Alcohol control policies and alcohol consumption: an international comparison of 167 countries

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ABSTRACT

Background Alcohol control policy has a fundamental role in limiting negative health, economic and social harm caused by alcohol consumption. However, there is substantial international heterogeneity in country-level policy adoption, implementation and monitoring. Comparative measures so far focused on Europe or the Organisation for Economic Co-operation and Development countries.

Methods We created an Alcohol Control Policy Index (ACPI) for 167 countries using five different methodological approaches. National policies were sourced from WHO's Global Information System on Alcohol and Health. We assessed ACPI's criterion-related validity by calculating the strength of the association among the different approaches. As for content validity, we tested whether the resulting scores explained variations in alcohol per capita consumption cross-nationally, controlling for gross domestic product, population age, urbanisation and world region using OLS and random coefficients models.

Results Index scores and ranks from different methodological approaches are highly correlated (r=0.99). Higher scores were associated with lower consumption across the five methods. For each 1 score increase in the ACPI, the reduction in per capita alcohol consumption varies from −0.024 L (95% CI (−0.043 to −0.004) to −0.014 L (95% CI (−0.034 to 0.005). We obtain larger coefficients and p values <0.005 when estimating random coefficients.

Conclusion ACPI offers a measure of alcohol control policy across countries that makes use of a larger number of countries than its predecessors, as well as a wider range of methodologies for its calculation, both of which contribute to its validity. Furthermore, it shows that the statutory strictness of alcohol control policies is associated with lower levels of alcohol consumption.

INTRODUCTION

Alcohol use is deeply rooted in the ancient and modern culture of many countries and regions across the world. Its effects often go beyond the celebratory and gregarious to include undesirable health, social and economic outcomes.

Alcohol accounts for 3.8% of all global deaths and 4.6% of global disability adjusted life years, and costs associated with its use represent over 1% of gross domestic product (GDP) in high-income and middle-income countries.[1] These costs are not limited to healthcare expenditures—they include productivity losses and various other social harms such as violence. In fact, harm inflicted on others is at times estimated to equal that incurred by the drinker.[2] Although some beneficial effects have been attributed to moderate consumption, these are largely outweighed by the negative ones.[1 3]

Attempts to mitigate the adverse consequences of alcohol drinking have largely rested on health policy efforts to modify the environments that promote alcohol use. However, the suite of policies adopted at the national level varies tremendously across countries, as does the strength and effectiveness of the implementation of these policies.

In order to gauge the range of policies and levels of effectiveness of alcohol control policies, several authors have developed composite measures and compared countries in Europe and the Organisation for Economic Co-operation and Development (OECD),[4–7] in the Western Pacific[8] and in Africa.[9] Some have used these indices to predict per capita consumption estimates and found positive associations.[5 8 10] No one, as best as we know, has applied a scale to data from all over the world.

We contribute to the existing evidence with a composite indicator—the Alcohol Control Policy Index (ACPI)—that comprises alcohol control policies from 167 countries worldwide. Our large sample allows us to add nuance to previous analysis of policy scores and consumption, namely adjust for known confounders in the association between scores in the ACPI and per capita alcohol consumption.

METHODS

Over 100 national-level alcohol control policies and alcohol consumption per capita were downloaded from WHO's Global Information System on Alcohol and Health (GISAH) for 190 countries. Policy areas and individual policies are described in online supplementary annex 1. They include policies pertaining to the 10 areas outlined in WHO's Global Strategy to Reduce the Harmful Use of Alcohol: leadership, awareness and commitment; health services' response; community action; drink driving policies and countermeasures; availability of alcohol; marketing of alcoholic beverages; pricing policies; reducing the negative consequences of drinking and alcohol intoxication; reducing the public health impact of illicit alcohol and informally produced alcohol; and monitoring and surveillance.

GISAH portraits the state of alcohol policy as of 2012.

We excluded countries that have a ban on alcohol use—Afghanistan, Brunei Darussalam, Iran, Libya, Maldives, Mauritania, Saudi Arabia, Somalia, Sudan and Yemen; or substantial missing information—Democratic People's Republic of Korea, Djibouti, Haiti, Kuwait, Lebanon, Marshall Islands, Solomon

Islands, South Sudan and United Arab Emirates, which resulted in a sample of 167 countries.

