Int J Public Health (2016) 61:545–551
DOI 10.1007/s00038-015-0779-3

ORIGINAL ARTICLE

Structure of deaths associated with heavy alcohol use and their contribution to general mortality in Northwest Slovakia

T. Baška · B. Kľučková · I. Komáreková · Ľ. Straka

Received: 3 June 2015 / Revised: 15 December 2015 / Accepted: 18 December 2015 / Published online: 6 January 2016

Abstract
Objectives The article analyses death cases with detected blood alcohol level ≥2 g/kg. Their contribution to general mortality is calculated.
Methods Death cases from 2005 to 2012 with detected blood alcohol concentration ≥2 g/kg (975 cases) were selected from autopsy records at the Department of Forensic Medicine and Medical Expertises of the Jessenius Faculty of Medicine in Martin. The selected cases were analysed by age and causes of death (pathological, fatal alcohol intoxication, other external causes). Their contribution to general mortality was calculated using official demographic data.
Results Deaths associated with heavy alcohol use comprised 2.2 % of general mortality in males and 0.3 % in females and showed declining trend. The proportion was highest in males aged up to 39 years (10.3 %). External causes dominated among death cases associated with heavy alcohol use (90.8 % in males, 83.7 % in females).
Conclusions Deaths associated with heavy alcohol use significantly contribute to general mortality, particularly in younger males. In spite of the trend indicating slight improvement of the situation, this specific part of alcohol-related problems still constitutes a significant public health issue.

Keywords Heavy alcohol use · Mortality · Causes of death

T. Baška (✉)
Department of Public Health, Jessenius Faculty of Medicine in Martin, Comenius University, Bratislava, Slovakia
e-mail: tibor.baska@jfmed.uniba.sk

B. Kľučková
Exact Systems Slovakia Ltd., Žilina, Slovakia

I. Komáreková
Forensic and Pathologic Anatomy Department, Health Care Surveillance Authority, Banská Bystrica, Slovakia

Ľ. Straka
Department of Forensic Medicine and Medical Expertises, Jessenius Faculty of Medicine in Martin, Comenius University, Bratislava, Slovakia

Introduction

Alcohol drinking ranks among the most significant global public health problems accounting for considerable number of premature deaths and loss of health. Each year about 3.3 million of people die due to alcohol drinking, accounting for about 5.9 % of all deaths (7.6 % in males and 4.0 % in females). Health consequences of alcohol consumption are common particularly among males and constitute a significant risk factor of premature mortality in adults, particularly due to cardiovascular diseases (33.4 % of alcohol-attributable deaths) and injuries (25.8 %, including both intentional and unintentional ones) (World Health Organization 2014). The burden of alcohol-related deaths is particularly high in Central and Eastern Europe. In Russia about one-fifth of all deaths in males and 6 % in females are attributable to alcohol drinking. In Central Europe (Slovakia, the Czech Republic, Poland, Hungary) the situation is not that dramatic. However, alcohol-related deaths, especially injuries, significantly contribute to a gap between premature mortality rate in Western and Central European countries (Zatonski et al. 2008; Rehm et al. 2007). According to the official data (World Health Organization 2015), age-standardized death rate attributable to selected alcohol-related causes shows that in Slovakia there is a downward trend (decrease by 34 % between 1992 and 2010, i.e. from 124.1 to

82.4 deaths per 100,000 population), yet it is still 1.4 times above the average level of the European Union (82.4 vs. 58.2 per 100,000 population as of 2010).

Moreover, the total social costs of alcohol drinking including namely indirect costs (such as productivity loss) in numerous developed countries outreach 1 % of the gross domestic product making it prominent and serious public health problem (Mohapatra et al. 2010).

