Published in final edited form as:
Alcohol Clin Exp Res. 2008 August ; 32(8): 1372–1379. doi:10.1111/j.1530-0277.2008.00708.x.

Alcohol Outlets, Youth Drinking and Self-Reported Ease of Access to Alcohol: A Constraints and Opportunities Approach

Andrew J. Treno, Ph.D., **William R. Ponicki, M.A.**, **Lillian G. Remer, M.A.**, and **Paul J. Gruenewald, Ph.D.**
Prevention Research Center, 1995 University Avenue, Suite 450, Berkeley, CA 94704

Abstract

Background—Despite recent research examining youth access to alcohol, the extent to which relative ease of access to alcohol from various sources translates into the use of these sources is not known.

Methods—Patterns of adolescent alcohol access in California were studied using a hierarchical analysis of self-reported and archival measures. A survey of 30 youths age 14-16 in each of 50 zipcodes selected to maximize variability in median household income and off-premise outlet densities was conducted.

Results—1) Both actual use of and perceived ease of access to formal sources were positively associated with off-premise outlet density (a measure of formal access). 2) Actual use of informal sources was negatively associated with outlet densities. 3) Perceived and realized informal access were associated positively with deviance and negatively with conformity. 4) Deviance was associated with increased and realized access from both formal and social sources, whereas conventionality was only associated with realized and perceived informal access.

Conclusion—Correlates of perceived and actual alcohol access differ somewhat, and the differences between informal and formal access (both perceived and actual) are many, creating a complex picture of the patterns of underage access to alcohol. Youth drinking is affected by opportunities and constraints. Specifically, as one form of access becomes constrained, youth appear to circumvent restrictions by relying on other modes of access. Thus interventions targeting formal alcohol access by youth may result in a shift to reliance on informal or social sources

Keywords

youth drinking; alcohol availability; alcohol access

Introduction

Over the past decade much research has addressed associations of actual ease of access to alcohol (as indexed by alcohol outlet densities and low enforcement of underage sales laws) and perceived ease of access to alcohol (as indexed by survey based self-reports) to subsequent drinking and related problems among young people (Abby et al., 1993; Dent et al., 2005; Jones-Webb et al., 1997; Klepp et al., 1996; Treno et al., 2003;). Additional research has considered the role of parental attitudes and parental provision of alcohol to young people on youth drinking and related problems (Foley et al., 2004). Across these studies, a consistent finding is that increased alcohol availability from both formal (i.e.,

Corresponding author: Andrew J. Treno, Prevention Research Center, 1995 University Avenue, Suite 450, Berkeley, CA 94704, Telephone: (510) 883-5760, Fax: (510) 644-0594, andrew@prev.org.

commercial) and informal (i.e., social) sources is associated with increased youth drinking and related problems. Based on this research, the field has experienced a conceptual shift from an exclusive focus on availability by formal sources (i.e., direct purchases by youth) to the broader social networks of family, schools and friends through which alcohol might be obtained (Harrison et al., 2000; Treno et al., 2005; Treno et al., 2007; Wagenaar et al., 1996).

Still, much remains to be learned about the relationship between relative ease of access to alcohol from various sources and the actual use of these sources. Although ease of access to alcohol should logically influence actual use, a person's perceptions about ease of access may be affected by their experiences with alcohol. Both perceived ease of access and reported use of alcohol from formal sources should be affected by outlet density measures, but are these density impacts simlar? Outlet densities may positively affect an individual's access and use from informal sources by increasing their friends' formal access, but could also reduce actual use from informal sources if individuals substitute from informal to formal access. What is the net impact of outlet densities on use of informal sources?

This paper examines the relationship between alcohol access and actual use in a population of California youths aged 14 to 16. Physical access to alcohol, as measured by outlet densities, is related to perceived access and reported use from both formal and informal sources. Multiple factors that support alcohol access by adolescents are considered. At the individual level, these factors can be divided into three categories: (1) personal factors such as age, gender, and deviance (willingness to break the law); (2) actual densities of alcohol outlets; and (3) additional environmental constraints and opportunities regulating individual access such as parents who drink, the amount of spending money and mobility (e.g., having a driver's license or friends that drive), and age of friends.

