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Contrasts in Alcohol-Related Mortality in Estonia: Education and Ethnicity

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Abstract — Aims: The aims of this study were to examine socio-demographic differences in alcohol-related mortality in Estonia, and how they changed over time. **Methods**: Individual death records (age at death 25–64) in Estonia from the late Soviet era (1983–1991) to Estonian re-independence (1992–2005) were analysed using a case-control design. Cases were deaths from alcohol-related causes (7981 deaths). Controls were deaths (13,820) from those neoplasms that are considered not to show variation in death risk according to the socio-demographic variables (that is, excluding cancer of the upper aero-digestive tract, lung, stomach, colon and female breast). Differences in alcohol-related mortality between socio-demographic groups were measured by mortality odds ratio. **Results:** In the study period as a whole, in both genders, an inverse relationship between the educational level and risk of alcohol-related death was apparent. Non-Estonians were more likely to die from alcohol-related causes than Estonians. Risk of alcohol-related death varied over time, being lowest just before Estonia regained its independence, and highest in the most recent period. In men, the educational gradient in the mortality odds ratio almost disappeared in 1988–1991, but reappeared in the transition period, while the impact of ethnicity remained stable over time. In women, educational contrasts in the risk of death existed throughout all subperiods, and ethnical inequalities widened in the re-independence period. **Conclusion:** Rapid societal changes had profound effects on alcohol-related mortality. Strategies to prevent alcohol misuse should include all sections in society, paying special attention to less educated and non-Estonians.

INTRODUCTION

Since the early 1980s, life expectancy at birth in Estonia has fluctuated enormously, dropping to an extremely low level of 60.5 years in men and 72.8 years in women in 1994 (Statistics Estonia, 2005). There are strong reasons to implicate alcohol in premature mortality in Eastern Europe and especially in the former Soviet countries (Leon *et al*., 1997; McKee and Britton, 1998; McKee and Shkolnikov, 2001; Kõlves *et al*., 2006; Kaasik *et al*., 2007; Leon *et al*., 2007; Rehm *et al*., 2007; Stickley *et al*., 2007). Gorbachev's anti-alcohol campaign in the mid-1980s (Reitan, 2001) was associated with a marked decline in overall mortality among the working-age population in Estonia. This favourable situation was prolonged by the so-called Singing Revolution (1988–1991), a period leading up to independence through non-violent events including spontaneous massive song festivals, and characterized by a strong sense of optimism (Thomson, 1992). In 1991, Estonia regained its independence after 50 years of Soviet occupation, ushering in a period of rapid societal change. This transition was accompanied by an immediate increase in mortality, which only reversed in 1995 (Fig. 1).

Considering that Estonia is a country with the tradition of heavy drinking (Simpura *et al*., 1999; Reitan, 2000; Rehm *et al*., 2006; Zaborskis *et al*., 2006; Popova *et al*., 2007), and that existing patterns in alcohol consumption (McKee *et al*., 2000; Helasoja *et al*., 2007) should reflect in mortality, our study focuses on the socio-demographic differences in alcohol-related mortality, and changes over late Soviet and re-independence periods. In addition to the usual socio-economic factors such as income, education and marital status, Estonia offers a valuable possibility of studying a large ethnic minority group. According to the 2000 census, ethnic Estonians constituted 68% of the population, with Russians comprising 26% and other nationalities 6% (Statistics Estonia, 2005). Previous research, conducted around the time of population censuses (1989 and 2000), has shown that having a low level of education and being Russian confer a disadvantage in terms of mortality (Leinsalu *et al*., 2003, 2004). However, we do not know how these factors operated beyond census years or how they interacted with each other.

METHODS

Data on deaths were extracted from the Estonian mortality database, developed in collaboration between Statistics Estonia and the National Institute for Health Development, containing individual data from 1983 (Rahu *et al*., 2006). In the study period, 1983–2005, 437,642 deaths (216,315 men, 221,327 women) were registered. We restricted our analyses to deaths occurring between the ages of 25 and 64 years (the working age population), which comprised 136,614 deaths.

