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## Socioeconomic factors, ethnicity and alcohol-related mortality in regions in Slovakia. What might a tree analysis add to our understanding?

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## ABSTRACT

Regional differences in alcohol-related mortality might reflect strong socioeconomic differences between regions. The present study examines the contribution of education, unemployment, income and minority proportion on regional differences in alcohol-related mortality for inhabitants aged 20–64 years. Linear regression analysis and a non-parametric regression tree analysis were used separately for males and females. The unemployment rate and low education appeared as important determinants of regional alcohol-related mortality, while the proportion of Roma and income were not significantly associated with alcohol-related mortality among males in Slovak districts. A district's unemployment rate was assumed to be the strongest predictor of the outcome measure.

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### 1. Introduction

Alcohol is a major determinant of premature death. It has been estimated that alcohol contributes more than 3% to global mortality (Blomgren et al., 2004; Herttua et al., 2007; Mohapatra et al., 2010; Rehm et al., 2007). Alcohol has been part of the European culture for centuries, and Central and Eastern Europe are not different in this respect. Results from a Polish health project (Zatonski et al., 2008) established that 25% of the male life expectancy gap in the 20–64 years age group between the new member states and the old member states of the European Union, and almost 6% of the female gap are due to alcohol. The alcohol-related mortality rate in the new EU member states is more than twice as high as in the old member states of the European Union for men and 40% higher for women (Mackenbach et al., 2007; Rehm et al., 2007; Van Oyen et al., 2007; Zatonski et al., 2008).

The negative impact of alcoholism on human health is indisputable. Although drinking cultures have become increasingly similar in recent years, in different parts of Europe people still prefer different kinds of alcohol (vodka, beer, wine, etc.), and patterns of drinking remain diverse across the continent (northern binge drinking vs. the southern Mediterranean model) (Zatonski et al., 2008). In addition, the quality of alcohol can vary as well: home-made, illicit and surrogate alcohols are likely to have significant health implications (Zatonski et al., 2008). This is especially true for countries of Central and Eastern Europe, which are characterised by higher alcohol consumption and higher values of alcohol-related mortality rates compared with the old member states of the European Union (Western Europe) (Anderson and Baumberg, 2006; Van Oyen et al., 2007; Zatonski et al., 2008).

In Slovakia a combination of two alcohol-related cultures are present. It has many viticulture areas, where alcohol (wine) is integrated into daily life as in Mediterranean countries or France ('wet culture'), but at the same time the consumption rates of spirits are quite high often resulting in intoxication ('dry culture') (Tomcikova et al., 2009).

Not only is the absolute level of alcohol consumption important, but also the relation between socioeconomic status and alcohol. Alcohol-related morbidity or alcohol-induced premature retirement may decrease a person's socioeconomic status before

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death from an alcohol-related cause. There are many studies about the relations between socioeconomic factors and alcohol-related mortality. For the past two decades, studies have consistently shown inequalities in health between socioeconomic groups and between gender, race or ethnicity, geographical areas and other social categories (Benach et al., 2001, 2003; Ginter, 2000; Ginter et al., 2001, 2005; Harrison and Gardiner 1999; Hemstrom, 2002; Huisman et al., 2005; Koupilova et al., 2001; Kunst, 1997; Mackenbach et al., 1999, 2007; Mackenbach, 2006; Makela, 1999; Mustard and Etches, 2003; Nolen et al., 2005; Schnohr et al., 2004; Sepkowitz, 2006; Zatonski et al., 2008). Many existing studies (Harrison and Gardiner, 1999; Hemstrom, 2002; Herttua et al., 2007; Huisman et al., 2005; Kovács, 2008; Menvielle et al., 2007; Schnohr et al., 2004; Van Oyen et al., 2007) are only partial in the sense of considering the impact of one factor or one dimension of inequality (mainly education level, income, social position, social class or occupation) on alcohol-related mortality, and not considering the interrelated impact of several dimensions of variation. Information is generally limited on the social variation in the health of the people in Central and Eastern Europe (Ginter, 2000; Ginter et al., 2001, 2005; Koupilova et al., 2001; Kunst, 1997; Mackenbach et al., 2007; Zatonski et al., 2008). The available data suggests that considerable differences do exist and that the process of economic and political transition generally tends to lead to an increase in income inequalities and consequently health inequalities within countries. The results of these studies confirm that many countries in Central and Eastern Europe and the Baltic regions have much larger inequalities and alcohol-related mortality than the European average.