The current research is best understood as an application of the general theory of the ecology of alcohol access, subsequent drinking and resulting problems (for a theoretical discussion of this perspective see Freisthler and Gruenewald, 2005; Holder et al., 2005; LaScala et al., 2005). According to this view, as applied to young people, youth consumption occurs within the context of both opportunities to drink and constraints against such drinking. Thus, outlet densities may directly affect the way young people obtain alcohol. Young people who reside in areas with high concentrations of alcohol outlets might be expected to rely on formal access, but may have more informal access as well due to increased formal purchases by friends. Youths' ability and propensity to obtain alcohol from formal and informal sources should also be affected by individual level characteristics such as propensity to engage in deviant behaviors and personal factors, such as age and ability to drive, which might affect outlet utilization patterns In the current research we test 5 hypotheses. According to Hypothesis 1, we would expect to see positive correlations between perceived ease of access and actual use within each source. According to Hypothesis 2, perceived alcohol availability should be related to similar individual and zipcode characteristics as actual access from the same source. According to Hypothesis 3, we would expect to find that both perceived ease of formal access and actual formal use are positively related to the number of outlets near a respondent's home. According to Hypothesis 4, we expect to find increased use of formal access as financial resources increase and increased use of social sources as forms of social capital (e.g., parents who drink or older friends) increase. According to Hypothesis 5, we expect both formal and informal access to be associated with general social-psychological traits such as deviance (positively) and conformity (negatively) associated with drinking behaviors.

Methods

Sample Selection

The current research used a hierarchical sample of surveyed youths age 14 to 16 within California. The survey was designed to obtain 30 completed surveys in each of 50 zipcodes in order to provide adequate statistical power to detect significant causal effects due to both individual-level and aggregate neighborhood-level characteristics. To ensure adequate completed surveys, only those 1,076 zipcodes (out of 1,647 statewide) with at least 200 youths age 14 to 16 were only considered for inclusion in the study (U.S. Census Bureau, 2001). These candidate zipcodes were picked to ensure adequate statistical power at reasonable costs. Specifically, zipcodes were selected from specified strata to ensure sufficient variability in two major constructs of interest: off-premise outlet density and median household income. Off-premise alcohol licenses obtained from the California Department of Alcoholic Beverage Control as of January 2000 were geocoded to the zipcode level. A preliminary spatially-corrected regression analysis was used to rank each zipcode's outlet density per roadway mile relative to its expected value based on population per roadway mile. Zipcodes were eligible for selection from three categories of both this outlet-density index and median household income (GeoLytics, 2001). The “low” category for each indicator includes the lowest 25% of zipcodes, the “medium” group has the middle 25% (i.e., ranked between 37.5% and 62.5%), and the “high” group has the top 25%. Ten zipcodes were then randomly selected from each of the 5 groups defined by their categories of outlet density and median income, respectively: Low-Low, Low-High, Middle-Middle, High-Low, and High-High, subject to the requirement that each selected zipcode was separated by at least two unselected zipcodes using ArcGIS 8.1 (Environmental Systems Research Institute, Inc. (ESRI), 2001a).

Telephone survey

Person-level data were collected using a Computer Assisted Telephone Interview (CATI) survey of 30 youths age 14-16 in each of the 50 selected zipcodes. The instrument included questions about background and demographics, alcohol access, alcohol consumption, drinking intentions, problems and venues, mobility (driving and riding with friends), normative beliefs, alcohol expectance, deviance, conventionality, social control, parental monitoring and information on their friends.

Due to the difficulty of targeting households by zipcode and reaching households with youths age 14-16, a listed sample was purchased from Marketing System Group (MSG). Of the eligible households, 43.2% completed interviews. Ultimately 1,541 surveys were collected with an average of 30.8 interviews per zipcode. Complete data on all measures were available for 1,419 respondents.

Individual level variables

Data on individual and family characteristics were collected from the telephone survey and recoded. Gender was coded 1 for male and -1 for female and ethnicity was recoded as 1 for Hispanic and -1 for non-Hispanic. Race was a multiple response question; 92% of respondents gave only one answer but multi-racial was an option, 8% gave at least 2 responses and 0.6% gave 3 responses. No one gave more than three responses. Effects codes were created for race in four categories including white, African-American, Asian (including Filipino and Pacific Islanders) and “other” (including multi-racial, Native American, other, and unspecified). Three effects coded race variables were created by coding “other” as -1 in each case, the specified race as 1 and the other two races as 0. Only the two minority variables were used in the final analyses. Spending money available to the respondent was recoded to dollars per week from the categorical responses. A single mobility variable was

created with 0 if neither the respondent nor his/her friends could drive, 1 if either could and a 2 if both could drive. An indicator variable was created for whether the youth thought that either parent had had any alcohol to drink in the past year.