One possibility would have been of estimating the relationship between mortality and different socio-demographic characteristics using the mortality rate ratio, but this was precluded by the absence of annual data on the distribution of the resident population by education, ethnicity, marital status and place of residence within each age–sex category. Intrapolation of census data would be unreliable, especially after 1991 when there was a high rate of migration. Hence, we used a type of case-control design, known as an alternative method to the proportional mortality, both of which are used in the situation when the population denominators are missing (Miettinen and Wang, 1981; Rothman *et al*., 2008). This approach is based on the assumption that mortality rate for the control causes of death is the same for the exposed and nonexposed populations. Differences

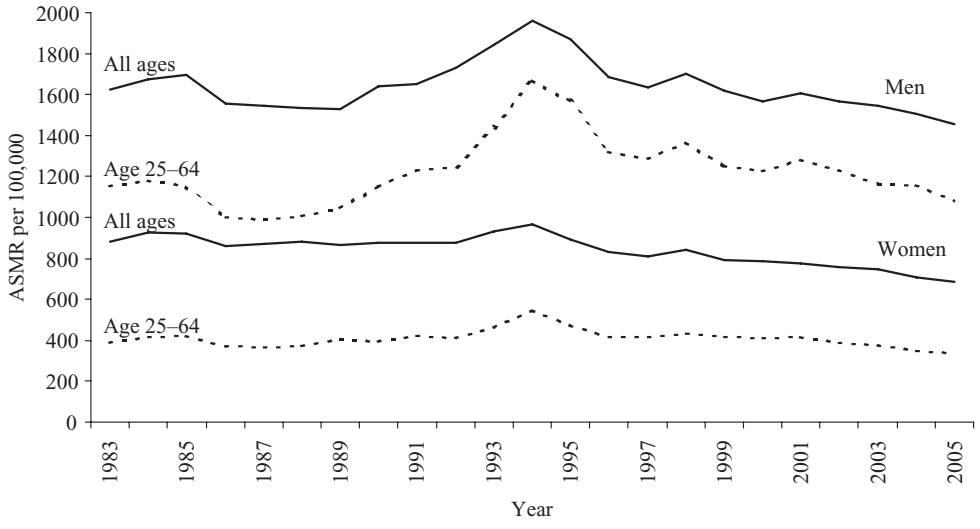

Fig. 1. Trends in the age-standardized mortality rates (ASMR, European standard population) in Estonia 1983–2005, by gender.

Table 1. Correspondence of codes in three classifications for causes of death of interest

Cause of death	Soviet (1983–1993)	ICD-9 (1994–1996)	ICD-10 (1997–2005)
Alcohol-related deaths (cases)			
Alcohol psychoses	73	291	F10.0, F10.3–F10.9
Alcohol dependence syndrome	75	303	F10.2, G31.2
Alcohol liver cirrhosis	122	571.0–571.3	K70
Diseases of the pancreas	126	577	K85–K86
Accidental poisoning by alcohol	165 (1983–1987) 163 (1988–1993)	E860	X45
All neoplasms (controls)	45–67	140–239	C00–D48
Except			
Cancer of upper aero-digestive tract	45, 46, 52	140–150, 161	C00–C15, C32
Stomach cancer	47	151	C16
Colon cancer	49	153	C18
Lung cancer	53	162	C33–C34
Breast cancer	57	174	C50

in mortality between population groups are measured by mortality odds ratio (MOR).

Our selection of cases and controls generally follows the example of Chenet *et al.* (1998) in their study of mortality in Moscow. Cases were deaths from alcohol-related causes: alcohol psychoses, alcohol dependence syndrome, alcohol liver cirrhosis, diseases of the pancreas and accidental poisoning by alcohol (7981 deaths). Controls were deaths from those neoplasms that are considered not to show any substantial variation in death risk according to the socio-demographic variables being studied (13,820 deaths). These comprised all neoplasms except cancer of the upper aero-digestive tract, lung, stomach and colon. For women, breast cancer was also excluded (Kogevinas *et al*., 1997; Baan *et al.*, 2007; Ezendam *et al*., 2008).

