Int J Public Health 54 (2009) S199–S208
1661-8556/09/020S199-10
DOI 10.1007/s00038-009-5411-y

Original article

Gender specific trends in alcohol use: cross-cultural comparisons from 1998 to 2006 in 24 countries and regions

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Submitted: 18 September 2008; revised 04 May 2009; accepted: 04 June 2009

Published Online First 21 July 2009

Abstract

Objective: To examine trends in the prevalence of monthly alcohol use and lifetime drunkenness among 15 year olds in 20 European countries, the Russian Federation, Israel, the United States of America, and Canada.

Methods: Alcohol use prevalence and drunkenness were assessed in the Health Behavior in School-aged Children Survey conducted in each country in 1998, 2002, and 2006. Trends were determined using the Cochran-Mantel-Haenszel test for trends.

Results: Average monthly alcohol use across all countries declined from 45.3 % to 43.6 % and drunkenness declined from 37.2 % to 34.8. There was substantial variability across countries, with decreases in some countries and increases or no change in use or drunkenness in others. The overall decline was greater among boys, from 41.2 % to 36.7 % than among girls, 33.3 % to 31.9 %. In most of the countries where drinking or drunkenness increased, it was due mainly to increases among girls.

Conclusions: Trends in alcohol use and drunkenness varied by country. Drinking and drunkenness remained higher among boys than girls, but the gap between boys and girls declined and girls appear to be catching up with boys in some countries.

Keywords: Alcohol – Drunkenness – Adolescents – Trends – Cross-national – Gender.

Introduction

Adolescence is a time for exploration and alcohol use is a common behavior with which many adolescents experiment. Drinking prevalence increases dramatically during adolescence[1–4]. Frequent and excessive drinking is associated with a range of negative outcomes to which some adolescents may be particularly susceptible[5]. Associations have been established between adolescent alcohol involvement and a range of adverse consequences, including academic problems[6], future drinking and drug use[7], unplanned and risky sex[8], motor vehicle crashes[9], and various physical and emotional problems[10]. Therefore, national policies and programs have been developed to limit adolescent risky alcohol use[11].

Prevalence among both boys and girls remains high in most Western countries[1,2,4], although the range across countries

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is substantial, with past year use among 16 year olds lower than 30 % in some countries and greater than 60 % in others[1]. Drunkenness also ranges considerably, with prevalence rates in the past month of over 20 % in some countries but lower than 10 % in other countries[1,2,4].

There is evidence that adolescent alcohol use may have declined in the past decade in the United States[4], but not in Europe[1]. However, alcohol remains the most commonly used substance among post-primary students internationally[1,2,4] and increases in some East European countries and a few Western European countries have been reported[1]. In addition, there is evidence that in some countries differences in substance use between adolescent boys and girls may have diminished in recent years[12,13].

A variety of factors might affect changes in prevalence in adolescent alcohol use, including income, marketing, prevention approaches, changes in adult prevalence, shifts in teen culture, and so on. Policies are in place in all Western countries to limit underage access and restrict use among those of all ages[11]. In all Western countries, alcohol is regulated, but there is variability in the legal age for purchase and penalties for underage possession, consumption, and sale, depending on the extent to which the national policy favors penalty-and-punish (as in the US), or harm-minimization orientations designed to alter higher-risk use as practiced in most Western European countries and Canada[14,15]. In addition, each country supports primary prevention efforts through schools and communities[16]. Many countries have advertising restrictions, but the marketing of alcohol to youth is prevalent, sophisticated, and dynamic[17].

Effective policy making depends on information on trends in adolescent alcohol use as measures of public health status, shifts in marketing trends, and the effectiveness of policies and prevention programs[11]. The purpose of this research is to examine trends from 1998–2002–2006 in monthly alcohol use prevalence and drunkenness among 15 year old boys and girls in 24 countries participating in the Health Behavior in School-aged Children survey (HBSC).

Methods

Study description

The data used for the analyses were part of the "Health Behaviour in School-aged Children (HBSC)" study[3,18]. HBSC surveys have been conducted every four years since 1983 in several European and North American countries and regions, in collaboration with the World Health Organization (WHO) European Office. The aim of the study is to gain further understanding of adolescent health and its determinants. The HBSC study includes questions on substance use and other health behaviors and social indicators. It therefore provides an unusual opportunity to examine cross-national trends in alcohol use in a large number of countries using the same methodology.

The sampling population in each country consisted of students aged 11, 13 and 15, with the desired mean age for the three age groups being 11.5, 13.5 and 15.5. Participating countries were required to include a minimum of 95 percent of the eligible target population within their sampling frame. Nationally representative samples of students (in most countries) were selected using a clustered sampling design, where the initial sampling unit was either the class or the school. The recommended sample size for each of the three age groups was approximately 1,500 students, assuming a 95 % confidence interval of +/- 3 per cent around a proportion of 50 per cent and allowing for the clustered nature of the samples.