Ten survey items were used to create a measure of deviance, nine of which are identical to items used by Grube et al. (2002). Respondents were asked how many times in the past 12 months they had done something categorized as never, 1-2 times, 3-5 times, 6-10 times and more than 10 times. Because the last of these categories does not have a logical midpoint, the responses were recoded as the low end of each range: 0, 1, 3, 6, and 11 respectively. Questions included: (1) given a false excuse for missing work or class; (2) lied to cover up something you did; (3) purposely damaged other people's property; (4) taken things from a store or shop without paying for them; (5) been in a fight where you hit or shoved someone; (6) skipped work or school without permission; (7) sold illegal drugs; (8) taken money that did not belong to you; (9) threatened someone with a gun, knife, or other weapon; and (10) taken illegal drugs? Chronbach's Alpha for the 10 items is 0.727, suggesting that the items are internally consistent. Because factor analysis did not reduce these 10 pieces of information to a manageable number of exogenous measures, a single deviance indicator was derived from the sum of the 10 items. The summed scale for the 10 items ranges from 0 to 75 with a mean of 6.75 and a standard deviation of 9.14 and skewness of 3.00. A square-root transformation of this sum was employed to reduce this positive skew.

Conventionality was measured using a series of items that address the respondents' bonding to three traditional social institutions: church, school, and family. Most of these items are from Grube et al. (2002) with minor elaboration. Respondents were asked how often they attend religious services, how important religion is to them personally, and how much they like or dislike attending religious observances. Relating to education they were asked how much they like or dislike school, how important it was to them to succeed in school, and what is the highest level of education they hope to attain. Regarding family, they were asked how important it was to get along with their mother/female guardian, how close they felt to her, and how much they liked going places with her. A similar series was asked for relationship with the father or male guardian. Questions were recoded as necessary to create a scale where increasing values are increasingly conventional. A sum of scores was not appropriate due to differing scales among these variables, so an unrotated first principle component of the conventionality items were used for analysis.

Perceived availability of alcohol was measured by asking how easy the respondent thought it would be to get alcohol from parents, a friend, a sibling, a person over 21, or by purchasing it themselves without an ID. These variables were recoded as -2 for very difficult -1 for difficult, 0 for no response, +1 for somewhat easy, and +2 for very easy. The first four items were added to create a variable of perceived ease of informal access and the last was used as the variable for perceived ease of formal access.

Data for alcohol licenses was obtained from the California Department of Alcoholic Beverage Control. Active off-premise alcohol retail outlets (license type 20 and 21) in January 2004 were geocoded to premise address and the number of off-premise establishments within a two-mile buffer of the respondent's residence was computed in TransCAD version 4.7 (Caliper, 2004). We restricted our inclusion of outlets to off-premise outlets as very few 14-16 year olds (26 of 1,541 in our sample) had ever obtained alcohol from a bar or restaurant. The two-mile buffer was used because zipcodes are not uniform in size (although they are somewhat uniform in character), and they seem too large for the mobility of most 14-16 year olds. In California, zipcodes average 95.6 square miles in area with a median of only 17.3 square miles. If we assume zipcodes are approximately square (in fact they can be quite irregular in shape), the average diameter would be nearly 10 miles

and the median diameter 4.2 miles. Because adolescents are often limited in mobility, we attempted to get a more consistent outlet density measure by aggregating counts of geocoded outlets within specified radii of each respondent's home. Using perceived formal access as the dependant measure, and multiple buffered distances for the off-premise outlet density measure, the density measure became highly significant at 1.25 miles with the basic model and somewhat further with more complex models. Because this distance is less than the mean or median diameter of a zipcode, we decided to use an individual-specific measure of actual off-premise density rather than a zipcode-level density, and settled on the log of the count of off-premise outlets within 2 miles of the respondent's home.

Actual access was measured by recoding the categorical questions on times in the past year that the respondent drank alcohol that was obtained from various sources. Initial categories were never, once or twice, 3 or 4 times, 5 or 6 times, more than 6 times. These were recoded to 0, 1, 3, 5, and 7 times (respectively). Purchasing with a fake ID and purchasing without a fake ID were added to create a measure of formal access. Got it from someone you know who is age 21 or older, someone you know who is under 21, home with your parent's permission, home without your parent's permission, a brother or sister, another relative, a stranger bought it for you, and you took it from a store without paying for it were added to create a measure of informal access. The last two of these sources require the youths' proximity to an alcohol outlet (to approach a stranger or to shoplift), but are coded as informal access because they do not involve a standard purchase. Supplementary analyses coding these two sources as formal access produced similar results.

