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Alcohol Control Policies and Alcohol Consumption by Youth: A Multi-National Study

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Abstract

Aims—The study examined relationships between alcohol control policies and adolescent alcohol use in 26 countries.

Design—Cross-sectional analyses of alcohol policy ratings based on the Alcohol Policy Index (API), per capita consumption, and national adolescent survey data.

Setting—Data are from 26 countries.

Participants—Adolescents (15-17 years old) who participated in the 2003 ESPAD (European countries) or national secondary school surveys in Spain, Canada, Australia, New Zealand and the USA.

Measurements—Alcohol control policy ratings based on the API; prevalence of alcohol use, heavy drinking, and first drink by age 13 based on national secondary school surveys; per capita alcohol consumption for each country in 2003.

Analysis—Correlational and linear regression analyses were conducted to examine relationships between alcohol control policy ratings and past-30-day prevalence of adolescent alcohol use, heavy drinking, and having first drink by age 13. Per capita consumption of alcohol was included as a covariate in regression analyses.

Findings—More comprehensive API ratings and alcohol availability and advertising control ratings were inversely related to the past-30-day prevalence of alcohol use and prevalence rates for drinking 3-5 times and 6 or more times in the past 30 days. Alcohol advertising control was also inversely related to the prevalence of past-30-day heavy drinking and having first drink by age 13. Most of the relationships between API, alcohol availability and advertising control and drinking prevalence rates were attenuated and no longer statistically significant when controlling for per capita consumption in regression analyses, suggesting that alcohol use in the general population may confound or mediate observed relationships between alcohol control policies and youth alcohol consumption. Several of the inverse relationships remained statistically significant when controlling for per capita consumption.

Conclusions—More comprehensive and stringent alcohol control policies, particularly policies affecting alcohol availability and marketing, are associated with lower prevalence and frequency of adolescent alcohol consumption and age of first alcohol use.

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Keywords

alcohol; alcohol control policy; alcohol availability; adolescent; prevention

The societal costs of alcohol consumption by youth and the burden of alcohol use on disease in general have prompted many countries to implement policies restricting alcohol availability in order to reduce consumption and related harm among young people [1-6]. Such regulatory policies include setting a minimum legal purchase or drinking age, restricting the types of alcoholic beverages sold in stores, restricting the density of stores selling alcoholic beverages in a given area, restricting the hours of business when alcohol can be sold, mandatory training of alcoholic beverage servers, and increasing the price of alcohol [4-6]. The aim of such policies is to increase the “full price” of alcohol for youth by increasing the resources necessary to obtain it or the potential costs for possessing or consuming it [4,5]. Alcohol policies may affect consumption by youth directly or do so indirectly through their effects on consumption and drinking norms in the general population. The comprehensiveness and stringency of a country's regulatory policies may therefore be particularly important for reducing alcohol consumption and related harm among youth [4,5].

Most previous research on the effects of alcohol policies on drinking behavior is based on analysis of data within single countries. While such designs can include temporal and spatial controls for observed phenomena, generalizability is typically limited. Discourse about alcohol policies and consumption is often framed in international terms, and for most countries alcohol policy is set at a national level. Accordingly, there are advantages to conducting studies in which the country serves as the unit of analysis. Here we adopt an ecological design examining statistical associations between alcohol policy ratings and drinking behavior in 30 Organization for Economic Cooperation and Development (OECD) countries.

Cross-national studies of alcohol policy and alcohol consumption are rare, in part because of the difficulty of quantifying such policies across different countries. Recently, however, the Alcohol Policy Index (API) was developed to rate the relative comprehensiveness and strength of alcohol control policies and has been applied to 30 countries [6]. The API comprises five domains (16 policy topics) corresponding to alcohol availability (e.g., minimum purchase age, hours of sale), drinking context (community mobilization to increase public awareness, mandatory training of servers), price (price indices for beer, wine, spirits), advertising (number of different media with advertising restrictions), and motor vehicles (e.g., random breath testing, legal blood alcohol limit)[6]. API scoring was based on a review of public policy data in published reports, databases maintained by the World Health Organization and individual countries, and/or interviews with knowledgeable public health officials [6]. Weights were assigned to each domain based on the potential effectiveness of the regulatory policy as suggested in the *Alcohol: No Ordinary Commodity* report [5]. Weights and proportionate point values for the 16 policy topics generated a potential API score ranging from 0 to 100, with a higher score indicating more comprehensive and stringent regulatory policies. The observed API scores ranged from 14.5 (Luxembourg) to 67.3 (Norway). The validity of the API was supported through (1) a sensitivity analysis in which several methodological assumptions were varied, which had only a minimal effect on the relative API scoring and ranking of countries; and (2) correlation and regression analysis showing an inverse association between API score and 2003 per capita alcohol consumption in litres of ethanol ($r = -0.57$, $p = .001$, $\beta = -.10$, 95% CI: -0.15, -0.04). Overall, each 10 point increase in the API score was associated with a one litre reduction in per capita ethanol consumption.

