

# Relationships Between Local Enforcement, Alcohol Availability, Drinking Norms, and Adolescent Alcohol Use in 50 California Cities

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**ABSTRACT. Objective:** This study investigated relationships between local alcohol policies, enforcement, alcohol outlet density, adult alcohol use, and underage drinking in 50 California cities. **Method:** Eight local alcohol policies (e.g., conditional use permit, social host ordinance, window/billboard advertising) were rated for each city based on their comprehensiveness. Local alcohol enforcement was based on grants received from the California Alcoholic Beverage Control agency for enforcement of underage drinking laws. Outlet density was based on the number of on- and off-premise outlets per roadway mile. Level of adult alcohol use was ascertained from a survey of 8,553 adults and underage drinking (frequency of past-year alcohol use and heavy drinking) from surveys of 1,312 adolescents in 2009 and 2010. Multilevel regression analyses were conducted to examine the effects of policies, enforcement, and other community-level variables on adolescent drinking, controlling for youth demographic characteristics. Mediating effects of adolescents'

perceived ease of obtaining alcohol, perceived enforcement, and perceived acceptability of alcohol use also were examined. **Results:** None of the eight local alcohol-policy ratings were associated with adolescent drinking. Funding for underage drinking enforcement activities was inversely related to frequency of past-year alcohol use, whereas outlet density and adult drinking were positively related to both past-year alcohol use and heavy drinking. These relationships were attenuated when controlling for perceived ease of obtaining alcohol, enforcement, and acceptability of alcohol use, providing evidence for mediation. **Conclusions:** Adolescent alcohol use and heavy drinking appear to be influenced by enforcement of underage drinking laws, alcohol outlet density, and adult alcohol use. These community-level influences may be at least partially mediated through adolescents' perceptions of alcohol availability, acceptability of alcohol use, and perceived likelihood of getting in trouble with local police. (*J. Stud. Alcohol Drugs*, 73, 657–665, 2012)

**P**OLICY APPROACHES TO PREVENTION are frequently advocated as best practices to reduce youth access to alcohol and thus drinking and drinking problems (National Research Council and Institute of Medicine, 2004; Pacific Institute for Research and Evaluation/Office of Juvenile Justice and Delinquency Prevention, 2000a, 2000b). Broadly defined, alcohol policy includes (a) formal legal and regulatory mechanisms, rules, and procedures for reducing the consumption of alcohol or risky drinking behaviors and (b) enforcement of these measures (Grube and Nygaard, 2001, 2005; Toomey and Wagenaar, 1999). The purpose of such policies is to increase the full costs to young people for obtaining, possessing, and consuming alcohol and to adults for providing alcohol to minors.

Such policies also may reinforce community norms against underage drinking and against providing alcohol to youth. Local communities may be particularly important for policy interventions. Although alcohol control is primarily a state responsibility in the United States, many states allow counties and municipalities to take steps to control alcohol that are more restrictive than those required by state law. Communities in California, for example, can implement zoning restrictions (e.g., regulate outlet densities, distances from schools), require responsible beverage service training, institute social host ordinances, or take other policy or enforcement actions (e.g., sales compliance checks, proactive party dispersal), as long as these activities are not less restrictive than state law. Much of the responsibility for enforcing alcohol laws and policies relating to underage drinking falls to local communities. Local policies and enforcement efforts are thus potentially important tools for reducing underage drinking and drinking problems.

Research indicates that there is considerable variability in alcohol policy and enforcement at the local level (Forster et al., 1994; Montgomery et al., 2006; Mosher et al., 2002; Wagenaar and Wolfson, 1995; Wolfson et al., 1995), but few studies have examined whether such variations are related to differences in drinking or drinking problems among young

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people or to the development of drinking and drinking problems over time. Moreover, little or no research has addressed the processes through which such policies and enforcement activities may affect adolescents' drinking behaviors.

