A Public Health Model of Alcohol Use and Related Problems: Data from the National Longitudinal Survey of Youth

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ABSTRACT. Using data from the 1994 National Longitudinal Survey of Youth, this paper presents a public health model of alcohol intensity and attendant consequences among adolescents We use path analyses to examine the influence of agent (beverage of choice) host (individual characteristics), and environment (contexts of drinking) on an index of alcohol intensity and three factor-based indexes of alcohol-related consequences Our analyses suggest that males, adolescents who begin drinking at a younger age, and older adolescents drink with more intensity Similarly, teenagers that drink in private contexts, perceive the majority of their friends to be drinkers, and prefer beer over other beverages tend to drink more intensely Drinking in private contexts is also a contributing factor to Loss of Control and School/Work Problems regardless of other predictors Implications for prevention practice and future research are offered *[Article copies available for a fee from The Haworth Document Delivery Service 1-800-342-9678 E-mail address <getinfo@haworthpressinc com> Website <http://www HaworthPress com>*

KEYWORDS. Public health model, alcohol consumption, alcohol-related problems

Adolescent alcohol misuse has long been a concern to prevention specialists and health researchers Much of the research concerning

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adolescent alcohol consumption has focused on the epidemiology of use Several large-scale studies have documented adolescents' drinking patterns and problems associated with alcohol use (Johnston, O'Malley and Bachman, 1998, Jones-Webb, Toomey, Short, Murray, Wagennar and Wolfson, 1997, Maddahian, Newcomb, and Bentler, 1988) Of the studies examining the etiological factors contributing to alcohol use, several studies have examined individual-level factors, typically demographic characteristics and psychological variables (Ellickson and Hayes, 1992, Kandel, Kessler, and Margulies, 1979, Maddahian et al , 1988, Novcek, Raskin and Hogan, 1991) Others have documented the importance of perceptions of peers' alcohol consumption on the drinking behavior of adolescents (Vega, Zimmerman, Warheit, Apospori and Gil, 1993, Downs, 1987, Brook, Balka, Gursen, Brook, Shapiro, and Cohen, 1997)

There has been relatively little research into environmental variables as they contribute to adolescent alcohol use Conceptually, environmental variables might be important either as direct etiological variables or as variables in more complex causal systems, to models of alcohol consumption and alcohol-related problems among adolescents Several prevention projects targeting alcohol problems in the general population of adults have focused on the social and physical environment with encouraging results (Holder, Saltz, Grube, Voas, Gruenewald, and Treno, 1997, Fisher, 1995, The COMMIT Research Group, 1995)

Environmental variables, individual level variables and variables related to alcohol beverages all might be important to conceptual models of adolescent alcohol use The basic public health model (agent, host, and environment) incorporates each of these conceptual domains Public health approaches to alcohol and other drug problems stress the importance of agent (the substance), host (individual characteristics), and environmental (social, economic, physical characteristics) variables in the manifestation of substance use and its attendant problems This paper seeks to contribute to the literature by examining the relationships among agent, host, and environmental variables as they contribute to adolescent alcohol consumption and alcohol-related problems Specifically, we present path models of alcohol involvement and related problems using agent, host, and environmental predictor variables We address the following

research questions using data drawn from the 1994 National Longitudinal Study of Youth

(1) What variables reflecting the agent, host, and environment predict adolescents' drinking intensity?
(2) What variables reflecting the agent, host, and environment predict alcohol-related problems experienced by adolescents?

ADOLESCENT ALCOHOL USE AND PROBLEMS

Interestingly, there is little agreement among researchers concerning the definition of alcohol problems for adolescents (Hays and Ellickson, 1996) Alcohol consumption itself has been conceptualized as a problem for adolescents in several studies, often with the rationale that alcohol consumption is illegal for adolescents (Hays and Ellickson, 1996) Consistent with studies with adult populations (Clapp, Shillington, Segars, in-press, Presley, Meilman, and Lyerla, 1995, Hilton, 1991), some adolescent studies have conceptualized alcohol-related problems as social, educational and legal consequences resulting from alcohol use (Welte and Barnes, 1988) Hays and Ellickson (1996) noted that there is a great deal of variation in measures both within adolescent alcohol studies and between adult and adolescent alcohol studies As they noted (p 297) "Drinking levels that may cause little or no problem for adults may be dangerous for adolescents, who typically have lower body weight, less drinking experience and less well-defined judgement "

