The Risk of Assaultive Violence and Alcohol Availability in Los Angeles County

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ABSTRACT

Objectives. Although there is considerable evidence that alcohol consumption facilitates assaultive violence, the extent to which alcohol outlets in a community influence assaultive violence remains controversial.

Methods. To assess the geographic association between city-specific rates of assaultive violence and alcohol-outlet density, an ecologic analysis of the 74 larger cities in Los Angeles County was conducted for the 1990 reporting year.

Results. Sociodemographic factors alone accounted for 70% ($R^2 = .70$) of the variance in the rate of assaultive violence in a multiple regression model. Adding the variable for alcohol-outlet density to the model yielded a significant positive slope. The magnitude of this relation indicates that in a typical Los Angeles County city (50 000 residents, 100 outlets, 570 offenses per year), one outlet was associated with 3.4 additional assaultive violence offenses in 1990.

Conclusions. These findings indicate that higher levels of alcohol-outlet density are geographically associated with higher rates of assaultive violence. This association is independent of measured confounders, including city-level measures of unemployment, ethnic/racial makeup, income, age structure, city size, household size, and female-headed households. (*Am J Public Health.* 1995;85: 335–340)

Introduction

The nation's leading health officials have declared a public health emergency to deal with the problem of assaultive violence in the United States.[1,2] The declaration is an acknowledgment that existing crime prevention policy has failed to bring national rates of assaultive violence under control. Rates of assaultive violence continue to remain at historic levels, and recent trends suggest these rates may be rising even higher.[3]

Existing crime prevention policy is based on economic theory. It is believed that increasing the cost associated with committing a crime will deter or incapacitate offenders.[4] Consequently, the number of incarcerated Americans has more than tripled since 1975, making both the rate at which Americans are incarcerated and the number of Americans incarcerated the highest in the world.[5] Unfortunately, national rates of homicide remain four to five times higher than those of other developed nations.[6]

Declaring assaultive violence a public health emergency implies that the problem of assaultive violence may yield to public health interventions. Approaches that appear to have been successful in reducing the risk of chronic diseases have thus been proposed for countering the epidemic of assaultive violence.[7] Central to the chronic-disease approach is the role of sociocultural factors in both the prevention and etiology of disease.

For many years, researchers have investigated the hypothesis that alcohol consumption is a cause of assaultive violence. Experimental studies of the effects of alcohol consumption in animals and humans consistently find an increased tendency to behave aggressively when alcohol is consumed,[8] and epidemiologic studies find that over 50% of all reported acts of assaultive violence involve alcohol.[6] These relations have been explained in terms of multiple partial processes involving complex interactions among pharmacologic, social, and cultural factors.[9] Despite these complexities, some public health officials have recommended that communities faced with unacceptable levels of assaultive violence address issues related to the physical availability of alcohol.[10] Such recommendations assume a causal process in which mere availability of alcohol increases the risk of assaultive violence via increased alcohol use or abuse. However, we know of no published studies providing epidemiologic evidence for or against such a causal model.

The purpose of the current study is to determine whether the rate of assaultive violence in Los Angeles County can be ecologically related to the density of alcohol outlets after accounting for several known correlates of assaultive violence that may confound such an association. City-level data from 74 contiguous cities within Los Angeles County with populations greater than 10 000 in 1990 were used for the analysis.

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Research Hypotheses

The empirical or theoretical rationale for inclusion of the following variables in regression models is given below.

1. Alcohol-outlet density. Although we know of no previous work relating outlet density to violence per se, there is statistical evidence linking both outlets where alcohol is sold to violence and alcohol-outlet density to a number of nonviolent, alcohol-related outcomes. It has been reported, for example, that certain types of establishments where alcohol is sold are locations in which the situational risk of violence is elevated.[11,12] Situational risk of violence may derive from the physical nature of many alcohol outlets (e.g., unlighted parking lots, lack of security) or from the fact that they bring potential victims and offenders together in situations where the risk of assaultive violence is greater for reasons unrelated to alcohol consumption itself.[13,14] Data from state, county, and city levels of aggregation have been used to link outlet density to a number of alcohol-consumption–related outcomes, including alcohol-associated motor vehicle crashes,[15] arrests for drunk driving and public drunkenness,[16–18] cirrhosis mortality,[19] and alcoholism rates.[20]

2. Economic structure. Economic structural approaches to understanding assaultive violence hypothesize that poverty and lack of opportunity predispose individuals to violent behavior.[6] One such model assumes that violence arises when individuals are denied legitimate access to resources for the realization of cultural goals.[21]