Data were collected on the basis of anonymous self-report questionnaires distributed in the classroom. Participation in the survey was voluntary, and students were assured that responses would be confidential and anonymous. In each country, every effort was taken to follow the international research protocol to ensure consistency in survey instruments, data collection and processing procedures. At the student participant level, known response rates varied from 64.5 % to 91.2 % across countries[19]. Each participating country obtained approval to conduct the survey from the relevant ethics review board or equivalent regulatory institution. Further information about the survey procedures can be found in this supplement and other publications[3,18,20,21].

Sample

These analyses are based on data from 1998, 2002 and 2006. In the 1998 survey, 30 countries or regions took part; in 2002, 36; and in 2006, 41. Of those, 24 countries obtained comparable data on alcohol use at all three time periods. The average sample size across countries/regions was 1479 in 1997/98, 1674 in 2001/02 and 1896 in 2005/06. The samples were almost equally distributed between boys and girls for all countries and years (Tab. 1).

Measures

The questionnaire was developed by an interdisciplinary research group from the participating countries. Under supervision of the national research teams, a translation/back translation procedure was used to guarantee language equivalence.

Monthly alcohol use: Students were asked how often they drank beer, wine, and liquor/spirits. For each alcoholic drink, response options were "1 = never," "2 = rarely," "3 = every month," "4 = every week," and "5 = every day." This variable

Table 1. Sample size for the study, by gender, country and year – HSBC 1998, 2002, 2006.

	1998			2002			2006		
Country*	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls
Austria	1294	577	717	*1277*	643	634	*1759*	785	974
Belgium	*1559*	797	762	*3411*	1658	1753	3030	1562	1468
Canada	*2403*	1134	1269	*1207*	528	679	*2289*	1095	1194
Czech Republic	*1181*	584	597	1660	806	854	*1665*	842	823
Denmark	*1339*	631	708	*1369*	656	713	*1552*	762	790
Estonia	587	252	335	*1267*	619	648	*1587*	801	786
Finland	*1478*	727	751	*1741*	867	874	1685	790	895
France**	*1245*	592	653	*2614*	1301	1313	*2222*	1139	1083
Germany	*1524*	763	761	1741	842	899	*2552*	1271	1281
Greece	*1283*	585	698	*1324*	643	681	*1416*	650	766
Greenland	346	174	172	*238*	100	138	*417*	207	210
Hungary	*560*	245	315	*1310*	498	812	1187	550	637
Ireland	*2538*	1314	1224	*919*	345	574	*1685*	914	771
Israel	*920*	421	499	1547	697	850	*1994*	757	1237
Latvia	*1130*	443	687	*1112*	481	631	*1330*	628	702
Lithuania	1401	626	775	*1904*	981	923	*1861*	940	921
Norway	*1660*	842	818	*1622*	799	823	1534	818	716
Poland	*1590*	866	724	*2127*	1022	1105	*2287*	1092	1195
Portugal	*933*	374	559	800	378	422	*1383*	613	770
Russian Federation	*1272*	597	675	*2574*	1138	1436	*2755*	1238	1517
Sweden	1134	599	535	*1218*	609	609	*1526*	752	774
Switzerland	*1832*	918	914	*1501*	770	731	1500	733	767
UK***	*4719*	2274	2445	*4077*	1982	2095	*4999*	2492	2507
US	*1571*	712	859	1625	754	871	*1284*	649	635
Means	*1479*	710	769	*1674*	796	878	*1896*	920	976

**See Currie et al., 2004 for national sampling plans[18]*
***In 1998, France collected data in only 2 regions, whereas in 2002 and 2006, it selected a nationally representative sample.*
****UK includes Wales, Scotland and England*

was dichotomized by combining options 1 and 2 (indicating less than monthly alcoholic use, coded as "0") and 3 to 5 (to reflect at least monthly alcohol use, coded as "1").

Drunkenness was assessed by asking students if they ever had so much alcohol that they were really drunk. Response options included "1 = no, never," "2 = yes, once," "3 = yes, 2–3 times," "4 = yes, 4–10 times," "5 = yes, more than 10 times". Responses to this question were grouped into two categories: drunkenness never or only once in life (options 1 and 2) and more frequent lifetime drunkenness experiences (options 3–5).