During the study period, three classifications were used for coding causes of death: 1983–1993 abridged Soviet version based on ICD-9 (USSR State Committee of Statistics, 1980), 1994–1996 ICD-9 and 1997–2005 ICD-10 (Table 1). Coding of underlying cause of death was the responsibility of Statistics Estonia and has been performed by the same medically qualified person since 1973 (Lang, 2000). When the fourth digit was missing from the ICD-9 code 571 or ICD-10 code G31 in the mortality database, and it was impossible to decide whether the death case was related to alcohol or not, original death certificates were checked in the archives. Double check identified 13 additional alcohol-related deaths.

In our analysis, we used the following variables from death records: gender, date of birth, date of death, education, ethnicity, marital status and place of residence. Age was calculated in full years and aggregated to 5-year age groups. We classified education as higher (university/higher professional), secondary special, secondary and basic (8 years of schooling) or less; ethnicity as Estonian and non-Estonian (self-identified in official documents); marital status as married/cohabiting, single and divorced/widowed; place of residence as urban (five bigger towns in Estonia) and rural (all other). The study period was subdivided into the late Soviet era 1983–1991: within which were the years of economic stagnation and Gorbachev's anti-alcohol campaign (1983–1987), economic reforms (perestroika) and the Singing Revolution (1988–1991); and into the period of independence 1992–2005: within which were the years of recession and survival (1992–1996), fluctuating economic growth (1997–2001) and rapid economic growth with diminishing unemployment (2002–2005).

The MOR for each socio-demographic group relative to a baseline was estimated using unconditional logistic regression. Independent effects of socio-demographic characteristics

Table 2. Distribution of death cases by selected characteristics in the age of 25–64 years in Estonia, 1983–2005

Characteristic	All causes of death *N* (%)	Alcohol-related causes (cases) *N* (%)	Neoplasms[a] (controls) *N* (%)
Gender			
Men	96,516 (70.6)	6082 (76.2)	6855 (49.6)
Women	40,098 (29.4)	1899 (23.8)	6965 (50.4)
Education			
Higher	10,300 (7.5)	426 (5.3)	1663 (12.0)
Secondary special	22,963 (16.8)	1261 (15.8)	2772 (20.1)
Secondary	31,087 (22.8)	2305 (28.9)	3101 (22.4)
Basic or lower	69,051 (50.5)	3590 (45.0)	6216 (45.0)
Unknown	3213 (2.4)	399 (5.0)	68 (0.5)
Ethnicity			
Estonian	79,547 (58.2)	3829 (48.0)	8919 (64.5)
Non-Estonian	56,060 (41.0)	4069 (51.0)	4892 (35.4)
Unknown	1007 (0.7)	83 (1.0)	9 (0.1)
Marital status			
Married/cohabiting	74,781 (54.7)	3480 (43.6)	8878 (64.2)
Single	22,950 (16.8)	1559 (19.5)	1584 (11.5)
Divorced/widowed	35,546 (26.0)	2536 (31.8)	3306 (23.9)
Unknown	3337 (2.4)	406 (5.1)	52 (0.4)
Place of residence			
Rural	67,801 (49.6)	3443 (43.1)	6688 (48.4)
Urban	68,369 (50.0)	4481 (56.1)	7128 (51.6)
Unknown	444 (0.3)	57 (0.7)	4 (0.0)
Age (years)			
25–34	10,004 (7.3)	715 (9.0)	571 (4.1)
35–44	19,797 (14.5)	2134 (26.7)	1353 (9.8)
45–54	38,750 (28.4)	2953 (37.0)	3754 (27.2)
55–64	68,063 (49.8)	2179 (27.3)	8142 (58.9)
Year of death			
1983–1987	27,367 (20.0)	1317 (16.5)	2957 (21.4)
1988–1991	23,588 (17.3)	834 (10.5)	2721 (19.7)
1992–1996	35,298 (25.8)	1904 (23.9)	3194 (23.1)
1997–2001	29,659 (21.7)	2032 (25.5)	2881 (20.8)
2002–2005	20,702 (15.2)	1894 (23.7)	2067 (15.0)

[a]All neoplasms except cancer of the upper aero-digestive tract, lung, stomach, colon and female breast.

on the risk of alcohol-related death were estimated for the study period as a whole, and age-adjusted and fully adjusted MORs were calculated. The final model included education, ethnicity, marital status, place of residence, time period and age group. To explore the variation in the effect of education and ethnicity on alcohol-related mortality over time, adjusted MORs were calculated for each time period separately. Death records with missing data were excluded from the analysis (507 cases, 83 controls); 88.1% of them came from the independence period. Possible interactions between socio-demographic characteristics were tested. All analyses were conducted using the statistical package Stata 10 (StataCorp, 2007).