Even with preliminary evidence for the validity of the API, there are some concerns about its utility for accurately gauging the comprehensiveness and strength of regulatory policies and evaluating their effectiveness in reducing alcohol consumption and related harm [7]. For example, the API does not capture the level of policy enforcement, which may vary considerably across policy topics, domains and geographic areas within each country. Additionally, the API does not reflect research on the effectiveness of regulatory policies since 2003, and thus may incorrectly weight some of the policy topics.

Nonetheless, the API provides an opportunity to examine possible relationships between alcohol control policies and national estimates of adolescent alcohol consumption. Such prevalence estimates are provided by the 2003 European School Survey Project on Alcohol and Other Drugs (ESPAD) and by national surveys of youth in other countries, such as the Monitoring the Future Survey in the USA. The accuracy of self-report measures of alcohol use among youth in different countries may be biased to some extent by differences in cultural drinking norms and policies such as the minimum legal drinking or purchase age. However, because national youth surveys such as ESPAD and Monitoring the Future are typically anonymous and respondents are encouraged to provide truthful responses to survey questions, such bias is likely to be minimal.

Based on previous research [6] and on considerations derived from deterrence and availability theories, we hypothesize that countries with more comprehensive and stringent alcohol control policies will have a lower prevalence of alcohol consumption, heavy drinking and related harm among youth. These relationships were explored using published ratings on the API for OECD countries [6] and available youth survey data from each of these countries. Both overall API scores and ratings within each policy domain were considered. Initial analyses examined simple bivariate correlations. Regression analyses controlling for per capita consumption were then conducted for those outcomes found to be significantly related to the API scores. Per capita consumption was included in these analyses because of its potential role as a confounder or mediator of observed associations between alcohol control policies and youth alcohol consumption.

Method

Data sources

Alcohol control policies—Alcohol Policy Index (API) scores and scores for the five policy domains (physical availability, drinking context, price, advertising, motor vehicles) comprising the API were obtained from the publication by Brand et al. [6] for countries in the Organization for Economic Cooperation and Development (OECD). Based on the most current public policy information that was available from 2000-2005, an overall API score was computed for each OECD country by summing the policy domain scores. For some policy domains, Brand et al. [6] were not able to find any data for some countries. Because extensive efforts were made by Brand et al. [6] to find data for each policy domain from a variety of potential sources, zero values were used where policy data were missing. That is, it was assumed that no policy existed in those cases, which is consistent with the computation of the overall API score by Brand et al. [6].

Per capita consumption—The 2003 per capita ethanol consumption data for OECD countries were obtained online from the 2005 OECD Health Report [8]. Per capita consumption was included in the regression analyses as a proxy for cultural or socio-economic factors that may influence both alcohol control policies and alcohol use by youth. Per capita consumption may also act as a mediator through which alcohol control policies are indirectly related to youth alcohol consumption.

Adolescent alcohol use—Prevalence data for any past-30-day alcohol use, measures of more frequent past-30-day use (3-5 times, 6 or more times), heavy or “binge” drinking (5 or more drinks), and age of having first standard drink (i.e., glass or bottle) of beer, wine and spirits were obtained from the 2003 ESPAD report [9]. The 2003 ESPAD report includes separate prevalence rates for drinking beer, wine and spirits by age 13 (i.e., prevalence rates for drinking *any type* of alcohol by age 13 are not provided). Therefore, we used the highest of the three prevalence rates for each country, recognizing that these were probably lower than the actual prevalence of drinking any type of alcohol by age 13. For simplicity, we refer to this variable as “having first drink by age 13”. The 2003 ESPAD report also summarizes past-30-day alcohol use data from national secondary school surveys conducted in Spain in 2002 and the USA in 2003 (Monitoring the Future). Past-30-day alcohol use and heavy drinking prevalence data were obtained from reports for national secondary school surveys in Australia in 2002 [10] and New Zealand in 2001 [11], and a national household survey conducted in Canada in 2003-04 [12]. Prevalence data for adolescents in the same age range as the ESPAD were obtained from these reports.