Zipcode Level Variables

Race, ethnicity, home ownership, and median household income variables were taken from the U.S. Census 2000 Summary File 3. Variables included % African American (single race black), % Asian/Pacific Islander (Asian only or Pacific Islander only), % Hispanic (Hispanic any race), % owner occupied (of occupied housing units), and median household income. Population density was computed as total census population divided by the area in square miles of the zipcode polygon from the ESRI 2001 shape file (ESRI 2001b).

Analysis Model

Separate regression models were estimated for four outcome measures: (1) perceived ease of access from formal sources; (2) perceived ease of access from informal sources; (3) number of times drank alcohol obtained personally from formal sources; and (4) number of times drank alcohol obtained from informal sources. Each regression included an identical set of explanatory variables measured at the individual level (deviance, conventionality, male, age, race, spending money, own and friends' ability to drive, average age of close friends, and off-premise alcohol outlets within a two mile radius) or the zip-code level (population density per square mile, racial composition, percent of housing that is owner occupied, and median household income). The nesting of surveyed individuals within zipcode sampling units violates the standard regression assumption that errors are independent, and could lead to overstating the precision of regression coefficients. To correct for this, all analyses were computed as hierarchical linear models using HLM 5.05 (Raudenbush et al., 2000). Both the individual (level 1) and aggregate (level 2) variables were grand-mean centered in each analysis. The regressions predicting actual use were estimated as Poisson models since these outcome variables indicate the number of times that individuals consumed alcohol from each source and many of these values were zero.

Results

Table 1 presents the basic descriptive statistics (i.e., mean or percentage and standard deviation) characterizing the analysis sample. Table 2 presents pairwise correlations between the four outcome measures used in this paper: perceived ease of access and actual use from both formal and informal sources. Each of these correlations is significantly greater than zero. Perceived access correlates most closely with actual use when both are from informal sources (0.47), while the next highest connection is when both are from formal sources (0.22). Perceived access via one source is less-positively related to actual use of the other source (e.g., perceived informal access versus actual use of formal sources). Youths reporting high perceived access via formal sources also tend to report high perceived access via informal sources (correlation = .21). Similarly, those who use formal sources more frequently also tend to use informal sources more often (correlation = .35).

Table 3 presents the results of our analyses explaining self-reported perceived ease of access from various formal and informal sources. Easy access from formal sources has a significant positive association with alcohol outlet density, available spending money, deviance, and zipcode-level percents Hispanic and Asian. Ease of access from informal sources has a significant positive relationship with available spending money, mobility (status as a licensed driver or having friends who can drive), age of friends, parental drinking, deviance and age, while it is negatively related to conventionality and the individual being African American.

Table 4 presents similar analyses explaining the number of times the respondent accessed alcohol from formal and social sources. At the individual level, actual formal access was positively associated with outlet density, average age of friends, deviance, and male gender, and negatively associated with parental drinking and being Asian/Pacific Islander. At the aggregate level, realized access from formal sources was positively associated with the zipcode percents Hispanic and Asian/Pacific Islander and negatively associated with percent African-American. At the individual level, use of social sources for alcohol access was associated positively with spending money, age of friends, parental drinking status, deviance, and Asian/Pacific Islander, and associated negatively with off premise outlets within 2 miles, conventionality, Hispanic ethnicity, and African-American ethnicity. At the aggregate level, use of informal sources was associated positively with percent Asian/Pacific Islander, population density, and percent owner occupied housing, while being negatively associated with proportion African-American ethnicity.

Discussion

The results presented here indicate that relationships among outlet densities, perceptions about ease of access from various sources, and actual use of formal and informal sources by young people are quite complex. Reviewing the four hypothesis and the four classes of factors we posited as linking them, we found:

(Hypothesis 1): As predicted, the correlations reported in Table 2 indicate that perceived access from a given source is strongly related to actual drinking via that source. Although the direction of causation between perceived access and use is not entirely clear, they move together more closely within a given source (formal versus informal) than between sources.

