

Decreases in adolescent weekly alcohol use in Europe and North America: evidence from 28 countries from 2002 to 2010

Margaretha de Looze¹, Quinten Raaijmakers², Tom ter Bogt¹, Pernille Bendtsen³, Tilda Farhat⁴, Mafalda Ferreira⁵, Emmanuelle Godeau⁶, Emmanuel Kuntsche^{7,8}, Michal Molcho⁹, Timo-Kolja Pfoertner¹⁰, Bruce Simons-Morton⁴, Alessio Vieno¹¹, Wilma Vollebergh¹, William Pickett¹²

- 1 Department of Interdisciplinary Social Science, Faculty of Social and Behavioural Sciences, Utrecht University, Utrecht, The Netherlands
- 2 Department of Pedagogical Sciences, Faculty of Social and Behavioural Sciences, Utrecht University, Utrecht, The Netherlands
- 3 Statens Institut for Folkesundhed, Syddansk Universitet, Copenhagen, Denmark
- 4 Prevention Research Branch, Eunice Kennedy Shriver National Institute of Child Health and Human Development, Bethesda/Rockville, MD, USA
- 5 Faculty of Human Kinetics, Technical University of Lisbon, Lisbon, Portugal
- 6 Service Médical du Rectorat de Toulouse, UMR Inserm U1027—Université Paul Sabatier, Toulouse, France
- 7 Research Institute, Addiction Switzerland, Lausanne, Switzerland
- 8 Behavioural Science Institute, Radboud University, Nijmegen, the Netherlands
- 9 Centre for Health Promotion, National University of Ireland, Galway, Republic of Ireland
- 10 Institute of Medical Sociology (IMS), Medical Faculty, Martin Luther University Halle-Wittenberg, Germany
- 11 Department of Developmental and Social Psychology, University of Padova, Padova, Italy
- 12 Department of Public Health Sciences, Queen's University, Kingston Ontario, Canada

Correspondence: Margaretha de Looze, Department of Interdisciplinary Social Science, Faculty of Social and Behavioural Sciences, Utrecht University, PO Box 80.140, 3508 TC, Utrecht, The Netherlands, Tel: +31 30 253 3489, e-mail: M.E.deLooze@uu.nl

Background: This study examined trends in adolescent weekly alcohol use between 2002 and 2010 in 28 European and North American countries. **Methods:** Analyses were based on data from 11-, 13- and 15-year-old adolescents who participated in the Health Behaviour in School-Aged Children (HBSC) study in 2002, 2006 and 2010. **Results:** Weekly alcohol use declined in 20 of 28 countries and in all geographic regions, from 12.1 to 6.1% in Anglo-Saxon countries, 11.4 to 7.8% in Western Europe, 9.3 to 4.1% in Northern Europe and 16.3 to 9.9% in Southern Europe. Even in Eastern Europe, where a stable trend was observed between 2002 and 2006, weekly alcohol use declined between 2006 and 2010 from 12.3 to 10.1%. The decline was evident in all gender and age subgroups. **Conclusions:** These consistent trends may be attributable to increased awareness of the harmful effects of alcohol for adolescent development and the implementation of associated prevention efforts, or changes in social norms and conditions. Although the declining trend was remarkably similar across countries, prevalence rates still differed considerably across countries.

Introduction

In recent decades, frequent alcohol use was common among adolescents in North American and Northern and Western European countries.^{1,2} However, between 1998 and 2006 alcohol use started to decline (see: Monitoring the Future reports (US), the European School Survey Project on Alcohol and other Drugs (Europe) and the Health Behaviour in School-Aged Children (HBSC) study (North America and Europe)).^{3–6} These trends may be attributable to an increased understanding of negative effects of alcohol on adolescent development and, consequently, the implementation of public health programs targeting adolescent alcohol use.⁷

However, during this same period substantial increases in adolescent alcohol use were reported for several Eastern European countries.^{3,4} Explanations for these increases include the (rapid) increase in wealth and availability of alcohol in Eastern Europe after its transition from communist to market economies in the late 1980s.⁸

As adolescent alcohol use has also gained more attention in public health domains in Eastern European countries,² increasing trends may have ceased after 2006, or even begun to decline, emulating the trends observed in other regions. The present study aimed to test this hypothesis.

