150 g per week (calculations based on Plavinski et al. (19)). One case–control study found increased cardiovascular disease (CVD) mortality risk among binge drinkers (18), but the authors were concerned with selection bias. Only one study included women (16), and reported a weak protective effect in females.

This study, larger than previous reports, shows an effect of both drinking and binge frequency on mortality in men, with no evidence of any protective effect of drinking. In women, there was also no protective effect of drinking, but the adverse risk associated with drinking was restricted to a small group of frequent drinkers (only about 5% of the female population). These analyses focus on all-cause mortality whereas the U-shaped curve has been most clearly demonstrated for CVD deaths. Although we had information from the relative on cause of death, and preliminary analyses showed similar or weaker associations with CVD deaths, it is possible that the causes of death have not been reported accurately. Analyses by cause of death have not been reported in detail because of uncertainty over the relatives' recall or accurate knowledge of the causes of death, especially in heavy drinkers where alcohol may have been given as cause of death when it was actually caused by heart disease.

The role of drinking pattern in determining the health risks associated with alcohol consumption is increasingly recognized (7, 8, 26). It has been suggested that the absence of a protective effect of drinking in Eastern Europe might be accounted for by binge drinking (13). This notion has been supported by data in the Russian Federation showing that risk was restricted to heavy drinkers (17, 18). Existing data on the U-shaped curve has used volume of alcohol consumption, rather than just frequency. It is possible that drinkers who drink rarely but heavily have a similar total volume intake to those who drink smaller amounts more regularly, which might account for the lack of a protective effect in these data. However, the present results indicate that men who never binged and drank only moderately are also at increased risk of death. Inaccuracy in the reporting of binge drinking may account for these findings for men since informants' knowledge of the quantity of alcohol consumed may be less accurate than that of the frequency of drinking episodes. Hence the group of men

Table 4. **Adjusted hazard ratios (95% confidence intervals) for mortality from all causes by drinking frequency and binge drinking**

|  | Binge drinking | |
|---|---|---|
| **Drinking frequency** | No | Yes |
|  | HR[a] (95% CI) | HR[a] (95% CI) |
| **Men** |  |  |
| Never | 1 (referent) |  |
| Occasionally | 1.24 (1.10–1.40) | 1.33 (1.15–1.52) |
| Several times a month | 1.50 (1.25–1.81) | 1.59 (1.38–1.84) |
| Weekly | 1.57 (1.25–1.97) | 1.73 (1.52–1.97) |
| Daily | 1.31 (0.75–2.28) | 2.06 (1.73–2.45) |
| **Women** |  |  |
| Never | 1 (referent) |  |
| Occasionally | 1.03 (0.81–1.31) | 1.29 (0.68–2.45) |
| Several times a month or more | 1.28 (0.47–3.45) | 2.68 (1.54–4.66) |

[a] Hazard ratio adjusted for relative (men only), smoking behaviour and decade of birth.

we classified as never binge drinking may include those who did in fact drink large quantities at a time, accounting for their increased risk. Data for women are more consistent with the adverse effect of drinking restricted to binge drinkers, but, as for men, fail to show any benefit from drinking.

Rather than providing unequivocal support for the binge drinking hypothesis, our results are consistent with the concept of hazardous drinking pattern scores that indicate, on a country level, the degree of hazard associated with each extra per capita litre consumed (27, 28). In the most recent version, the Russian Federation has been assigned the most hazardous score (29). A recent population study in three eastern European countries confirmed this scoring. The Russian Federation had the highest rates of problem drinking and negative social consequences of drinking, despite relatively low volume of alcohol consumption, and only part of this excess was explained by binge drinking (30).

This suggests that aspects of alcohol consumption other than binge drinking also contribute to the harmful nature of drinking in the Russian Federation. This could be related to the nature, content, and type of the alcohol beverages consumed in the Russian Federation. Vodka accounts for more than 80% of all alcohol consumed in the Russian Federation (31). Although some studies report stronger beneficial effects for wine (32, 33) than for spirits, there is debate as to the role of confounding in these observations (34, 35). However, a considerable proportion of vodka, especially until about the mid-1990s, came from home or illicit production and was of questionable quality, and this may have further increased the hazard related to drinking.