3. Ethnicity. Minority status is strongly associated with being a victim of violence.[6] Blacks, in particular, are at greater risk of being victims of violent crime compared with Whites for all age categories.[22] The association between minority status and violence may be related to both the economic and cultural factors associated with minority status in the United States, including the physical structure of communities in which minorities tend to live.[23]

4. Age structure. The age structure of a society is one the strongest predictors of violence victimization.[24] Risk of victimization peaks among 15- to 19-year-olds and declines with age. Age structure is also one of the strongest predictors of alcohol consumption, with males in their twenties comprising the group with the highest consumption.[25,26]

5. Urbanicity. The size of communities in the United States is related to rates of assaultive violence.[3] Small cities, rural cities, and suburban areas tend to have lower crime rates than large cities and metropolitan areas. High population density, another aspect of urbanicity, is also positively associated with rates of violence.[27]

6. Social structure. The social structure of a community is believed to be related to rates of violence. Wilson[28] argues that recent economic changes in Black communities have served to concentrate the social isolation of urban ghettos. As the emerging Black middle class has moved out of inner-city areas, the remaining residents have ever-declining resources. These communities can be identified by a high rate of female-headed households.

Methods

Data Collection

All data analyzed are part of the Local Alcohol Availability Database,[16] with *city* as the unit of analysis. Original sources of these data are as follows:

1. Assaultive violence data. Uniform Crime Reports of assaultive violence at the city level were obtained from the California Department of Justice for the 1990 reporting year. The California Department of Justice maintains city-level Uniform Crime Reports data as part of the Federal Bureau of Investigation's Uniform Crime Reporting program. Offenses defined as assaultive violence include criminal homicide, forcible rape, robbery, and aggravated assault.[10] These four types of assaultive-violence offenses for a city in 1990 were added together and divided by the total city population in 1990. The per capita rate was then multiplied by 10 000 to yield the rate of assaultive-violence events per 10 000 population.

2. Alcohol outlet data. In California, seven retail alcohol license types account for over 95% of all alcohol outlets. These seven alcohol license types were used for the determination of outlet density. The specific license types are listed in Table 1. To render the outlet density data into a variable format that could be analyzed statistically, outlets were categorized as off-sale outlets and on-sale outlets. Off-sale outlets are retail establishments where the license type permits alcohol to be purchased for consumption off the premises. Typically, these establishments include minimarkets (license type 20) and liquor stores (license type 21). On-sale outlets are retail establishments where the license type permits alcohol to be purchased for consumption on the premises. Typically, these establishments include bars (license types 40, 42, and 48) and restaurants (license types 41 and 47).

Only license types listed as active by the California Department of Alcoholic Beverage Control were included. The percentage of active licenses that are actually inactive for whatever reason has not been formally assessed; however, informal surveys estimate that 5% to 15% of active outlets may actually be inactive.

Data on the number of alcoholic beverage outlets by type and city were obtained from the California Department of Alcoholic Beverage Control for the 1990 reporting year. The total number of licenses within each outlet category was summed, divided by the total city population in 1990, and then multiplied by 10 000 to indicate the density of alcohol outlets per 10 000 population.

3. Sociodemographic data. Sociodemographic data at the city level were obtained from the California Department of Finance. The Department of Finance compiles Census Bureau data for a number of variables. Only data compiled from the 1990 census were used.

We estimated the economic status of a community by using both median household income and the proportion of unemployed individuals over the age of 16 years. The proportion of Blacks residing within a city in 1990 and the proportion of Latinos residing within a city in 1990 were used as estimates of the racial/ethnic structure of a city. Age structure was defined as the ratio of males aged 20–29 years to males aged 40–44 years.[25] To indicate the level of urbanicity, two measures were incorporated: city size and household formation. We estimated city size by using the total 1990 population from the US census and household composition by using the number of households per 10 000 population. To measure a family characteristic, the proportion of female-headed households to total households was used.

Cities with populations of fewer than 10 000 residents were excluded from the analysis. In previous studies of outlet density at the city level, unstable estimates of outlet density were obtained with cities that had a population of fewer than 10 000. For example, industrial cities within Los Angeles County may have 10 outlets serving the daytime work force but

only 500 residents, yielding unrealistically high outlet densities contributing to a potentially significant outlier effect.[17,18]

Statistical Analyses

Least-squares regression analysis was used to examine the relation between the rate of assaultive violence and the covariates. All variables were transformed to their base 10 logarithms. The purpose of this transformation was to permit interpretation of the results in terms of elasticities. Thus, the regression slope, β, estimates the percent change in the dependent variable associated with a 1% increase in a predictor variable.

