ABSTRACT

SIMONS-RUDOLPH, JOSEPH MICHAEL. The Impact of Institutional Investment in Alcohol Prevention on Drinking and Drinking Related Consequences Among Fraternity Members. (Under the direction of Dr. Roger Mitchell.)

National estimates suggest that at least 20 percent of undergraduates report episodic heavy drinking and 20 percent report frequent heavy drinking (Berkowitz & Perkins, 1986; Pendergast, 1994; Wechsler et al., 1998). Students who drink frequently and heavily are at a much higher risk of experiencing alcohol related consequences such as assaults, academic, and social problems. (Wechsler, Lee et al., 2000). Of student subgroups, fraternity members consistently drink more heavily and more frequently than their college peers putting them at a much higher risk of experiencing alcohol related consequences (Danielson, Taylor, & Hartford, 2001; Pace & McGrath, 2002; Wechsler & et al., 1996).

Recent national expert panels have called for more comprehensive, ecological and empirically based approaches to reduce drinking and related problems among college students (Task Force of the National Advisory Council on Alcohol Abuse and Alcoholism, 2002a, 2002b). However, many colleges and universities do not have the infrastructure in place (e.g., regular assessment of student alcohol use; university-community coalitions) needed to support such comprehensive initiatives (DeJong & Langford, 2002, Wechsler, Seibring, Liu, & Ahl, 2004). This purpose of this study was to examine the impact of institutional investments in prevention infrastructure on fraternity members’ drinking frequency and drinking related consequences

The study used hierarchical linear modeling to examine secondary data collected in 2000 from 1,254 fraternity members across 31 campuses. Drinking frequency was assessed using the timeline followback technique (Sobell & Sobell, 2003) administered through Audio-CASI.
interviews, and drinking related consequences were assessed using with the Rutgers Alcohol Problem Index (RAPI) (Brown et al, 1980). Institutional investment in prevention was significantly and negatively associated with drinking related consequences, even when controlling for individual covariates (i.e., fraternity residence, social norms, sensation seeking, positive alcohol expectancies, family history of alcohol use, and age of first use of alcohol) and institutional level covariates (i.e. enrollment, region of country and urban or rural location). There were no significant relationship between institutional investment and drinking frequency. These results were replicated in analyses of a subsample of universities (n=23), in which increases in institutional investment from 1997 and 2000 were significantly associated with fewer drinking related consequences.

The strengths of the study include a focus on a high risk group (i.e., fraternities), robust measures of drinking frequency and consequences, and the use of HLM to deal with the nested nature of the data. Limitations of the study include the small sample size at the University level, limits of the 5 item institutional investment scale, and the lack of longitudinal data for student outcomes. Suggestions for future research and intervention are provided.
THE IMPACT OF INSTITUTIONAL INVESTMENT IN ALCOHOL PREVENTION ON DRINKING
AND DRINKING RELATED CONSEQUENCES

AMONG FRATERNITY MEMBERS

by

JOSEPH M. SIMONS-RUDOLPH

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Roger E. Mitchell
DEDICATION

I would like to dedicate this to my wife who has supported me through this process. She has been a sounding board, pillar of support, critic, advocate and motivator. And throughout it all has never lost faith in me, even when I was unsure.
BIOGRAPHY

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I would also like to thank my family for both their support and sacrifice in helping me complete this project.
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CHAPTER 1: INTRODUCTION

Over the last 15 years, national estimates have consistently shown that approximately 80 percent of college students report drinking (Berkowitz & Perkins, 1986; Pendergast, 1994; Wechsler, Dowdall, Maenner, Gledhill Hoyt, & Lee, 1998). Across studies, approximately 44 percent of drinkers have been identified as non-binge drinkers (less than 5 drinks at a sitting), 21 percent as binge drinkers (5+ drinks in one setting in the last 2 weeks) and 23 percent as frequent binge drinkers (binging 3+ times in last 2 weeks) (Pendergast, 1994; Substance Abuse and Mental Health Services Administration, 2005; Wechsler et al., 1998). Wechsler, Molnar, Davenport, & Baer (1999) estimated that “binge drinkers consumed 68 percent of all the alcohol that students reported drinking, and they accounted for the majority of alcohol-related problems” (p. 247).

The effects of heavy and excessive alcohol use are seen on individual students, campuses, and surrounding communities. Students who drink frequently and heavily are at a much higher risk of personally experiencing alcohol related consequences including health consequences (e.g., blackouts), academic or legal problems, interpersonal problems, and greater participation in other high risk behaviors such as drug use or unprotected sex (Hingson, Heeren, Winter, & Wechsler, 2005; Wechsler, Davenport, Dowdall, Moeykens, & Castillo, 1994; Wechsler, Lee, Hall, Wagenaar, & Lee, 2002; Wechsler, Moeykens, Davenport, Castillo, & Hansen, 1995). For example, Jennison (2004) found that the 22% of college students characterized as frequent binge drinkers experienced 40% of reported alcohol-related consequences.
In addition to harm to the drinker himself/herself, high levels of heavy drinking on campus have also been related to negative consequences to fellow students. Secondary consequences from drinking include but are not limited to insults, interruptions of studying and sleep, and unwanted sexual advances. One study found that students at schools with a high percentage of binge drinkers (over 50% of students), experienced significantly more secondary consequences from drinking of alcohol related consequences, than students at school with lower levels of binge drinking (1-35% of students) (Wechsler et al., 1995).