We describe (i) trends in weekly alcohol use from 2002 to 2010 in 28 countries; and (ii) variations in these trends by gender, age and

geographical region. The variations by gender and age are relevant as boys and older adolescents are generally more likely to drink alcohol on a weekly basis compared with girls and younger adolescents.⁹ Recent research has suggested that the gender gap in adolescent alcohol use has become more narrow between 1998 and 2006;^{3,4} this study also sheds light on the potential continuation of this reduction.

Methods

We used data from the three most recent cycles of HBSC study. Anonymous surveys were conducted in the classrooms of 11-, 13- and 15-year-olds for academic years ending in 2002, 2006 and 2010, according to a common research protocol.⁹ A clustered sampling design was used, where the initial sampling unit was either the class or the school. Schools were selected to ensure that samples were representative by regional geography and other demographic characteristics, with variations in sampling criteria permitted to fit country-level circumstances. In some countries (i.e. Germany, Greece, Hungary, the Netherlands, Ukraine and UK), data were weighted to ensure representativeness. Sample sizes can be found online (see Supplementary Table X).

Each of the 28 participating countries obtained approval to conduct the survey from their ethics review board or equivalent regulatory institution. Responses were treated as confidential and

anonymous. School and student response rates were above 70% in most countries. Further information about survey procedures can be found elsewhere.^{9,10}

Measures

Weekly alcohol use

Students were asked how often that they drank beer, wine and liquor/spirits. For each type, response options were '1 = never', '2 = rarely', '3 = every month', '4 = every week' and '5 = every day'. This variable was dichotomized by combining options 1 through 3 (indicating less than weekly alcoholic use, coded as '0') and 4 to 5 (indicating weekly alcohol use, coded as '1').

Time

Time was included as a categorical variable based on the academic year (ending in 2002, 2006, 2010). To test our hypothesis that trends in Eastern Europe were stabilizing or declining; a curvilinear time variable (time squared) was also included in the model.

Demographic predictors

Socio-demographic variables included gender, country of residence and age group. Although alcohol use is rare among 11-year olds, this group was included because alcohol misuse is a risky behaviour particularly during early adolescence.

Statistical analyses

To account for potential differences in sample composition across survey years, prevalence estimates for each country and survey year were standardized by age and gender, using the overall study population (all 28 countries combined) for 2010 as the standard. Regression analyses were conducted with Mplus (version 6.12).¹¹ Trends were calculated by means of multiple group logistic regression analyses (with country as a grouping variable) in which both linear and curvilinear time variables were regressed on weekly drinking. To examine whether trends were different across geographical regions, this analysis was repeated with geographic region as a grouping variable. Group membership was based on geographical location (Northern, Western, Southern, Eastern Europe and Anglo-Saxon countries). Finally, to test whether the trends within countries and regions differed across age and gender, we conducted a multiple group analysis with six groups (3 age groups × 2 genders).

Percentages of missing values ranged from 0 (several countries) to a maximum of 2.9 (for Danish respondents). Missing values were model estimated in Mplus.

Results

Table 1 presents the prevalence of weekly alcohol use for boys and girls per country, categorized by geographic region. In 2010, the average of weekly alcohol use ranged from 2.4% in Finland to 19.6% in the Czech Republic.

In gender and age adjusted analyses, a trend towards decreasing weekly alcohol use was observed in 20 out of 28 countries. In some countries, this decrease was linear (e.g. Canada). In other countries, the decrease was steepest between 2002 and 2006 (e.g. France) or between 2006 and 2010 (Russia). Exceptions to this decline were found in eight countries. These countries showed an increase in weekly alcohol use (Croatia), no trend (Austria, Latvia, Portugal, Slovenia) or a fluctuating trend (Czech Republic, Macedonia, Ukraine).