RESULTS

During the 23-year study period, 96,516 deaths between 25 and 64 years of age were registered in men and 40,098 in women (Table 2). The number of men and women in this age group dying from neoplasms (controls) was almost the same, but for alcohol-related deaths (cases) the ratio of men to women was 3.2. At least one of the putative explanatory variables was unknown for 3.4% of all causes, 6.4% of cases and 0.6% of controls.

In the study period as a whole, there was an obvious inverse relationship between educational level and the risk of dying from an alcohol-related cause (Table 3). The difference in risk between those in the lowest and highest educational levels increased after full adjustment, reaching twofold in men and fivefold in women. There was a higher risk of alcohol-related death among non-Estonians compared to Estonians, and the difference was greater in women—adjusted MOR 2.35 versus 1.67 in men. Marital status was a more important determinant of risk in men than in women. Being single doubled the risk, and being divorced or widowed increased the risk three times compared to married or cohabiting men. The respective adjusted MORs in women were 1.23 and 1.54. In the age-adjusted model, a statistically significant but weak association was found between the place of residence and risk of dying from an alcohol-related cause among both genders, but it disappeared after full adjustment. The risk of alcohol-related death varied over time, being lowest just before Estonia regained its independence (1988–1991) and highest in the latest time period (2002–2005). The magnitude of the association did not change substantially after full adjustment, and it was larger among women.

The variation over time in the effect of socio-demographic characteristics on alcohol-related death was most pronounced in relation to education (Table 4). In men, the educational gradient seen in the middle of 1980s almost disappeared in 1988–1991. It then increased considerably in the period 1992–1996, decreasing again subsequently. In women, an effect of education was seen throughout the entire study period but was most evident in the period of rapid transition between 1992 and 1996. In contrast, the impact of ethnicity to the death risk among men did not show the expected increase in the re-independence period and remained stable over time. However, among women, the ethnical gap in the death risk was wider in the re-independence period than in the Soviet period.

In men, we observed statistically significant interactions between ethnicity and educational level, and between ethnicity and marital status. The effect of ethnicity was stronger at the lowest educational level ($P = 0.047$), and in single men ($P = 0.007$). The same interactions were not seen in women. Interactions between ethnicity and other characteristics were not observed in any of the five sub-periods.

DISCUSSION

This study confirms the social gradient in alcohol-related mortality reported previously (Chenet *et al*., 1998; Mäkelä, 1999; Hemström, 2002; Leinsalu *et al*., 2003, 2004; Rahu *et al*., 2003; Yoon *et al*., 2003; Herttua *et al*., 2007; Koskinen *et al*., 2007; Mackenbach *et al*., 2008). The risk of alcohol-related death increased considerably with decreasing education and was roughly twice as high in women compared to men in each educational category. Health surveys in Estonia show that episodic heavy drinking—associated with higher mortality (Laatikainen *et al*., 2003)—is more common among less-educated people (Helasoja *et al*., 2007).

In general, drinking in Estonia is characterized by heavy consumption of spirits (including surrogate alcohols such as aftershaves and technical spirits) (Rehm *et al*., 2006;

Table 3. Mortality odds ratios (MOR) and 95% confidence intervals (CI) for alcohol-related mortality in the age of 25–64 years in Estonia, 1983–2005