However, valid evaluation of impact of alcohol drinking on health of the population is a rather complicated issue. There is almost no way to directly measure the consumption of alcohol in the population; moreover, the most of alcohol-related health consequences result from multifactorial aetiology. Estimations of impact of excessive alcohol drinking on population, including official information (World Health Organization 2014), are mostly based on indirect calculation using prevalence data on health disorders associated with alcohol together with respective attributable and relative risks as well as other measurable indicators such as Alcohol-Related Disease Impact (ARDI) or Comparative Risk Assessment (Centers for Disease Control and Prevention 2015; Rehm et al. 2004). The published estimations of the contribution of alcohol drinking to mortality rate in Slovakia (Rosicova et al. 2011) focused primarily on chronic diseases. The impact of alcohol was calculated indirectly using official health statistics on disease-specific mortality rate.

Deaths associated with alcohol drinking do not concern necessarily alcoholism and addiction from psychiatric aspect but can also occur as a consequence of occasional heavy episodic drinking or risky single occasion drinking, where the pattern of drinking plays a significant role (Baggio et al. 2015; Rehm et al. 2009). Our study focuses on the specific issue within the problem, namely deaths immediately associated with heavy drinking episodes. Existing studies focused particularly on a development of certain chronic diseases in association with various drinking patterns (Mukamal et al. 2005; Ruidavets et al. 2010; Stranges et al. 2006); there is, however, not enough information on direct fatal consequences of heavy drinking and drunkenness itself.

In Slovakia the autopsy register provides the most relevant data on deaths directly associated with heavy alcohol use, i.e. the blood alcohol concentration (BAC) equal to or higher than 2 g/kg in time of death (Straka et al. 2011). In accordance with the Act No. 581/2004 Coll. on Healthcare Insurance Companies and Surveillance over Health Care, autopsy should be obligatory in each case of external cause of death, including any suspicion of alcohol use before the death. Moreover, laboratory test to detect BAC is an integral part of each autopsy. All autopsies are carried out within a network of forensic departments legislatively appointed by the Healthcare Surveillance Authority.

The study includes deaths comprising Northwest part of Slovakia, i.e. the appointed catchment area of the Department of Forensic Medicine and Medical Expertises of the Jessenius Faculty of Medicne, Comenius University in Martin, where BAC equal to or higher than 2 g/kg was detected. The study analyses cases of death immediately associated with heavy alcohol use episodes to estimate their impact on health of the population.

The goals of the study include calculation of proportion of death cases where BAC equal to or higher than 2 g/kg was detected to overall number of deaths in the population of Northwest Slovakia within given time period (2005–2012). The data were further analysed by sex, age and causes of death.

Methods

Data from the forensic registry including all autopsy records over a period from 2005 to 2012 at the Department of Forensic Medicine and Medical Expertises of the Jessenius Faculty of Medicine, Comenius University in Martin were used. The catchment area of the Department includes northwest part of Slovakia, namely the whole Trencin Region (districts of Myjava, Nové Mesto nad Váhom, Trenčín, Bánovce nad Bebravou, Partizánske, Prievidza, Ilava, Púchov and Považská Bystrica) and vast part of the Zilina Region (districts of Turčianske Teplice, Martin, Ružomberok, Dolný Kubín, Námestovo, Tvrdošín and Liptovský Mikuláš). The deaths in which blood alcohol concentration (BAC) equal to or higher than 2 g/kg was detected during autopsy were defined as associated with heavy alcohol use. The BAC was assessed by a gas chromatography. Within the given period 975 autopsy cases met the including criteria (BAC equal to or higher than 2 g/kg), among them 871 were males and 104 females (Tables 1, 2).

The data on overall number of deaths as well as population size of the respective geographic area within the given period (2005–2012) were obtained from the official data of the Statistical Office of the Slovak Republic (Statistical Office of the Slovak Republic 2015). Mortality rate from deaths associated with heavy alcohol use and their contribution to overall death rate were calculated considering gender, age group, and year. The relevant catchment area of the Northwest part of Slovakia included 972,804 inhabitants as of December 31, 2012 (Tables 1, 2).

The data on overall number of suicides in the region within the given time (2005–2012) were obtained from the official annual reports of the National Health Information Center published online and downloadable from the respective webpage (National Health Information Center 2015).