Table 1 provides selected characteristics of ESPAD and other national youth surveys, the majority of which were self-administered (i.e., written) surveys in school settings in March-May, 2003. Exceptions include: the Canadian household survey conducted from December, 2003 through April, 2004 using computer-assisted telephone interviews; the New Zealand secondary school survey conducted in 2001 with laptop computers; and the national school surveys in Australia and Spain that were conducted in 2002. Response rates were greater than 80% for the majority of school-based surveys, but lower response rates were reported for the Australian, Canadian, and New Zealand surveys. Post-hoc sample weights were developed for some of the surveys to adjust for under- or over-representation of demographic subgroups. Sample sizes varied across the 26 countries (range: 581 - 16,244). Further details about survey methods, data analysis procedures, and validity and reliability of survey results can be found in the referenced reports [9-12].

Data analysis

Overall API scores and past-30-day alcohol use prevalence data were available for 26 countries. The number of countries with data for at least one specific policy domain *and* alcohol use prevalence data ranged from 21 to 26. Statistical power tables for Pearson product-moment correlations indicate that a minimum sample size of 19 is needed to detect a large effect size ($r \geq .60$) with power $\geq .80$ at the .05 significance level (two-sided test) [13].

Pearson product-moment correlations between alcohol policy ratings and alcohol prevalence measures were examined first. Regression analyses controlling for per capita consumption were then conducted for those outcomes found to be significantly related to the API scores.

Results

The overall API score and alcohol availability and advertising control ratings were inversely related to per capita consumption and to the prevalence of adolescents' past-30-day alcohol use, drinking 3 to 5 times, and drinking 6 or more times in the past 30 days (Table 2). The alcohol advertising control rating was also inversely related to the prevalence of adolescents' past-30-day heavy drinking (5 or more consecutive drinks) and having first drink by age 13. No other correlations for alcohol policy and past-30-day alcohol use or drinking by age 13 prevalence measures were statistically significant at the .05 level.

Per capita consumption was also inversely associated with alcohol price control rating, and was positively related to the prevalence of adolescents' past-30-day alcohol use, drinking 3

to 5 times, drinking 6 or more times in the past 30 days, and having first drink by age 13. However, per capita consumption was not significantly associated with the prevalence of past-30-day heavy drinking by youth.

Regression analyses

Results of linear regression analyses (Tables 3 and 4) indicate that inverse relationships between the overall API score and past-30-day prevalence of alcohol use and drinking 3 to 5 times were attenuated and no longer significant after controlling for per capita consumption. However, the inverse relationship between API score and prevalence of drinking 6 or more times in the past 30 days remained statistically significant. The inverse relationships between alcohol availability control and two of the three past-30-day prevalence measures remained statistically significant at the .05 level when controlling for per capita consumption. However, the inverse relationships between alcohol advertising control and prevalence of past-30-day alcohol use and having first drink by age 13 were no longer statistically significant after controlling for per capita consumption.

Discussion

The inverse associations between past-30-day adolescent alcohol use prevalence measures and the API and alcohol availability and advertising control ratings suggest that more comprehensive and stringent alcohol control policies could potentially reduce the prevalence and frequency of alcohol consumption by youth. The regression analyses further suggest, however, that alcohol use in the general population (per capita consumption) may at least partially mediate or confound the observed relationships between alcohol control policies and prevalence of youth alcohol consumption and having first drink by age 13. That is, stricter policies may reduce adult consumption which, in turn, influences consumption by youth through normative or other processes. Alternatively, more conservative adult drinking styles may lead to the adoption of stricter drinking policies and independently to lower rates of drinking among youth. Unfortunately, the available data do not allow us to distinguish between these alternative explanations of the findings.