To capture the state of the policy area pertaining to pricing policies, we created a new variable, a measure of alcohol affordability based on alcohol prices collected by GISAH.[5 11]

$$\text{Alcohol Affordability: } 100 * \frac{\textit{Price calculated based on standard containers of } 50cl\textit{ beer, } 75cl\textit{ wine, } 70cl\textit{ spirits}}{(\textit{Gross National Income at PPP Per Capita } (\textit{current international } \$)}$$

Data on gross national income were downloaded from the World Bank World Development Indicators Database.

The Alcohol Control Policy Index

The first step in the ACPI calculation was to address the incompleteness of the data set. Missing data were nearly negligible, under 1%. Accordingly, we ruled out sophisticated imputation methods and replaced missing values with the mode of the policy category of the variable in question. For example, if information on restrictions on advertising for spirits on the internet was missing, that value was replaced with the mode of the category 'Advertising restrictions for Beer, Wine and Spirits on the Internet'.

Ordinal variables denoting policy options were not homogeneously coded across the data set. To ensure comparability across policy categories, we recoded ordinal variables to obtain four ordinal categories as follows: 0 'Voluntary/No Restriction', 1 'Partial Restriction', 2 'Partial restriction Time Place and Content' and 3 'Ban'. Binary variables were not recoded and continuous variables were coded into discrete categories. For example, 'Blood alcohol concentration limit was coded as '0 'No BAC Limit', 1 'Limit above the median', 2 'Limit equal or below median' and 3 'Zero tolerance and bans'.

Second, we proceeded to normalise, weigh and aggregate policy variables. We used two approaches to variable normalisation – transformation of each categorical and continuous variable into a binary variable and transformation of all variables into Z_scores -, one to multivariate analysis – factor analysis –and two approaches to weighing and aggregation – equal weighing of all variables and 'Budget Allocation' weighing, based on theory and expert opinion and not on technical manipulation.[12]

The rationale behind the binary transformation is that it is problematic to build a measure that assumes that the leap from one level of policy adoption to another is of equal magnitude than that from another level to the next. In other words, the step from 'No restrictions to advertising of beer' to 'Partial restrictions on the advertising of beer' is not necessarily equivalent in magnitude to the step from 'Partial Restriction on Time Place and Content of the advertising of beer' to 'Total Ban on the Advertising of Beer'. We address this issue by recoding both continuous and categorical variables into the binary variable 'Above or equal/Below the variable mean'. Z_score transformation is a widespread method of normalisation, although it does not address this issue.

The third step of composite indicator building, multivariate analysis, consists of a reduction of the dimensionality of the data to fewer components or factors that measure unique 'statistical' dimensions in the data. Some authors argue, however, that 'the disadvantage of using this approach to weighting is that the correlations do not necessarily correspond to the real-world links and underlying relationships between the indicators and the phenomena being measured'.[13] The authors of the European Alcohol Policy Index (EAPAI), an alcohol policy measure for European countries, for example, go a step further and attribute equal weights to all items on their index because '(A)ll meaningful items in the European Action Plan to Reduce the Harmful use of Alcohol, regardless of their statistical contribution ought to be retained in the composite indicator as an indication of their practical importance'.[7]

We undertook a factor analysis of the variables normalised using Z_scores. The weights attributed to each factor come from the proportion of the overall variance that the factor explains.[12]

Fourth, we attributed theory-based weights to each of the variables. The theoretical scoring framework was developed by the WHO Regional Office for Europe.[11] The framework groups policies according to the 10 areas for national action outlined in the Global Strategy to Reduce the Harmful Use of Alcohol, and attributes weights to each policy according to the quality of the scientific evidence underpinning it, that is, policies with a stronger evidence base are weighted proportionally higher than those with weaker evidence base. The scoring scheme relies on the principle that countries adopting stronger policies should be rewarded, but that it should be possible for all countries to obtain the maximum score.

In the fifth and last step, all resulting index scores were normalised to a 0–100 scale to ensure comparability.

We used five different approaches to calculate the ACPI. These approaches differ from each other in the methods used in each of the above steps to composite indicator calculation—normalisation, multivariate analysis, and weighing and aggregation.[12] Formulation ACPI is a simple unweighted average of binary variables; formulation ACPI_Z is a simple unweighted average of variables transformed into Z_scores; formulation ACPI_Z_Weight is a weighted aggregation of Z_scores according to theory and expert opinion; and formulation ACPI_Z_FA is obtained by a weighted aggregation of Z_scores according to the weights produced by factor analysis.