Table 1 Deaths associated with heavy alcohol use and their contribution to overall number of deaths in males

	2005	2006	2007	2008	2009	2010	2011	2012
Population size	479 543	479 462	480 034	480 560	480 493	480 427	477 457	477 125
Crude death rate (per 100,000 population)	1062.5	1050.1	1063.5	1044.0	1061.6	1019.5	992.8	1009.8
Number of deaths associated with heavy alcohol use	211	150	111	89	84	81	82	63
Mortality rate caused by deaths associated with heavy alcohol use (per 100,000 population)	44.0	31.3	23.1	18.5	17.5	16.9	17.2	13.2
Contribution of deaths associated with heavy alcohol use to overall number of deaths (percent and CI 95 %)	4.1 (3.6–4.7)	3.0 (2.5–3.4)	2.2 (1.8–2.6)	1.8 (1.4–2.1)	1.6 (1.3–2.0)	1.7 (1.3–2.0)	1.7 (1.4–2.1)	1.3 (1.0–1.6)

Northwest Slovakia, 2005–2012—males

Table 2 Deaths associated with heavy alcohol use and their contribution to overall number of deaths in females

	2005	2006	2007	2008	2009	2010	2011	2012
Population size	500 533	500 411	500 190	500 147	500 200	500 511	496 163	495 679
Crude death rate (per 100,000 population)	892.2	877.5	893.9	882.5	883.4	872.5	873.7	891.1
Number of deaths associated with heavy alcohol use	28	16	10	9	11	14	6	10
Mortality rate caused by deaths associated with heavy alcohol use (per 100,000 population)	5.6	3.2	2.0	1.8	2.2	2.8	1.2	2.0
Contribution of deaths associated with heavy alcohol use to overall number of deaths (per mille and CI 95 %)	6.3 (4.0–8.6)	3.6 (1.9–5.4)	2.2 (0.9–3.6)	2.0 (0.7–3.4)	2.5 (1.0–4.0)	3.2 (1.5–4.9)	1.4 (0.3–2.5)	2.3 (0.9–3.7)

Northwest Slovakia, 2005–2012—females

Causes of death associated with heavy alcohol use found in the autopsy records (BAC equal to or higher than 2 g/kg) were grouped into three categories: pathological causes (i.e. fatal complications of chronic diseases), direct fatal alcohol intoxication, and external causes other than alcohol intoxication.

The results are presented as percentage (%) or per mille (‰) with relevant 95 % confidence intervals. Differences between the rates were considered statistically significant if the 95 % confidence intervals did not overlap.

Results

The deaths associated with heavy alcohol use accounted for 2.2 % of all deaths in males and 2.9 ‰ in females. Within the study period (2005–2012) the proportion markedly decreased both in males (from 4.1 to 1.3 %) and females (from 6.3 to 2.3 ‰). During the whole period the proportion in males was approximately ten times higher than in females. Similarly, mortality rate from death associated with heavy alcohol use per 100,000 population shows a decreasing trend (Tables 1, 2).

Deaths related to heavy alcohol use contributed to the general mortality remarkably in males in age groups 39 years and less and 40–49 years accounting for 10.3 and 8.2 % of all deaths, respectively. In females the differences across age groups were not so remarkable; however, in age group 60 years and more the proportion (0.08 %) was remarkably lower than in the other age groups (Fig. 1).

Considering causes of deaths associated with heavy alcohol use, external causes except alcohol intoxication comprised in males (Fig. 2) the highest proportion