Table 1 and figure 1 also present time trends by geographical region. In all regions, weekly alcohol use decreased over time. The decrease was strongest in Northern European, Southern European and Anglo-Saxon countries, followed by Western European countries. This trend was equally strong across time periods in Anglo-Saxon countries, but especially strong between 2002 and

2006 in the other regions. In Eastern European countries, adolescent alcohol use increased slightly between 2002 and 2006, but decreased substantially thereafter.

Figure 1 further presents the results of the multiple group regression analysis by age group and gender. Overall, weekly drinking was most prevalent among boys and older age groups. The multiple group analysis revealed that weekly alcohol use decreased to a similar degree in all gender and age subgroups (i.e. regression coefficients did not significantly differ; data available from first author).

Discussion

This study of adolescents from 28 European and North American countries (2002–10) identified a decline in weekly alcohol use in Anglo-Saxon and Northern, Western and Southern European countries. In Eastern European countries, alcohol use (slightly) increased between 2002 and 2006, but declined considerably between 2006 and 2010. Across countries and regions, weekly drinking declined to a similar degree among boys and girls of all age groups.

A variety of factors may have affected the general decrease in adolescent weekly drinking, including income, marketing, prevention approaches, changes in adult prevalence and shifts in teen culture.⁴ Policies are in place in all Western countries to limit underage access and restrict use among those of all ages,¹² and stricter prevention policies are emerging in many countries.^{2,13} In addition to the potential effects of these restrictions, changes in social norms, i.e. more societal disapproval of adolescent drinking, may account for the observed trends.

The general decline in weekly drinking is consistent with a general decline in adolescent tobacco and cannabis use,¹⁴ sexual risk behaviours¹⁵ and fighting¹⁶ in the beginning of the twenty-first century in Europe and North America, reflecting a robust pattern of decrease in risk behaviours among adolescents.

Exceptions to the generally observed decline in adolescent alcohol use were observed in eight countries. Six of these were in Eastern Europe. The lack of a decline in these countries may be explained by rapid increases in wealth in these countries and adolescents' subsequent opportunity to be more financially independent and to consume goods that were previously unavailable, including alcohol.¹⁷ However, other Eastern European countries have followed the more general tendency towards declines in alcohol use, with awareness, policies and social norms helping to curb alcohol consumption among adolescents. Hence, overall, alcohol use appeared to decrease in the Eastern region as of 2006.

Our finding that weekly alcohol use decreased to a similar extent among boys and girls and among adolescents from different age groups is inconsistent with earlier findings suggesting a closure of the gender gap in adolescent alcohol use in Europe.^{3,4} It appears that gender convergence is more visible for more extreme drinking behaviours (i.e. drunkenness) in contrast to more regular drinking behaviours, such as weekly alcohol use, or that gender convergence has diminished in recent years.

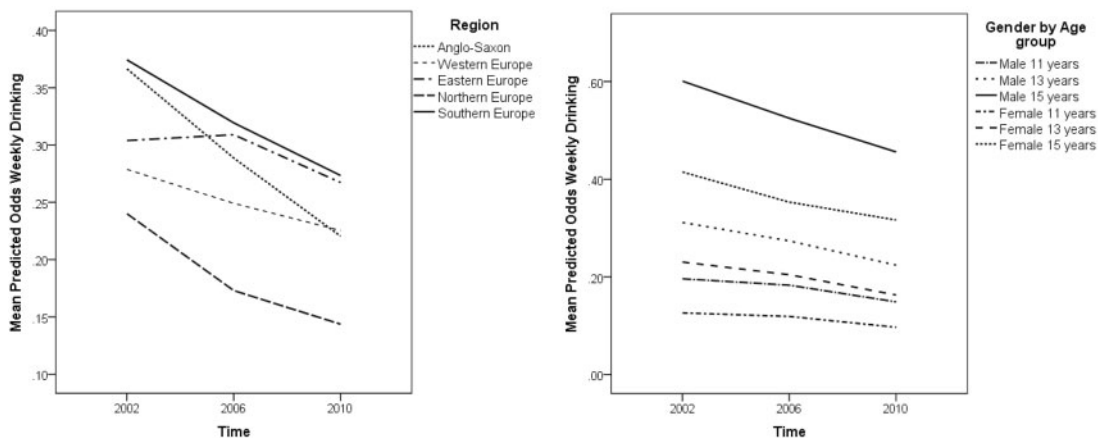
Strengths of this study include our use of large, nationally representative datasets, inclusion of many countries, and uniformity of the protocol across countries and time. Limitations include (i) the study's reliance on self-reports, which may have caused some adolescents to provide dishonest or inaccurate answers (although anonymity was stressed); and (ii) our time frame, limited to the 8-year period between 2001/02 and 2009/10, so caution should be exercised in extending these conclusions to periods after this period. Finally, it is important to recognize that our outcome measure was (at least) weekly drinking of beer, wine and spirits. This measure did not include the consumption of other alcoholic drinks, such as alcopops and national alcoholic drinks. We did not include alcopops because we wanted to base our trend analysis on similar items across time, and alcopops were not included in the 2002 HBSC