Analyses

Only 15-year old students were included in these analyses. We used SAS software (version 9.1) and incorporated a design factor of 1.2 to account for the clustered sampling design as suggested by Roberts and colleagues[19]. Because of the clustered sample design, we adjusted the p-value to be more conservative. The limits obtained by widening the standard 95% confidence interval by the factor 1.2 correspond to an unadjusted p-value of 0.018; this is the cut-off used for denoting effects as statistically significant. We compared alcohol use for each country across the three study periods, for the total sample and separately by gender, using the Cochran-Mantel-Haenszel test for trends with the "non-zero correlation" option. The Cochran-Mantel-Haenszel (CMH) tests for a correlation between categorical variables (in this case, time and alcohol use or drunkenness)[22]. A similar analysis was conducted for drunkenness. Countries were grouped according to observed trends in alcohol use and drunkenness from 1998 to 2006. Groups 1, 2 and 3 respectively included countries that experienced a significant increase, no trend, or a significant decrease in monthly alcohol use or drunkenness for the total sample. Weighted means for each trend group were created to adjust for variations in the sample size of countries within each trend group. Bar charts display the trends in monthly alcohol use and drunkenness, with countries displayed by trend group, using the total sample. We also created bar diagrams separately by gender, only for countries with significant trend differences between boys and girls.

Table 2. Monthly alcohol use (%) for the total sample and by gender, by study year and by country, grouped by direction of trend, between 1998 and 2006 (increase, no change, decrease)[§ #].

	Total			Boys			Girls		
	1998	2002	2006	1998	2002	2006	1998	2002	2006
Group 1: Overall increase between 1998 and 2006									
Austria	53.2	43.4	**56.5**	59.3	45.0	58.2	**48.3**	**41.8**	**55.1**
Belgium	**51.8**	**45.3**	**55.2**	58.3	49.9	58.9	**44.9**	**41.0**	**51.3**
Czech Republic	46.2	55.2	**54.9**	55.8	60.9	60.6	**36.8**	**49.8**	**49.0**
Estonia	**39.9**	**41.0**	**46.2**	47.8	49.1	49.7	**33.9**	**33.3**	**42.6**
Hungary	32.1	47.9	**46.3**	42.9	58.9	50.3	**23.8**	**41.2**	**42.8**
Latvia	**37.8**	**35.3**	**52.0**	48.4	38.9	54.2	**31.0**	**32.5**	**50.1**
Lithuania	31.1	36.4	**40.9**	36.3	43.3	40.2	**26.8**	**29.2**	**41.6**
Switzerland	32.6	42.4	41.0	39.9	52.4	47.2	25.2	31.8	35.0
UK	59.0	65.0	**62.2**	**57.4**	**66.7**	**61.0**	60.4	63.4	63.4
Weighted average	**47.0**	**48.7**	**53.1**	51.7	53.8	55.2	42.7	44.0	51.0
Group 2: No trend									
Canada	43.1	45.8	41.9	46.3	48.2	41.3	40.3	43.9	42.4
France	42.4	32.5	40.2	51.8	37.3	45.5	34.0	27.7	34.5
Greenland	28.8	29.8	30.4	31.2	36.4	27.5	26.3	25.0	33.2
Israel	26.4	29.4	30.0	37.6	38.5	41.3	**16.8**	**21.9**	22.8
Poland	30.9	31.1	29.3	38.2	39.6	38.6	22.2	23.3	20.7
Portugal	26.7	30.4	27.5	36.2	34.6	35.3	20.3	26.7	21.3
Weighted average	35.6	33.2	32.1	42.4	39.2	40.3	29.3	27.8	28.9
Group 3: Overall decrease between 1998 and 2006									
Denmark	74.0	72.5	60.6	76.2	71.9	63.2	72.1	73.0	58.1
Finland	**41.3**	**39.0**	**36.9**	43.6	43.6	38.6	39.2	34.4	35.5
Germany	50.3	50.1	42.0	53.0	55.2	45.6	47.6	45.3	38.4
Greece	67.5	47.8	51.3	76.0	58.6	61.3	60.3	37.7	42.7
Ireland	44.7	28.0	36.1	51.8	**33.5**	**35.4**	37.1	24.6	37.0
Norway	**38.6**	**43.5**	**31.2**	**37.7**	**40.4**	**29.0**	39.6	46.4	33.7
Russian Federation	54.9	43.3	41.2	54.6	49.0	42.9	55.1	38.8	39.8
Sweden	41.2	36.3	28.8	42.8	37.2	29.7	39.4	35.4	28.0
US	36.8	27.3	28.1	39.6	32.1	27.0	34.5	23.2	29.3
Weighted average	**48.9**	**43.4**	**39.9**	51.8	47.4	41.5	46.2	39.9	38.4
Total sample weighted average	45.3	43.6	43.6	41.2	40.5	36.7	33.3	33.0	31.9

[§] *Highlighted percentages correspond to trends that are significant at the 95% CI.*
[#] *This grouping refers to the overall change between 1998 and 2006; different trends may appear when separately considering any two of these three years.*

The grouping described above refers to the overall change in alcohol use or drunkenness between 1998 and 2006; different trends may appear when separately considering any two of these three years. To further illustrate the changes occurring between 1998 and 2006 for countries that experienced a significant increase or decrease in alcohol use/drunkenness, we compared alcohol use and drunkenness for 1998–2002; 2002–2006 and 1998–2006 using the CMH test. We set the 95% significance level at 0.006 (overall p-value of 0.018 divided by 3) to avoid problems arising from multiple comparisons and to avoid inflating the type I error.