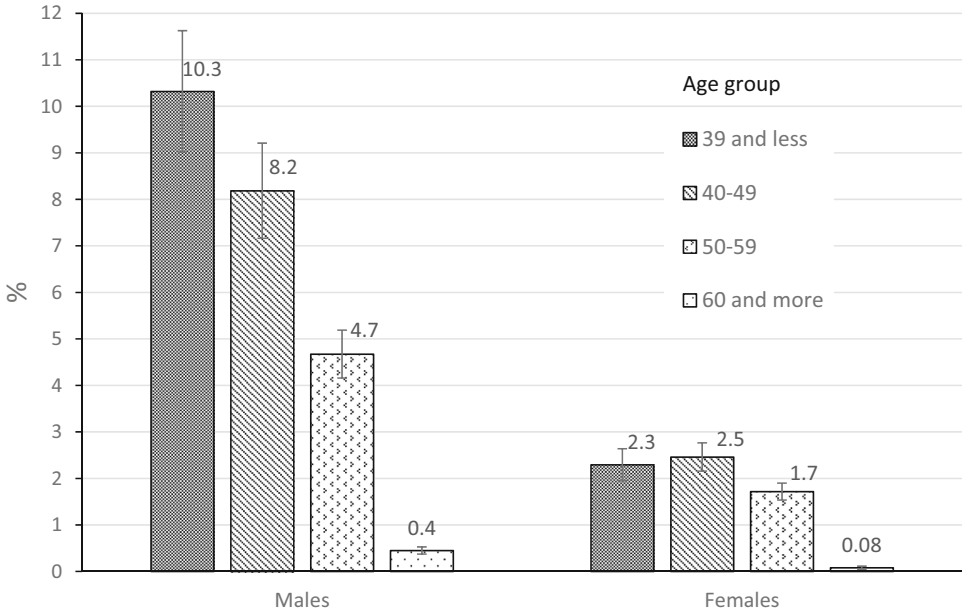

Fig. 1 Proportion of death associated with heavy alcohol use in all deaths by age groups. Northwest Slovakia, 2005–2012

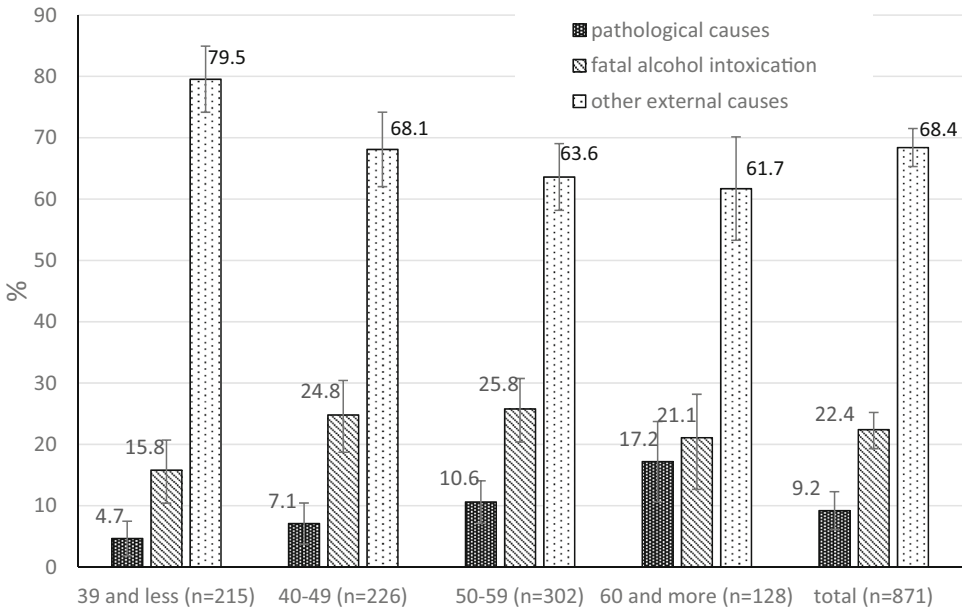

Fig. 2 Causes of deaths associated with heavy alcohol use by age groups. Northwest Slovakia, 2005–2012—males

gradually declining with age from 79.5 % (up to 39 years) to 61.7 % (60 years and more). Fatal alcohol intoxication accounted for about one quarter of the deaths in age group of 40 years and more. In the youngest age group these causes of death accounted for more than 15 %; the difference, however, did not reach statistical difference. The proportion of deaths caused by pathological causes gradually increased from 4.7 % in the youngest age group to 17.2 % in the age group of 60 years and more; while in the age groups younger than 60 years, fatal alcohol intoxication distinctly predominated above pathological causes, in the oldest age group (60 years and more) the proportions almost evened out. In females (Fig. 3) the differences were not so apparent, mainly due to small numbers and, thereby, wide confidence intervals. However, similarly as in males, pathological causes comprised the smallest percentage and were significantly different from the other external causes only in the oldest age group.