The majority of prior studies on the effects of alcohol control policies have used "presence/absence" indicators of policies (e.g., minimum legal drinking age), as opposed to measures reflecting policy comprehensiveness and stringency. A few recent studies have attempted to measure policy comprehensiveness and stringency at the national and state levels. For example, Brand et al. (2007) developed the Alcohol Policy Index (API) for 30 Organisation for Economic Co-operation and Development countries based on 16 national policy topics comprising five domains: 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). The policies were weighted for effectiveness based on empirical evidence. They found that the overall API was inversely associated with per capita alcohol consumption in the 30 countries. Overall, each 10-point increase in the API score was associated with a 1-L reduction in per capita ethanol consumption. A more recent study (Paschall et al., 2009) found that the overall API score and the alcohol availability domain rating, in particular, were inversely related to national prevalence rates of any past-30-day alcohol use and frequent alcohol consumption among adolescents. Although these policies may, in fact, serve to prevent drinking by youths, an alternative interpretation is that both policy and adolescents' drinking reflect broader societal drinking norms. That is, countries with more conservative drinking norms may be more likely to enact and enforce comprehensive policies, and these norms also discourage young people from drinking. A recent study has shown that adult drinking rates at the state level are moderately to strongly correlated with youth drinking rates in the United States (Nelson et al., 2009). It is important to note, then, that the relationships between adolescents' drinking with the availability domain rating from the API were reduced but remained statistically significant after controlling for per capita alcohol consumption (Paschall et al., 2009). Thus, national drinking norms may partially, but not entirely, account for relationships between alcohol control policies and alcohol use among adolescents.

At the state level, Fell et al. (2008, 2009) examined relationships between comprehensiveness and stringency ratings of state alcohol policies and traffic crashes and fatalities among underage drivers (<21 years old). Results of their analyses indicated that stronger possession and purchase laws were associated with an 11.2% reduction over time in the ratio of underage drinking to nondrinking drivers in fatal

traffic crashes, and stronger laws restricting the use of fake IDs were associated with a 7.3% decrease in the percentage of underage drivers under the influence of alcohol in fatal crashes.

More recently, Ringwalt and Paschall (2011) examined associations between state beer keg registration policy ratings and state-level prevalence estimates of past-30-day heavy drinking, driving after drinking, and riding with a drinking driver among adolescents. Correlational analyses indicated significant inverse associations between more comprehensive and stringent keg registration policies and all four of these behaviors. When controlling for per capita beer consumption, the relationships with heavy drinking and driving after drinking were no longer significant, but the association with riding with a drinking driver remained significant. These findings again suggest that the observed associations between policy and adolescent drinking behavior may be partially attributable to drinking norms.

Local alcohol policies often focus on controlling outlet density as a means of reducing alcohol availability. Although outlet density has been associated with adolescents' drinking and drinking problems (Treno et al., 2003, 2008), only a few studies have investigated the relation between outlet density and changes in adolescents' drinking behaviors over time (Chen et al., 2010). A stronger case can be made if density is shown to be related to initiation of drinking or changes in drinking prevalence over time. Similarly, few studies have investigated the mechanisms through which outlet density may affect adolescent drinking.

The present study investigated the relation between ratings of local alcohol control policies in 50 California cities and underage drinking. Going beyond previous research, we examined whether four types of local policies (social host liability, regulation of on- and off-premise outlets, advertising restrictions, public drinking restrictions) and enforcement activities are related to levels of and changes in adolescent alcohol use and heavy drinking. In addition, we examined whether measures of perceived alcohol availability, enforcement, and acceptability of alcohol use at the individual level mediate the effects of policy/enforcement on these behaviors. We also examined whether the physical availability of alcohol (i.e., alcohol outlet density) is associated with adolescent alcohol use and heavy drinking and, if so, whether this relationship is mediated by perceived alcohol availability and enforcement or moderated by local alcohol control policies or enforcement. To account for overall drinking norms in each community, we included level of adult drinking in our analyses.

We hypothesized that more comprehensive local alcohol policy and greater enforcement would be related to lower levels and slower growth in adolescents' drinking and heavy drinking. Conversely, we expected that greater density of alcohol outlets would be related to higher levels and more rapid growth in these outcomes. We further hypothesized

that enforcement would moderate the relations of policy comprehensiveness and outlet density with consumption, such that these relations would be weaker when enforcement was low. Finally, we anticipated that individual perceptions of enforcement, availability, and acceptability of alcohol use would mediate the effects of community-level comprehensiveness and enforcement on rates of drinking and heavy drinking. We also expected that drinking norms in the communities as indicated by adult drinking levels would be positively related to levels and growth in youths' drinking.

## Method

### *Study design*

The study included annual assessments of local alcohol control policies and underage drinking enforcement activities in 50 mid-sized communities (population range: 50,000 to 500,000) throughout California and annual telephone interviews with a cohort of adolescents (13–18 years old) in these communities. Data on adult drinking were obtained through a cross-sectional random-digit-dial telephone survey of adults (ages  $\geq 18$  years). Population and outlet data were obtained from census records and from the California Alcoholic Beverage Control (ABC) agency.