Although the findings indicate that more comprehensive alcohol policies are associated with lower prevalence rates of alcohol use among youth, some limitations should be noted. While per capita alcohol consumption was included as a potential confounder, there may be other cultural or socio-economic factors (e.g., political ideology) that act as confounders by influencing both alcohol control policies and youth consumption. The cross-sectional design precludes making causal inferences about observed relationships between alcohol policy and consumption measures. However, prior research within single countries indicates that changes in youth alcohol consumption and related problems (e.g., drinking and driving, drink-driving crashes and fatalities) follow after enactment of stricter alcohol control policies [14-16]. Therefore, it seems plausible that more comprehensive and stringent national policies, especially policies that limit alcohol availability, can reduce consumption by youth [4,5]. The fact that some of the associations between alcohol policy ratings and youth alcohol consumption measures were maintained after controlling for per capita consumption, an indicator of the overall drinking culture, lends credence to this interpretation. An additional limitation is that this study relied on self-reports of alcohol consumption within each of the participating countries. Such self-report measures are subject to recall and social desirability biases. The latter may be of greater concern in countries with a higher minimum legal drinking or purchase age, thereby biasing our estimates of association. Prevalence rates for having first drink by age 13 were based on the highest of the three estimates provided for beer, wine and spirits in the 2003 ESPAD report. The actual prevalence rates for drinking any type of alcohol by age 13 may be somewhat higher if some youth in the ESPAD samples drank only beer, wine or spirits by age 13. For

example, if the highest prevalence estimate for drinking by age 13 is based on wine, but some youth drank only beer by age 13, then the wine prevalence estimate would not include those youth who drank only beer and would be lower than the actual prevalence of having first drink by age 13. Differences in the timing and modality of survey administration may also have influenced national prevalence estimates of youth alcohol use and observed associations with alcohol control policy ratings. However, parallel associations between alcohol control policy ratings and 2003 per capita consumption from alcohol sales data helps to reduce the likelihood of biased estimates of association. Importantly, the present study relied on data from a small number of countries, thus limiting our statistical power to detect associations. In a number of cases correlations in the expected direction were observed, but did not attain statistical significance. The range of possible policy options may also be limited given the fact that countries in the study are predominately European and “first world” in terms of development. If a broader sample of countries could have been included, greater heterogeneity in exposure to various policies may have been observed, enhancing the study's power to estimate associations between the policy variables and youth drinking.

The API is limited in a number of ways that may have influenced our findings [7]. For example, the accuracy of the overall API score for each country may be limited by incomplete policy data across the five domains. As noted previously, the level of enforcement of alcohol control policies may vary considerably between and within countries and across policy domains, but indicators of policy enforcement were not included in the API. Thus, the API should be further developed to reflect level of policy enforcement and in other ways that may improve its utility for future research and policy decision-making.

Alcohol marketing to youth is of particular concern to public health officials, health practitioners and parents, and has received a great deal of research attention [4,5]. Our findings suggest that more comprehensive and stringent advertising control policies may be inversely related to youth alcohol consumption. However, it is also possible the observed relationships between advertising policy and youth alcohol consumption were at least partially attributable to drinking norms in the general population, as indicated by regression analyses.

Although motor vehicle policy ratings were not associated with prevalence estimates for youth alcohol consumption, they may be related to youth drinking and driving [14-16]. Self-report measures for drinking and driving or riding with a drink-driver were not included in the ESPAD and some of the other national youth surveys, presumably because the minimum legal driving age is above 16 in most or all those countries or public transportation is more commonly used by youth than private motor vehicles. However, future research could examine relationships between API motor vehicle policy ratings and national rates of alcohol-related motor vehicle crashes and fatalities among youth, ideally with adjustment for motor vehicle use levels or driver licensing age.

Further cross-national research on temporal changes in alcohol control policies and youth alcohol consumption is needed to more rigorously assess the effectiveness of such policies. Natural experiments may be conducted using the API and national youth survey data or alcohol-related injury and mortality data over multiple years for OECD countries. Such research would provide more definitive evidence regarding effects of national alcohol regulatory policies on alcohol use and related harm among youth.