Results

Monthly alcohol use

Tab. 2 shows the prevalence of monthly alcohol use for the total sample, with countries grouped by trend. For the total sample the weighted average monthly use was 45.4% in 1998, 43.6% in 2002, and 43.6% in 2006. Average use varied considerably across countries, in 2006 ranging from less than 30% in 4 countries to over 50% in 7 countries. Some countries experienced increases and some decreases.

Group 1 countries with a significant increase in monthly alco-

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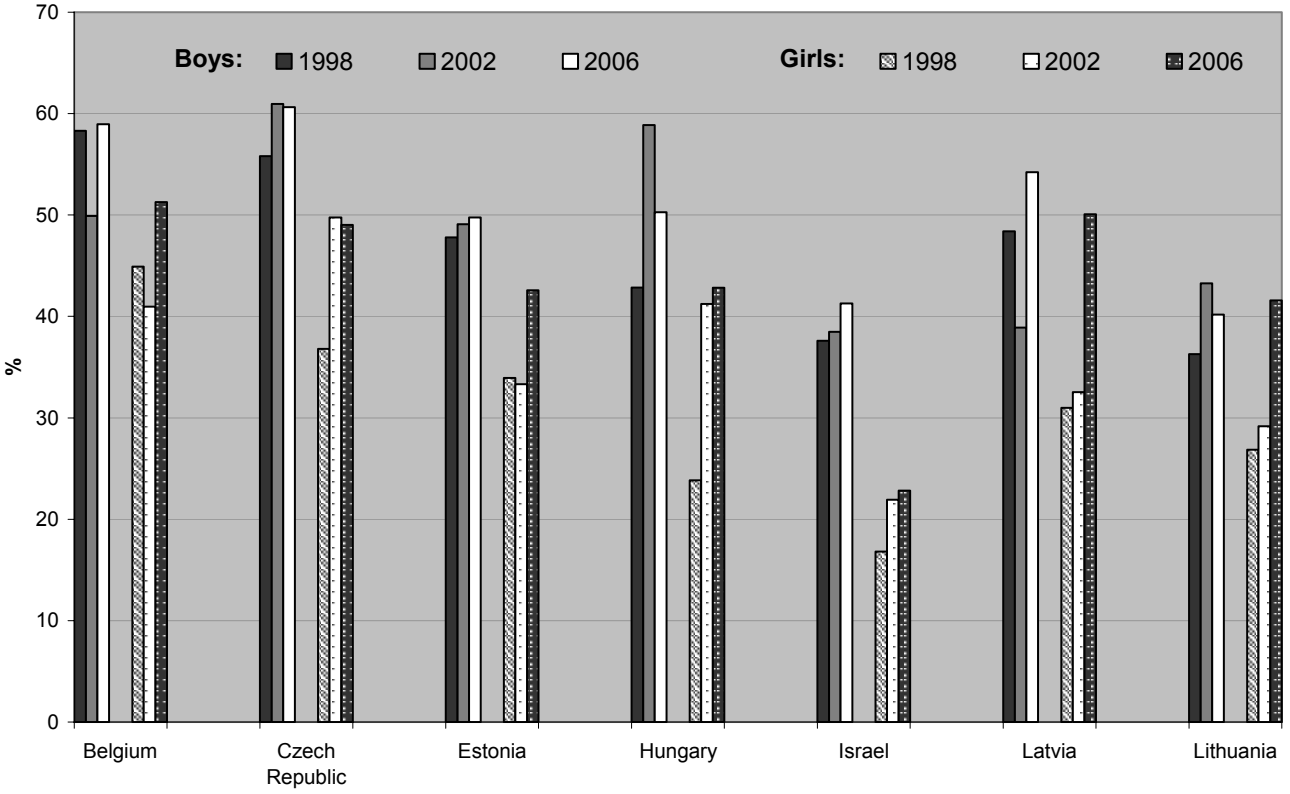

*Note: Three other countries with a different pattern are not displayed: UK (boys increase their alcohol use while girls don't experience a change) and Ireland and Norway (boys decrease their alcohol use while girls don't experience a change).