Given this, most studies of adolescent alcohol problems focus on alcohol consumption Lloyd Johnston and associates (1998) reported that 43 7% of eighth graders, 62 7% of 10th graders and 74 3% of 12th graders had consumed alcohol within the past year Self-reported intoxication rates for these three groups were 17 9%, 38 3%, and 52 0%, respectively Binge drinking rates (5 or more drinks in a single setting) among these students ranged from 14 5% to 29 8% (1995 data) Furthermore, the use of alcohol by high school seniors has decreased from the late 1970s to the present for daily drinking, monthly prevalence, and binge drinking (Johnston et al , 1998)

A Public Health Model of Adolescent Alcohol Consumption and Consequences

Presented below is a public health model of adolescent alcohol consumption and its attendant consequences The conceptual domains presented in the model represent agent, host, and environment Mosher and Jernigan (1989 248) suggested that the agent can be conceptualized as the "presentation of alcohol. including packaging, labeling and price " They conceptualize host as the individual consuming alcohol. while environment is conceptualized as "the physical and social structures in which alcohol problems occur" (p 248) The variables included in each domain are drawn from the extant literature on adolescent drinking

The host In models of alcohol consumption the host can be conceptualized as the individual, who is then viewed as being comprised of several key domains related to alcohol consumption The individual domains include biological, psychological, demographic, and historical Given that the bulk of adolescent alcohol research uses survey methodologies and relies on self-reports, the biological domain is typically not a measured domain in social science studies examining host-level variables There is, however, a great deal of research concerning the other domains related to the host

Psychological antecedents (both direct and indirect) to AOD use include alcohol expectancies (Brown, Creamer, and Stetson, 1987), attitudes, beliefs, social learning (Ellickson and Hays, 1992), conventionality, ego integration, guilt, coping skills (Brook et al 1997), rebelliousness, non-traditional values (Block, Block, and Keyes, 1988), sensation-seeking, self-deviancy (Brook, Whiteman, Cohen, Shapiro, and Balka, 1995), risk-taking, depression (Brook, Whiteman, Gordon, Nomura, and Brook, 1986), self-esteem (Vega et al , 1993) and perceptions of peers' use (Iannotti, Bush, and Weinfurt, 1996) In general, the psychological research concerning adolescent AOD use indicates that positive expectancies concerning drinking, perceiving that one's peers are heavy drinkers, unconventional behavior, rebelliousness, a predisposition to risk-taking behavior, poor coping skills and the like all contribute to increased adolescent AOD use

Demographic variables associated with adolescent alcohol use include gender, age, and race/ethnicity Using a national data set, Windle (1991) reported that the use of alcohol increased with age, white

adolescents drank more than African Americans and Hispanics, and males drank more than females Concerning heavy drinking, Johnston and associates reported from their 1997 survey that more male high school seniors reported heavy drinking (38%) than did their female counterparts (24%) and the number of occasions of heavy drinking increased with age

Using a sample of high school students in Miami, Florida, Vega et al (1993) also found white adolescents reported the highest prevalence of lifetime alcohol use compared to all other ethnic groups The study, however, also noted that when other risk factors were accounted for, racial differences in alcohol use narrowed

History of alcohol use, particularly age of first use, is an important conceptual predictor of current alcohol use (Kandel, 1980, Jessor and Jessor, 1977, Kandel, 1975) When viewed from a developmental perspective, onset of drinking represents a pathway into heavier drinking and other risk behaviors (Kandel, 1980)

The agent As noted above, from a public health perspective, alcohol is considered the agent Although the agent can be conceptualized as being comprised of several domains, beverage of choice, price, and availability are particularly relevant to adolescent alcohol consumption In a study that addressed beverage of choice as it relates to alcohol problems, Smart and Walsh (1995) reported that beverage type was not related to alcohol problems, holding other predictors constant When looking at the heaviest drinkers, however, beer and spirits were predictors of heavy episodic drinking (e.g , binge drinking–five or more drinks in a single setting) (Smart and Walsh, 1995)