Table 3 shows distribution of individual external causes of deaths associated with heavy alcohol use. In males alcohol intoxication was the most frequent cause comprising among one quarter of all external causes, followed by suicides (16.9 %) and injuries (13.5 %). Drowning, traffic accidents, and deaths in fire or hypothermia each of them comprised about one tenth of all external causes of deaths. Others (accidental suffocation, railway accidents,

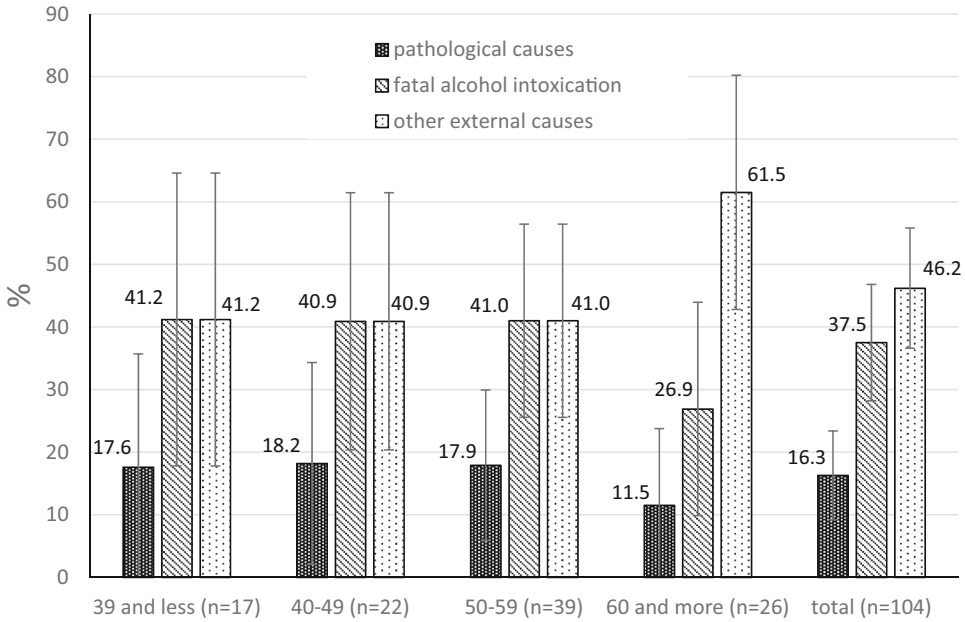

Fig. 3 Causes of deaths associated with heavy alcohol use by age groups. Northwest Slovakia, 2005–2012—females

Table 3 Deaths associated with heavy alcohol use caused by external causes

Cause	Total		Males		Females	
	Abs.	% (CI 95 %)	Abs.	% (CI 95 %)	Abs.	% (CI 95 %)
Alcohol intoxication	234	26.7 (23.7–29.6)	195	24.7 (21.6–27.7)	39	44.8 (34.4–55.3)
Suicide	141	16.1 (13.6–18.5)	134	16.9 (14.3–19.6)	7	8.0 (2.3–13.8)
Injury	114	13.0 (10.8–15.2)	107	13.5 (11.1–15.9)	7	8.0 (2.3–13.8)
Drowning	102	11.6 (9.5–13.7)	87	11.0 (8.8–13.2)	15	17.2 (9.3–25.2)
Traffic accidents	100	11.4 (9.3–13.5)	94	11.9 (9.6–14.1)	6	6.9 (1.6–12.2)
Death in fire or hypothermia	89	10.1 (8.1–12.1)	82	10.4 (8.2–12.5)	7	8.0 (2.3–13.8)
Accidental suffocation	50	5.7 (4.2–7.2)	46	5.8 (4.2–7.4)	4	4.6 (0.2–9.0)
Railway accidents	34	3.9 (2.6–5.1)	33	4.2 (2.8–5.6)	1	1.1 (0.0–3.4)
Homicide	14	1.6 (0.8–2.4)	13	1.6 (0.8–2.5)	1	1.1 (0.0–3.4)
Total	878		791		87	

Percentual distribution of specific causes
Northwest Slovakia, 2005–2012

and homicides) represented only a small fraction. In females alcohol intoxication, including almost half of all external causes (44.8 %), markedly dominated the other causes. Considering the gender differences, the proportion of alcohol intoxication was almost two times higher in females than in males (44.8 vs. 24.7 %). On the other hand, males dominated females in proportion of suicides (16.9 vs. 8.0 %).