Figure 1. Monthly alcohol use for boys and girls, for countries where use increased among girls but did not change among boys, HBSC 1998, 2002, 2006*

hol use between 1998 and 2006 include Austria, Belgium, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Switzerland, and the United Kingdom (UK). The mean monthly alcohol use for these countries increased from 47.0 % in 1998 to 48.7 % in 2002 to 53.1 % in 2006. In this group, only Lithuania showed a significant increase both from 1998 to 2002, and from 2002 to 2006. Austria and Belgium displayed an interesting pattern in that they experienced a significant decline in alcohol use between 1998–2002, followed by a significant increase between 2002 and 2006. All other countries in this group experienced an increase in only one period, while remaining relatively constant for the other.

Group 2 countries that experienced no significant change in monthly alcohol use between 1998 and 2006 include Canada, France, Greenland, Israel, Poland and Portugal. For this group the mean monthly alcohol use in 2006 was 32.1 %. Group 3 countries with a significant decrease in monthly alcohol use between 1997/98 and 2005/06 include Denmark, Finland, Germany, Greece, Ireland, Norway, the Russian Federation, Sweden and the United States (US). The mean monthly alcohol use for these countries decreased from 48.9 % in 1998 to 43.4 % in 2002 to 39.9 % in 2006. In this group, most countries showed a significant decline in alcohol use in only one period. Ireland, however, experienced a significant decrease between 1998 and 2002, which was followed by a significant increase between 2002 and 2006. Conversely, Norway showed a significant increase in monthly alcohol use between 1998 and 2002 that was followed by a significant decrease in alcohol use.

Weighted average monthly alcohol use for boys decreased from 41.2 % in 1998, to 40.5 % in 2002 and 36.7 % in 2006. For girls, weighted average monthly use was 33.3 % in 1998, 33.0 % in 2002 and 31.9 % in 2006. Gender differences in monthly alcohol use trends were observed for 10 countries out of the 24 included in these analyses. In Belgium, the Czech Republic, Estonia, Hungary, Israel, Latvia and Lithuania monthly alcohol use increased significantly between 1998 and 2006 among girls but not boys as shown in Fig. 1. Also, Ireland and Norway experienced a decrease in monthly alcohol use among boys, but no change among girls. Switzerland was the only country with an increase among both boys and girls. The UK was the only country with an increase in monthly alcohol use among boys, but no significant change among girls.

Table 3. Drunkenness (%) for the total sample and by gender, by study year and by country grouped by direction of trend, between 1998 and 2006 (increase, no change, decrease) [*] [§] [#].

	Total			Boys			Girls		
	1998	2002	2006	19/98	2002	20/06	1998	2002	2006
Group 1: Overall increase between 1998 and 2006									
Estonia	32.0	49.2	49.7	44.0	56.7	57.3	23.0	42.0	42.0
Hungary	**27.9**	**34.2**	**35.7**	39.3	47.2	39.8	**19.1**	**26.3**	**32.2**
Latvia	**31.2**	**32.4**	**44.4**	45.1	41.4	50.4	**22.1**	**25.5**	**39.1**
Lithuania	25.7	49.7	53.6	32.4	56.8	56.8	20.4	42.2	50.3
Poland	**30.7**	**30.9**	**34.4**	39.4	39.6	42.0	**20.4**	**22.9**	**27.4**
Russian Federation	**28.1**	**33.7**	**34.5**	31.8	39.0	38.1	**24.7**	**29.4**	**31.6**
Weighted average	**29.1**	**37.9**	**41.2**	37.7	46.2	46.8	**21.7**	**30.8**	**36.1**
Group 2: No trend									
Belgium	27.5	30.1	27.4	32.7	35.1	32.4	22.1	25.3	22.1
Czech Republic	29.2	33.1	33.5	36.9	37.5	36.4	**21.6**	**29.0**	**30.4**
France	24.1	18.6	23.5	28.8	22.1	28.6	19.8	15.0	18.1
Greece	22.1	20.1	19.2	23.4	23.4	21.7	20.9	16.9	17.1
Greenland	51.3	57.6	43.9	49.7	64.0	43.3	52.9	52.9	44.4
Israel	9.7	15.2	12.3	14.1	21.1	18.4	6.0	10.3	8.4
Portugal	17.8	22.1	21.0	25.2	25.6	24.9	12.9	18.9	18.0
Switzerland	20.5	32.3	23.1	25.4	38.1	28.9	15.7	26.2	17.7
Weighted average	23.3	25.8	24.0	28.2	28.7	28.1	18.3	20.5	19.3
Group 3: Overall decrease between 1998 and 2006									
Austria	42.5	36.4	37.7	49.3	38.0	40.9	37.0	34.9	35.1
Canada	42.2	42.3	35.3	42.5	43.9	34.9	42.0	41.1	35.7
Denmark	66.2	66.1	57.3	69.2	67.4	59.0	63.5	64.9	55.7
Finland	**54.4**	**54.5**	**45.4**	51.7	53.4	46.6	**56.9**	**55.7**	**44.3**
Germany	32.8	39.2	29.4	35.6	44.4	31.2	29.9	34.4	27.7
Ireland	**41.1**	**32.0**	**33.6**	**46.8**	**32.6**	**35.7**	35.0	31.7	31.1
Norway	38.9	39.5	28.2	36.6	38.4	25.3	41.2	40.6	31.6
Sweden	39.9	38.6	26.1	39.2	39.3	26.4	40.7	37.9	25.7
UK	58.1	55.3	47.8	60.5	55.2	45.6	55.8	55.3	49.9
US	31.3	26.3	19.8	34.4	30.4	20.0	28.8	22.7	19.6
Weighted average	**46.4**	**45.3**	**37.9**	48.4	46.6	37.9	44.6	44.0	38.0
Total sample weighted average	37.2	37.1	34.8	49.8	48.5	47.0	41.2	39.0	41.3