Once we obtained the alternative measures, we proceeded to test our index's measurement validity. We assessed criterion-related validity, or the strength of relation between the measure and a measurable external criterion, as well as content validity, or the extent to which the measure's content represents the concept to be measured.[14] To assess the former, we used the indices as an independent variable in a regression of alcohol consumption per capita on ACPI scores. We employed, first, a simple multivariate ordinary least squares (OLS) regression followed by a random coefficient multilevel model as a robustness check. To assess the latter, for each country, we calculated a median rank and score under each of the five ACPI formulations (ACPI, ACPI_Z, ACPI_Z_FA, ACPI_Z_Weight and ACPI_Weight) and compared them with a baseline, which we set to the simple mean of a binary variables, using Pearson or Spearman correlation coefficients.

We controlled for GDP per capita, percentage of the population between 0 and 14 years old, and percentage of urban dwellers as part of the total population as well as world region.

GDP per capita was included because the prevalence of drinking increases as income rises from very low amounts,[1] and it influences a country's ability to formulate and instate alcohol control policies. The extent of urbanisation is related to drinking patterns—increasing urbanisation has been associated with both increasing[15 16] and decreasing alcohol consumption[17]—and with the alcohol policy architecture as urban settings require different policy tools to those of rural areas. Adjusting for urbanisation will account for this effect in either direction.

The age composition of a population bears influence on both drinking patterns—incidence of heavy drinking and alcohol

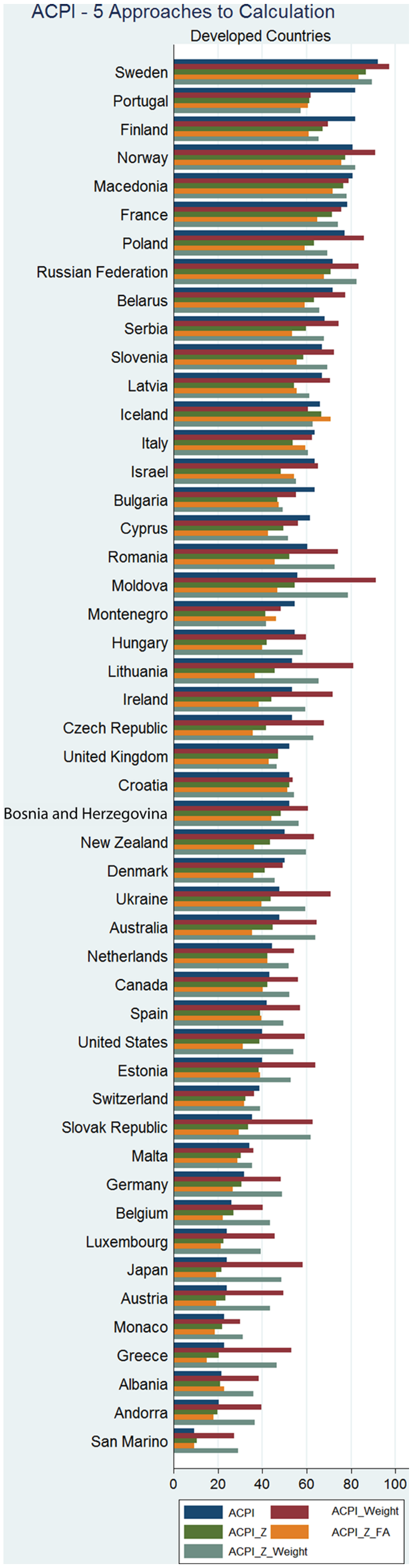

Figure 1 Comparison of five methodological approaches to the calculation of the Alcohol Control Policy Index (ACPI)—developed countries. Formulation ACPI is a simple unweighted average of binary variables; formulation ACPI_Z is a simple unweighted average of variables transformed into Z_scores; formulation ACPI_Z_Weight is a weighted aggregation of Z_scores according to theory and expert opinion; and formulation ACPI_Z_FA is obtained by a weighted aggregation of Z_scores according to the weights produced by factor analysis.

problems decreases with age[18 19]—and the policy architecture, for example, the need to regulate advertising on social media. Furthermore, the alcohol industry's increasing investment in areas of the globe with rapid population growth and urbanisation means increased availability of alcoholic beverages and an incentive to weaken alcohol control policies that curb alcohol consumption.[20]

Mother's age at childbirth and female employment have been documented as confounders of the association between alcohol policy strength and alcohol consumption.[17] While we acknowledge the importance of these factors as indicators of larger structural changes in society, we did not include them because, to a large extent, they are captured by the variables we did include—GDP/purchasing power, urbanisation, population age change and region dummies (below)—and thus highly collinear.