Heavy college student alcohol use also has effects beyond those residing in the college campus. Respondents living near colleges (within 1 mile) were significantly more likely to report community problems such as loitering, underage drinking, and crime as well as vandalism, vomit or urination and noise. Further, respondents who lived near high binge drinking schools (over 50% of students) were significantly more likely to report litter and noise or disturbance than those living near low binge drinking schools (Wechsler et al., 2002). These studies demonstrate that the effects of college student drinking are not confined to campuses but affect the surrounding community as well.

**Alcohol use and Fraternity membership**

Although drinking among college students is widespread, membership in a fraternity has consistently been identified as a major correlate for binge drinking and experiencing drinking related consequences. Fraternity members consistently drink more heavily and more frequently than their college peers (Danielson, Taylor, & Hartford, 2001; Pace & McGrath, 2002; Wechsler & et al., 1996). While 44 percent of the national college population binge drinks (Wechsler, Lee, Kuo, & Lee, 2000), between 65 percent and 85
percent of fraternity members binge drink (Caudill, Crosse et al., 2001; Meilman, Leichliter, & Presley, 1999; Wechsler, Lee et al., 2000), and as many as 65% report frequent binge-drinking (Caudill, Crosse et al., 2001). Nationally about 18 percent of students are involved in Greek organizations. Extrapolating from these percentages the Greek population could account for as much as 38 percent of student binge drinking and about 59 percent of frequent binge drinking nationally.

Several factors may account for such greater risk. Students who select fraternities are more likely to bring a history of heavy pre-college drinking, and perhaps greater vulnerability to social pressures to drink heavily. Male high school students who are heavy drinkers already may be self-selecting at higher rates into fraternities because of the compatibility with drinking norms (O’Connor, Cooper, & Thiel, 1996; Read, Wood, Davidoff, McLacken, & Campbell, 2002). For example in a study of 121 freshmen interested in pledging a fraternity, 76.2 percent of heavy drinking students actually pledged compared to 48.1 percent of light and 43.8 percent of medium drinking students (O’Connor et al., 1996) Members of fraternities also hold normative values which are more likely to view heavy drinking positively. For example, fraternities with reputations for high alcohol use generally report more positive perceptions of high alcohol use than fraternities without such reputations (Larimer, Irvine, Kilmer, & Marlatt, 1997). These issues make fraternity members a particularly challenging group to reach through campus-wide prevention initiatives.

Although increasingly varied intervention approaches have been examined in student populations generally (Davidson & DeJong, 2004; Vicary & Karshin, 2002), empirical evidence of the effectiveness of interventions with fraternity members has been sparse.
Motivational interviewing, for example, is a client-centered approach that is designed to help at-risk students reduce their alcohol use by helping them “clarify ambivalence, build discrepancy, and increase motivation for change” (Walters & Neighbors, 2005). These interventions rely on presenting students, especially heavy drinkers, with discrepant information such as their drinking profile, risk factors, and normative comparisons in order to facilitate a change in their drinking behavior. Larimer, et al. (2001) applied this approach to a group of fraternity members and found that fraternity members in the treatment groups reported significant reductions in total consumption of alcohol and typical peak blood alcohol concentrations, compared to members in the control condition (Larimer et al., 2001). However, there have been little replication of such work with fraternity members.

Social marketing campaigns have become an increasingly prevalent response by college administrators. In a nationwide survey, (Wechsler, Sebring, Liu, & Ahl, 2004) Wechsler, Sebring, Liu and Ahl’s (2004) found that over half of the colleges sampled had reported implementing a social norms campaign. Such campaigns typically involve the dissemination of drinking norms through various media outlets such as posters, flyers, campus newspapers, and radio announcements on campus stations. Since students tend to overestimate the percentage of fellow students who are drinking heavily, such information may cause students to readjust their expectations. However, Carter et al (2000) suggest that there has been limited effectiveness of such approaches with fraternity groups in large part because “there is no predominant, healthy drinking norm in this population.” Students’ reports of binge drinking among their fraternity peers may accurately reflect their drinking behavior. While non-Greek students may typically overestimate the level of drinking
engaged in by other students, Greek students’ reports of high levels of drinking among their peers may be accurate reflections of drinking among their fraternity cohort. This may make it difficult for social norms campaign to have the same kind of effect among members of fraternities.

Increasingly, there have been calls for more sophisticated initiatives that combine multiple approaches. Clapp et al (2005), for example, employed social marketing, a media advocacy campaign and increased law enforcement (i.e., DUI checkpoints and roving DUI patrols) to reduce driving while intoxicated among students of a large public University. Over a three year period, driving while intoxicated was significantly lower among students at the experimental site than among students at a comparison University. Along these lines, Ziemelis et al (2002) examined longitudinal data from a sample of 94 colleges and universities, comparing those that demonstrated decreases in binge drinking versus those that did not. Universities that demonstrated decreases were more likely to have also reported employing multiple prevention strategies (e.g., student participation and involvement in prevention activities; curriculum infusion; policy enforcement; changing campus physical/regulatory environment). Little evidence exists regarding the effects of such multiple component interventions on fraternity members specifically. Nonetheless, more comprehensive approaches that take into account the ecological context seem the logical next step in efforts to address this group.