Alcohol has been proposed to have underpinned the fluctuations in mortality since 1991 (36), but this hypothesis has been disputed (37, 38). This study estimated the association of alcohol with long-term term mortality risk, rather than with short-term fluctuations. We are aware that factors affecting long-term mortality risk may have no relation to short-term mortality changes and vice versa (39). However, the results for women, where the adverse effect of drinking is restricted to a very small proportion of the population, make it more difficult to argue that changes in mortality of the whole population (that were of similar magnitude in men and women) could be accounted for by changes in alcohol consumption.

In conclusion, the findings indicate that alcohol has contributed to the high long-term mortality rates in Russian men. The pattern of results in women suggests that alcohol is unlikely to be a major contributor to female mortality in the Russian Federation. The relation between alcohol and the short-term fluctuations in mortality and deaths from different causes remains unclear. ■

**Competing interests:** none declared.

## Résumé

### Consommation d'alcool et augmentation de la mortalité masculine et féminine en Russie : étude de cohorte reposant sur la mortalité des proches

**Objectif** Étudier les relations entre la fréquence de la consommation d'alcool et des alcoolisations excessives irrégulières et la mortalité des hommes et des femmes adultes russes.

**Méthodes** Une cohorte de commodité a été constituée par des techniques démographiques indirectes, à partir des informations fournies par des personnes soumises à une enquête concernant leurs proches. Auprès d'un échantillon aléatoire de la population générale de la Fédération de Russie, regroupant 7172 personnes interrogées (taux de réponse : 61 %), les enquêteurs ont obtenu des informations sur 10 475 hommes et 3129 femmes faisant partie des proches des répondants, parmi lesquelles l'âge, le statut vital et la fréquence de la consommation d'alcool et des alcoolisations excessives irrégulières. La cohorte analysée dans ce rapport a été formée à partir de ces proches. La mortalité toutes causes confondues après l'âge de 30 ans a été utilisée comme critère de jugement.

**Résultats** Il existait une forte relation linéaire entre la fréquence de la consommation d'alcool et des alcoolisations excessives irrégulières et la mortalité toutes causes confondues chez les hommes. Après prise en compte du tabagisme et de la période de naissance, le rapport du risque de décès pour les buveurs journaliers par rapport aux buveurs occasionnels était de 1,52 [intervalle de confiance à 95 % (IC) : 1,33 - 1,75]. Les buveurs excessifs irréguliers de sexe masculin présentaient une plus forte mortalité que les buveurs ayant une consommation sans grand excès et régulière, cette différence persistant après ajustement par rapport à la fréquence de la consommation alcoolique (risque relatif ajusté : 1,09, IC à 95 % : 1,00 - 1,19). Dans le cas des femmes, l'accroissement de mortalité concernait seulement le petit groupe de celles faisant une consommation excessive et ponctuelle d'alcool une fois par mois au moins (risque relatif ajusté : 2,68, IC à 95 % : 1,54 - 4,66).

**Conclusion** Les résultats suggèrent une association positive entre la consommation d'alcool et la mortalité en Russie. L'étude ne relève aucune preuve de l'effet protecteur d'une certaine consommation d'alcool, observé dans les populations occidentales. L'alcool semble avoir contribué à la valeur depuis longtemps très élevée du taux de mortalité chez les hommes en Russie, mais il est peu probable qu'il constitue une cause majeure de mortalité chez les femmes de ce pays.

## Resumen

### Consumo de alcohol y aumento de la mortalidad de hombres y mujeres en Rusia: estudio de cohortes basado en la mortalidad de parientes

**Objetivo** Analizar la relación entre la frecuencia de consumo habitual y compulsivo de alcohol y la mortalidad de adultos entre los hombres y las mujeres en Rusia.

**Métodos** Utilizando técnicas demográficas indirectas modificadas, se configuró una cohorte de conveniencia basada en la información aportada por los encuestados acerca de sus familiares cercanos. Una muestra seleccionada al azar de la población general de la Federación de Rusia, constituida por 7172 encuestados (tasa de respuesta: 61%), suministró información sobre 10 475 parientes masculinos y 3129 femeninos. Los datos comprendían la edad, el estado vital y la frecuencia de consumo habitual y compulsivo de alcohol. En este informe se analiza la cohorte integrada por esos familiares. La medida de resultado fue la mortalidad por todas las causas después de los 30 años.