Lastly, alcohol consumption and regulatory attitudes to alcohol show some regional clustering. The European region as a group has the world's highest alcohol consumption, followed by the Americas. With the exception of some African countries, alcohol consumption is lower in the rest of the world.[1] Similarly, factors such as religion, which may confound the association, tend to be geographically clustered. The regional grouping of countries is that of the Millennium Development Goals (MDG).

Data on GDP per capita purchasing power parity (PPP), population age distribution and urbanisation were obtained from the World Bank World Development Indicators Database.

Finally, we correlated our measure against existing composite indicators of alcohol policy developed for Europe (EAPA Index),[7] the OECD (Alcohol Policy Index (API)),[5] in 46 African countries[9] and in the Western Pacific.[8]

RESULTS

Criterion-related validity

The results are displayed in figure 1 (figures 1.2–1.4 in the online supplementary figures). For ease of interpretation we clustered the 167 countries per the MDG regional groupings: developed regions, Northern Africa, Sub-Saharan Africa, Caribbean, Latin America, Caucasus and Central Asia, Eastern Asia, Southern Asia, South-eastern Asia, Western Asia, and Oceania.

In countries in the MDG 'Developed Countries' regional grouping, the median scores ranged from 13 in San Marino to 88 in Sweden (table 1.3); from 35 in Armenia to 96.7 in Uzbekistan in the 'Caucasus' regional grouping (online supplementary table 1.2); from 9.6 in Bolivia to 64.6 in Costa Rica in the 'Latin America' regional grouping (table 1.6); and from 3 in Antigua and Barbuda to 96 in Cuba in the Caribbean (online supplementary table 1.1). Several countries shifted several positions under the different methodological approaches. For example, within the developed countries group, Japan has a range of 76 positions between its minimum and maximum scores, while France has a range of only 4 (table 1.3). It is worth noting that the width of the range seems to be driven primarily by the scores calculated using the theory weighing.

Tables 1.1, 1.2, 1.4, 1.5, 1.7 and 1.10 with the remaining world regions can be found in the online supplementary materials.

The correlation coefficient between the baseline and the median of all six approaches was r=0.99 for both ranks and scores.