Discussion

Our analysis indicates that heavy drinking is a significant public health issue in Slovakia, particularly in men. It represents one of the main risk factors of premature mortality in young men (under 40 years) accounting for about one tenth of all deaths in this age group. Heavy drinking relatively common in Central and Eastern Europe, besides overall high alcohol consumption, plays an important role in the large social-health impact of alcohol drinking in this region (Rehm et al. 2007).

However, the declining trend allows some level of optimism. Similar changes are indicated also in official estimation of the World Health Organization. According to it, the overall alcohol consumption in Slovakia has slightly declined since 2006 (World Health Organization 2014). Moreover, the consistent results found among adolescents in the most of European countries (Looze et al. 2015)

indicate that the decline is a part of the overall trend in Europe. The decline possibly reflects progressive changes of social environment, namely decreasing of social acceptability of excessive drinking. Legislative changes and their better enforcement played at least partial role in these changes. In 2009, Act No. 219/1996 Coll. on Protection against Alcohol Abuse was amended (Act. 214/2009 Coll.) making it more effective. Moreover, from March 1, 2010, the excise tax on spirits was increased by 15 % (Act. 474/2009 Coll.).

Since our findings point out the role of drinking pattern, the alcohol control measures should focus also on changes in drinking culture and drinking preferences, namely decrease of consumption of beer strongly associated with binge drinking (Naimi et al. 2007).

The overall predominance of males in our sample results from historical context in which the traditional social norms do not accept heavy drinking in women (Zilberman et al. 2003). On the other hand, considering relatively high occurrence of binge drinking in adolescent girls in numerous European countries (Currie et al. 2012; Looze et al. 2015), we should expect gradual disappearance of the above-mentioned traditional gender differences and increase of impacts of heavy drinking in women.

Pathological causes of death comprise only a small proportion and include namely acute complications such as rupture of oesophageal varices, acute coronary or cerebrovascular events, etc. as described in previous analysis (Straka et al. 2008). The high proportion of external causes of death underlines the impact of behavioural changes following heavy drinking, particularly in younger age groups. The predominance of men is related to their prevailing drinking pattern, i.e. drinking outside homes leading to a higher risk of injury.

Pathological causes of death, relatively rare in younger age group, dominate in age 60 and more. It indicates that the role of risk behaviour with increasing age declines and is replaced by health consequences of long-lasting alcohol abuse.

Relatively high proportion of suicides including almost one-fifth of all deaths in the sample is related to effects of alcohol intoxication on emotive functions and considerably increasing risk of suicide attempt (Yuodelis-Flores and Ries 2015). Persons addicted to alcohol were 90 times more likely to be at risk for suicide than the norm (Sher 2006). Within 2005 and 2012 in the given area of Northwest Slovakia 718 suicides in men and 86 in women were officially recorded. Therefore, the suicide cases associated with heavy drinking included as much as 18.7 % of all suicides in men and 8.1 % in women. Our numbers are comparable with the findings in other countries (Pompili et al. 2010) and indicate the close link between alcohol and suicide, particularly in males.

A relatively high proportion of females dying from acute intoxication (44.8 %) can be explained by specific biological features. Different body composition (relatively large proportion of fat on account of water content) and pharmacokinetics of alcohol make women more vulnerable to toxic effects of alcohol (Baraona et al. 2001; Thomasson 1995). Danger of alcohol intoxication in women is further enhanced by their predominant drinking pattern: they traditionally drink alone and in case of intoxication adequate aid is usually not available. Within 1994–2005 most of fatal alcohol intoxications in Slovak women occurred at their homes (Straka et al. 2011).