Comprehensive, Ecological Approaches

Heavy drinking among college students is not a new phenomenon. However, a number of recent high profile incidents (e.g., deaths, sexual assaults), coupled with the
publication of several national studies and Federal reports examining the impact of college
drinking, has propelled this issue back onto the agendas of policy makers, campus
administrators and researchers (Hingson, Heeren, Winter, & Wechsler, 2005; Hingson,
Heeren, Zakocs, Kopstein, & Wechsler, 2002; Task Force of the National Advisory Council
on Alcohol Abuse and Alcoholism, 2002, 2002a, 2002b). Many researchers and policy
makers have promoted using broader, social ecological approaches to alcohol prevention. In
general these approaches seek to reduce alcohol consumption, and alcohol related problems,
by working simultaneously at campus, community, state, and national levels to change the
physical, social, economic, and legal contexts that surrounds the binge drinking behavior of
college students (DeJong & Langford, 2002). These comprehensive, ecological approaches
have been used successfully to reduce substance use among adolescents and young adults in
community settings (Toomey & Wagenaar, 2002; Weitzman, Nelson, Lee, & Wechsler,
2004; Ziemelis, Bucknam, & Elfessi, 2002). In contrast to programs that target specific
causes of drinking, ecological approaches presume to address more directly the social and
cultural influences that encourage college students to drink.

One ecological model being promoted for college campuses is the Environmental
Management Approach (DeJong et al., 1998). The environmental management approach
suggests three spheres of action: (a) campus, (b) local community, and (c) state. At the
campus level this approach emphasizes the development of a task force of administrators,
faculty, staff, students, and community members to provide leadership and oversight for the
campus alcohol programming and policies. The key responsibilities include strategic
planning, policy and program development, advocacy, as well as program monitoring and
evaluation (DeJong et al., 1998). Examples of possible programs or actions at the campus level revolve around the development of a campus task force to examine campus level environmental strategies (e.g. alcohol free dorms), education (e.g. peer education programs), enforcement (e.g. judicial sanctions) and early intervention (e.g. student counseling and support groups). At the local community level campuses are advised to develop campus-community coalitions, focusing largely on the increased enforcement and revision of alcohol related ordinances/laws. Finally, at the state level this approach suggests the cooperation of colleges and universities to advocate for state level laws and programs to reduce underage drinking and alcohol related problems (DeJong et al., 1998).

Complementing this work by DeJong and colleagues, the NIAAA convened an expert panel to examine the issue of college drinking and make recommendations for research and practice (Task Force of the National Advisory Council on Alcohol Abuse and Alcoholism, 2002a). The reports from this panel suggested the need for more comprehensive and empirically based programs to address college drinking and its attendant problems. The Call to Action provided recommendations for four primary constituencies: (a) colleges and universities, (b) campus presidents, (c) research community, and the National Institute of Alcohol Abuse and Alcoholism (NIAAA). For campuses the report suggests the use of “comprehensive, integrated programs with multiple complementary components.” The report suggests a 3-in-1 approach along with recommended strategies for each tier of intervention: (1) individuals, brief motivational enhancement interventions, (2) the student population as a whole, increased enforcement of minimum drinking age laws, and (3) the college and surrounding community, provision of ‘safe rides’ programs. In addition, the
report emphasized that strong presidential leadership is necessary component of any successful alcohol program (Task Force of the National Advisory Council on Alcohol Abuse and Alcoholism, 2002a).

The challenges of implementing such environmental initiatives can be considerable. Weitzman et al (2004) examined 10 colleges that had launched multisite environmental prevention initiatives that included interventions to target availability (e.g. keg registration), legal sanctions (e.g. Restrictive policy for Greek students), physical context (e.g. substance-free residence halls), advertising (e.g. ban on alcohol ads in student newspaper), key influences (e.g. parental notification policy), and sociocultural context (e.g. alcohol-free programming). At the end of a five year intervention, there was no statistically significant difference between these experimental schools and a group of 32 comparison schools along standard measures of drinking, drinking related consequences, and second-hand effects of drinking. However, there were significant pre-post differences in the subset of experimental schools that had shown the most fidelity in implementing the intervention. This suggests that infrastructure available to implement prevention activities may play an important role in the success of such ecological approaches. However, it is important to note that while institutional investment in prevention is an important prerequisite for launching comprehensive, environmental interventions, it is not the same thing as, or a proxy measure of such interventions.

Investment in Prevention Infrastructure to Support More Comprehensive Approaches

DeJong and colleagues suggest that the implementation of an ecological strategy will require: (a) strong presidential leadership, (b) engagement of administration, faculty, staff,
and students, (c) engagement of leaders in the surrounding community, and (d) active participation of campus official in state policy (DeJong & Davidson, 2000; The Higher Education Center for Alcohol and Other Drug Prevention, 1997). In addition there are several practical components including hiring of program and evaluation staff, creating task forces, conducting needs assessments or evaluation survey, and staff to conduct a comprehensive reviews of alcohol policies and programs. However, it is unclear that Universities and Colleges are investing the level of resources needed to make such comprehensive initiatives feasible.