Table 1 Results of the sensitivity analysis by world region

Table 1.3: developed countries				
Country	Ranks		Scores	
Developed countries	Baseline	Median (Range)	Baseline	Median (Range)
San Marino	5.5	10.5 (5.5–30)	9.1	13 (9.01–29.3)
Andorra	28	29 (16–59)	20.5	22.4 (19.1–39.7)
Albania	31.5	41.5 (30–57)	21.6	26.9 (21.6–38.7)
Monaco	35.5	35.25 (31.5–37)	22.7	24.9(22.6–31.5)
Greece	35.5	37.25 (27–94)	22.7	25.3 (21.3–53.2)
Luxembourg	39	39 (36–72)	23.9	25.6 (23.3–45.6)
Japan	39	40 (36–112)	23.9	26.5 (22.2–58.1)
Austria	39	40.5 (29–86)	23.9	24.5 (23.9–49.6)
Belgium	45.5	54 (45–81)	26.1	29.7 (26.1–44.2)
Germany	64	67.5 (51–64)	31.8	32.6 (31.2–49.2)
Malta	72	63 (47–72)	34.1	34.2 (31.0–36.1)
Slovakia	74	76.5 (65–130)	35.2	37.2 (34.5–62.7)
Switzerland	80.5	67.5 (48–80.5)	38.6	36.7 (31.9–39.7)
USA	82.5	88 (80–114)	39.8	41.5 (39.2–59.1)
Estonia	82.5	84.5 (82–129)	39.7	41.8 (38.6–63.9)
Spain	84	87 (83–108)	42	42.4 (40.1–56.9)
Canada	85.5	95 (85.5–104)	43.2	45.1 (43.0–56.1)
The Netherlands	87	100.5 (87–102)	44.3	45.4 (43.8–54.2)
Australia	92.5	102 (92.5–135)	47.7	48.9 (44.6–64.6)
Ukraine	92.5	106.5 (92.5–142)	47.7	51.7 (44.9–70.9)
Denmark	98	85.5 (83–98)	50	44.8 (41.6–50)
New Zealand	98	108.5 (98–128)	50	51.9 (44.8–63.4)
UK	102.5	105.25 (79–113)	52.2	49.9 (47.0–81.0)
Croatia	102.5	106.75 (97–121)	52.2	53.3 (50.4–55.4)
Bosnia and Herzegovina	102.5	115 (102.5–119)	52.2	52.7 (49.2–60.5)
Ireland	106.5	105.25 (96–144)	53.4	52.7 (44.9–71.7)
Lithuania	106.5	110.5 (106.5–164)	53.4	54.6 (46.8–81.0)
Czech Republic	106.5	100.25 (91–136)	53.4	50 (42.1–68.0)
Montenegro	111	94.5 (70–111)	54.5	47.2 (41.8–54.5)
Hungary	111	105 (93–122)	54.5	52.3 (42.6–59.6)
Moldova	114.5	127.5 (114.5–171)	55.7	61.6 (55.7–91.4)
Romania	119	124.5 (119–151)	60.22	61.7 (53.3–74.0)
Cyprus	121.5	112 (99–129)	61.4	54.2 (49.2–64.3)
Bulgaria	129	107 (95–129)	63.7	52.3 (47.2–63.6)
Israel	129	119 (114–134)	63.7	59.1 (48.8–65.0)
Italy	129	122 (116–129)	63.7	59.8 (54.1–63.6)
Iceland	132	135 (117–142)	65.9	66.3 (60.7–67.8)
Slovenia	134	133 (126–149)	67	65.5 (59.7–72.4)
Latvia	134	132.5 (122–140)	67	64.5 (55.2–70.5)
Serbia	137	138.5 (133–150)	68.2	67.03 (60.6–74.5)
Russia	140.5	151 (140.5–167)	71.6	76.6 (71.4–83.6)
Belarus	140.5	141.25 (135–155)	71.6	68.9 (64.1–77.3)
Poland	147.5	147.75 (138–168)	77.3	73 (64.4–85.9)
France	150.5	150.75 (149–153)	78.4	75.1 (72.1–78.4)
Macedonia	153.5	156 (153.5–161)	80.7	79.5 (77.3–82.8)
Norway	153.5	155.5 (150–170)	80.7	79.6 (77.5–91.0)
Portugal	156.5	134.5 (118–156.5)	81.8	62.4 (58.0–81.8)
Finland	156.5	143 (139–156.5)	81.8	68.8 (66.0–81.8)

Continued

Table 1 Continued

Table 1.3: developed countries				
Country	Ranks		Scores	
Developed countries	Baseline	Median (Range)	Baseline	Median (Range)
Sweden	163	163 (160–174)	92	88.8 (84.3–97.2)
Table 1.6: Latin America				
Latin America	**Baseline**	**Median**	**Baseline**	**Median**
Bolivia	7	5 (1–7)	9.7	9.6 (0.0–11.2)
Suriname	17	27 (17–42)	15.9	23.8 (15.9–32.9)
Guatemala	26	25 (20–42.5)	20	23.2 (17.0–32.2)
El Salvador	31.5	36.5 (23–43)	21.6	25.7 (21.6–31.9)
Uruguay	35.5	37.75 (29–91)	22.7	25.9 (20.8–60.0)
Honduras	41.5	45 (37–60)	25	30.4 (25–33.5)
Guyana	56.5	56.75 (52–65)	29.5	30.9 (28.3–40.6)
Chile	60	60 (58–127)	30.7	32 (28.8–63.5)
Panama	60	63 (21–71)	30.7	30.2 (25.1–35.4)
Belize	66	56.5 (36–66)	32.4	31.6 (28.3–32.7)
Ecuador	85.5	102 (85.5–123)	43.2	49.1 (42.9–62.8)
Peru	102.5	103.75 (74–113)	52.3	47.3 (44.9–57.0)
Paraguay	109	81 (39–109)	54	42.6 (32.4–54.0)
Colombia	114.5	120.5 (114.5–154)	55.7	57.8 (49.7–76.9)
Brazil	116	96 (75–116)	56.8	48.5 (43.0–56.8)
Nicaragua	124.5	121.5 (98–125)	62.5	55.4 (52.4–62.5)
Argentina	124.5	126.5 (120–139)	62.5	63.2 (54.8–65.9)
Mexico	139	137.5 (129–145)	70.5	67.6 (57.0–71.9)
Venezuela	144	146 (132–152)	75	73.1 (64.8–78.3)
Costa Rica	152	138 (125–154)	79.5	64.6 (60.4–79.5)

Content validity

Simple bivariate associations between scores in the ACPI and alcohol per capita consumption in litres show a negative association across all approaches for index calculation, with the exception of theoretically weighed variables. Controlling for GDP per capita, population from 0 to 14 years old, urban population and dummies for world region increases the magnitude of the negative association for all approaches, and results in a negative coefficient for the association between ACPI scores calculated with theoretically weighed variables and alcohol per capita consumption (table 2).