Characteristic	Age-adjusted MOR (95% CI)		Fully adjusted MOR[a] (95% CI)	
	Men	Women	Men	Women
Education				
Higher	1	1	1	1
Secondary special	1.50 (1.27–1.77)	2.19 (1.69–2.84)	1.35 (1.14–1.60)	2.38 (1.82–3.12)
Secondary	2.29 (1.96–2.68)	3.51 (2.74–4.50)	1.79 (1.52–2.11)	3.48 (2.70–4.50)
Basic or lower	2.22 (1.91–2.57)	3.72 (2.91–4.74)	2.05 (1.76–2.40)	4.94 (3.82–6.38)
Ethnicity				
Estonian	1	1	1	1
Non-Estonian	1.58 (1.46–1.71)	2.42 (2.17–2.70)	1.67 (1.53–1.83)	2.35 (2.08–2.65)
Marital status				
Married/cohabiting	1	1	1	1
Single	2.45 (2.19–2.73)	1.17 (0.99–1.39)	2.27 (2.02–2.55)	1.23 (1.02–1.48)
Divorced/widowed	3.26 (2.95–3.59)	1.76 (1.56–1.97)	2.92 (2.64–3.23)	1.54 (1.37–1.74)
Place of residence				
Rural	1	1	1	1
Urban	1.11 (1.03–1.20)	1.24 (1.11–1.38)	1.05 (0.96–1.14)	1.06 (0.94–1.19)
Year of death				
1983–1987	1.39 (1.22–1.59)	1.31 (1.06–1.62)	1.40 (1.22–1.61)	1.25 (1.01–1.56)
1988–1991	1	1	1	1
1992–1996	1.68 (1.48–1.92)	2.00 (1.64–2.44)	1.65 (1.44–1.88)	2.04 (1.66–2.50)
1997–2001	2.11 (1.85–2.40)	2.86 (2.36–3.47)	2.06 (1.80–2.36)	3.26 (2.67–3.98)
2002–2005	2.73 (2.38–3.12)	3.97 (3.25–4.84)	2.57 (2.23–2.97)	4.53 (3.68–5.58)

[a]Each MOR was adjusted for age (5-year age groups) and all other characteristics in the table.

Table 4. Mortality odds ratios (MOR) and 95% confidence intervals (CI) for alcohol-related mortality in the age of 25–64 years by educational level and ethnicity in Estonia in five time periods

Characteristic	Fully adjusted MOR[a] (95% CI)				
	1983–1987	1988–1991	1992–1996	1997–2001	2002–2005
Men					
Educational level					
Higher	1	1	1	1	1
Secondary special	1.69 (1.08–2.66)	1.00 (0.64–1.57)	1.71 (1.18–2.49)	1.17 (0.83–1.64)	1.30 (0.92–1.85)
Secondary	2.47 (1.60–3.83)	0.97 (0.63–1.49)	2.55 (1.78–3.66)	1.53 (1.10–2.13)	1.61 (1.15–2.25)
Basic or lower	3.17 (2.13–4.71)	1.49 (1.02–2.19)	2.85 (2.02–4.03)	1.69 (1.22–2.33)	1.68 (1.20–2.35)
Ethnicity					
Estonian	1	1	1	1	1
Non-Estonian	1.95 (1.59–2.38)	1.62 (1.29–2.05)	1.58 (1.31–1.90)	1.61 (1.34–1.94)	1.63 (1.33–1.99)
Women					
Educational level					
Higher	1	1	1	1	1
Secondary special	2.00 (0.87–4.59)	1.62 (0.66–3.92)	3.29 (1.61–6.70)	2.47 (1.55–3.92)	2.31 (1.41–3.80)
Secondary	1.55 (0.68–3.52)	2.49 (1.07–5.76)	5.66 (2.86–11.20)	3.17 (2.05–4.89)	4.08 (2.56–6.52)
Basic or lower	4.83 (2.28–10.27)	3.62 (1.61–8.14)	7.04 (3.58–13.86)	4.78 (3.06–7.46)	3.68 (2.24–6.05)
Ethnicity					
Estonian	1	1	1	1	1
Non-Estonian	2.13 (1.59–2.87)	1.96 (1.38–2.80)	2.46 (1.91–3.16)	2.81 (2.21–3.58)	2.28 (1.76–2.95)

[a]Additionally to the characteristics in the table, each MOR was adjusted for age (5-year age groups), marital status and place of residence.