Table 1 Trends in adolescent weekly alcohol use by country and region

Region	Country	Age/gender-standardized rate per 100 children			Age/gender-adjusted linear time trend (per year of study)			Age/gender-adjusted curvilinear time trend (per year of study)		
		2002	2006	2010	B	SE	P	B	SE	P
Anglo-Saxon countries		12.1	8.6	6.1	-0.263 ^{ab}	0.026	<0.001	0.001 ^a	0.013	0.932
	Canada	11.6	7.3	5.5	-0.278	0.066	<0.001	0.039	0.031	0.215
	Ireland	5.5	6.4	4.1	0.191	0.088	0.029	-0.141	0.040	<0.001
	UK	23.5	15.3	10.2	-0.332	0.033	<0.001	0.024	0.016	0.139
	USA	7.6	5.4	4.7	-0.224	0.081	0.006	0.053	0.039	0.182
Western Europe		11.4	9.3	7.8	-0.178 ^a	0.025	<0.001	0.028 ^a	0.012	0.025
	Austria	10.5	12.2	10.8	-0.072	0.072	0.318	-0.028	0.034	0.417
	Belgium	13.0	11.2	8.2	-0.058	0.047	0.220	-0.045	0.024	0.057
	France	7.2	7.0	6.6	-0.227	0.061	<0.001	0.069	0.030	0.022
	Germany	13.3	7.0	6.5	-0.454	0.063	<0.001	0.120	0.032	<0.001
	Netherlands	14.1	11.0	6.5	-0.098	0.074	0.186	-0.079	0.037	0.032
	Switzerland	10.2	7.3	8.1	-0.197	0.075	0.009	0.093	0.036	0.009
Eastern Europe		12.2	12.3	10.1	0.055 ^c	0.019	0.003	-0.062 ^b	0.009	<0.001
	Croatia	13.6	17.0	15.6	0.227	0.060	<0.001	-0.088	0.028	0.002
	Czech Rep	19.4	17.8	19.6	-0.125	0.056	0.025	0.063	0.027	0.020
	Estonia	9.8	7.8	6.0	-0.353	0.077	<0.001	0.070	0.037	0.062
	Hungary	15.7	11.4	10.4	-0.292	0.073	<0.001	0.074	0.035	0.037
	Latvia	8.1	9.4	7.2	0.049	0.077	0.530	-0.050	0.037	0.172
	Lithuania	9.8	6.1	6.9	-0.473	0.069	<0.001	0.175	0.034	<0.001
	Poland	7.3	5.2	6.0	-0.348	0.071	<0.001	0.141	0.036	<0.001
	Russia	14.5	11.4	5.5	0.004	0.049	0.928	-0.130	0.025	<0.001
	Slovenia	12.1	10.9	11.1	-0.024	0.069	0.724	0.007	0.032	0.818
	Ukraine	17.4	29.2	16.4	1.064	0.057	<0.001	-0.543	0.028	<0.001
	Macedonia	6.6	8.8	6.5	0.364	0.073	<0.001	-0.178	0.035	<0.001
Northern Europe		9.3	5.3	4.1	-0.390 ^b	0.041	<0.001	0.073 ^a	0.020	<0.001
	Denmark	18.6	11.1	8.5	-0.519	0.069	<0.001	0.134	0.034	<0.001
	Finland	5.1	3.7	2.4	-0.160	0.087	0.068	-0.004	0.043	0.935
	Norway	6.5	3.3	3.1	-0.456	0.094	<0.001	0.162	0.047	0.001
	Sweden	7.0	3.0	2.5	-0.533	0.099	<0.001	0.185	0.048	<0.001
		16.3	12.7	9.9	-0.238 ^{ab}	0.042	<0.001	0.045 ^a	0.020	0.025
Southern Europe	Greece	15.9	13.3	14.1	-0.601	0.079	<0.001	0.216	0.036	<0.001
	Italy	24.1	19.4	12.1	-0.140	0.060	0.020	-0.040	0.029	0.171
	Portugal	8.9	5.4	3.5	-0.096	0.091	0.291	-0.026	0.044	0.558