DeJong and colleagues conducted a study in 1998, designed to better understand “the extent to which colleges and universities have installed the infrastructure they need to develop, implement and evaluate a comprehensive program that includes prevention strategies with an environmental management focus” (DeJong & Langford, 2002; DeJong et al., 1998; Larimer & Cronce, 2002). This study found that less than 40 percent of campuses have implemented a comprehensive approach to alcohol programming, such as campus wide task force (39.8%), participation in a local coalition on AOD issues (28.5%), or participation in a state–level association (32.6%). Only 37.3 percent conducted a survey on student AOD use, knowledge and attitudes and less than 20 percent conducted a formal assessment of AOD policies and programs. This suggests that most campuses have not yet put in place the basic elements of a comprehensive approach to alcohol prevention, and further have a limited infrastructure to implement and evaluate such an approach (DeJong and Langford, 2002).

Similarly, two studies by Wechsler and his colleagues were designed: (a) “to take stock of current efforts and trends in alcohol prevention nationally and (b) to assess if
administrators’ perception of drinking problems impacted implementation of prevention programs (Wechsler, Kelley, Weitzman, San Giovanni, & Seibring, 2000; Wechsler et al., 2004). These studies found that approximately 60 percent of schools had a “task force to deal with on-campus abuse”, 54.6 percent measured the extent of binge drinking occurring at their schools, 40 percent reported any effort to assess program impact, and 39.7 percent had a cooperative agreement with local community agencies (Wechsler, Kelley et al., 2000; Wechsler, Seibring, Liu, & Ahl, 2004). Some of the differences in findings between Wechsler and DeJong may be attributed to differences in methodology and time of the study. Nonetheless, the overall conclusion to be drawn is that many schools have not invested in elements presumed to be important for prevention programming.

Wechsler and colleagues also found that the level of institutional investment in prevention infrastructure was related to both the administrators’ perception of alcohol problems on campus and the size of the school (enrollment). Schools in which administrators’ perceived alcohol use as a more serious problem were more likely to have made greater institutional investments. However, administrators’ perceptions of the seriousness of campus alcohol abuse may be influenced by a variety of factors other than student outcomes, such as a prominent alcohol-related events, or a legal challenge (Wechsler, Kelley et al., 2000; Wechsler et al., 2004). Likewise, the differences between large and small schools may represent natural differences in logistics and financial resources. While these studies provide an important context for understanding campus institutional investment in prevention there is currently no study that has looked at how institutional investment relates to college drinking assessed in some more independent fashion.
Taken together the above studies suggest that Universities and colleges vary widely in their investment in the prevention infrastructure seemingly necessary to support the implementation and maintenance of these environmental management approaches (DeJong & Langford, 2002; DeJong et al., 1998; Wechsler et al., 2004; Weitzman et al., 2004; Ziemelis et al., 2002) However, to date there has been no systematic examination of the relationship between institutional investment in prevention infrastructure and student drinking outcomes, such as drinking related consequences or drinking frequency. In addition, there is no data on the extent to which such investments are related to student outcomes among particularly at-risk and hard to reach groups such as fraternity members.

**Study Overview**

This study examines the impact of investing in prevention resources on drinking behavior and drinking related consequences among fraternity members. This study will contribute to the college drinking literature in several ways. First, this study focuses on the drinking of Fraternity members, the highest risk group among college students. Second, drinking frequency is measured the timeline follow-back technique, the most reliable self-report methods for acquiring self-reported drinking information. Fourth, it brings together the two literatures of environmental management and Fraternity drinking. It provides a critical next step in the research by examining the relationship between institutional investment in prevention infrastructure and level of student drinking, controlling for both individual and school level risk factors. Fifthly, this study uses hierarchical linear modeling (HLM) analysis as a means of dealing with the nested nature of the fraternity data. Specifically the following hypotheses will be tested:
Hypothesis 1a: Students' drinking frequency will be significantly related to institutional investment.

Hypothesis 1b: Students' drinking frequency will be significantly related to institutional investment, after controlling for the individual level variables of: residence, social norm, sensation seeking, positive alcohol expectancies, family history, and age first used alcohol and the institutional level variables of enrollment, region, and urbanicity.

Hypothesis 2a: Students' drinking related consequences will be significantly related to institutional investment.

Hypothesis 2b: Students' drinking related consequences will be significantly related to institutional investment, after controlling for the individual level variables of: residence, social norm, sensation seeking, positive alcohol expectancies, family history, and age first used alcohol and the institutional level variables of enrollment, region, and urbanicity.

Hypothesis 3a: Students' positive alcohol expectancies will be significantly related to institutional investment.

Hypothesis 3b: Students' positive alcohol expectancies will be significantly related to institutional investment, after controlling for the individual level variables of: residence, social norm, sensation seeking, family history, and age first used alcohol and the institutional level variables of enrollment, region, and urbanicity.
CHAPTER 2: METHODS

Participants

This study is a secondary analysis of student level and institutional level data collected at the same 31 campuses from two different studies.