Alcohol consumption is related to the sales and availability of alcohol, controlling for other theoretical predictors (Gruenwald, Ponicki, and Holder, 1992) For instance, research by Coate and Grossman (1988) indicates that higher prices tend to have the greatest impact on young heavy drinkers (i e , lowered consumption) Similarly, Jones-Webb et al (1997) found that greater alcohol availability was related to higher alcohol consumption among adolescents Finally, in a qualitative study of adolescents' access to alcohol, Wagennar, Finnegan, Wolfson, Anstine, and Perry (1993) showed that teenagers typically get alcohol from older siblings and peers, often in the context of parties

The environment Environmental contexts of use can be defined in several ways (see Jessor, 1982) Drinking contexts can represent social, temporal and physical characteristics of drinking events including

group composition, duration, location, protective factors such as food and risk factors such as the availability of illicit drugs (Clapp, Shillington, and Segars, in-press)

Mayer and associates examined the social situations of adolescent drinking and found the vast majority of subjects in their study last drank with friends, primarily under-age peers (Mayer, Forster, Murray and Wagennar, 1998) Studies examining heavy drinking behaviors reflect that adolescent heavy drinkers drink with peers (Harford and Grant, 1987), at parties (Wagennar et al , 1993), in other contexts that facilitate social interaction, or outdoor settings and in other people's homes (Mayer et al , 1998) In contrast, Webb-Jones et al (1997) examined the association between public and private drinking contexts and alcohol-related consequences and found no significant relationship

Although perceptions can be viewed as host-level variables, adolescents' perceptions of drinking norms or peers' alcohol use can also be viewed as indicators of social drinking environments Webb-Jones et al (1997) reported that perceived peer drinking and permissive drinking norms predicted drinking consequences Similarly, Beck and Treiman's (1996) results indicated that a combination of social context and peer drinking norms discriminated between problem drinkers and non-problem drinkers.

In summary, a variety of variables related to agent, host and environment have been shown to predict alcohol consumption and alcohol-related consequences The present paper uses a large, national data set to examine an empirical model with variables representing each of these domains

METHODS

The National Longitudinal Study of Youth (NLSY), funded by the Department of Labor, is a longitudinal study that started in 1979 with an original sample of 12,600 individuals who were aged 14-21 The study over-sampled both Black and Hispanic youth This sample has been interviewed annually since the inception of the study and boasts an 89% retention rate In 1982, with the funding from National Institutes of Child Health, the survey included questions pertaining to pregnancy and childcare As of 1994, the study protocol changed in order to interview children of the original cohort of young women,

who were 15 years and older These young adults are interviewed and fill out the confidential, self-administered Young Adult Survey, that asks questions regarding alcohol and other substance use, sexual activity, delinquent activities and friend affiliations. It is important to note that a large percentage of this cohort of adolescents was born to teenage mothers (Center for Human Resource Research, 1997)

Measures

Endogenous variables The NLSY Young Adult Survey contained 14 alcohol consequence questions These items included responses with a four-point Likert scale (0 = Never, 3 = Very Often) that reflected alcohol-related consequences experienced by respondents within the past 12 months Consequences included fights and arguments, school or work problems, loss of control items (drank more than intended, etc), legal problems, and high-risk behaviors (DWI) To reduce the number of variables for analysis, a principal components analysis (PCA) was conducted, using orthogonal rotation Three PCAs were run prior to deriving a conceptually sound solution Two alcohol consequence items were dropped from the final PCA model–an item reflecting missing school or work obligations and an item reflecting driving after drinking. The former item was conceptually similar to another item included in the final PCA. The omitted item asked respondents how often they had missed school, work or other obligations due to drinking The included item asked respondents how often they stayed home or went to work or school late because they were drunk or had a hangover The item asking about driving after drinking loaded on several components in an earlier PCA, thus it was omitted from the final model.

The final PCA resulted in a three-component solution that explained 67 25% of the variance in the model Factor loadings of 5 or above were used to name components (Hair, Anderson, Tatham and Black, 1992) Consistent with the Kaiser criterion (Kaiser, 1958), only components with an Eigenvalue of 1 0 or higher were retained Examination of diagnostic tests (KMO and Bartlett's Test of Sphericity) indicated the model met the assumptions of PCA (Norusis, 1988) The first component in the solution had an Eigenvalue of 5 82 and reflected problems with school or work The items loading on this component included the frequency the respondent missed or was late to school while drunk or hung-over, had their grades suffer due to drinking;

missed or was late to work while drunk or hung-over, didn't do necessary things while drinking, and had chances for a job or raise hurt because of drinking.