Notes: Due to the rising popularity of alcopops, in 2006 and 2010, an item 'alcopops' was included in the list of alcoholic drinks. Sensitivity analyses were conducted to check whether the inclusion of alcopops would influence the trends. No substantial differences in the outcomes of the trend analyses were found (results available on request).

Within columns, at the regional level, different subscripts refer to statistically significant differences at $P < 0.01$. For instance, the linear time trend in Anglo-saxon countries^{ab} does not differ from the linear time trend in Western^a, Northern^b or Southern^{ab} Europe, but it does differ from the linear time trend in Eastern Europe^c.

**Figure 1** Trends in adolescent weekly alcohol use by region and by demographic group

questionnaire. Furthermore, a decrease in weekly alcohol use does not necessarily imply a decrease in the quantity of alcohol consumed. Future research may examine whether trends in different drinking behaviours, such as drunkenness, are also reflective of such decreases.

Our study confirms the need for an understanding of adolescent alcohol use trends in different populations that can facilitate establishing effective policies and programs to prevent the problematic consequences of these behaviours. Although observed trends in adolescent weekly drinking were remarkably similar across

countries and demographic subgroups, absolute prevalence rates in weekly drinking still differed substantially across countries. Future research may examine the role of national factors, such as wealth, alcohol control policies, preventive measures, the general availability of alcohol, adult drinking patterns and social norms, in further explaining these cross-national differences.

Supplementary data

Supplementary data are available at *EURPUB* online.

Acknowledgements

HBSC is an international study carried out in collaboration with WHO/EURO. The international coordinator was Prof. Candace Currie, University of St. Andrews, and the databank manager was Prof. Oddrun Samdal, University of Bergen. A complete list of participating countries and researchers is available on the HBSC website (<http://www.hbsc.org>). We thank Robert Smith (Norway) for his careful assembly of the international HBSC trends data file.

Funding

The data collection for each HBSC survey is funded at the national level.

Conflicts of interest: None declared.

Key points

- A substantial decline in adolescent alcohol use in the period from 2002 to 2010 was observed in North America and across Europe.
- The general decrease in alcohol use was not equally present in all Eastern European countries; however, after 2006 most of Eastern Europe seems to follow the declining trend established in the rest of Europe and North America.
- Adolescent boys still drink more than adolescent girls and the closing of the gender gap in alcohol use seems to have come to a halt.
- The general decline in alcohol use fits into a pattern of overall decrease in risk behaviours (smoking, drug use, sexual risk behaviour, fighting), characteristic of the early twenty-first century in western countries
- Results of cross-national monitoring studies can lead to higher awareness of the frequency of early adolescent alcohol use and its negative effects across a wide geographical area. Therefore cross-national monitoring studies are a crucial first step in the development of alcohol prevention and reduction programs among adolescents.