(Hypothesis 2): Do actual and perceived access from a given source show similar associations with exogenous measures? While prior research has found both alcohol consumption and perceived access to alcohol to be predictors of future drinking behavior among adolescents, the correlates of perceived and actual alcohol access differ

somewhat, and the differences between informal and formal access (both perceived and actual) are many, creating a complex picture of the patterns of alcohol access. For formal sources, both actual and perceived access have a significant positive relationship with outlet density, deviance, and the zipcode percentages Hispanic and Asian, but six other variables have significant effects in one but not both of these analyses. For informal sources, both actual and perceived access have a significant positive association with available spending money, average age of friends, parental drinking, and deviance, and both have a significant negative relationship with conventionality and being African American, but nine other variables have significant effects in one but not both regressions. Thus while there are many similarities between the results for actual and perceived access, there are also many differences.

(Hypothesis 3): As predicted, both actual use and perceived ease of access to formal sources were positively associated with off-premise outlet density. Additionally, actual use of informal sources had a significant negative association with outlet densities (a measure of formal access). This rather striking finding suggests that the effects of outlet density may be to shift behavioral contexts from informal to formal outlets rather than to simply increase overall usage. However, this negative association between outlet density and use from informal sources was not statistically significant in supplementary analyses where shoplifting and asking a stranger to purchase alcohol were characterized as formal access.

(Hypothesis 4): Various forms of capital are clearly associated with the manner in which youth access alcohol. Young people who have more discretionary spending money have higher perceived ease of access of formal sources, though not increased usage of formal sources. As the average age of friends increases, actual access from both formal and informal sources increases; this measure is also associated with perceived ease of social access but not with perceived formal access to alcohol. Interestingly, having parents who drink is positively associated with both perceived and realized ease of access from social sources, but negatively associated with realized formal access. Again, this latter finding suggests that in the presence of one form of access, youth may find themselves less likely to use other forms.

(Hypothesis 5): Both perceived and realized informal access are associated positively with deviance and negatively with conformity. Deviance is associated with increased and realized access from both formal and social sources, whereas conventionality is negatively associated only with realized and perceived informal access. This is likely explained by the fact that these constructs are not, strictly speaking, opposites. Deviance is a measure of action while conventionality is a measure of attachment to traditional institutions. Assuming people congregate with others of similar psycho-social values, conventional adolescents would have limited access to social sources of illegal substances including alcohol. Perhaps, engaging in actual purchase of alcohol, rather than simply relying on the social environment, requires the higher level of problem behavior associated with deviance.

One finding, not originally anticipated, concerned the relationship between actual use of formal and informal sources of alcohol at the individual level. Of the seven individual level predictors of formal access only two predict informal access in the same direction, while three are in the opposite direction. Specifically, actual use from both sources had a significant positive relationship with the average age of close friends and deviance. However, outlet density had a significant positive coefficient for formal and significant negative effect for informal use, whereas parental drinking and being Asian had negative effects for formal and positive for informal use. This suggests that different predictors operate differently for actual formal and informal access and that differently situated individuals may utilize different routes for access. Young people whose parents drink, and

who presumably are likely to have alcohol in the home, utilize formal routes less often while those who live in areas with high alcohol outlet densities utilize social sources less often. Interestingly, individuals with older friends are more likely to utilize both forms of access.

Limitations

These analyses do present a number of limitations. While the distribution by age group (mean 14.98 with range 14 to 16), gender (51.1% male) and ethnicity (35.0% Hispanic) of respondents corresponded to expectation and the mean of the sampled zipcodes, the racial distribution has fewer minorities and fewer whites (51.1% compared to 59.8% average for the single race category at the zipcode level) than expected. This may be due to selection of "other" and "multi-racial" as racial categories by young respondents. For example, 76.7% of youths who gave Hispanic as their ethnicity gave only "other" as their racial category.

An issue that affects the analysis power of this survey is the unexpectedly low rate of drinkers. Overall, only 10% of 14 year olds, 19.6% of 15 year olds, and 27.5% of 16 year olds in this survey had consumed any alcohol in the past 30 days. By comparison, in the Monitoring the Future surveys of 2003 and 2004, 19.7% and 18.6% of eighth graders (generally 13-14 years old) and 35.4% and 35.2% of 10^{th} graders (generally 15-16 years old) had drunk some alcohol in the past 30 days (Monitoring the Future (MTF), 2005). This may be the result of using a listed sample, and the difficulty in reaching this adolescent population.