However, some limitations of the study should be taken into consideration.

Distribution of causes of death in our sample only partially corresponds with the overall alcohol-related causes of mortality in Slovakia (Rosicova et al. 2011; Zatonski et al. 2008). Our findings reflect only part of the overall problem, i.e. immediate fatal consequences of heavy alcohol use episodes and underline the need to consider the impacts of heavy drinking as a specific issue. Heavy alcohol use episodes are associated with particularly high risk of intoxication, injury, and violence, even if the average level of alcohol consumption is not relatively high. Moreover, occurrence of heavy drinking is not necessarily related to overall alcohol consumption but reflects rather drinking pattern distribution based on historical and cultural background and particularly social norms accepting drunkenness (World Health Organization 2014; Rehm et al. 2003).

The chosen threshold of the BAC ($\geq$2 g/kg) delimits the issue rather narrowly and the findings should be considered as a "top of iceberg" of the public health impacts of heavy drinking. On the other hand, it makes the results more valid since such high BAC is hardly overlooked during the death investigation, namely in younger age groups.

Proportion of suicide should be evaluated carefully: the presented results represent only the confirmed cases (evident intention, left farewell letter, etc.) and the actual number of suicides could be even higher. It applies especially for railway or traffic accidents where the intention can be hardly determined.

Socioeconomic factors are considered as important determinants of alcohol-related problems (Liu et al. 2013). However, the forensic registry data do not contain particular information on socioeconomic status (i.e. education level, last occupation, etc.) so their analysis, potentially very interesting, was not possible.

Conclusions

Our results indicate that heavy alcohol use in Slovakia significantly contributes to premature deaths of males,

particularly in age up to 39 years. Moreover, the findings point out the role of drinking pattern, i.e. heavy or excessive drinking.

The decreasing trend shown within the last decade indicates slight improving of the situation and can suggest narrowing of a gap between Western and Central Europe regarding alcohol-attributable health impacts.

However, we should still keep in mind that deaths immediately associated with heavy alcohol use episodes represent, besides chronic health effects of its long-term excessive use, only a part of the overall public health consequences. Thus, our results can be considered as "a tip of iceberg" underlying significance of this public health issue.

References

Baggio S, Dupuis M, Iglesias K, Daeppen JB (2015) Independent and combined associations of risky single-occasion drinking and drinking volume with alcohol use disorder: evidence from a sample of young Swiss men. Drug Alcohol Depend 154:260–263

Baraona E, Abittan CS, Dohmen K, Moretti M, Pozzato G, Chayes ZW et al (2001) Gender differences in pharmacokinetics of alcohol. Alcohol Clin Exp Res 25(4):502–507

Centers for Disease Control and Prevention (2015). Alcohol and public health. Online Tools. http://www.cdc.gov/alcohol/ardi.htm. Accessed 4 March 2015

Currie C, Zanotti C, Morgan A et al (2012) Social determinants of health and well-being among young people: health behaviour in school-aged children (HBSC) study: international report from the 2009/2010 survey. World Health Organisation Regional Office for Europe, Copenhagen

Liu Y, Wang M, Tynjälä J, Villberg J, Lv Y, Kannas L (2013) Socioeconomic inequalities in alcohol use of adolescents: the differences between China and Finland. Int J Public Health 58(2):177–185

Looze Md, Raaijmakers Q, Bogt TT et al (2015) Decreases in adolescent weekly alcohol use in Europe and North America: evidence from 28 countries from 2002 to 2010. Eur J Public Health 25(Suppl 2):69–72

Mohapatra S, Patra J, Popova S, Duhig A, Rehm J (2010) Social cost of heavy drinking and alcohol dependence in high-income countries. Int J Public Health 55(3):149–157

Mukamal KJ, Ascherio A, Mittleman MA, Conigrave KM, Camargo CA Jr, Kawachi I et al (2005) Alcohol and risk for ischemic stroke in men: the role of drinking patterns and usual beverage. Ann Intern Med 142(1):11–19