For each 1 score increase in the ACPI, the reduction in per capita alcohol consumption varies from −0.024 L (95% CI (−0.043 to −0.004), when ACPI is calculated using factor analysis on Z_scores, to −0.014 L (95% CI (−0.034 to 0.005), when ACPI is calculated using equal weighing of binary variables.

As a robustness check we performed a region random coefficient analysis, which yielded similar results. We found that the association between scores in the ACPI and alcohol consumption is always negative and $p<0.05$. Reductions ranged from –0.035 L of alcohol per capita (95% CI (−0.054 to −0.017) when ACPI is calculated using factor analysis on Z_scores, to −0.028 L (95% CI (−0.046 to −0.009) when calculated using equal weighing of binary variables. The region random coefficient for the effect of ACPI scores on alcohol per capita consumption varies according to unobserved region level characteristics, hinting at regional factors potentially related to drinking culture (table 3).

Table 2 Summary of coefficients of OLS regression of alcohol consumption on scores of the ACPI

	API (binary variables)	API (binary variables)	API (Z_scores)	API (Z_scores)	API (Z_scores)
	Simple mean	Theory weighing	Simple mean	Factor analysis	Theory weighing
Alcohol per capita consumption					
Simple bivariate association coefficients	−0.005 (−0.030 to 0.021) p Value 0.720	0.021 (−0.007 to 0.050) p Value 0.145	−0.013 (−0.040 to 0.014) p Value 0.337	−0.024 (−0.050 to 0.001) p Value 0.064	0.017 (−0.013 to 0.046) p Value 0.269
Adjusted coefficients	−0.014 (−0.034 to 0.005) p Value 0.140	−0.020 (−0.043 to 0.002) p Value 0.078	−0.019 (−0.040 to 0.002) p Value 0.070	−0.024 (−0.043 to −0.004) p Value 0.019	−0.023 (−0.046 to 0.000) p Value 0.052
GDP per capita	0.00 (−0.00 to 0.00) p Value 0.107	0.00 (−0.00 to 0.00) p Value 0.099	0.00 (−0.00 to 0.00) p Value 0.103	0.00 (−0.00 to 0.00) p Value 0.112	0.00 (−0.00 to 0.00) p Value 0.090
Population 0–14 (% of total)	−0.156 (−0.242 to −0.0704) p Value 0.000	−0.160 (−0.246 to −0.075) p Value 0.000	−0.157 (−0.242 to −0.072) p Value 0.000	−0.158 (−0.242 to −0.074) p Value 0.000	−0.164 (−0.250 to −0.078) p Value 0.000
Urban population (% of total)	−0.008 (−0.035 to 0.018) p Value 0.529	−0.010 (−0.036 to 0.017) p Value 0.462	−0.010 (−0.035 to 0.018) p Value 0.537	−0.008 (−0.034 to 0.018) p Value 0.545	−0.010 (−0.036 to 0.017) p Value 0.475
Dummy world region	…	…	…	…	…
Observations	167	167	167	167	167
Adjusted R^2	0.62	0.62	0.62	0.62	0.62

… represents omitted values.
ACPI, Alcohol Control Policy Index; API, Alcohol Policy Index; GDP, gross domestic product; OLS, ordinary least squares.

Finally, figure 2 shows the plots of ACPI scores and the scores of existing measures. The correlation coefficient between the ACPI and the EAPA was r=0.7886, the API was r=0.4232 and the indicator for 46 African countries was r=0.4635.