The second component reflected relationship problems due to drinking, with an Eigenvalue of 1 2 Four items loaded on the second component These included how often a respondent experienced the following while drinking got into a fight or argument; had problems with their teacher or principal, had problems with their family or friends, and had problems with the police The final component in the solution reflected loss of control due to drinking and had an Eigenvalue of 1 0 This component included items reflecting how often a respondent found it hard to stop drinking once they had started, felt they could hurt themselves or others while drinking, and drank more than intended

Summative indexes were created for each component Cronbach's Alpha (Cronbach, 1951) for the School/Work index was 86 while the alpha values for the Relationship and Loss of Control indexes were 80 and 76, respectively The valid value ranges for these indexes were 0-15 (Relationship Problems), 0-15 (School/Work) and 0-12 (Loss of Control)

Intervening variable Alcohol intensity Alcohol intensity was conceptualized as the number of times a respondent drank and was intoxicated The NLSY supplement for young adults contained two measures of past year alcohol use A frequency of use item asked respondents on average how often they drank in the past year This item was an ordinal scale with 9 progressive categories of use (1 = abstainer, 9 = daily drinker) The second item, a ten point ordinal frequency of intoxication scale (1 = abstainer, 10 = intoxicated daily), asked respondents the number of times they were drunk in the past year To assess alcohol intensity, we multiplied frequency of use with frequency of intoxication This "Alcohol Intensity" index had a Cronbach's Alpha of .83 and a valid value range of 0-90 Higher scores on this scale represent more frequent intoxication

Exogenous variables Based on the Public Health Model, we categorized items in the survey into agent, host, and environmental variables These variables are presented below by conceptual domain

Agent The survey contained one item reflecting the agent This item asked which beverage respondents usually drank when they consumed alcohol Categories included beer, wine, liquor, and "it varies "

We dummy coded (1 = yes) this item into individual beer, liquor, and "it varies" variables Wine was used as the referent variable in the multivariate models

Host We identified several host-level variables in the survey. These included demographic variables gender (1 = female), age, race, self-esteem scale, and age of first use of alcohol The race variable was dummy coded (1 = yes) into individual variables reflecting White, African American, and Hispanic (other = referent as it had the lowest frequency) The self-esteem variables included Rosenberg's (1962) self-esteem scale, which includes 10 Likert-type items (1 = Strongly Disagree, 4 = Strongly Agree) Three of these items were reverse coded prior to constructing an index Scores on the Rosenberg scale range from 10-40 with higher scores indicating higher self-esteem

Environment We identified several indicators of the environment related to alcohol consumption in the survey Two questions asked respondents about their typical drinking contexts One asked respondents with whom they typically drank (social context) This item included alone, with friends, a date, parents, other relatives, and other adults This item was recoded into a series of dummy variables (1 = yes) including "typically drinks alone," "typically drinks with friends," and "typically drinks with family" (other adults and a date were referent variables) The second context item on the survey asked respondents where they typically drank (physical context) Categories included at home, in a car, at dances, at parties, at friends' homes, in bars, at relatives' homes and other Based on previous research into drinking contexts (Clapp, Shillington, and Segars, in-press, Hilton, 1991), we recoded this variable into dummy variables (1 = yes) public (dances, parties and bars) and private drinking contexts (home, friends' home, relatives' home) (other = referent) Another set of environmental variables were derived from three questions that asked respondents how many of their classmates, neighborhood peers, and friends drink alcohol (0 = none, 4 = all).

Analysis Strategy

We used forced-entry ordinary least squares (OLS) multiple regression analysis in the first phase of the study The Alcohol Intensity index was regressed on each conceptual predictor variable set (agent, host and environment) Variables with significant beta weights ($p \leq .05$), were retained for the second phase of analysis We selected this

strategy for two reasons First, although we identified conceptual domains of interest, specific indicators were limited to items available in the survey To identify the most parsimonious indicators within domains, it was necessary to reduce the number of variables within each domain prior to running the final path models. Second, as noted earlier, the majority of studies in this area conducted to date have conceptualized alcohol use as the primary criterion variable Thus, there was better empirical support for identifying potential indicators of alcohol use than there was to identify such predictors for alcohol consequences