It has been proposed that the relation between outlet density and alcohol-related outcomes may be modified by the effects of economic or social structures.[29] To determine whether the relation between outlet density and violence depends on the level of economic and social variables included in the models, two-way interactions between outlet density and all variables were examined. Only logarithmically transformed variables were used to create the interaction terms. The means of the logarithmically transformed variables were subtracted from each observation before multiplication.

Results

Bivariate Analysis

The percentages of different types of alcohol-outlet licenses in Los Angeles County are reported in Table 1. These percentages for 1990 are from the California Department of Alcoholic Beverage Control.

Means and standard deviations of study variables are presented in Table 2. Note that the standard deviation is large relative to the mean for several variables, and the plots of these variables suggest skewed distributions. Logarithmic transformation substantially reduces this skew.

In bivariate analysis all covariates demonstrated an association with the rate of assaultive violence in the expected direction (see Table 3). Off-sale outlet density demonstrated much the same pattern of associations with the covariates as did the rate of assaultive violence, and it is correlated 0.47 with violence. In contrast, on-sale outlets showed a correlation of greater than 0.4 with only one covariate (household composition). This pattern of associations indicates the need for multivariate analysis to isolate the independent association of outlet density and rate of assaultive violence.

TABLE 1—Outlet Categories for Alcoholic Beverage Control License Types, 1990

Outlet Category	License Type	Percentage of All Outlets (n = 16 598), 1990
Off-sale		
Minimarkets	Type 20, beer and wine	23
Liquor stores	Type 21, general	22
On-sale		
Bars	Type 40, beer only public premises	23
	Type 42, beer and wine public premises	
	Type 47, general public premises	
Restaurants	Type 41, beer and wine eating place	32
	Type 48, general eating place	

TABLE 2—Means and Standard Deviations for Study Variables

	Mean	SD
Sociodemographic variables (n = 74)		
% unemployed	6.6	3.04
Median household income	$40 922	$16 071
% Black	6.2	10.1
% Latino	36.5	27.4
Ratio of males 20–29 to males 40–44	2.9	1.1
No. households/10 000 population	3501	821.1
City population	104 632	402 249
Female-headed households/total households	12.5	4.2
Alcohol availability variables		
No. on-sale outlets/10 000 population	11.1	7.2
No. off-sale outlets/10 000 population	8.7	3.2
Total outlets/10 000 population	19.9	9.1
Assaultive-violence variable: assaultive offenses/10 000 population	114.1	74.5

Multivariate Analysis

Only the sociodemographic variables that may confound the relation of interest were included in the initial model (Table 4, model 1). These sociodemographic variables alone explained 70% of the variance in the rate of assaultive violence in the 74 Los Angeles County cities. Three variables—percent unemployed, percent Black, and the ratio of males aged 20–29 to males aged 40–44—remained strongly related to the violence rates in the multivariate analysis. In models 2, 3, and 4 in Table 4, different measures of outlet density were added to the original model. Both off-sale outlet density (β ± SE) (β = .56 ± .21) and on-sale outlet density (β = .36 ± .09) were significantly related to the rate of assaultive violence. However, total outlet density (β = .62 ± .14) was most strongly related to the city-specific rate of violent offenses. The model including total outlet density explained the greatest amount of variance in the rate of assaultive violence (R^2 = .77), increasing the amount of variance explained by 7% over the basic model.

Comparison of model 1 with model 4 in Table 4 provides some estimates of the extent to which the significant relations between covariates and violence rates in model 1 were confounded by alcohol-outlet density. Fifteen percent of the effect of unemployment and 45% of the effect of age structure (young men relative to older men) on the violence rate were explained by total outlet density. In contrast, none of the relation between the percentage of Blacks and the violence rate is explained by alcohol availability.

Because all variables were entered as base 10 logarithms, the regression coefficients can be interpreted as elasticities. In the model for total outlet density (Table 4, model 4), a 1.00% increase in the density of alcohol outlets is associated with a 0.62% ± 0.14% increase in the rate of violent offenses in 1990. Thus, in an

TABLE 3—Pearson Correlation Coefficients among Study Variables

	Violence Rate	Variables for Alcohol-Outlet Density: On-Sale Density	Off-Sale Density	Total Density
Economic structure				
Median income	−.59	−.04	−.52	−.21
% unemployed	.70	−.24	.46	−.03
Ethnicity				
% Black	.57	−.12	−.01	−.10
% Latino	.52	−.24	.50	−.02
Age structure: ratio of males 20–29 to males 40–44	.60	−.10	.55	.11
Urbanicity				
Total population	.22	−.02	−.02	−.02
No. households/ 10 000 population	−.29	.62	−.08	.46
Social structure: % female-headed households	.72	−.31	.39	−.11
Alcohol-outlet density				
On-sale density	.11	1.0	.49	.95
Off-sale density	.47	.49	1.0	.73
Total density	.25	.95	.73	1.0

Note. A coefficient of .23 is significant with $P = .05$ (n = 74).