*City sample.* Beginning with a list of all 138 California cities with populations between 50,000 and 500,000, a purposive geographic sample of 50 noncontiguous cities was drawn to maximize validity with regard to the geography and ecology of the state. The sampled cities tended, on average, to have slightly smaller populations (106,588 vs. 108,000), somewhat less ethnic diversity (e.g., 64% vs. 59% White), smaller household sizes (2.82 vs. 2.93 persons), and lower median household incomes (\$50,000 vs. \$52,000) than unsampled cities on the list. Importantly, however, none of these differences was statistically significant, and the coverage of these measures across cities was good. Re-sampling using different starting seeds provided much the same results, offering further evidence as to the robustness and geographic and ecological validity of these sampled places.

*Youth survey method.* Telephone interviews were completed in 2009 and 2010. Households were identified through a commercially available list-assisted sample of addresses and phone numbers in the 50 cities. An invitation letter about the study was mailed to sampled households followed by telephone contact. Parental consent for the interviews was first obtained by interviewers followed by assent from the youth respondents. Telephone interviews took approximately 30 minutes, and respondents received \$25 as compensation for their participation in the study. They also gave their permission to be re-contacted for future interviews. Of 3,062 sampled households with eligible respondents, 1,543 (50.4%) participated in the first telephone interview (Wave 1) in 2009. Results presented here are based on 1,312 re-

spondents (85% follow-up) who also participated in a second telephone interview (Wave 2) 1 year later in 2010.

*Survey sample.* Of the 1,312 respondents, 1,236 (94%) provided complete data for all variables included in this study. Respondents who were retained across the waves were similar on Wave 1 variables to those who dropped out with respect to past-year alcohol use and heavy drinking, age, and gender; however, a significantly higher proportion of those retained in the study reported their race/ethnicity as White (72%) compared with those dropped out by Wave 2 (60%),  $\chi^2(1) = 12.1, p < .01$ . The number of Wave 2 respondents per city ranged from 15 to 44 ( $M [SD] = 26.2 [6.0]$ ).

### *Measures*

*Local alcohol policies.* Our sources of authoritative best practice recommendations to reduce underage drinking include the U.S. Surgeon General's 2007 Call to Action to Prevent and Reduce Underage Drinking, the Community Guide developed in 2011 by The Community Preventive Services Task Force, a list of model ordinances, and peer-review policy research pertaining to the effects of existing state and federal law. The review of these sources resulted in the selection of eight local alcohol-policy topics:

- conditional use permit required for new establishments selling or serving alcohol (e.g., designating hours of operation, type of alcoholic beverages that can be served, outdoor lighting requirements);
- deemed approved requirements that preexisting establishments selling or serving alcohol now comply with a set of minimum operating standards;
- outdoor advertising/billboards of alcoholic beverages prohibited or limited;
- public drinking prohibited or limited;
- responsible beverage service training required for staff of establishments selling or serving alcohol;
- social host policies mandating criminal and/or civil sanctions of hosts of underage drinking parties;
- special outdoor events policies governing alcohol service and consumption at such events (e.g., street fair); and
- window advertising of alcoholic beverages prohibited or limited.

Once selected, we used a two-stage process for locating all extant ordinances across the cities in the first half of 2009. First, data were gathered by first locating the website for each city to determine that city ordinances were available online. The second stage of the process was to contact the city clerk in each city to ensure that all relevant ordinances were located and to ensure that our understanding of the provisions of each relevant ordinance was accurate. Next, to reflect the elements critical to comprehensiveness and stringency of each type of ordinance, we assigned scores to each policy element. These scores are based on the recent work by

Fell et al. (2008, 2009), who developed a coding scheme to assess the strength of 16 U.S. state-level underage drinking laws. In our adaptation of the Fell et al. scoring process, for each policy topic, a city received a +1 if it had the relevant type of ordinance in question and a 0 if no such law existed. Then, each element of law was assigned points for comprehensiveness and stringency or the reverse in cases in which individual provisions limit the law.

The number and stringency of provisions within each type of policy varied among the cities, as did the policy ratings. Principal components analysis was conducted to determine whether the policy ratings could be represented by fewer underlying constructs. This analysis yielded two factors corresponding to regulation of licensed businesses (conditional use permit, deemed approved, responsible beverage service) and restrictions on advertising (windows and billboard). Social host liability, public drinking, and special outdoor events ordinances loaded on independent factors. Because of limited variability in public drinking ordinances, this policy was not included in our analyses. We used factor scores for regulation of licensed businesses and advertising in the analyses, whereas raw scores were used for other policies.