During this phase of analysis we also addressed concerns of multicollinearity Public and private drinking contexts were highly negatively correlated with each other as were drinking with family and drinking with friends Private drinking contexts and drinking with friends were both better predictors of Alcohol Intensity and therefore retained for further analysis, while public drinking and drinking with family members were dropped from the analysis

A path analysis strategy was used, again using forced-entry OLS multiple regression, to examine the relationships among the salient predictor variables, Alcohol Intensity, and the three alcohol problem indexes To accomplish this, we first regressed Alcohol Intensity on the predictor variables retained in phase one In phase two, we separately regressed each alcohol problem variable (Relationship Problems, School/Work Problems, Loss of Control) on the predictor variables and Alcohol Intensity. Path models showing significant ($p \leq .05$) paths are presented for each alcohol problem index below

FINDINGS

Descriptive statistics for all variables assessed in the analyses are presented in Table 1 This sample had nearly an equal proportion of males and females, with a mean age of 16.3 years The sample has an over-representation of African Americans and Hispanics, which would be expected since the original sample of mothers over-sampled for these two ethnic groups as discussed above

On average, respondents reported an average age at onset of drinking alcohol three years prior to their age during the 1994 survey The most popular alcoholic beverage consumed by respondents was beer, followed by consumption of "various" alcoholic beverages Respond-

TABLE 1 Demographic Characteristics and Descriptive Statistics for Predictor Variables

Variable	N	%	Mean	(sd)
Gender				
Males	475	48 5		
Females	605	51 5		
Age			16 3	(1 74)
Age of first alcohol use			13 3	(3 48)
Race/Ethnicity				
Black	473	48 3		
White	296	30 2		
Hispanic	187	19 1		
Other	21	2 1		
Agent Indicators				
Typically drinks beer	261	48 2		
Typically drinks wine	67	12 4		
Typically drinks liquor	57	10 5		
Typically drinks different things	156	28 8		
Social Context				
Typically drinks alone	16	3 0		
Typically drinks with family	98	18 4		
Typically drinks with friends	374	70 2		
Typically drinks with other	45	8 4		
Extent to which peers drink			1 9	(1 3)
Extent to which school mates drink			2 2	(1 0)
Extent to which neighborhood peers drink			1 9	(1 3)
Physical Context				
Typically drinks in a public context	175	33 1		
Typically drinks in a private context	296	56 1		
Typically drinks in another context	57	10 8		
Self-Esteem Scale			25 7	(1 9)
Alcohol Consumption				
Number of days consumed alcohol (year)			4 0	(2 2)
Number of days intoxicated (year)			3 9	(2 6)
Alcohol intensity index			20 4	(21 9)
Alcohol Related Consequences				
Relationship problems			1 4	(2 2)
School or work problems			78	(2 1)
Loss of control			1 3	(1 9)

ents typically drank with their friends and in private settings On average, respondents believed most of their classmates, same-age neighborhood peers, and friends drink alcohol As for their own alcohol consumption, respondents typically reported drinking "every other month or so" (6-11 days per year) and being intoxicated 3-5 times in the past year There was an average of slightly more than one Relationship Problem, less than one alcohol-related School/Work Problem, and slightly more than one alcohol-problem resulting in a Loss of Control

Table 2 presents the zero order correlation coefficients for variables remaining in the multivariate path models During the first phase of analysis we regressed Alcohol Intensity on the host, agent, and environmental variables presented in Table 1 During this phase of analysis the following variables fell out of the model race/ethnicity, self-esteem, all alcohol beverages except beer, and all drinking contexts except drinking with friends and in private In addition, only perceptions of close peers' drinking remained in the model Thus, the variables included in Table 2 are also statistically associated with Alcohol Intensity net of each other

As Table 2 indicates, being male is associated with drinking beer. Alcohol Intensity, and drinking with friends In contrast, being female is associated with drinking in private settings As respondents aged, their perceptions of peer alcohol use increased This perception of peers' alcohol use was positively associated with Alcohol Intensity and all three alcohol consequence indexes Finally, all three alcohol consequence indexes were positively associated to a moderate degree