DISCUSSION

The worldwide distribution of ACPI scores shows similar levels of intraregional and inter-regional variation. The developed countries region, for instance, the one with the highest prevalence of high APCI scores, ranges from 100 points in some formulations in Sweden to under 20 points in Andorra and San Marino. The same is true in Sub-Saharan Africa, where Zimbabwe scores over 80 in some formulations and São Tomé consistently scores near 0. A number of factors may drive differences between countries. Developed countries, in particular those of Europe, for example, by virtue of their higher alcohol consumption may be more inclined to formulate more stringent policies. Postmodern values too have been put forward as possible explanations for more stringent policy formulation. It has been hypothesised that societies that have moved beyond a focus on basic survival towards self-expression will be more likely to invest in the future well-being by enacting both preventative and health enhancing policies. On the other hand, countries where survival values prevail may view investments in regulatory enforcement as a luxury.[21 22] Postmodern values can partly explain the higher scores observed in developed countries. The religious composition of the population may affect alcohol policy formulation. Turkey, Jordan and Oman in the West Asia region, or Bangladesh and Indonesia in South Asia, all of which have large Muslim populations, show fairly high scores. It could also be argued, on the other hand, that the prevalence of religious norms around alcohol consumption renders policy redundant given the normative incentive to abstain. This could explain why countries such as Syria or Iraq show low scores. Naturally, protracted armed conflict may also explain weak alcohol policy formulation as governments prioritise more pressing areas. Finally, the saturation of developed countries' alcohol markets and the subsequent expansion of the alcohol industry into middle-income and

Table 3 Summary of coefficients of random coefficients multilevel analysis

	API (binary variables)	API (binary variables)	API (Z_scores)	API (Z_scores)	API (Z_scores)
	Simple mean	Theory weighing	Simple mean	Factor analysis	Theory weighing
Alcohol per capita consumption					
Bivariate association	−0.011 (−0.030 to 0.008) p Value 0.275	−0.015 (−0.038 to 0.007) p Value 0.183	−0.015 (−0.036 to 0.005) p Value 0.143	−0.020 (−0.041 to −0.000) p Value 0.047	−0.014 (−0.037 to 0.010) p Value 0.252
Adjusted coefficients	−0.028 (−0.046 to −0.009) p Value 0.003	−0.030 (−0.052 to −0.008) p Value 0.006	−0.032 (−0.051 to −0.012) p Value 0.001	−0.035 (−0.054 to −0.017) p Value 0.000	−0.033 (−0.055 to −0.011) p Value 0.004
Observations	167	167	167	167	167

API, Alcohol Policy Index.