**The drunkenness variable refers to 2 or more episodes of drunkenness*
[§] Highlighted percentages correspond to trends that are significant at the 95% CI.
[#] This grouping refers to the overall change between 1998 and 2006; different trends may appear when separately considering any two of these three years.

Drunkenness

Tab. 3 shows the prevalence of lifetime drunkenness for the total sample, with countries grouped by trend. For the total sample, the weighted average drunkenness was 37.2 % in 1998, 37.1 % in 2002, and 34.8 % in 2006. Drunkenness varied across countries and in 2006 was less than 20 % in 3 countries and greater than 40 % in 7 countries. Group 1 countries with a significant increase in drunkenness between 1998 and 2006 include Estonia, Hungary, Latvia, Lithuania, Poland, and the Russian Federation. The mean drunkenness for these countries increased from 29.1 % in 1998 to 37.9 % in 2002 to 41.2 % in 2006. In this group, Estonia, Latvia, Lithuania and the Russian Federation experienced a significant increase in drunkenness in only one time period, while remaining relatively constant for the other. Hungary's only significant increase in drunkenness occurred between 1998 and 2006.

Group 2 countries that experienced no significant change in drunkenness between 1998 and 2006 include Belgium, the Czech Republic, France, Greece, Greenland, Israel, Portu-

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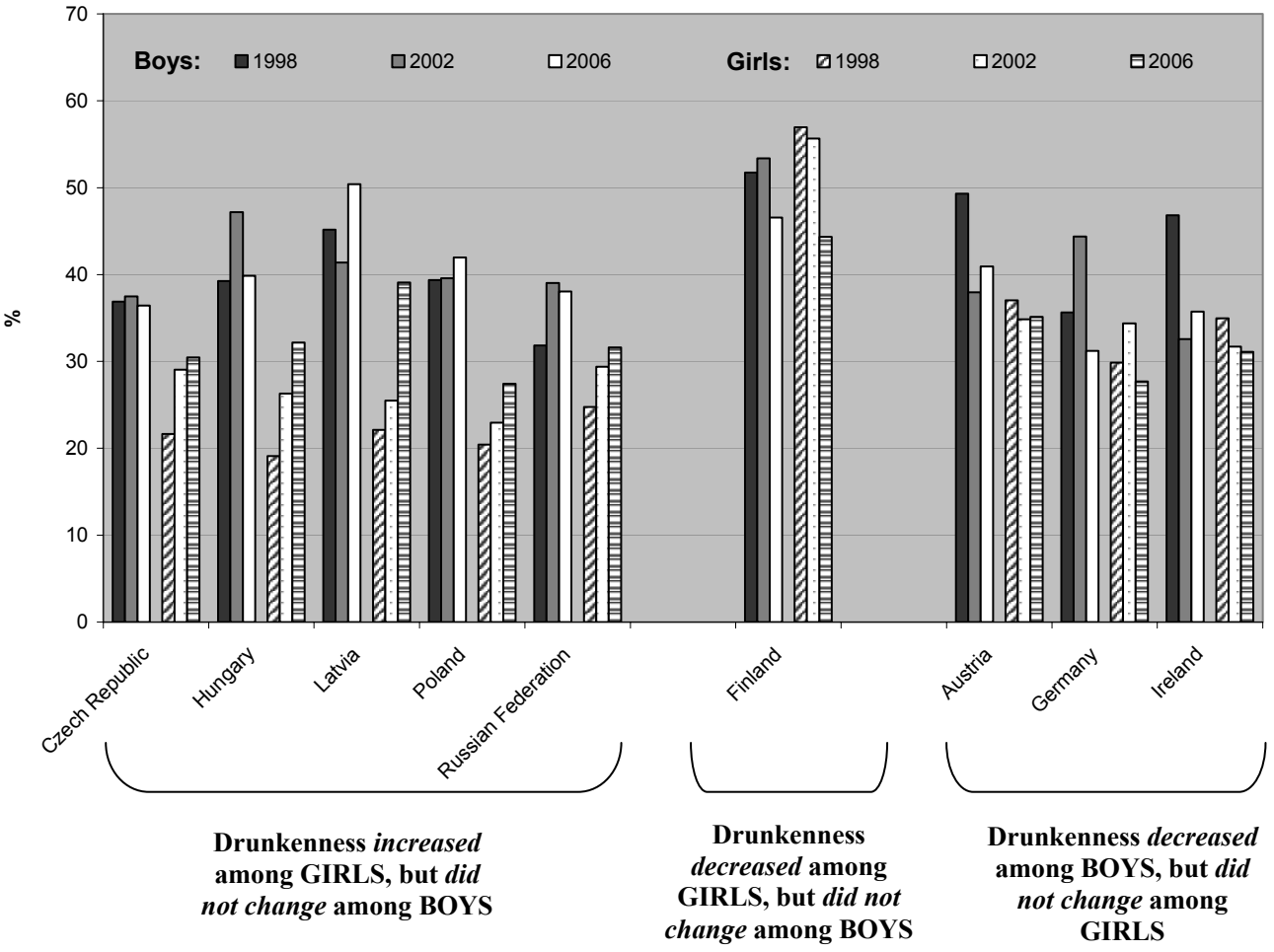