Although international differences in alcohol-related mortality have been established, partly related to measures of national prosperity (Mackenbach et al., 2007; Menvielle et al., 2007; Rehm et al., 2007; Vrana, 2007; Zatonski et al., 2008), less is known about subnational geographical variations at the small-area level (Benach et al., 2001, 2003), which is important for reviewing and explaining differences between areas within a country and to formulate area-tailored preventive policies.

Accompanying the changes in political and social conditions in the Slovak Republic starting in 1990, there was a strong change in the demographic trend, which may be characterised as a transition to a new model of reproductive behaviour. Since that time, the period of mortality stagnation has ended and life expectancy for both sexes has increased.

At the same time the most significant economic change after “Velvet Revolution” in 1989 was an increase of unemployment. Until 1989 the Slovak Republic had practically a zero unemployment rate and nearly no experience with unemployment at all. After 1989 the unemployment rate was about a 16% in 1998. The unemployment rate then began to drastically drop and continued

to show a decreasing tendency until the end of the year 2007 till about 8.0%, until the onset of the economic crisis, when the unemployment rate again increased to 12.7% in the year 2009.

The aim of the present work was to study the geographic distribution of alcohol-related mortality in the 20–64 years age group by gender and by small area and to assess the associations between socioeconomic factors and ethnicity and alcohol-related mortality in all districts of the Slovak Republic.

## 2. Methods

### 2.1. Study population

The study population covers all the inhabitants of the Slovak Republic aged 20–64 years in the period 2001–2003. The selected age group is primarily associated with the labour market; it is the economically active population. This part of the population has relatively the lowest mortality rate by age, has finished the process of education and receives a certain kind of income, either salary or social security benefits.

In the period 2001–2003 the average number of inhabitants aged 20–64 years in the Slovak Republic as of July 1st was 3,332,789 people (49.4% men). The total number of alcohol-induced deaths among those aged 20–64 years over the three-year period was 9732 (77.4% men), or 3244 per year on average.

To be able to explore regional differences, the study population was analysed at the district level using an ecological study design. The Slovak Republic is divided into 8 regions at regional level NUTS 3 and deeper into 79 districts at local level LAU 1, 5 of which constitute the capital city Bratislava and 4 the second largest city, Košice. The mean number of inhabitants aged 20–64 per district is 42,187 persons, with values ranging from 7347 to 102,582 inhabitants (average for the period 2001–2003).

### 2.2. Data

The data consist of absolute population numbers and numbers of alcohol-related deaths by gender in the districts of the Slovak Republic in the period 2001–2003 and were obtained from the Statistical Office of the Slovak Republic (Mortality by age and causes of death, 2004a). A complete list of causes of death attributable to alcohol-related mortality, according to the International Classification of Disease (ICD-10) from the year 1996, is presented in Table 1 (Harrison and Gardiner, 1999; Hemstrom, 2002; Hoyert et al., 2006). The selected causes of death in our study were known to be caused directly by alcohol consumption, while providing the best correlation with the alcohol-related causes

**Table 1**  
Causes of alcohol-related death.

Official cause of death	ICD-10 codes	Group of causes in Slovak statistics
Alcohol-related pseudo-Cushing's syndrome	E24.4	Not observed
Mental and behavioural disorders due to alcohol use	F10	F10-F19
Degeneration of nervous system due to alcohol	G31.2	Other causes from Chapter VI
Alcoholic polyneuropathy	G62.1	Other causes from Chapter VI
Alcoholic myopathy	G72.1	Other causes from Chapter VI
Alcoholic cardiomyopathy	I42.6	I30-I52
Alcoholic gastritis	K29.2	Other causes from Chapter XI
Alcoholic liver disease	K70	K70-K76
Alcohol-related chronic pancreatitis	K86.0	Other causes from Chapter XI
Finding of alcohol in blood	R78.0	Not observed
Accidental poisoning by and exposure to alcohol	X45	X40-X49
Intentional self-poisoning by and exposure to alcohol	X65	X60-X84
Poisoning by and exposure to alcohol, undetermined intent	Y15	Other causes from Chapter XX

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