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Table 1

Characteristics of national youth surveys, by country

Country	Year	Months	Method	Response Rate (%)	N
Australia	2002	Jan. - Dec.	School, self-administered	65 ¹	11,303
Austria	2003	March-April	School, self-administered	90	2,402
Belgium	2003	March-May	School, self-administered	81	2,320
Canada	2003-04	Dec. 03, Jan.-Apr. 04	Household, computer-assisted telephone interview	47 ²	581
Czech Republic	2003	April	School, self-administered	95	3,195
Denmark	2003	March-May	School, self-administered	89	2,978
Finland	2003	March-April	School, self-administered	91	3,543
France	2003	March-May	School, self-administered	91	2,199
Germany	2003	March-April	School, self-administered	89	5,110
Greece	2003	March-April	School, self-administered	83	1,906
Hungary	2003	March	School, self-administered	82	2,677
Iceland	2003	March	School, self-administered	81	3,348
Ireland	2003	April	School, self-administered	96	2,407
Italy	2003	March-April	School, self-administered	98	4,871
Netherlands	2003	Oct.-Nov.	School, self-administered	93	2,095
New Zealand	2001	March-Oct.	School, laptop computer	64	5,212
Norway	2003	March-April	School, self-administered	87	3,833
Poland	2003	May-June	School, self-administered	85	5,964
Portugal	2003	May	School, self-administered	96	2,946
Slovak Republic	2003	March	School, self-administered	87	2,276
Spain	2002	Nov.-Dec.	School, self-administered	86	13,714
Sweden	2003	March	School, self-administered	87	3,232
Switzerland	2003	May-June	School, self-administered	83	2,613
Turkey	2003	May	School, self-administered	91	4,177
United Kingdom	2003	March-May	School, self-administered	84	2,068
United States	2003	Jan.-May	School, self-administered	88	16,244

¹ Overall school response rate; 80 students per secondary school were surveyed, but the student response rate was not provided in the survey report [10].

² Overall household interview response rate. The response rate for the 15-17 age group was not provided in the survey report [12].

Table 2

Correlations among alcohol policy and alcohol consumption variables¹

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. Alcohol policy index	1.0	.67 [†]	.44 [*]	.65 [†]	.53 [†]	.33	-.56 [†]	-.48 [*]	-.48 [*]	-.64 [†]	-.32	-.29
2. Alcohol availability		1.0	.29	.17	.06	.19	-.50 [*]	-.63 [†]	-.57 [†]	-.64 [†]	-.22	-.42
3. Drinking context			1.0	.19	-.04	.37 [*]	-.02	-.002	-.01	-.11	.20	-.04
4. Alcohol prices				1.0	.09	.07	-.44 [†]	-.09	-.13	-.19	-.11	-.05
5. Motor vehicles					1.0	.10	-.13	-.17	-.17	-.32	-.30	-.08
6. Advertising						1.0	-.42 [*]	-.46 [*]	-.48 [*]	-.57 [†]	-.43 [*]	-.56 [†]
7. Per capita consumption							1.0	.61 [†]	.55 [†]	.52 [*]	.39	.62 [†]
8. Past-30-day alcohol use								1.0	.93 [†]	.85 [†]	.78 [†]	.83 [†]
9. Past-30-day drinking 3-5 times									1.0	.77 [†]	.78 [†]	.80 [†]
10. Past-30-day drinking 6+ times										1.0	.70 [†]	.58 [*]
11. Past-30-day heavy drinking											1.0	.61 [*]
12. Had first drink by age 13 ²												1.0

*
 $p < .05$ [†]
 $p < .01$ ¹ The number of countries for which alcohol policy and youth alcohol consumption data were available for variable pairs ranged from 21 to 26.² Having first drink by age 13 is based on the highest of three prevalence rates provided for beer, wine and spirits in the 2003 ESPAD report [9].

Table 3

Regression analysis results, standardized beta and p value

Variable	Past-30-day prevalence rate					
	Alcohol use		Drinking 3-5 times		Drinking 6+ times	
	beta	p	beta	p	beta	p
Alcohol policy index	-.23	.23	-.27	.22	-.51	.02
Per capita consumption	.49	.01	.41	.07	.25	.21
R ²	.41		.35		.45	
Alcohol availability control rating	-.44	.01	-.40	.06	-.51	.02
Per capita consumption	.39	.03	.34	.10	.26	.19
R ²	.51		.42		.45	
Alcohol advertising control rating	-.23	.21	-.26	.24	-.41	.06
Per capita consumption	.50	.01	.41	.07	.29	.18
R ²	.41		.35		.39	

Table 4

Additional regression results for alcohol advertising policy, standardized beta and p value

Variable	Past-30-day heavy drinking		Had first drink by age 13	
	beta	p	beta	p
Alcohol advertising control rating	-.31	.21	-.25	.33
Per capita consumption	.23	.35	.45	.09
R ²	.22		.42	