Implications

The implications of the current findings extend beyond considerations of outlet effects or even youth consumption more broadly considered. The consideration of youth drinking provides clear illustration of the opportunities and constraints approach, largely because of the specific legal and social frameworks in which young people live. Young people may have parents who drink, friends who drive, outlets that may or may not sell to them, etc. To illustrate, assume a young person in a community with one outlet has a 50% chance of a "successful" purchase at that outlet. However, another youth with two such outlets and similar individual chances per outlet has 75% chance of a successful purchase. Of course, as the number of outlets increase the probability of a successful purchase approach certainty. In fact, even such an assumption of independent probabilities likely provides an underestimate because as outlets saturate communities competitive pressures to sell increase while social monitoring of problematic outlets strain social resources. Similarly, as a young person's social circle expands to increase other young people with access to alcohol, availability through social sources increases. This latter observation suggests the importance of considering the analysis of youth social networks relative to informal access.

An additional implication of the current findings pertains to the relationship between social and formal access. Specifically, as one form becomes constrained, youth may circumvent such restrictions by relying on other modes of access. Thus, interventions targeting formal access may in fact simply shift youth to reliance on informal or social sources. Moreover, the distinction here between formal and informal modes of access should not be overdrawn. One older youth's purchase may translate into another possibly younger youth's social access.

To what extent do these findings provide support for prior research in this area? First, and in support of prior work, this research indicates that young people differently situated in terms of age and gender access alcohol in different ways, although social access predominates across groups (Harrison et al., 2000). Second, as a result, it suggests that environmental prevention efforts currently focusing on social access (Treno et al., 2005; Treno et al., 2007;

Wagenaar et al., 1996) are well directed. Third, it provides support for the view that perceived alcohol availability and consumption are associated (Jones-Webb et al., 1997), although the nature of this association is impossible to fully understand given the use of cross-sectional data sets. For example, does perceived availability lead to attempted purchases, or is that perception more the result of successful past attempts at obtaining alcohol? Clearly, the development of longitudinal designs is required for the determination of causal directionality. The unique contribution of the analysis presented here is the social ecological frame in which it is presented and the notion that observed associations are the result opportunism in response to alcohol availability. How such patterns of availability and access develop over time, however, remains a question for future research.

More careful study needs to be directed toward the problem of youth access to alcohol. At the individual level, more complex models need be developed to understand why and how youth pursue and access alcohol in the social environment. Also, population models are needed to address how alcohol “flows” throughout communities and into the hands of young people. At what point, for example, have alcohol outlets reached such saturation levels that communities become overwhelmed with problems of youth access? Finally, careful consideration needs be given toward the economic interests that provide the ultimate source of such access.

Acknowledgments

Research for and preparation of this manuscript was supported by NIAAA Research Center Grant #P60-AA06282 to Prevention Research Center, Pacific Institute for Research and Evaluation.

References

Abbey A, Scott RO, Smith MJ. Physical, subjective, and social availability: Their relationship to alcohol consumption in rural and urban areas. Addiction. 1993; 88:489–499. [PubMed: 8485426]

Caliper, Inc.. TransCAD [computer program]. Version 4.7. Newton, MA: Caliper, Inc.; 2004.

Dent CW, Grube JW, Biglan A. Community level alcohol availability and enforcement of possession laws as predictors of youth drinking. Preventive Medicine. 2005; 40:355–362. [PubMed: 15533551]

Environmental Systems Research Institute, Inc (ESRI). ArcGis [computer program]. Version 8.1. Redlands, CA: ESRI; 2001a.

Environmental Systems Research Institute, Inc (ESRI). ESRI Data & Maps Media Kit Western United States CD #4. Redlands, CA: ESRI; 2001b.

Freisthler, B.; Gruenewald, PJ. Social ecology and the invention of new regulatory strategies for preventing drug and alcohol problems. In: Stockwell, T.; Gruenewald, PJ.; Toumbourou, JW.; Loxley, W., editors. Preventing Harmful Substance Use: The Evidence Base for Policy and Practice. John Wiley & Sons, Ltd.; Chichester, West Sussex, England: 2005. p. 291-306.

Foley KL, Altman D, DuRant RH. Adults' approval and adolescents' alcohol use. Journal of Adolescent Health. 2004; 35(4):345e17–e26. [PubMed: 15830441]

GeoLytics, Inc.. CensusCD Long Form (SF3). Version1.0. E. Brunswick, NJ: GeoLytics, Inc.; 2001.