TABLE 4—Coefficients (Standard Errors) for Regression Models in Which the Dependent Variable Is the City-Specific Rate of Assaultive Violence

	Model 1	Model 2	Model 3	Model 4
Sociodemographic variables (n = 74)				
Median income	.53 (.60)	.43 (.55)	.33 (.58)	.41 (.53)
% unemployed	1.09 (.31)**	1.05 (.29)**	.90 (.31)**	.93 (.28)**
% Black	.18 (.05)**	.18 (.05)**	.21 (.05)**	.20 (.05)**
% Latino	.09 (.20)	−.01 (.19)	−.04 (.20)	−.03 (.18)
Ratio of males 20–29 to males 40–44	.58 (.28)*	.40 (.26)	.42 (.27)	.32 (.25)
Total population	−.01 (.07)	.02 (.06)	.06 (.07)	.06 (.06)
No. households/10 000 population	.79 (.59)	−.01 (.59)	.01 (.64)	−.35 (.58)
% female-headed households	.03 (.38)	.12 (.35)	−.16 (.37)	.16 (.37)
Availability of alcohol outlets				
On-sale density		.36 (.09)**		
Off-sale density			.56 (.21)*	
Total density				.62 (.14)**
R^2	.70	.75	.73	.77
R^2 change (relative to model 1)		.05	.03	.07

Note. Unit of analysis is 74 cities within Los Angeles County in 1990. Coefficients of variables are shown only if included in the model. All variables were entered as base 10 logarithms.
*$P < .05$; **$P < .01$.

average Los Angeles County city of 50 000 residents with 100 alcohol outlets and 570 assaultive violence events in 1990 (see Table 2), one additional outlet is cross-sectionally associated with a 0.62% increase in the number of violent offenses, or 3.4 additional offenses in 1990.

Two-way interaction terms composed of outlet densities and each of the independent variables were included in regression models (see Table 5). The interaction terms for household composition and both outlet-density types were positive and significant. The effect size for off-sale outlets and household composition was larger ($\beta = 4.18 \pm 2.28$) than that for on-sale outlets ($\beta = 2.29 \pm 0.74$), but the latter was estimated with greater precision. These findings indicate that the relation between alcohol outlets and assaultive violence is greater in communities where there are fewer people per household.

Another two-way interaction that modified the relation between outlet density and rate of assaultive violence was that of city size and off-sale outlet density. The interaction is negative ($\beta = -1.72 \pm .52$). This finding indicates that the association between off-sale outlets and assaultive violence is greater in smaller communities. None of the other interactions was significant (see Table 5).

Discussion

Our findings demonstrate a geographic association between the rate of assaultive violence and the density of alcohol outlets in 74 Los Angeles County cities. Specifically, the rate of assaultive violence across Los Angeles County cities during 1990 was significantly associated with the density of both on-sale and off-sale alcohol outlets. Although these findings are from analysis of cross-sectional ecologic data, which means that numerous alternative explanations are plausible, they are consistent with a model in which alcohol availability has an impact on violence. As mentioned above, evidence from other sources renders such a model plausible. For example, factors associated with the environment surrounding alcohol consumption have been linked to assaultive violence in various types of studies.[7,8,10–12,30]

Cross-sectional relations between alcohol-outlet density and other alcohol-related outcomes have been detected across several domains of outcome. These include alcohol-related civil offenses, alcohol-related mortality, and alcohol-involved motor vehicle crashes.[15–20] Despite the fact that these results are consistent with this previous body of research and do suggest a shared pathway mediated by outlet-sensitive factors, a number of limitations must be noted in the interpretation of these findings. First, unmeasured or confounding factors could account for the findings presented. Longitudinal analysis of ecologic data on this issue would be instructive, because some unmeasured confounders would be filtered from difference scores.[31] Second, the degree to which city as a unit of analysis adequately

TABLE 5—Coefficients (Standard Errors) from Models Regressing City-Specific Rates of Assaultive Violence on Interaction Terms Composed of Outlet Density and Listed Covariates