Pathways to Alcohol Intensity (as shown in Figures 1-3) indicate males and older respondents drink with more intensity Similarly, the earlier one started drinking, the higher their Alcohol Intensity score tended to be Environmental variables making positive contributions to Alcohol Intensity included drinking with friends, in private contexts, drinking beer, and perceptions of the extent to which close peers drink The multiple regression model for the Alcohol Intensity as the endogenous variable was statistically significant ($F = 17\ 7$, $p \leq .001$) and accounted for about 24% of the variance in Alcohol Intensity (adjusted $R^2 = 243$)

Figure 1 presents the path analysis for the School/Work Problem index As can be seen, only drinking in private contexts had a direct significant path to School/Work index The beta weight for this path

TABLE 2 Zero Order Correlation Coefficients of Variables Remaining in Path Models

Variable	1	2	3	4	5	6	7	8	9	10	11
1) Gender	--										
2) Age	01	--									
3) Age of First Drink	10*	31**	--								
4) Drinks Beer	- 25**	01	- 07	--							
5) Drinks with Friends	13**	17*	03	007	--						
6) Drinks in Private Context	13**	- 03	05	- 05	22**	--					
7) Extent Peers Drink	- 01	31**	15**	08	22**	- 07	--				
8) Relationship Problems	09*	03	- 10*	05	10*	- 06	17**	--			
9) School/Work Problems	- 06	09	- 09	10*	06	- 03	14**	58**	--		
10) Loss of Control	- 01	10*	09	06	18*	09	33**	56**	54**	--	
11) Alcohol Intensity	16**	15**	- 19**	10*	21**	07	33**	35**	47**	27**	--

Note * $p \leq .05$ ** $p \leq .01$

was negative, suggesting respondents who drink in private contexts are less likely to experience alcohol-related problems at school or work. Decomposition of effects indicates a small indirect effect (.05) of drinking in private contexts on School/Work Problems. Thus, the total effect for drinking in private contexts on School/Work Problems is −.06. As one would expect, the strongest predictive path in the model was from Alcohol Intensity to School/Work Problems. Overall, the multiple regression model for this figure was statistically significant ($F = 7.8$, $p \leq .001$) and explained about 14% of the variance in the dependent measure (adjusted $R^2 = .138$).

Figure 2 presents the path model for the Loss of Control problem index. Similar to the model presented in Figure 1, Alcohol Intensity was the strongest predictor of Loss of Control. Also, similar to the model for School/Work Problems, drinking in private contexts was directly related to both the Loss of Control problem index and Alcohol

FIGURE 1 Path Model for School and Work Problems

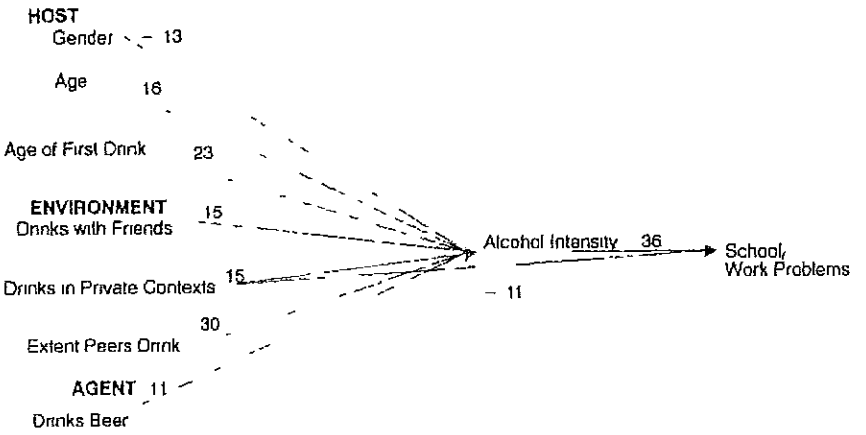
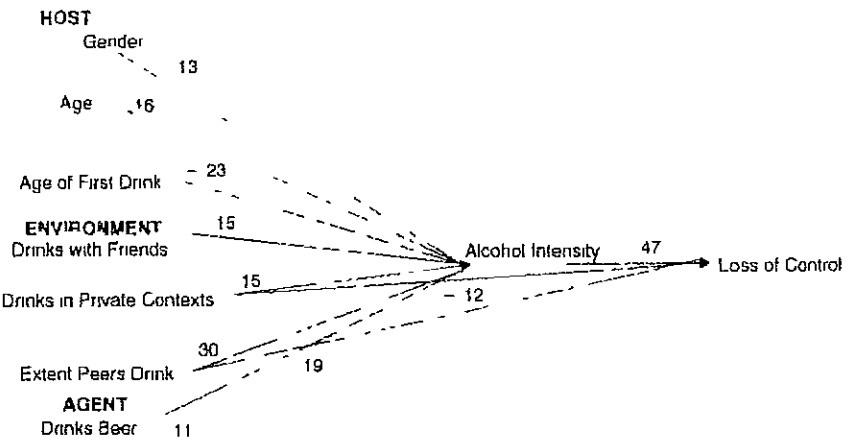