Grube, JW.; Keefe, DB.; Stewart, K. Guide to Conducting Youth Surveys. Updated Edition. U.S. Department of Justics, Office of Justice Programs, Office of Juvenile Justice and Delinquency Prevention; Washington DC: 2002. available at http://www.udetc.org/documents/YouthSurveys.pdf

Harrison PA, Fulkerson JA, Park E. The relative importance of social versus commercial sources in youth access to tobacco, alcohol, and other drugs. Preventive Medicine. 2000; 31(1):39–48. [PubMed: 10896842]

Holder, HD.; Treno, AJ.; Levy, D. Community systems and ecologies of drug and alcohol problems. In: Stockwell, T.; Gruenewald, PJ.; Toumbourou, JW.; Loxley, W., editors. Preventing Harmful Substance Use: The Evidence Base for Policy and Practice. John Wiley & Sons, Ltd.; Chichester, West Sussex, England: 2005. p. 149-161.

Jones-Webb R, Toomey TL, Short B, Murray DM, Wagenaar A, Wolfson M. Relationships among alcohol availability, drinking location, alcohol consumption, and drinking problems in adolescents. Substance Use and Misuse. 1997; 32(10):1261–1285. [PubMed: 9286000]

Klepp KI, Schmid LA, Murray DM. Effects of the increased minimum drinking age law on drinking and driving behavior among adolescents. Addiction Research. 1996; 4(3):237–244.

LaScala, E.; Freisthler, B.; Gruenewald, PJ. Population ecologies of drug use, drinking and related problems. In: Stockwell, T.; Gruenewald, PJ.; Toumbourou, JW.; Loxley, W., editors. Preventing Harmful Substance Use: The Evidence Base for Policy and Practice. John Wiley & Sons, Ltd.; Chichester, West Sussex, England: 2005. p. 67-78.

Monitoring the Future (MTF). Monitoring the Future Data Tables, Table 3 “Trends in 30-Day Prevalence of Use of Various Drugs for Eighth, Tenth, and Twelfth Graders” 30-day, Any Use of Alcohol data for 2003 and 2004. 2005 [6/8/2006]. [On-line] Available: http://monitoringthefuture.org/data/05data/pr05t3.pdf

Raudenbush, S.; Bryk, A.; Cheong, YF.; Congdon, R. HLM 5 Hierarchical Linear and Nonlinear Modeling. Scientific Software International; Lincolnwood, IL: 2000.

Treno, AJ.; Lee, JP.; Freisthler, B.; Remer, LG.; Gruenewald, PJ. Application of evidence-based approaches to community interventions. In: Stockwell, T.; Gruenewald, PJ.; Toumbourou, JW.; Loxley, W., editors. Preventing Harmful Substance Use: The Evidence Base for Policy and Practice. Chichester, West Sussex, England: John Wiley & Sons, Ltd.; 2005. p. 177-189.

Treno AJ, Grube JW, Martin SE. Alcohol availability as a predictor of youth drinking and driving: A hierarchical analysis of survey and archival data. Alcoholism: Clinical and Experimental Research. 2003; 27(5):835–840.

Treno AJ, Gruenewald PJ, Lee JP, Remer LG. The Sacramento Neighborhood Alcohol Prevention Project: Outcomes from a community prevention trial. Journal of Studies on Alcohol and Drugs. 2007; 68(2):197–207. [PubMed: 17286338]

Wagenaar AC, Toomey TL, Murray DM, Short BJ, Wolfson M, Jones-Webb R. Sources of alcohol for underage drinkers. Journal of Studies on Alcohol. 1996; 57(3):325–333. [PubMed: 8709591]

US Census Bureau. Census 2000 Summary File 1: Census of Population and Housing. V1-D00-S1AS-08-US1. US Department of Commerce; Washington DC: 2001.

Table 1

Descriptive statistics of measures used in analysis models

* * Dependant Measures * *	Mean	Std. Dev
Perceived ease of formal access (possible range -2 to 2)	-1.43	1.02
Perceived ease of informal access (possible range -8 to 8)	-3.3	3.54
Times drank alcohol self-purchased from formal sources	0.13	0.88
Times drank alcohol obtained from informal sources	2.35	5.16
* * Individual Level Variables * *	Mean or %	Std. Dev
Off premise alcohol outlets within 2 miles (mean)	50.89	54.23
Available spending money ($/week) (mean)	$27.84	32.64
Mobility indicator (sum of youth drives & friends drive)	0.83	0.7
Average age of close friends	15.57	1.45
Indicator of past year parental drinking	0.65	0.48
Deviance scale (square root of mean of 10 items)	6.42	8.4
Unrotated first principal component of conventionality items	-0.004	0.919
% Male	50.7	5
Age (mean)	14.98	0.82
% Hispanic	34.46	0.48
% African-American	6.77	0.25
% Asian or Pacific Islander	5.07	0.22
* * Aggregate Level Variables * *	Mean or %	Std. Dev
% Hispanic	35.4	27.29
% African American (one race only)	7.34	12.77
% Asian or Pacific Islander (one race only)	8.13	9.88
Census Pop 2000 / sq mile	5,705.69	5,980.72
% owner occupied (of occupied Housing)	58.05	17.57
Median HH Income	48,492	20,492