Student Level Participants

Data from student level participants were collected from an experimental evaluation of the Training for Intervention Procedures (TIPS) program on the drinking behavior and drinking related consequences among the chapter members of a single national fraternity (Caudill, Crosse et al., 2001; Caudill, Luckey, & Kong, 2001). The chapters were randomly assigned a standard intervention group, enhanced intervention group, or an assessment only control group. Data were collected in person at each campus at baseline, 6, 12, and 18 months using an audio-enhanced computer assisted self interviewing (A-CASI) procedures (Sobell & Sobell, 1992, 1993). In addition, the alcohol use questions were collected using a computerized version of Sobell and Sobell’s Alcohol Timeline Followback Interview (Sobell & Sobell, 1992), which has been demonstrated as an effective methodology for providing reliable estimates of alcohol use (Sobell et al., 2003).

In order to avoid any confounds from the intervention, the baseline data were used in this study, to assessed student alcohol use, alcohol related problems, and individual level risk factors for drinking. The baseline sample was collected in fall 2000 and included 98 of 99 chapters with a total of 3,411 participants, representing 88 percent of eligible members. The sample for this study is 1,254, representing participants from the 31 campuses overlapping
with the institutional level data. Similar to the overall sample, the study sample was 95.1 percent white, with an average age of 20.26 (sd = 1.65).

**Institutional Level Participants**

Data from institutional level participants come from a national survey of campus administrators at 330 institutions that has been conducted every three years since 1979. The data collected in fall 2000 will be used in this study, to represent campus policies at the time of the fraternity drinking baseline. In 2000 a total of 193 campuses completed the survey, 58.8 percent of eligible participants (Anderson & Gadelto, 2001). In addition, data from 1997 will be used to examine changes in institutional investment from 1997 to 2000. In 1997 a total of 245 institutions completed the survey, 74.2 percent of eligible schools (Anderson & Gadelto, 2001).

A general timeline of when the data were collected for both of the studies is summarized below in Table 1.

**Table 1: Timeline of Data Collection for Study Datasets**

<table>
<thead>
<tr>
<th>Dataset</th>
<th>Date of Data Collection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1997</td>
</tr>
<tr>
<td>Fraternity Drinking Study</td>
<td>FA</td>
</tr>
<tr>
<td>Campus Administrators</td>
<td>X</td>
</tr>
</tbody>
</table>

**Variables**

A summary of the variables by level and by dataset is included in Appendix A.
Dependent Variables

Drinking Frequency: This variable was measured based on the number of days a person drank in the last 28 days. In the total sample \( n=3,411 \) the number of days drinking ranged from 0 to 28, with a mean number of 11 (sd = 1.75) days and a median of 10 days. On drinking days participants reported drinking an average of 7.05 drinks per day (range = 0 to 22.58).

This data were collected using the timeline follow-back technique, which utilizes several memory aides, including a calendar, to help individuals remember their activities over a specified period of time. The participant is asked to “fill-in” a blank calendar with relevant personal events (e.g., holidays, trips, exams, etc). The student is then presented with the calendar and asked to complete a daily inventory of their drinking frequency using daily events as “triggers” to their recall (Sobell & Sobell, 1992). The use of this technique helps reduce telescoping through the use of the calendar. Further, the structured environment and memory cues seem likely to reduce response biases such as social desirability. Further, by providing standard definitions for drink sizes it is possible that it could increase the accuracy of the level of drinking. The use of this technique provides a very robust measure of alcohol use and increases our confidence in the credibility of this measure (Sobell & Sobell, 2003).

Drinking related consequences was measured using a composite score from the Rutgers Alcohol Problem Index (RAPI) (Brown, Goldman, Inn, & Anderson, 1980). Among the total sample the RAPI scale had an alpha reliability of 0.871.

The RAPI contains items that were rated based on how many times in the past 30 days the participant had experienced the items while drinking alcohol or because of their
alcohol use. This scale included a total of 23 items, such as: (a) got into fights, (b) went to work or school high or drunk, and (c) noticed a change in your personality. The scale used in this study had three additional items, for a total of 26, relevant to college populations: (a) acted badly, or did mean things, (b) were too sick to go to class, and (c) had a hangover. RAPI scores were calculated using a count of the number of different problems a student reported experiencing over 28 days. For example a student reporting hangovers and a fight received a score of two. Participants had an average RAPI score of 7.23 with a range from 0 to 26.

**Correlation between Dependent Variables**

The dependent variables, drinking days and RAPI, were significantly and positively correlated ($r = 0.533$, $p < 0.01$).

**Individual Level Independent Variables**

At the individual level the analyses will control for six variables related to college alcohol use:

**Residence:** this variable was measured using a single forced choice item with four possible responses: (a) dorm, (b) fraternity house, (c) with parents, and (d) off-campus. The data were collapsed into dummy variable for living in fraternity house (coded 1; 49.7%) or other residence (coded 0; 50.3%).

**Social Norms:** This construct was measured using a single item, “For each situation, please answer how often you think the average male in that situation probably drinks alcohol each month…An average male college student residing in a fraternity.” The responses were on a 7 point likert scale ranging from “Less than once a month” to “Once a day.” The mean
score of the total sample was 4.56 indicating that the perceived drinking frequency of “men residing in fraternities” is between “Once or twice a week” and “three or four times a week.”