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Main effects								
Availability of alcohol outlets								
On-sale density	.54 (.26)*		.34 (.20)		.38 (.13)*		.30 (.09)*	
Off-sale density		.12 (.57)		.21 (.45)		.23 (.23)		.32 (.25)
Covariates								
% Black	.19 (.05)*	.21 (.05)*						
% unemployed			1.05 (.31)*	.97 (.33)*				
Total population					−.03 (.08)	.03 (.09)		
No. households/10 000 population							.08 (.56)	.14 (.65)
Interaction								
Density × covariate	.11 (.14)	−.29 (.35)	−.03 (.37)	−.67 (.78)	.09 (.33)	−1.72 (.52)*	2.29 (.74)*	4.18 (2.28)*
R^2	.75	.72	.74	.72	.74	.76	.78	.73

Note. The interaction term is composed of the availability variable and the covariate variable, whose coefficients are also presented in each labeled model column. Only the interaction term and the main effects are presented for each model. Additional sociodemographic covariates were included in the model (see Table 4), but the coefficients are not shown here. All variables were transformed to base 10 logarithms before analysis.
*$P < .05$.

captures the relation in question was not determined. Further research is needed to determine the rate at which cross-boundary purchases and outcomes occur at several units of analysis (e.g., county, city, zip code, census tract) so that the potential for bias associated with the relative size of the unit of analysis can be assessed. Third, the use of outlet-density data as a proxy measure of alcohol availability does not acknowledge that a number of other factors are also associated with the availability of alcohol (e.g., price, alcohol content of the product). Finally, the proportion of assaultive-violence offenses attributable to alcohol could not be estimated. Thus, the interpretation of these findings assumes that this proportion is relatively constant across Los Angeles County cities, which may not be the case. However, a preliminary study of California cities demonstrates that when alcohol involvement is recorded by local police, the proportion of offenses in which alcohol is involved is consistent across cities.[32]

In the multivariate analysis the only covariates besides outlet density that were consistently associated with the rate of assaultive violence were percent Black and percent unemployed. Considering that all the covariates have previously been described as predictors of assaultive violence and that all the covariates demonstrated an association with assaultive violence in bivariate analysis, the relative importance of the percent Black and percent unemployed variables is noteworthy.

The positive interaction between alcohol outlets and household composition seems paradoxical. Communities in which the number of individuals per household is low are generally thought to have a higher living standard.[6] The finding of a positive interaction indicates that fewer persons per household may be a proxy for social isolation, which may facilitate the relation between outlet density and assaultive violence. The interaction between alcohol outlets and city size suggests that in small communities off-sale outlets (i.e., convenience stores and liquor stores) serve a broader social role compared with off-sale outlets in larger communities, where other types of commercial establishments (e.g., malls) serve the same social role but do not emphasize the sale of alcohol.

It is worthwhile to place these findings in the context of existing theories used to describe associations among alcohol-related outcomes, alcohol consumption, and alcohol availability. Skog suggested that a community-level factor like community norms must be invoked to explain the consistency with which a log normal distribution can be applied across populations to characterize the distribution of alcohol consumption within a population.[33] In this context alcohol-outlet density could represent an environmental factor that shapes community norms related to alcohol consumption in a community.

Pernanen also postulated a mediating effect for community norms in the relation between alcohol use and violence.[9] However, Pernanen suggested that violent behavior in a community is not necessarily associated with norms affecting alcohol consumption but with norms that have arisen around situations in which alcohol is consumed. According to Pernanen, alcohol predisposes individuals toward excessive forms of behavior. Over time, a particular behavior can become associated with a particular situation such that the behavior becomes expected or normative for the situation.[9] Thus, even for a sober individual the normative expectation in certain situations is to express the stereotyped excessive behavior. The density of alcohol outlets may be a factor that tends to influence this process of cultural evolution. As the number of venues in which alcohol-influenced behavior is witnessed increases, the adoption of excessive norms is promoted.

The fact that some individuals are able to resist community norms more than others indicates that individual-level factors protect against deleterious community norms. However, the implication of these findings is that interventions designed to help individuals resist deleterious community norms could be supported by community-level interventions directed at alcohol availability. These efforts might promote the evolution of less deleterious community norms.

In summary, the findings add assaultive violence to an increasing list of alcohol-related outcomes that have been associated with alcohol-outlet density in

ecologic analyses.[15–20] Although no inferences can be drawn as to the direction of the relation between outlet density and assaultive violence, the findings do indicate that higher levels of outlet density are geographically associated with a higher rate of assaultive violence independent of the effect of a number of potential confounders. Similar relations between outlet density and other alcohol-related outcomes have prompted public health officials to recommend that localities use measures that address the physical availability of alcohol to reduce alcohol-related problems.[10,34] □

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