Table 2

Pearson correlations among outcome measures

	Perceived Formal Access	Perceived Informal Access	Actual Formal Use	Actual Informal Use
Perceived Formal Access	1.000			
Perceived Informal Access	0.212	1.000		
Actual Formal Use	0.223	0.170	1.000	
Actual Informal Use	0.119	0.468	0.350	1.000

N=1,419 for each correlation; all correlations are significantly different from zero ($p < .00001$)

Table 3

Models of Perceived Access

	FORMAL		INFORMAL	
	b	**t**	**b**	**t**
Individual level variables:				
Off-premise outlets within 2 miles	0.081 ***	3.79	0.004	0.04
Available spending money	0.002 *	2.16	0.004 *	2.03
Mobility indicator	0.063	1.35	0.613 ***	4.39
Average age of close friends	0.023	0.98	0.341 ***	3.81
Past year parental drinking	0.001	0.02	0.747 ***	4.47
Deviance scale	0.106 ***	4.32	0.647 ***	8.52
Conventionality scale	-0.024	-0.88	-0.561 ***	-5.19
% Male	-0.012	-0.58	-0.139	-1.67
Age	0.058	1.25	0.298 *	2.24
Hispanic	-0.055	-1.77	-0.179	-1.63
African-American	-0.053	-0.70	-0.476 *	-2.04
Asian or Pacific Islander	0.092	0.96	0.165	0.67
Aggregate (zipcode) level variables:				
% Hispanic	0.003 **	3.10	-0.007	-1.46
% African American	0.002	0.80	0.001	0.16
% Asian or Pacific Islander	0.005 *	2.41	-0.003	-0.33
Population density	0.000	0.34	0.000	0.93
% owner occupied	0.005	1.55	0.001	0.06
Median HH Income	0.000	0.61	0.000	-0.86
Intercept	-1.454 ***	-51.73	-3.316 ***	-34.45

Results are based on hierarchical linear regression analyses of 1,419 persons nested within 50 zip codes; perceived ease of formal access outcome measure is based on a single survey item ranging from -2 to 2; perceived ease of informal access is the sum of four survey items, so outcome measure has a possible range of -8 to 8; exogenous variables are grand-mean centered;

*** p <= .001,

** p <= .01,

* p <= .05

Table 4

Models of Actual Access (# of times)

	FORMAL		INFORMAL	
	b	**t**	**b**	**t**
Individual level variables:				
Off-premise outlets within 2 miles	0.391 **	2.99	-0.228 *	-2.45
Available spending money	0.003	0.91	0.018 ***	7.55
Mobility indicator	0.392	1.63	0.231	1.65
Average age of close friends	0.160 ***	4.35	0.341 ***	5.48
Past year parental drinking	-1.544 ***	-8.90	0.549 ***	3.60
Deviance scale	0.565 ***	5.90	0.567 ***	11.61
Conventionality scale	0.252	1.57	-0.250 *	-2.32
% Male	0.341 **	2.70	-0.090	-1.19
Age	0.354	1.92	-0.009	-0.10
Hispanic	0.110	0.57	-0.463 ***	-4.04
African-American	0.597	1.39	-1.504 ***	-5.82
Asian or Pacific Islander	-0.973 *	-2.40	0.760 **	3.36
Aggregate (zipcode) level variables:				
% Hispanic	0.028 **	2.78	0.002	0.71
% African American	-0.034 **	-3.00	-0.013 **	-2.73
% Asian or Pacific Islander	0.046 *	2.37	0.048 ***	7.89
Population density	0.000	-1.04	0.000 ***	8.98
% owner occupied	0.031	1.75	0.012 *	2.05
Median HH Income	0.000	-0.42	0.000	-1.10
Intercept	-1.905 ***	-11.65	0.653 ***	4.82

Results are based on hierarchical Poisson regression analyses of 1,419 persons nested within 50 zip codes; outcome measures are the number of drinking occasions on which alcohol was obtained from each source; exogenous variables grand-mean centered;

*** p <= .001,

** p <= .01,

* p <= .05