**Sensation Seeking:** This construct was measured using the 40-item Zuckerman Sensation Seeking Scale (Arnett, 1994). Internal reliability of this scale has ranged between 0.83 and 0.86 (Zuckermam, Eysenck, & Eysenck, 1978). Participants were asked to select from one of two choices for each item:

“Please choose the ONE which better describes your likes or feelings
I like “wild uninhibited parties”.................................1
I prefer quiet parties with good conversation..............2

This study will use an averaged scale score, which is calculated by adding items coded 1 indicating higher level of sensation seeking and dividing by the total number of items. The average score was 0.56 and ranged from 0.08 to 0.92.

**Positive Alcohol Expectancies:** This construct was measured using the Alcohol Expectancy Questionnaire (Brown et al., 1980). This instrument was developed to assess what an individual believes the effects of alcohol are, regardless of actual drinking experience. The instrument used in this study contains 41 items answering the question “Drinking alcohol makes me _____;” and includes such items as: (a) active, (b) outgoing, and (c) forgetful. Items are rated on an 11 point likert scale with the anchors of 0 “Never” to 10 “Always”. Positive alcohol expectancies have been found to be a more powerful motivator of drinking than negative alcohol expectancies (Leigh & Stacy, 1993). Internal reliability of the positive expectancies scale was .95 (Kellior, Perkins, & Horan, 1996).

**Family History of Alcohol Use:** This variable was constructed by combining responses from two questions about the participants’ parent’s level of drinking:
How would you categorize the drinking behavior of your [Mother/Father]?

- a. Never drank
- b. Social \drinker
- c. Possible problem drinker
- d. Definite problem drinker
- e. Don’t know/don’t remember

The data were collapsed into 2 categories identifying problem drinkers (22%) and non-problem drinkers (78%). Parents were labeled problem drinkers if either parent were categorized as “possible problem drinker” or “definite problem drinker.”

**Age of First Use of Alcohol:** This is a continuous variable based on a single open-ended item: “How old were you the first time you used alcohol?”

**Institutional Level Independent Variables**

At the campus level there is one main independent variable, institutional investment in prevention. This variable is composed of 5 yes/no items from the George Mason College Alcohol Survey (Anderson & Gadelto, 2001):

- a. Does your campus have an individual to serve as its Alcohol/Substance Abuse Educator or Specialist?
- b. Does your campus have a task force to address drug- and alcohol- related concerns?
- c. In the last 2 years, has your campus conducted a survey focusing the drinking behavior of students?
- d. In the last several years, has your campus conducted a formal assessment of the effectiveness of its drug and alcohol prevention program?
- e. Does your campus have a task force or partnership with the surrounding community to address drug- and alcohol- related concerns?

These items were chosen in order to match variables used by Wechsler et al. (2000). The average Institutional Investment score was 3.39 with a range of 1 to 5.

Three additional variables are used as covariates at the campus level: (a) enrollment (transformed to Natural Log), (b) urbanicity of campus (urban/suburban vs rural), and (c)
region of the country (northeast/north central vs rest). These covariates were added to control for the possibility that study findings are simply an artifact of school location or size of enrollment.

**Enrollment** was included as a campus level covariate to control for differences in drinking frequency based on enrollment. Wechsler and colleagues (2000, 2002) found that large schools (enrollments > 10,000) has significantly higher levels of binge drinking than schools with small schools (enrollment < 5,000). The school undergraduate enrollment in this sample for Fall 2000 ranged from 2,115 to 44,126 with a mean of 18,196. Twenty-five schools (80.6%) have enrollments greater than 10,000 students. Among these 25 schools the enrollment ranges from 10,019 to 44,125 while the enrollment for the other 6 school ranges from 2,115 to 9,847. Because of the large variation in the enrollment this variable was transformed using natural log.

**Region** has also been identified as a significant predictor of binge drinking, with schools in the north east and north central regions having significantly higher levels of binge drinking than other regions in the US (Substance Abuse and Mental Health Services Administration, 2005; Vicary & Karshin, 2002). The 31 schools were distributed across 21 states, with 6 containing more than one school. Four of the states had two schools, one had three schools and one had five schools. Sixteen schools (51.6%) were classified into the north east or north central region (coded 1). Schools from north east and north central region reported higher level of drinking days (X = 11.24) compared to schools in other regions (X = 9.55).
Urban/Rural variable was used to examine the impact of school location on drinking behavior (Vicary & Karshin, 2002). There were 17 schools in the urban or suburban regions (coded 1; 54.8%) and 14 in rural areas (coded 0; 45.2%).

Bivariate Comparisons of Variables

Comparison between Study Sample and Full Dataset

The first set of analyses compared students in this study with the remaining students from the original fraternity sample on the individual level variables (see Appendices B & C). There were no significant differences between students in these two groups on the following variables: race/ethnicity, family history of problem drinking, age, positive alcohol expectancies, sensation seeking, and age of first use of alcohol. Students in this study were significantly different from the remaining fraternity sample, showing higher scores on measures of drinking related consequences ($F = 23.39, r < .001$), number of drinking days ($F = 7.53, p < .006$), and social norms for drinking ($F = 16.18, P < .001$). Students in this study were also more likely to reside outside of a fraternity ($\chi^2 = 10.67, df = 4, p \leq .031$).