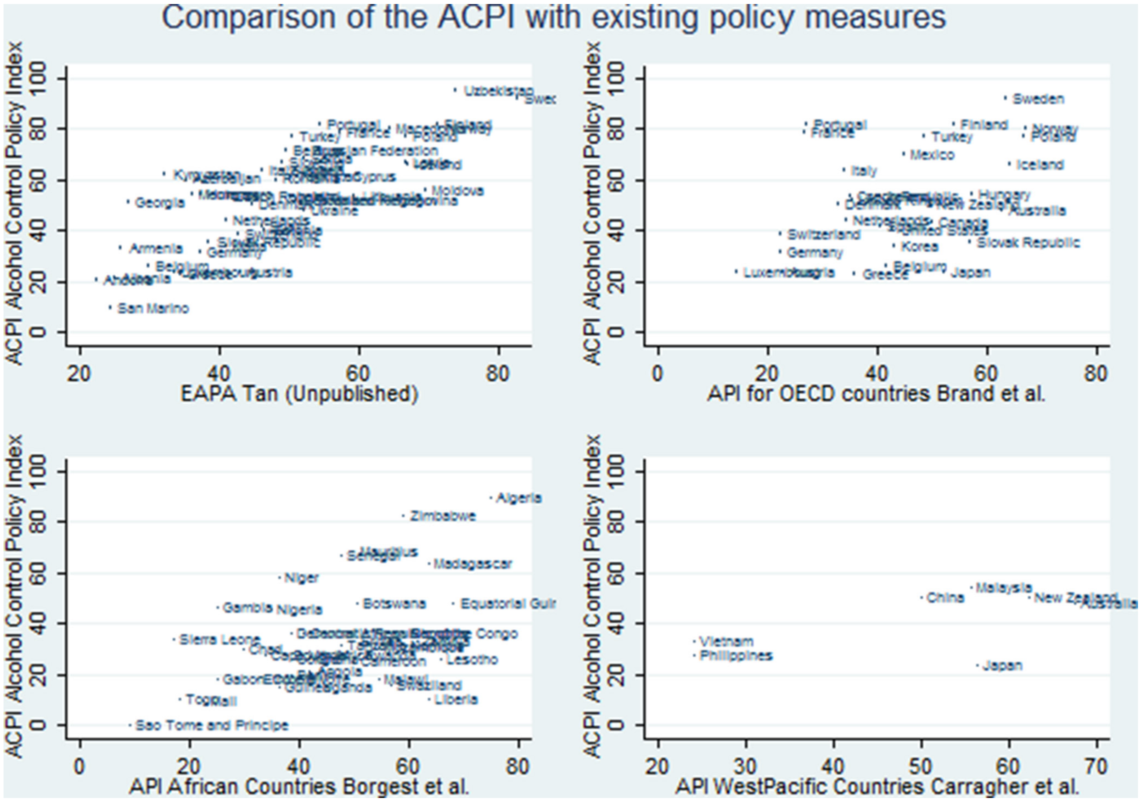

Figure 2 Comparison of the ACPI with existing policy measures. ACPI, Alcohol Control Policy Index; API, Alcohol Policy Index; EAPA, European Alcohol Policy Index; OECD, Organisation for Economic Co-operation and Development.

low-income countries has been identified as a factor in the weakening of alcohol control policies.[20 23 24]

Our analysis has a number of limitations, the most important of which is arguably the absence of measures of implementation and enforcement of the policies on which the index relies. This has at least two implications. First, the absence of measures of implementation precludes an analysis of a possible lagged effect between policy implementation and changes in consumption. GISAH captures the state of alcohol policy as of 2012, but we know very little about how long a particular policy had been in place. Second, it is difficult to disentangle the effects of poor de facto implementation from those of a pervasive drinking culture that evades regulation. Hungary, for example, has very strict statutory alcohol control policies and a very high level of alcohol consumption.[5]

Our index scores correlate quite highly with previous measures, suggesting that the tools devised by both Tan and Brand and colleagues were capturing the same underlying concept than the ACPI, although using different data (figure 2). The few outliers—Portugal and France and the Slovak Republic—in the case of the comparison with Brand and colleagues' API may be a consequence of policy changes in the 10 years separating the data used in the two indices. The apparent low correlation obtained with Carragher and colleagues' measure must be interpreted with caution due to the small sample of countries. Nonetheless, one potential explanation could lie in the fact that the authors incorporated measures of enforcement of the policies.

Comparative studies of alcohol policy enforcement have so far included a limited number of countries and covered only a portion of the policies collected by GISAH,[8 25] making it impossible for us to incorporate this element into the analysis. We traded off a marginal loss of accuracy for the advantages that our large sample awarded us, namely the possibility to control for known confounders such as GDP or urbanisation.

Another limitation is that the diversity of alcohol control policies in countries with federal systems where alcohol policy is determined at the state level—for example, India or the USA—is not reflected in our measure as it only encompasses the federal level. Federal states, however, represent only a fraction of the sample.

As far as our dependent variable is concerned, our reliance on recorded consumption does not adequately capture illicit trade in alcoholic beverages and may result in an underestimation of per capita alcohol consumption in some regions of the world. The very nature of illicit trade implies an impossibility of accurately ascertaining its dimension. Whereas figures exist, it is plausible that their accuracy is not homogeneous across the globe, which could further bias our results.

The ACPI contributes to the alcohol control scholarship in two ways. First, it adds a measure of the state of alcohol control policy across countries, one that makes use of a larger number of countries than its predecessors, as well as a wider range of methodologies for its calculation, both of which contribute to its validity as an indicator.

Second, it highlights the need for improved data collection on the implementation of these policies. Including a measure of policy implementation in the ACPI would allow for more precise benchmarking of countries as well as a finer analysis of the role of levels of implementation of existing policies on the protection of populations from alcohol exposure.

In addition, we showed that the statutory strictness of alcohol control policies is associated with lower levels of alcohol consumption. This finding has policy implications: governments should formulate and enact strict alcohol control policies as they seem to

What is already known on this subject

Several authors have developed composite measures of alcohol policies and compared countries in Europe and the OECD, in the Western Pacific and in Africa. Some have used these indices to predict per capita consumption estimates and found positive association. No one, as best as we know, has applied a scale to data from all over the world.

What this study adds

We contribute to the body of evidence by creating a composite indicator—the Alcohol Control Policy Index—that comprises alcohol control policies from 167 countries all over the world. Our large sample allows us to add nuance to previous analysis of policy scores and consumption, namely adjust for known confounders in the association between scores in the ACPI and per capita alcohol consumption.

be effective tools in reducing population exposure to alcohol, a net contributor to the global burden of disease.

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