*Local enforcement activities.* Reporting of underage drinking enforcement activities is highly variable and unreliable across local jurisdictions. However, the level of proactive enforcement of underage drinking laws by local police departments in California cities is determined to some extent by funding from the California ABC agency. Therefore, we used total funds received from the California ABC in 2008–2009, 2009–2010, and 2010–2011 as a surrogate measure of enhanced enforcement activities or capacity. Fifteen of the 50 cities had received California ABC funds in at least one of those years, ranging from \$11,500 to \$200,000 total. Compliance checks to reduce alcohol sales to underage youth are the most common type of enforcement activity using these funds, but they may also be used for other activities such as enforcement of minor-in-possession laws, cops-in-shops programs targeting youth purchase, or shoulder-tap interventions targeting adults purchasing alcohol for minors. To account for variation in city population size, which could influence level of funding, the per capita funding rate was computed (i.e., total amount of funding/city population size). Because of the skewed distribution, this variable was log-transformed for analyses.

*Alcohol outlet density.* Based on records of licensed establishments obtained from the California ABC agency, we computed outlet densities for bars, restaurants, and off-premise establishments (e.g., supermarkets, convenience stores, liquor stores) based on the number of outlets per roadway mile in each city. We also calculated total density as outlets per roadway mile. We chose to use these indicators of access instead of outlets per area (square miles) or population because outlets are clustered along roadways.

This measure is thought to be a better indicator of access to alcohol outlets (Chen et al., 2010).

*Adult alcohol use.* A random digit dial household telephone survey of 8,553 adults in the 50 cities was conducted in 2009 to assess levels of alcohol consumption and related problems such as drinking and driving. The number of adult respondents per city ranged from 109 to 204 ( $M = 171$ ). Respondents' age ranged from 18 to 98 ( $M = 54.6$ ); 57% were female and 59% were White. The survey included a graduated frequency measure that was used to calculate the total volume and frequency of alcohol use in the past 28 days. This variable was log-transformed to reduce skewness and kurtosis. The mean level of past-28-day adult alcohol use was then obtained for each city.

*Adolescent alcohol use and heavy drinking.* Respondents to the youth survey were asked, "Have you ever had a whole drink (not just a sip or a taste) of an alcoholic beverage?" Respondents who answered "yes" were then asked, "In the past 12 months, on how many days did you have a whole drink of an alcoholic beverage?" and "In the past 12 months, on the days when you drank alcohol, how many drinks did you typically have?" Response values for these latter two variables were multiplied to create a past-year Alcohol Frequency  $\times$  Quantity measure. Respondents who indicated any past-year drinking were also asked, "In the past 12 months, on the  $X$  days when you drank, on how many of these days would you say you had five or more drinks?" The past-year drinking variables were log-transformed before the analyses to reduce skewness and kurtosis.

*Perceived availability of alcohol.* Youth survey respondents were asked, "Suppose you wanted to obtain alcoholic beverages. Overall, how easy or difficult would it be for you to get them?" Possible response options (values) were *very easy* (1), *somewhat easy* (2), *somewhat difficult* (3), and *very difficult* (4). We reverse coded response values so that a higher value represented greater perceived availability of alcohol.

*Perceived enforcement of underage drinking laws.* Respondents to the youth survey were asked six questions regarding perceived likelihood of being caught by the police in six drinking situations: (a) trying to buy alcohol, (b) drinking at a party, (c) drinking in a public place, (d) driving after having 1–2 drinks, (e) driving after having too much to drink, and (f) riding or driving around in a car while drinking alcohol. Possible response options were *very unlikely* (1), *somewhat unlikely* (2), *somewhat likely* (3), and *very likely* (4). A mean score was computed for each respondent, with a higher score indicating greater perceived enforcement of underage drinking laws. The internal reliability (Cronbach's  $\alpha$ ) for the six-item scale was .74.

*Perceived acceptability of alcohol use.* Youth survey respondents were asked, "How much do you think your mother or female guardian would disapprove or approve if you were to have three or four whole drinks in a row?" and "How

much do you think your father or male guardian would disapprove or approve if you were to have three or four whole drinks in a row?" Four possible responses to these questions ranged from *strongly disapprove* (1) to *strongly approve* (4). The correlation between these two items was .57 ( $p < .01$ ). A mean value was computed for each respondent, with a higher value representing greater perceived acceptability of alcohol use. If there was a missing value for one parent, then the response value for only one of these questions was used.