**Resultados** Se observó una estrecha relación lineal entre la frecuencia de consumo habitual y compulsivo de alcohol y la mortalidad por todas las causas en los hombres; tras realizar los ajustes necesarios en función del tabaquismo y de la fecha de nacimiento, el riesgo relativo de muerte entre los bebedores diarios en comparación con los ocasionales fue de 1,52 (intervalo de confianza (IC) del 95%: 1,33 - 1,75). Los hombres con pautas compulsivas presentaban una mayor mortalidad que los bebedores no compulsivos, y esa diferencia persistía después de ajustar los datos en función de la frecuencia de consumo de alcohol (riesgo relativo ajustado: 1,09; IC95%: 1,00 - 1,19). En las mujeres, la mayor mortalidad se limitó al pequeño grupo de las que bebían en exceso al menos una vez al mes (riesgo relativo ajustado: 2,68; IC95%: 1,54 - 4,66).

**Conclusión** Los resultados sugieren una asociación positiva entre el consumo de alcohol y la mortalidad en Rusia. No hay ningún dato que avale los efectos protectores observados en poblaciones occidentales. El alcohol parece haber contribuido a las tasas de mortalidad persistentemente altas observadas entre los hombres en Rusia, pero es poco probable que constituya una causa importante de mortalidad femenina.

ملخص

يترافق تعاطي المسكرات بازدياد في معدلات الوفيات الناجمة عن جميع الأسباب لدى الرجال والنساء في روسيا: دراسة أتراب مستندة على وفيات الأقارب

**الهدف**: دراسة العلاقة بين تكرار تعاطي المسكرات وتعاطيها المفرط من جهة وبين وفيات البالغين في الرجال والنساء الروس.

**الطريقة**: باستخدام طرائق ديموغرافية غير مباشرة ومعدَّلة، تم تجميع أتراب ملائمين وفقاً للمعلومات التي أدلى بها المستجيبون حول أقربائهم الوثيقي القرابة. وقد بلغ عدد المستجيبين 7172 شكلوا عينة عشوائية تمثل عامة السكان في الاتحاد الروسي، وبلغت معدلات الاستجابة 61%، وقدمت المعلومات حول 10 475 رجلاً و3129 من النساء من الأقارب؛ وتضمنت المعلومات العمر والحالة الحياتية ومدى تكرار تعاطي المسكرات أو تعاطيها المفرط. وقد تم تشكيل أتراب من هؤلاء الأقارب، ثم تم تحليلهم في هذا التقرير. أما قياس الحصيلة فقد كان معدل جميع الوفيات بعد عمر الثلاثين.

**الموجودات**: لقد كانت هناك علاقة خطية قوية بين مدى تكرار تعاطي المسكرات وبين تعاطيها المفرط من جهة وبين جميع الوفيات لدى الرجال، وذلك بعد إجراء التصحيح على التدخين وعلى الفترات الخاصة بالولادة، واتضح أن الاختطار النسبي للوفيات بين من يتعاطون المسكرات يومياً بالمقارنة مع من يتعاطونها في فترات متقطعة يعادل 1.52 وذلك بفاصلة ثقة مقدارها 95%، إذ تراوحت قيمة الاختطار بين 1.33 و61.75، ويبدو أن معدلات الوفيات كانت أعلى لدى الرجال الذين يتعاطون كمية كبيرة من المسكرات مقارنة بغيرهم ممن لا يفعل ذلك، وقد استمرت هذه المعدلات مرتفعة بعد التصحيح لتواتر تعاطي المسكرات، وبلغ الاختطار النسبي المصحح، 1.9 وذلك بفاصلة ثقة مقدارها 95%، إذ تراوح الاختطار بين 1.00 و1.19. أما في النساء فقد ازداد معدل الوفيات لدى مجموعة صغيرة ممن كن يتعاطين كميات كبيرة من المسكرات بتواتر لا يقل عن مرة واحدة شهرياً، وبلغ الاختطار النسبي المصحح، 2.68 وبفاصلة ثقة مقدارها، 95 إذ تراوح الاختطار بين 1.54 و4.66.