Figure 2. Drunkenness for boys and girls, for countries with gender differences in drunkenness, HBSC 1998, 2002, 2006.

gal and Switzerland. The mean drunkenness for this group in 2006 was 24.0%. Group 3 countries with a significant decrease in drunkenness between 1998 and 2006 include Austria, Canada, Denmark, Finland, Germany, Ireland, Norway, Sweden, the UK and the US. The mean drunkenness for these countries decreased from 46.4% in 1998 to 45.3% in 2002 to 37.9% in 2006. In this group, only the US showed a significant decrease in drunkenness in both time periods; all other countries, with the exception of Germany, experienced a significant decrease in drunkenness in only one time period. Germany showed a significant increase in drunkenness between 1998 and 2002, which was followed by a significant decrease.

Curiously, in three countries with relatively high prevalence, Austria, the UK, and the Russian Federation, the trends for alcohol use and drunkenness were in opposite directions. In Austria and UK monthly drinking increased, but drunkenness decreased from 1998 to 2006. In the Russian Federation, drinking declined, but drunkenness increased.

Weighted average drunkenness for boys was 49.8% in 1998, 48.5% in 2002 and 47.0% in 2006. For girls, weighted drunkenness remained stable: 41.2% in 1998, 39.0% in 2002 and 41.3% in 2006. Gender differences in drunkenness trends were observed for 9 countries out of the 24 included in these analyses (Fig. 2). In 5 countries, Czech Republic, Hungary, Latvia, Poland and Russia, drunkenness increased among girls but not boys. Austria, Germany, and Ireland experienced a decrease in drunkenness among boys with no significant change among girls. Finland was the only country with a decrease in drunkenness among girls and no change among boys.

Discussion

National trends in drinking provide information about public health status. Trends in prevalence may be due to a variety of factors including marketing, cost, national income, and national programs and policies. The current analyses of alcohol

use from 24 countries in the HBSC study showed that rates and trends varied considerably across countries and by gender. Average alcohol use in 2006 ranged from less than 30 % to over 60 %. Significant trends were noted, with increases in use in 9 countries, decreases in 9 countries, and no change in 6 countries.

Gender differences were pronounced. Overall, boys had higher prevalence rates of drinking and drunkenness than girls in each survey year. However the data suggested that the gender gap between boys and girls, which was 41.2 % vs 33.37 % in 1998 and 36.7 % vs 31.9 % in 2006, may be shrinking. Significant increases occurred in 7 countries among girls but not boys, while increases among boys but not girls occurred in only one country. Moreover, prior to 2006, average prevalence was higher among boys than girls in almost all countries studied: it was higher in girls in only three countries in 1998 and in two countries in 2002. However, in 2006, prevalence was higher among girls than boys in seven countries. In countries with an increase in use over time the average difference between boys and girls was 8.9 percentage points in 1998, which declined to 4.1 percentage points in 2006. In the countries with decreases, the difference between boys and girls declined over this period from 5.7 to 3.1 percentage points.

A similar pattern emerged with drunkenness. In countries with an increase over time, the increase was due to increases among girls in 4 of the 6 countries. In the countries with significant declines over time, the declines occurred only among boys in 3 countries. A similar reduction in the prevalence differences between boys and girls has been found for smoking from 1990 to 2002[23].