Analysis Plan

This study examines the relationship of school level variables on individual level behavior. Individuals are nested within school/fraternity chapter, so that each individual is more likely to be similar to his/her school/fraternity peers than to individuals in the sample as a whole. This violates the assumption of independent observations underlying standard multivariate analyses. Nested designs using individuals as the unit of analysis (and not accounting for the hierarchical nature of the data) can underestimate the error term and produce overestimates of the effects of group level variables (e.g., institutional investment in
One way to address this problem is through the use of multi-level modeling techniques, such as Hierarchical Linear Modeling (i.e., HLM).

Conceptually, HLM addresses nested relationship by fitting a regression equation at the individual level within each group, allowing the parameters of the regression equations (i.e. intercept and Beta coefficients) to vary by school membership. Simultaneously, group-level variables are examined to see if they explain any variation in the individual-level parameters. In addition, this allows for testing main effects and interactions within and between levels, adjusting the error terms for interdependence of within group observations.

**Null Model and ICC**

A null model was tested to see if there were significant differences between campuses for each of the dependent variables, thus warranting the use of HLM. The null models took the following form.

The Level 1 Model was:

\[ Y_{ij} = \beta_{0j} + r_{ij} \]

where:

- \( Y_{ij} \) is the outcome of participant i in school j (j=1,..,31 schools);
- \( \beta_{0j} \) is the mean outcome in school j;
- \( r_{ij} \) is the Level-1 error of participant i in school j;

The Level 2 model was:

\[ \beta_{0j} = \gamma_{00} + u_{0j} \]

where:

- \( \gamma_{00} \) is the grand mean outcome across schools;
$u_{0j}$ is the residual error variance at Level 2.

For all three outcome variables the Var($u_{0j}$) was significant, therefore school membership explains a significant amount of variation in $Y_{ij}$, for each dependent variable: (a) drinking days ($T=25.215$, df=29, $p < .001$), (b) drinking related consequences ($T=20.318$, df=29, $p < 0.001$), and (c) positive alcohol expectancies ($T=75.310$, df=29, $p < 0.001$).

Further, the Intraclass Correlation Coefficients (ICC’s) indicates the amount of variance in each of the outcomes accounted for by campus-level variables: (a) drinking days was 0.1817, (b) drinking related consequences was 0.1376, and (c) positive alcohol expectancies was 0.0308.

**Hypothesis Testing**

Hypotheses 1a, 2a, and 3a represent base models developed to examine the relationship between institutional investment and each dependent variable: (a) drinking frequency, (b) drinking related consequences, and (c) positive alcohol expectancies.

The Level 1 Model will be:

$$Y_{ij} = \beta_{0j} + r_{ij}$$

The Level 2 model will be:

$$\beta_{0j} = \gamma_{00} + \gamma_{01} \text{ (institutional investment)} + u_{0j}$$

For these models a significant $\gamma_{01}$ parameter would indicate significant differences in the outcome variables as a function of institutional investment in prevention infrastructure.

Next a full model was developed to examine the relationship between the institutional investment variable and the dependent variables controlling for the identified risk factors.
For drinking frequency (hypothesis 1b) and drinking related consequences (hypothesis 2b) the models were as follows:

The Level 1 Model was:

\[ Y_{ij} = \beta_{0j} + \beta_{1j} \text{ (residence)} + \beta_{2j} \text{ (social norms)} + \beta_{3j} \text{ (sensation seeking)} + \beta_{4j} \text{ (positive expectancies)} + \beta_{5j} \text{ (family history)} + \beta_{6j} \text{ (age of first use)} + r_{ij} \]

The Level 2 model was:

\[ \beta_{0j} = \gamma_{00} + \gamma_{01} \text{ (institutional investment)} + \gamma_{02} \text{ (enrollment)} + \gamma_{03} \text{ (region)} + \gamma_{04} \text{ (urbanicity)} + u_{0j} \]

\[ \beta_{1j} = \gamma_{10} + u_{1j} \]
\[ \beta_{2j} = \gamma_{20} + u_{2j} \]
\[ \beta_{3j} = \gamma_{30} + u_{3j} \]
\[ \beta_{4j} = \gamma_{40} + u_{4j} \]
\[ \beta_{5j} = \gamma_{50} + u_{5j} \]
\[ \beta_{6j} = \gamma_{60} + u_{6j} \]

Where:

\( Y_{ij} \) is the outcome of participant i in school j (j = 1, … , 31 schools);
\( \beta_{0j} \) is the mean outcome (drinking frequency or drinking related consequences in school j; and
\( r_{ij} \) is the Level-1 error of participant i in school j;
\( u_{ij} \) is the residual Level 2 error variance for school j.

The model for positive alcohol expectancies (hypothesis 3b) was as follows:
The Level 1 Model was:

\[ Y_{ij} = \beta_{0j} + \beta_{1j} \text{ (residence)} + \beta_{2j} \text{ (social norms)} + \beta_{3j} \text{ (sensation seeking)} + \beta_{4j} \text{ (family history)} + \beta_{5j} \text{ (age of first use)} + r_{ij} \]

The Level 2 model was:

\[ \beta_{0j} = \gamma_{00} + \gamma_{01} \text{ (institutional investment)} + \gamma_{02} \text{ (enrollment)} + \gamma_{03} \text{ (region)} + \gamma_{04} \text{ (urbanicity)} + u_{0j} \]

\[ \beta_{1j} = \gamma_{10} + u_{1j} \]
\[ \beta_{2j} = \gamma_{20} + u_{2j} \]
\[ \beta_{3j} = \gamma_{30} + u_{3j} \]
\[ \beta_{4j} = \gamma_{40} + u_{4j} \]
\[ \beta_{5j} = \gamma_{50} + u_{5j} \]