**الاستنتاج**: تشير النتائج إلى وجود علاقة إيجابية بين تعاطي المسكرات وبين معدلات الوفيات في روسيا. ولم تكن هناك بينات على التأثير الواقي لتعاطي المشروبات الذي لوحظ في البلدان الغربية. ويبدو أن الكحول يسهم في زيـــادة معدلات الوفيـــات على المدى الطويل بين الرجال الروس، إلا أن ذلك لم يكن واضحاً كأحد الأسباب الرئيسية للوفيات بين النساء الروسيات.

## References

1. Leon DA, Chenet L, Shkolnikov V, Zakharov S, Shapiro J, Rakhmanova G, et al. Huge variation in Russian mortality rates 1984-94: artefact, alcohol, or what? Lancet 1997;350:383-8.
2. Notzon FC, Komarov YM, Ermakov SP, Sempos CT, Marks JS, Sempos EV. Causes of declining life expectancy in Russia. JAMA 1998;279:793-800.
3. Cornia GA. Short-term, long-term, and hysteresis mortality models: a review. In: Cornia GA, Paniccia R, editors. The mortality crisis in transitional economies. Oxford: Oxford University Press; 2000. p. 253-79.
4. Leon DA, Shkolnikov VM. Social stress and the Russian mortality crisis JAMA 1998;279:790-1.
5. Shkolnikov VM, Nemtsov A. The anti-alcohol campaign and variations in Russian mortality. In: Bobadilla JL, Costello CA, Mitchell F, editors. Premature death in the New Independent States. Washington, DC: National Academy Press; 1997. p. 239-61.
6. Rimm EB, Williams P, Fosher K, Criqui M, Stampfer MJ. Moderate alcohol intake and lower risk of coronary heart disease: meta-analysis of effects on lipids and haemostatic factors. BMJ 1999;319:1523-8.
7. Murray RP, Connett JE, Tyas SL, Bond R, Ekuma O, Siversides CK, et al. Alcohol volume, drinking pattern, and cardiovascular disease morbidity and mortality: is there a U-shaped function? Am J Epidemiol 2002;155:242-8.
8. Rehm J, Greenfield TK, Rogers JD. Average volume of alcohol consumption, patterns of drinking, and all-cause mortality: results from the US National Alcohol Study. Am J Epidemiol 2001;153:64-71.
9. Kauhanen J, Kaplan GA, Goldberg DE, Salonen JT. Beer binging and mortality: results from the Kuopio ischaemic heart disease risk factors study, a prospective population based study. BMJ 1997;315:846-51.
10. Kauhanen J, Kaplan GA, Goldberg D, Salonen R, Salonen JT. Pattern of alcohol drinking and progression of atherosclerosis. Arterioscler Thromb Vasc Biol 1999;19:3001-6.
11. Laatikainen T, Manninen L, Poikolainen K, Vartiainen E. Increased mortality related to heavy alcohol intake pattern. J Epidemiol Community Health 2003;57:379-84.
12. Bobak M, McKee M, Rose R, Marmot M. Acohol consumption in a national sample of the Russian population. Addiction 1999;94:857-66.
13. Britton A, McKee M. The relation between alcohol and cardiovascular disease in Eastern Europe: explaining the paradox. J Epidemiol Community Health 2000;54:328-32.
14. Malyutina S, Bobak M, Kurilovitch S, Ryizova E, Nikitin Y, Marmot M. Alcohol consumption and binge drinking in Novosibirsk, Russia, 1985-95. Addiction 2001;96:987-95.
15. Nemtsov AV. Alcohol-related human losses in Russia in the 1980s and 1990s. Addiction 2002;97:1413-25.
16. Deev A, Shestov D, Abernathy J, Kapustina A, Muhina N, Irging S. Association of alcohol consumption to mortality of middle aged US and Russian men and women. Annal Epidemiol 1998;8:147-53.
17. Malyutina S, Bobak M, Kurilovitch S, Gafarov V, Simonova G, Nikitin Y, et al. Relation between heavy and binge drinking and all-cause and cardiovascular mortality in Novosibirsk, Russia: a prospective cohort study. Lancet 2002;360:1448-54.
18. Shkolnikov VM, Mesle F, Leon DA. Premature circulatory disease mortality in Russia in light of population and individual-level evidence. In: Weidner G, Kopp SM, Kristenson M, editors. Heart disease: environment, stress and gender. Brussels: NATO; 2001.
19. Plavinski SL, Plavinskaya SI, Klimov AN. Social factors and increase in mortality in Russia in the 1990s: prospective cohort study. BMJ 2003;326:1240-2.
20. Brass W, Coale AJ, Demeny P, Heisel DF, Lorimer F, Romaniuk A, et al. The demography of tropical Africa. Princeton (NJ): Princeton University Press; 1968.
21. Hill K, Trussel J. Further developments in indirect mortality estimation. Popul Stud 1977;31:313-34.
22. Bobak M, Murphy M, Pikhart H, Rose R, Martikainen P, Marmot M. Mortality patterns in the Russian Federation: indirect technique using widowhood data. Bull World Health Organ 2002;80:876-81.
23. Bobak M, Murphy M, Rose R, Marmot M. Determinants of adult mortality in Russia. Estimates from sibling data. Epidemiology 2003;14:603-11.
24. Centre for the Study of Public Policy. New Russia Barometer Survey, 2004. Available from: http://www.cspp.strath.ac.uk/ index.html?catalog1_0.html
25. Lin DY, Mei LJ. The robust inference for the proportional hazards model. J Am Stat Assoc 1989;84:1074-8.