*Demographic characteristics.* Youth survey respondents reported their age, gender, whether they were Hispanic or Latino, and their race (White, African American, Asian, Pacific Islander/Hawaiian, Alaskan/Native American). The race items were coded as a series of dummy variables, with White serving as the reference group. City demographic characteristics were obtained from census data and included total population, population density, median household income, unemployment rate, poverty rate, and percentage of residents in racial/ethnic groups (e.g., White, African American, Asian, Hispanic).

#### *Data analysis*

Multilevel linear regression analyses were conducted with HLM Version 6.06 software (Raudenbush et al., 2004) to examine the relationships of local alcohol policies, enforcement, alcohol outlet densities, and adult alcohol use with the time-related slopes and intercepts (mean levels) for dependent variables. We initially included main effects and interaction terms in the analyses. The models included three levels: observation, individual, and city. At the observation level, time was the only predictor. At the individual level, age, gender, and race/ethnicity were initially included as predictors; perceived alcohol availability, enforcement, and acceptability of alcohol use were added in a second step to assess their possible mediating effects. At the city level, local alcohol-policy ratings were examined as predictors, along with level of funding for enforcement, alcohol outlet density, adult alcohol use, and city demographic characteristics (e.g., total population, population density, unemployment rate). City-level variables not related to past-year frequency of alcohol use or heavy drinking were dropped from the models. Cross-level interactions between city-level policy ratings, enforcement, alcohol outlet density, adult alcohol use, and time were examined to determine whether they were predictive of outcome slopes. The interaction terms were dropped from the model if not statistically significant. We also examined the possible mediating effects of perceived alcohol availability, enforcement, and acceptability of alcohol use at the individual level. HLM software provided adjustment for variance in outcomes that is attributable to clustering of observations within individuals, and individuals nested within cities (Raudenbush et al., 2004). Between-city vari-

ation is measured by the intraclass correlation coefficient. Intraclass correlation coefficients for the outcomes were .006 for past-year alcohol use and .002 for past-year heavy drinking.

## **Results**

Descriptive statistics for study variables are provided in Table 1. Prevalence rates for past-year alcohol use were 20% in 2009 and 33% in 2010. Prevalence rates for past-year heavy drinking were 8% in 2009 and 15% in 2010. The mean age of the study sample in 2010 (Wave 2) was 15.7 years, 51% were male, and 75% were White. The average city alcohol-policy ratings were generally at the lower end of the possible range, with the exception of public drinking laws. Figure 1 shows the number of cities with each type of alcohol control policy. Although there is little or no variability in the communities for the presence of some policies (e.g., restrictions on public drinking), there was more variability in terms of the comprehensiveness ratings of policies.

#### *Multilevel analyses*

Initial multilevel models indicated no significant interactions between any of the local alcohol-policy ratings, enforcement, or alcohol outlet density measures and time. Interaction terms were dropped from the models and only main effects of local alcohol policies, enforcement, and outlet density on past-year alcohol use and heavy drinking were examined. None of the local alcohol-policy variables or city demographic characteristics were associated with past-year alcohol use or heavy drinking, and therefore these variables and characteristics were dropped from the models.

*Past-year alcohol use.* As shown in Table 2 (Model 1), enforcement, total outlet density, and adult alcohol use were associated with past-year levels of adolescent alcohol use, controlling for individual background characteristics. The regression coefficients indicated an inverse association between level of past-year alcohol use and funding for underage drinking enforcement activities, while positive associations were observed between past-year alcohol use and total outlet density as well as adult alcohol use. Separate analyses indicated that both bar and restaurant densities, when considered individually, were positively associated with past-year drinking. Off-premise outlet density was not significantly associated with this behavior, although the effect was in the hypothesized direction ( $\beta = .31, p < .11$ ). Including perceived alcohol availability, enforcement, and acceptability of alcohol use at the individual level (Model 2) reduced the strength and significance of relationships between community-level variables and past-year alcohol use, suggesting that these individual-level variables may be partial mediators of enforcement, outlet density, and adult alcohol use. Perceived alcohol availability and acceptability