Naimi TS, Brewer RD, Miller JW, Okoro C, Mehrotra C (2007) What do binge drinkers drink? Implications for alcohol control policy. Am J Prev Med 33(3):188–193

National Health Information Center (2015) Edition Health Statistics [in Slovak]. http://www.nczisk.sk/Publikacie/Edicia_Zdravotnicka_statistika/Pages/default.aspx. Accessed 9 Jan 2015

Pompili M, Serafini G, Innamorati M, Dominici G, Ferracuti S, Kotzalidis GD et al (2010) Suicidal behavior and alcohol abuse. Int J Environ Res Public Health 7(4):1392–1431

Rehm J, Rehn N, Room R, Monteiro M, Gmel G, Jernigan D, Frick U (2003) The global distribution of average volume of alcohol consumption and patterns of drinking. Eur Addict Res 9(4):147–156

Rehm J, Room R, Monteiro M et al. Alcohol use. In: M Ezzati, AD Lopez, A Rodgers, CJL Murray (Eds.), Comparative quantification of health risks. Global and regional burden of disease attributable to selected major risk factors, vol 1 World Health Organization, Geneva (2004), pp. 959–1109

Rehm J, Sulkowska U, Mańczuk M, Boffetta P, Powles J, Popova S, Zatoński W (2007) Alcohol accounts for a high proportion of premature mortality in Central and Eastern Europe. Int J Epidemiol 36(2):458–467

Rehm J, Mathers C, Popova S, Thavorncharoensap M, Teerawattananon Y, Patra J (2009) Global burden of disease and injury and economic cost attributable to alcohol use and alcohol-use disorders. Lancet 373(9682):2223–2233

Rosicova K, Geckova AM, Rosic M, Speybroeck N, Groothoff JW, van Dijk JP (2011) Socioeconomic factors, ethnicity and alcohol-related mortality in regions in Slovakia. What might a tree analysis add to our understanding? Health Place 17(3):701–709

Ruidavets JB, Ducimetière P, Evans A, Montaye M, Haas B, Bingham A et al (2010) Patterns of alcohol consumption and ischaemic heart disease in culturally divergent countries: the Prospective Epidemiological Study of Myocardial Infarction (PRIME). BMJ 23(341):c6077

Sher L (2006) Alcohol consumption and suicide. QJM 99(1):57–61

Statistical Office of the Slovak Republic (2015). Mortality rate tables for lower territorial units 2005–2012 [in Slovak]. http://portal.statistics.sk/showdoc.do?docid=33034. Accessed 9 January 2015

Straka L, Štuller F, Novomeský F, Novotný V (2008) Alcohol intoxications and death in hard drunkenness in North Slovakia region [in Slovak]. Psychiat Pro Praxi 9(2):80–82

Straka L, Zubor P, Novomesky F, Stuller F, Krajcovic J, Kajo K, Danko J (2011) Fatal alcohol intoxication in women: a forensic autopsy study from Slovakia. BMC Public Health 11:924

Stranges S, Notaro J, Freudenheim JL, Calogero RM, Muti P, Farinaro E et al (2006) Alcohol drinking pattern and subjective health in a population-based study. Addiction 101(9):1265–1276

Thomasson HR (1995) Gender differences in alcohol metabolism. Physiological responses to ethanol. Recent Dev Alcohol 12:163–179

World Health Organization (2014) Global status report on alcohol and health. Geneva

World Health Organization, Regional Office for Europe (2015) European Health For All Database. http://data.euro.who.int/hfadb/tables/tableA.php?w=1920&h=1080. Accessed 12 March 2015

Yuodelis-Flores C, Ries RK (2015) Addiction and suicide: a review. Am J Addict. doi:10.1111/ajad.12185

Zatonski W, Manczuk M, Sulkowska U et al. (2008) Closing the health gap in European Union. Cancer Epidemiology and Prevention Division, the Maria Skłodowska-Curie Memorial Cancer Center and Institute of Oncology, Warsaw

Zilberman M, Tavares H, el-Guebaly N (2003) Gender similarities and differences: the prevalence and course of alcohol- and other substance-related disorders. J Addict Dis 22(4):61–74