References

- 1 Rehm JUR, Rehn N, Room R, et al. The global distribution of average volume of alcohol consumption and patterns of drinking. *Eur Addict Res* 2003;9:147–56.
- 2 Anderson P, Baumberg B. *Alcohol in Europe. A Public Health Perspective*. Luxembourg: European Communities, 2006:75–130.
- 3 Kuntsche E, Kuntsche S, Knibbe R, et al. Cultural and gender convergence in adolescent drunkenness. Evidence from 23 European and North American countries. *Arch Pediatr Adolesc Med* 2011;165:152–58.
- 4 Simons-Morton BG, Farhat T, ter Bogt TFM, et al. Gender specific trends in alcohol use: cross-cultural comparisons from 1998 to 2006 in 24 countries and regions. *Int J Public Health* 2009;54:199–208.
- 5 Hibell B, Guttormsson U, Ahlström S, et al. *The 2011 ESPAD Report. Substance Use among Students in 36 European Countries*. Stockholm: The Swedish Council for Information on Alcohol and Other Drugs (CAN), 2012:123–34.
- 6 Johnston LD, O'Malley PM, Bachman JG, Schulenberg JE. *Monitoring the Future National Survey Results on Drug Use, 1975–2010. Volume I, Secondary School Students*. Bethesda: National Institute on Drug Abuse, 2011:28–30.
- 7 Bendtsen P, Damsgaard MT, Huckle T, et al. Adolescent alcohol use: a reflection of national drinking patterns and policy? *Addiction* 2014;109:1857–68.
- 8 Demetrovics Z. Cultural changes and the changing face of youth subculture and drug use: some comparisons between Western and Eastern Europe. In: Nechifor M, Boisteanu P, editors. *Pharmacodependences: Mechanisms, Clinical Aspects, Treatment*. Iasi: Romania Editura Glissando, 2001:109–17.
- 9 Currie C, Zanotti C, Morgan A, et al. *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. Health Policy for Children and Adolescents, No. 6*. Copenhagen, Denmark: WHO Regional Office for Europe, 2012.
- 10 Roberts C, Freeman J, Samdal O, et al. The Health Behaviour in School-Aged Children (HBSC) study: methodological developments and current tensions. *Int J Public Health* 2009;54:140–50.
- 11 Muthén LK, Muthén BO. *Mplus User's Guide (1998–2010)*, 6th rev edn. Los Angeles, CA: Muthén & Muthén, 1998–2010.
- 12 Brand DA, Saisana M, Rynn LA, et al. Comparative analysis of alcohol control policies in 30 countries. *PLoS Med* 2007;4:e151.
- 13 Anderson P, Møller L, Galea G. *Alcohol in the European Union. Consumption, Harm, and Policy Approaches*. Copenhagen, Denmark: WHO Regional Office for Europe, 2012.
- 14 Hublet A, Bendtsen P, de Looze ME, Fotiou A, Donnelly P, Vilhjalmsson R, Baska T, Aasvee K, Frelenc IP, Nic Gabhainn S, Ter Bogt TFM. Trends on the co-occurrence of tobacco and cannabis use in 15-year-olds in 5 European regions and North-America. *Eur J Public Health* 2015;25(suppl 2):73–75.
- 15 Ramiro L, Windlin B, Reis M, Nic Gabhainn S, Jovic S, Matos MG, Josephine Magnusson J, Godeau E. Gendered trends in early and very early sex and condom use in 20 European countries 2002–2010. *Eur J Public Health* 2015; 25(suppl 2):65–68.
- 16 Pickett W, Molcho M, Elgar FJ, et al. Trends and socioeconomic correlates of adolescent physical fighting in 30 countries. *Pediatrics* 2013;131:e18–26.
- 17 Zaborskis A, Sumskas L, Maser M, Pudule I. Trends in drinking habits among adolescents in the Baltic countries over the period of transition: HBSC survey results, 1993–2002. *BMC Public Health* 2006;6:67–77.