TABLE 1. Descriptive statistics

Variable	<i>M</i> ( <i>SD</i> ), range or %
Observation level ( <i>n</i> = 2,472)	
Past-Year Frequency × Quantity <sup>a</sup>	0.60 (1.3), 0–7.0
Past-year heavy drinking <sup>a</sup>	0.21 (0.7), 0–5.0
Individual level ( <i>n</i> = 1,236)	
Age	15.7 (1.1), 13–18
Male	51%
Race/ethnicity	
Hispanic	20%
Alaskan/Native American	1%
Hawaiian/Pacific Islander	2%
Asian	6%
African American	4%
White	75%
Perceived alcohol availability	2.64 (1.0), 1.0–4.0
Perceived enforcement	3.25 (0.5), 1.3–4.0
Perceived acceptability of alcohol use	1.12 (0.3), 1.0–4.0
City level ( <i>n</i> = 50)	
Social host ordinance	2.84 (3.1), 0–7.0
Responsible beverage service training	1.48 (2.9), 0–10.0
Conditional use permit	3.50 (2.4), 0–7.0
Deemed approved ordinance	1.02 (1.8), 0–6.0
Window advertising	0.86 (1.2), 0–3.0
Outdoor advertising	0.72 (0.8), 0–2.0
Public drinking	2.88 (0.4), 1.0–3.0
Special outdoor events	1.34 (0.8), 0–3.0
Funding for enforcement activities <sup>a</sup>	0.14 (0.3), 0–1.0
Total outlet density	0.72 (0.32), 0.24–1.71
Bar density	0.05 (0.04), 0–0.16
Off-premise outlets density	0.28 (0.14), 0.10–0.96
Restaurant density	0.39 (0.20), 0.13–1.17
Adult alcohol use <sup>a</sup>	0.45 (0.16), 0.14–0.76
Total population	106,588 (79,422), 51,912–427,224
Population density	290.48 (100.7), 128.4–740.6
Median household income	50,108.24 (14,259.2), 26,839–84,429
Percentage receiving public assistance	0.05 (0.01), 0.01–.13
Percentage unemployed	0.07 (0.03), 0.03–.13
Percentage ethnic minority	0.27 (0.05), 0.14–.36

Notes: Funding for enforcement activities in 15 cities ranged from \$11,500 to \$200,000 from 2008 to 2010. Prevalence rates for past-year alcohol use were 20% in 2009 and 33% in 2010. Prevalence rates for past-year heavy drinking were 8% in 2009 and 15% in 2010.

<sup>a</sup>Log transformed from original variables.

of alcohol use were positively associated with frequency of past-year drinking, and perceived enforcement was negatively associated with this behavior.

*Heavy drinking.* Of the city-level variables, total outlet density and adult alcohol use were associated (positively) with past-year heavy drinking (Model 1), as were bar and restaurant density when analyzed separately. Off-premise density was not associated with this behavior, although the effect was again in the expected direction ( $\beta = .25, p < .10$ ). The positive associations of total outlet density and adult alcohol use with past-year heavy drinking were reduced in strength and significance when perceived alcohol availability, enforcement, and acceptability of alcohol use were included at the individual level (Model 2), suggesting that these latter variables may be partial mediators of these relationships.

Perceived availability, enforcement, and acceptability of alcohol use were associated with past-year heavy drinking in the expected directions.

## Discussion

This study is one of the first to investigate possible effects of community-level local alcohol policies, enforcement, outlet density, and adult alcohol use on drinking among adolescents over time (Chen et al., 2010). Although alcohol-policy comprehensiveness and enforcement at the city level were not related to change in adolescents' alcohol use, enforcement funding was negatively related to overall frequency of past-year drinking, and outlet density was positively related to both frequency of past-year drink-