Pärna *et al*., 2007), but patterns of alcohol consumption differ among ethnic groups. Estonians tend to drink more frequently while non-Estonians are more likely to engage in episodic heavy drinking (Leinsalu *et al*., 1999; McKee *et al*., 2000). It therefore seems plausible to suggest that these more harmful drinking habits led non-Estonians to be at greater risk of dying from alcohol-related causes than Estonians, and similarly to educational gradient, the difference was greater in women.

The study demonstrates a protective effect of marriage/cohabitation on alcohol-related death, especially in men, a phenomenon described in other studies (Chenet *et al*., 1998; Yoon *et al*., 2003; Koskinen *et al*., 2007). This is thought to reflect a combination of direct protection and selection; spouses offer social support to each other, while people may remain single or divorced because of their alcohol-problems. As expected, tests for interactions showed that non-Estonian ethnicity increased the risk of alcohol-related death among the least educated and single men.

Our study provides information about two historically different time periods: Soviet Estonia with its planned economy and free Estonia in transition to a market economy. The risk of alcohol-related death grew steadily during the transition period, more sharply in women. Given the marked polarization of Estonian society over this period (the Gini coefficient of income disparity grew from 0.25 in 1989 to its maximum 0.40 in 1999) (UNICEF Innocenti Research Center, 2006), we assumed that

there would be a widening of socio-demographic differences in alcohol-related mortality. This assumption was confirmed in women but not in men.

An educational gap was almost nonexistent in men during the period of perestroika and the Singing Revolution, but it was present and statistically significant in women even though the number of cases was small. At the beginning of the transition, at a time characterized by shock due to rapid economic reforms (real wages dropped sharply at the beginning of 1990s) (UNICEF Innocenti Research Center, 2006), unemployment (unknown in the Soviet era) emerged and educational differences in alcohol-related mortality grew markedly. These differences were extremely high in women, who seemed to be more sensitive to instability in society. In the last two subperiods studied (1997–2005), educational inequalities in alcohol-related mortality did not increase, but in men, dropped even below the level seen in 1983–1987.

Surprisingly, in men, ethnic inequalities in alcohol-related mortality were highest in the mid-1980s and have remained stable ever since the period of perestroika. Ethnic differences did not widen with the collapse of the Soviet Union, although Russian immigrants lost their privileges in the society. In women, with several times lower alcohol-related mortality rates than those in men, the ethnic gap was narrower during the Soviet period than that in the period of transition. The fact that health outcomes in non-Estonians are poorer than those in native Estonians is consistent with other studies (Koupilova *et al*., 2000; Leinsalu, 2002, 2004; Koupil *et al*., 2007) and is a matter of some concern.

When interpreting the study results it is necessary to bear in mind certain limitations. First, as population denominators were not available during this study and we used cancer deaths as the comparison group, higher cancer mortality rates in those who were less educated/non-Estonians/unmarried (similarly to alcohol-related mortality rates) could introduce bias. In this case, socio-demographic inequalities in alcohol-related mortality would be underestimated. We tried to diminish the bias excluding certain cancer sites strongly associated with socio-demographic characteristics. Second, when defining alcohol-related deaths, we could use only the underlying cause of death, because contributory causes were included in the mortality database since 1992. Third, although studies validating mortality data in Estonia have not been published, regular and careful data checks were carried out to exclude data-entry errors. For example, for the years 1989–1991, a second data-entry was undertaken a decade later and the data frequencies did not differ (Rahu *et al*., 2005). Fourth, the majority of the death records with missing socio-demographic characteristics of the deceased belonged to the period of transition (Rahu *et al*., 2005), but we could not ascertain whether this reflected more accurate completion of death certificates during the totalitarian period, falsification or both. As there were more cases than controls among excluded deaths, and recognizing that age could also be missing, there could be an underestimation of both alcohol-related death rates in the age group 25–64 and MORs for alcohol-related mortality by time periods.

In conclusion, while education and ethnicity remain important predictors of alcohol-related mortality in Estonia, the risk of alcohol-related mortality has increased for almost every group in the Estonian society. Health policy priorities in Estonia should not only be limited to reforming the health care system but also adopt evidence-based practices to reduce harmful health behaviour, including alcohol consumption. Strategies for prevention should include all sections of society, paying special attention to social groups at greater risk—the less educated and non-Estonians.

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