26. Grant M, Litvak J. Drinking patterns and their consequences. Washington, DC: Taylor & Francis; 1998.

27. Gmel G, Rehm J, Frick U. Methodological approaches to conducting pooled cross-sectional time series analysis: the example of the association between all-cause mortality and per capita alcohol consumption for men in 15 European states. Eur Addict Res 2001;7:128-37.

28. Rehm J, Monteiro M, Room R, Gmel G, Jernigan D, Frick U, et al. Steps towards constructing a global comparative risk analysis for alcohol consumption: determining indicators and empirical weights for patterns of drinking, deciding about theoretical minimum, and dealing with different consequences. Eur Addict Res 2001;7:138-47.

29. Rehm J, Room R, Monteiro M, Gmel G, Graham K, Rehn N, et al. Alcohol. In: Ezzati M, Lopez AD, Rodgers A, Murray CJL, editors. Comparative quantification of health risks: global and regional burden of disease due to selected major risk factors. Volume 1. Geneva: World Health Organization; 2004. p. 959-1108.

30. Bobak M, Room R, Kubinova R, Malyutina S, Pajak A, Kurilovitch S et al Contribution of alcohol consumption and drinking patterns to rates of alcohol-related problems in urban populations in Russia, Poland and the Czech Republic. A cross-sectional study. J Epidemiol Community Health 2004;58:238-42.

31. World Health Organization. Global status report on alcohol. WHO/HSC/SAB/99.11 ed. Geneva: World Health Organization; 1999.

32. Gronbaek M, Becker U, Johansen D, Gottschau A, Schnohr P, Hein HO, et al. Type of alcohol consumed and mortality from all causes, coronary heart disease and cancer. Arch Intern Med 2000;133:411-9.

33. Klatsky AL, Friedman GD, Armstrong MA, Kipp.H. Wine, liquor, beer, and mortality. Am J Epidemiol 2003;158:585-95.

34. Wannamethee SG, Shaper AG. Type of alcoholic drink and risk of major coronary heart disease events and all-cause mortality. Am J Public Health 1999;89:685-90.

35. Gronbaek M. Alcohol and cardiovascular disease — more than one paradox to consider. Type of alcoholic beverage and cardiovascular disease — does it matter? J Cardiovasc Risk 2003;10:5-10.

36. McKee M, Shkolnikov V, Leon D. Alcohol is implicated in the fluctuations in cardiovascular disease in Russia since the 1980's. Annal Epidemiol 2001;11:1-6.

37. Bobak M, Marmot M. Alcohol and mortality in Russia: is it different than elsewhere? Annal Epidemiol 1999;9:335-8.

38. Vlassov V, Gafarov V. Mortality in Russia. Lancet 2001;358:669.

39. McMichael AJ, Anderson HR, Brunekreef B, Cohen AJ. Inappropriate use of daily mortality analyses to estimate longer-term mortality effects of air pollution. Int J Epidemiol 1998;27:450-3.