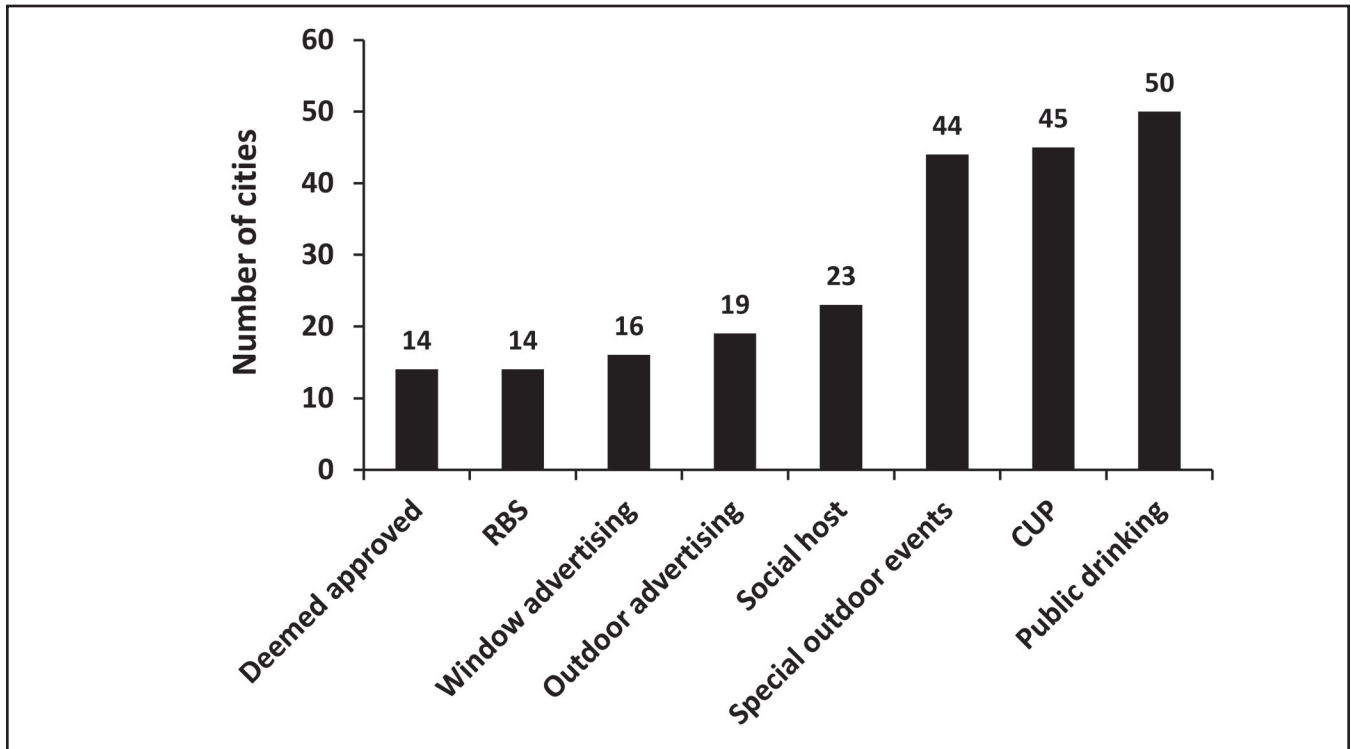


FIGURE 1. Number of cities with each type of alcohol policy. RBS = responsible beverage service; CUP = conditional use permit.

ing and frequency of heavy drinking. We also found that adult alcohol use at the city level was consistently related to higher levels of past-year drinking and heavy drinking among youth in the 50 cities. Enforcement efforts, as indicated by California ABC funding, was inversely related to level of past-year drinking among adolescents but was

unrelated to heavy drinking. Other policy-related variables such as responsible beverage service requirements, advertising restrictions, and social host ordinances were not significantly related to adolescents' drinking in our analyses. In keeping with a social cognitive model of behavior (e.g., Bandura, 1986), the effects of adult alcohol use, outlet den-

TABLE 2. Results of multilevel analyses predicting past-year drinking,  $\beta$  (SE)

Predictor	Past-year drinking			
	Frequency $\times$ Quantity		Heavy drinking	
	Model 1	Model 2	Model 1	Model 2
City level <sup>a</sup>				
Enforcement funding	-.11 (.05)*	-.07 (.06)	—	—
Total outlet density	.21 (.09)*	.15 (.09)	.08 (.03)*	.05 (.03)
Adult alcohol use	.55 (.23)*	.29 (.20)	.32 (.10)**	.21 (.08)*
Individual level <sup>b</sup>				
Age	.37 (.02)**	.25 (.03)**	.15 (.01)**	.10 (.02)**
Male	.19 (.05)**	.20 (.04)**	.10 (.02)*	.11 (.02)**
Race/ethnicity				
Hispanic	.33 (.10)**	.28 (.09)**	.12 (.05)*	.10 (.05)*
Alaskan/Native American	.04 (.25)	.08 (.21)	.04 (.13)	.05 (.11)
Hawaiian/Pacific Islander	-.15 (.18)	-.19 (.14)	.03 (.10)	.01 (.07)
Asian	-.25 (.07)**	-.31 (.07)**	-.11 (.04)*	-.16 (.03)**
African American	.08 (.20)	.11 (.19)	.07 (.09)	.09 (.09)
Perceived alcohol availability	—	.24 (.03)**	—	.09 (.01)**
Perceived enforcement	—	-.22 (.08)**	—	-.11 (.03)**
Perceived acceptability of alcohol use	—	1.0 (.07)**	—	.51 (.08)**
Observation level				
Survey year	.40 (.04)**	.40 (.04)**	.15 (.01)**	.15 (.01)**

<sup>a</sup>City-level variables not associated with past-year alcohol use or heavy drinking in the initial regression models (i.e., Model 1) were dropped from analyses; <sup>b</sup>White was the referent category for race/ethnicity.