FIGURE 2 Path Model for Problems with Loss of Control



Intensity Again, drinking in private contexts had a small indirect effect (.07), with a total effect (−.05) on the endogenous problem index Respondents' perceptions of the extent to which their close peers drink also had direct effects on Alcohol Intensity and the Loss of Control problem index The indirect effect of peers' drinking on Loss of

Control is 14, with a total effect of .33 Overall, the multiple regression model for this problem index was statistically significant ($F = 21.1$, $p \leq .001$) and accounted for 32% (adjusted) of the variance in the endogenous variable

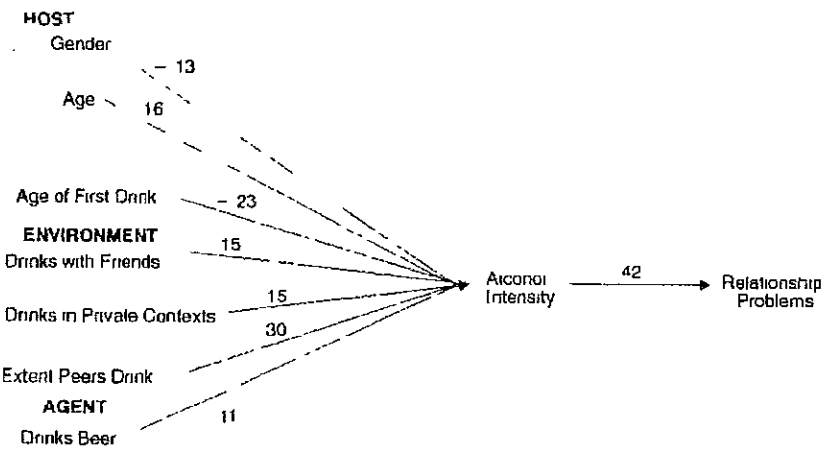
Figure 3 presents the path analysis for the Relationship Problem index As illustrated in the Figure, none of the predictor variables directly influence the endogenous measure Similar to the other path models, the path from Alcohol Intensity to Relationship problems is the strongest path in the model The adjusted R^2 for this model was 18 ($F = 10.5$, $p \leq .001$)

DISCUSSION

This paper examined a public health model of adolescent drinking behavior and related problems Variables represent host, agent, and environment with each domain having significant pathways to intensity of alcohol consumption The variable drinking in a private context had significant pathways to two of the alcohol problem indexes examined in the present study Similarly, perceptions of close peers' alcohol use had a direct significant pathway to one of the alcohol problem indexes

Thus, the present study suggests that males, adolescents who begin drinking at a younger age, and older adolescents drink with more

FIGURE 3 Path Model for Problems with Relationship Problems



intensity Similarly, teenagers that drink in private contexts, perceive that the majority of their friends to be drinkers, and prefer beer over other beverages tend to drink more intensely Drinking in private contexts is also a contributing factor to Loss of Control and School/ Work Problems regardless of other predictors

Strengths and Limitations

One strength of this study is that it is one of the first endeavors to examine adolescent alcohol with the use of the Public Health Model Although others have assessed variables in the domains of interest (e g , Webb-Jones et al , 1997), this study is the first, to our knowledge, to assess them guided by the Public Health Model as a theoretical perspective As indicated in the findings section, variables in each of the public health domains-agent, host, environment-contributed to alcohol-related behaviors