A few cross-cultural patterns have also been noted. The Northern European countries (Sweden, Norway, Finland and Denmark) showed a declining trend in alcohol use and drunkenness and Eastern European countries experienced an increasing trend in alcohol use (except for Poland and the Russian Republic) and for drunkenness (except the Czech Republic). Northern American countries (US and Canada) showed a decreasing trend in drunkenness, but only the US showed a concurrent decreasing trend in alcohol use. The Southern European countries (Greece, Portugal and France) showed no change in drunkenness, and no change in alcohol use, except for Greece, where drinking prevalence declined.

Possible hypotheses are suggested to explain the observed trends. The variability in trends by country suggests that marketing and country-level policies and programs may be important in this regard. For example, alcohol accessibility is much more restricted in the US compared to European countries: In the US, only beer and wine can be purchased in grocery stores; spirits are sold mainly in state-controlled liquor outlets[24]. Alcohol prevention programs, especially those targeted to youth, are increasingly more widespread in the US, thus prompting a decline in both alcohol use and drunkenness among young people.

The differing trends between Eastern European and other European countries are worth noting, especially that increases in both alcohol use and drunkenness were only observed in Eastern European countries. These countries have experienced significant political and economic change between 1998 and 2006 (e. g., adherence to the European Union, rise of free-market economies) that may have prompted increases in alcohol use, due to temporary government deregulation[25]. More information is also needed on the types of alcoholic beverages consumed in the different regions. Studies suggest that Eastern European countries consume mostly homemade and more highly concentrated alcoholic beverages (greater than 35 % in alcohol content), which are linked to greater health problems[25]. An increase in consumption of those types of drinks can pose significant public health problems for these countries in the long run.

The variability in trends by gender in these countries could be due to increased effectiveness of contemporary marketing practices or relative ineffectiveness of policies and programs with girls. However, these changes in prevalence could also be due in part to changes in the social roles of women in these societies, allowing girls greater autonomy and a wider range of social options[26]. Additional research is needed on the nature of differences in drinking attitudes and patterns among boys and girls and the relative emphasis and effectiveness of marketing practices and prevention programs and policies in various countries.

The study provides cross-national information about alcohol and drunkenness prevalence trends; however, there are study limitations. Despite concerted efforts to obtain uniform data sets in all countries, there was some variability across countries in the age of study participants, which could have affected the prevalence rates. We examined experimental use and lifetime drunkenness, which are common measures of prevalence, but are not necessarily risky use. Also, with only three time periods the stability of the trends could not be determined. Finally, it should be noted that some countries with a relatively high prevalence in 1998 decreased, while some countries low in 1998 increased, suggesting that some of the variability over time may be transient and due to random variability.

Response rates at the student level varied between countries, ranging from 64.5 % to 91.2 %[19], which may have introduced a selection bias if the characteristics of students who did not complete questionnaires differed across countries. However, the response rate was towards the upper level of the range for most countries. Given this high response rate, and the uni-

formity of the protocol across countries (the protocol required that data collection in each country occur over one academic year, between October and May, lasting one to two months), it seems unlikely that a selection bias was introduced as a result of students with certain characteristics (e. g. heavy drinkers) being collectively absent in select countries. It is possible, though, that the study was affected by random error (or sampling variability) despite best efforts to ensure sampling uniformity across countries. To offset the possibility a design effect was included in the analyses based on previous research[19].

A possible information bias may have also been introduced as a result of the multiple languages used for the HBSC questionnaire across the different countries, thus resulting in the misclassification of respondents with respect to the outcome. However, a standard approach was employed according to the study protocol to use the same question in each country. All questions were initially framed in English, and then translated into the national languages. To facilitate translation the protocol provided notes about how terms should be interpreted. Translations were then checked through a back-translation process and closely reviewed by the researchers to ensure minimal errors[19]. As a result, the risk of misclassifying respondents as "drunk," for example, in one country but not another, is minimized.

While it is useful to examine cross-national differences in adolescent alcohol trends, the causes of the observed trends could not be determined and might in any case vary from one country to another. The findings suggest that prevalence (1) varied substantially across countries at all three data collection periods; (2) increased over time in some countries and decreased or remained unchanged in others; and (3) was more likely to increase among girls than boys. The implications of the findings for public health include the need to monitor trends in alcohol prevalence and to examine national effects of alcohol marketing practices and preventive measures, with particular focus on the possibility that changes in the social roles of adolescent girls may make them more susceptible to drinking.

Acknowledgement

HBSC is an international study carried out in collaboration with WHO/EURO. The international coordinator of the 2001–2002 and 2005–2006 study was Candace Currie, University of Edinburgh, Scotland; and the data bank manager was Oddrun Samdal, University of Bergen, Norway. A complete list of the participating researchers can be found on the HBSC website (www.HBSC.org).

This research was supported in part by the intramural research program of the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development (Contract # N01-HD-5-3401).

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