\* $p < .05$ ; \*\* $p < .01$ .

sity, and enforcement appear, at least in part, to be mediated by individual perceptions of enforcement of underage drinking laws, ease of access to alcohol, and acceptability of alcohol use.

The lack of any associations between city alcohol-policy ratings and adolescent drinking may be partly the result of the permeability of city boundaries (i.e., alcohol could be available to youth in bordering communities), in contrast to national and state alcohol policies, which apply to much larger geographic areas. This may explain why recent studies on relationships between national- and state-level alcohol control policies, in contrast to this study, found inverse associations between stronger policies regulating the availability of alcohol to underage youth and measures of adolescent drinking (Paschall et al., 2009) and underage motor vehicle fatalities (Fell et al., 2008, 2009).

Our findings are consistent with other studies that have documented a relationship between outlet density and drinking and drinking-related problems among youth (Chen et al., 2010; Treno et al., 2003, 2008). Going beyond these studies, however, our findings suggest that the level of adult alcohol use in the community, which may reflect both community drinking norms and social alcohol availability, was strongly and positively related to adolescent drinking. The associations between adult alcohol use and adolescent drinking were at least partially mediated by perceived availability of alcohol and perceived acceptability of alcohol use, indicating that alcohol may be more readily available to adolescents (especially from social sources) in communities where alcohol use is more normative and acceptable. These findings suggest that adult drinking norms and consumption patterns at the community level may be important influences on underage drinking and should be targeted in interventions to reduce drinking and drinking problems among young people.

Overall, outlet density was related to drinking and heavy drinking among youth. These relations persisted even when adult drinking in the communities was included in the models. Interestingly, additional analyses indicated that bar and restaurant density were more closely related to drinking by young people than was off-premise density. That supplemental analyses showed that bar and restaurant density were more strongly related to youths' consumption than was off-premise density is noteworthy because underage youth in the United States rarely drink in on-premise outlets (e.g., Paschall et al., 2007). Some research suggests, however, that on-premise density may be associated with lower levels of adult monitoring and supervision of their children (Freisthler et al., 2009). This lack of supervision may then increase the likelihood of drinking among youth. On-premise density may also increase adult drinking, which, in turn, increases youth access to alcohol through normative processes or through increased social availability of alcohol.

Importantly, we also found that having funds from the California ABC to support enforcement activities was related to lower levels of past-year drinking in the communities. This finding is consistent with deterrence theories and prior research, which suggest that increasing the likelihood of apprehension can be effective in reducing problem behaviors, including underage drinking. Moreover, this finding and prior research (Wagenaar et al., 2005) suggest that providing resources and training for adequate enforcement may be an important point of intervention.

Finally, the finding that the effects of adult alcohol use, outlet density, and enforcement are at least partially mediated through adolescents' perceptions or beliefs suggests that media campaigns or social marketing may be an important component of prevention programs. In particular, increasing awareness and visibility of enforcement activities may be essential to obtain a deterrent effect (Ferguson et al., 2000; Hingson et al., 1994; Voas et al., 1998).

The present study provides evidence that community drinking norms, outlet density, and local enforcement activities are related to level of drinking among youth. Although our findings are suggestive, some shortcomings should be noted. The causal nature of relationships between community-level variables and adolescent drinking cannot be inferred conclusively because we were not examining change in adolescent drinking in response to change and community-level variables. Additionally, this study only measured policy enforcement with a measure of funding from the California ABC. This measure may not completely reflect levels and types of enforcement across the 50 cities and thus may have led to an underestimation of the importance of local enforcement for preventing drinking among youth.

Additional research is needed to better understand how local alcohol policies and enforcement may influence alcohol availability to youth and underage drinking. Studies that focus on how local alcohol policies get implemented or intervention studies focusing on policy change would be particularly informative. It is also important to better understand the mechanisms through which policies affect young people and prevent underage drinking. At the present time, only two waves of survey data collection have been completed. As a result, the mediational analyses cannot be considered definitive unless stationarity and equilibrium are assumed (Cole and Maxwell, 2003). A third wave of data was collected beginning in fall 2011. When these data become available, we will be able to better address mediational processes. Despite these shortcomings, the present study provides an important step toward understanding if and how local policies may influence drinking and drinking problems among young people. Although tentative, our findings can help communities make decisions about prevention and the allocation of prevention resources.



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