Another strength is that this is one of the first studies to apply the conceptualization of alcohol problems, intensity of use, and context issues to the adolescent population Until now this approach has been limited to the research of young and older adult populations Prevention literature focusing on college students (Clapp, Shillington, and Segars, in-press, DeJong, Wittman, Colthurst, Cretella, Gilbreath, Rosati and Zweig, 1998 Ryan, Colthurst and Segars, 1994) and the general adult population (Holder et al , 1997) has increasingly stressed the importance of environmental factors as they relate to alcohol consumption and its attendant problems As noted earlier, much of the research concerning adolescent alcohol problems has emphasized host-level variables Thus, efforts to identify protective and high-risk aspects of the environment have potential to complement extant prevention efforts that target individuals

Although interesting, the present findings must be viewed in light of some limitations that would be useful for inclusion in future research First, the present study's secondary analytic design precluded full specification of the path models and should have included variables such as availability of alcohol To this end, several potential indicators in each domain were unavailable for analysis in the present For instance, conceptually, availability (i e , price, access) of alcoholic beverages is an important consideration in the environmental domain Also, the study would have benefited by inclusion of variables measuring alcohol expectancy measures, frequency of use and alcohol

content of beverage of choice Finally, event-specific items that examine the context of respondents' last drinking event would have allowed for greater precision in identifying the exact characteristics of an event that promote (or preclude) alcohol consumption and related problems (see Clapp, Shillington and Segars, in-press) Given the limited number variables available for analysis in each domain, the findings presented above must be viewed with caution when assessing the utility of the public health model

Implications for Practice

These results have a number of implications for prevention and intervention work with adolescents. First, these findings indicate that there are significant differences between males and females per their drinking behaviors and their resultant alcohol related problems. The teen's use of alcohol increased with age and the younger they were when they started their alcohol use the more likely they were to have problems caused from their drinking This indicates that interventionists and educators need to first fine-tune their work to address the issues in place specifically for teenaged boys and then how those issues might change as the population gets older, moving from junior high ages to high school age groups The mean age of onset for alcohol use was 13, which is when this sample was in junior high school, so intervention and prevention should start in early grade school A key to being able to offset alcohol problems may lie in the ability to delay the onset of alcohol use until older ages

The results indicate that this sample of adolescents use alcohol more if they perceive their peers to be like users. These findings are similar to those found among college aged samples (Perkins and Wechsler, 1996) In fact, research among college samples indicate that perceptions of peer use is enough in and of itself to increase usage (Perkins and Wechsler, 1996). This would support the inclusion of more group-oriented education among children and adolescents in which accurate information is given per age-peer substance use

A final implication is that this sample reported they were drinking in private contexts which was found to be associated with the intensity of alcohol use These data suggest that children are drinking with their friends in the home while unsupervised or with the consent of supervising adults One possible insight from this is that parents may need

their own educational interventions or may need to be included in educational efforts with their children to some extent

Future Research

The present study generally supports the efficacy of a public health approach to adolescent drinking and attendant problems As suggested above, future research is needed to better specify each domain within a Public Health Model Greater detail is not only desirable for conceptual purposes but has great import for prevention efforts as well For instance, identification of specific protective or high-risk environmental characteristics could be used to facilitate environmental prevention efforts Further, the combination of such factors with specific host and agent factors would enhance comprehensive prevention efforts

In addition to further specifying the conceptual domains within a public health model of adolescent drinking, two other additions to future research in this area would be beneficial First, examination of the exact temporal ordering of events might be better specified For the purposes of the present study we assumed that all host, agent, and environmental domains temporally preceded alcohol consumption and its associated problems. This assumption was predicated in part on the cross-sectional nature of the data available to us It is reasonable to assume, however, that all host level variables temporally precede agent-level and environmental variables That is, people bring their individual characteristics into environmental contexts of alcohol use Conceptually, these individual characteristics do not cause environmental variables, but rather interact with them More advanced latent modeling might shed light on the presumably complex relationships among the agent, host, and environmental variables as they relate to drinking and problems

A second addition to future research would be to include measures of the environment that do not rely on self-reports For instance, environmental variables such as density of alcohol outlets, regional price and law enforcement data (see Holder et al , 1997) and the like might be strong predictors of alcohol use and problems net of social contexts, perceptions and other commonly used predictors Mixing individual-level and environmental-level variables in research designs present unique challenges to researchers but also better reflect the complexity of many etiological and epidemiological issues Given the

serious nature of adolescent alcohol use, such research is both warranted and desirable

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