Where:

\( Y_{ij} \) is the outcome of participant i in school j (j = 1,…,31 schools);
\( B_{0j} \) is the mean outcome (positive alcohol expectancies) in school j; and
\( r_{ij} \) is the Level-1 error of participant i in school j;
\( u_{ij} \) is the residual Level 2 error variance for school j.
CHAPTER 3: RESULTS

Data Management

At the campus level only one data point for one school was missing among the five items that made up the Institutional Investment measure. To retain this school in the analysis, the mean score for that item was substituted and Institutional Investment was then calculated.

At the individual level there was also missing data. To handle missing data, cases were deleted listwise when the data were imported into the HLM program. Thus a total of 1,148 complete cases were included in the HLM analyses out of 1,254 total cases.

The variable examining social norms frequency of drinking of a student residing in a fraternity had significant skew and kurtosis. The variable was recoded from 7 categories into 4 categories. The first 3 categories (Less than once a month, n=5; About once a month, n=4; and two or three times a month, n=43) were combined into a single category and the last 2 categories (Nearly every day, n=94; Once a day, n=14) were combined.

The age of first use variable had significant skew (-1.467) and kurtosis (2.997). To correct these problems the values were transformed to Z-scores and then all scores that fell above 3 standard deviations from the mean were removed from the analysis. This resulted in excluding 30 cases from analysis so that the youngest age of first alcohol use was 5 years old. Such ages of first use may seem young. However, the question wording was ambiguous with regard to the context of first use (e.g., experimentation, use at a religious celebration such as a Seder). The wording for the age of first use question varies in the literature with some using qualifiers to clearly indicate experimentation (e.g. can of beer with a friend)
(Haemmerlie, Montgomery, & Saling, 1994; Labouvie, Bates, & Pandina, 1997). Some
questions use. Nonetheless, age of first use had a significant, negative correlation with age
drinking frequency ($r=-.21$) and drinking related consequences ($r=-.20$).

At the campus level enrollment was transformed using natural log to reduce the skew.

**Individual Level Variables**

Descriptive statistics for the dependent and predictor variables are summarized below
in Table 2.

<table>
<thead>
<tr>
<th>Variable</th>
<th>M</th>
<th>SD</th>
<th>Skew</th>
<th>Kurtosis</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drinking Days</td>
<td>11.01</td>
<td>5.22</td>
<td>0.45</td>
<td>0.46</td>
<td>0-28</td>
</tr>
<tr>
<td>Drinking Related Consequences</td>
<td>7.93</td>
<td>5.26</td>
<td>0.51</td>
<td>-0.08</td>
<td>0-26</td>
</tr>
<tr>
<td>Positive Alcohol Expectancies</td>
<td>5.28</td>
<td>1.62</td>
<td>-0.80</td>
<td>0.67</td>
<td>0-9.33</td>
</tr>
<tr>
<td>Social Norms*</td>
<td>2.64</td>
<td>0.71</td>
<td>-0.11</td>
<td>-0.22</td>
<td>1-4</td>
</tr>
<tr>
<td>Sensation Seeking</td>
<td>0.56</td>
<td>0.14</td>
<td>-0.29</td>
<td>0.02</td>
<td>0.08-0.92</td>
</tr>
<tr>
<td>Age First Used Alcohol*</td>
<td>14.30</td>
<td>2.92</td>
<td>-0.95</td>
<td>1.20</td>
<td>5-21</td>
</tr>
<tr>
<td>Percent Fraternity Residence</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>49.7%</td>
</tr>
<tr>
<td>Percent Family History of</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>22.0%</td>
</tr>
<tr>
<td>Problematic Drinking</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Variable was transformed for analysis

Correlations were conducted to examine the multicollinearity between all variables
used in the analyses and are listed in Table 3. Correlations ranged from - 0.22 to 0.49. The
largest correlation among dependent variables was between drinking related consequences
and drinking days ($r = 0.49$, $p < .01$). The largest correlation among independent variables
was between social norms and positive alcohol expectancies \((r = 0.23, p < 0.01)\). Overall the correlations are all consistent with the literature except for residence. Residence does not correlate with either dependent variable or the independent variables in this sample. The literature suggests that residing in a fraternity house is a risk factor for higher levels of drinking and drinking related consequences (Wechsler & et al., 1996). However, the data for these findings were typically focused on the general student population and compared fraternity residents with all nonresidents, combing both fraternity and non-fraternity students.

### Table 3: Correlations among Individual Level variables

<table>
<thead>
<tr>
<th>Measure</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Drinking Days</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>2. Drinking Related Consequences</strong></td>
<td>.49**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Positive Alcohol Expectancies</td>
<td>.25**</td>
<td>.38**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Fraternity Residence</td>
<td>-.005</td>
<td>.02</td>
<td>-.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Social Norms</td>
<td>.36**</td>
<td>.30**</td>
<td>.23**</td>
<td>-.09**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Sensation Seeking</td>
<td>.30**</td>
<td>.25**</td>
<td>.16**</td>
<td>-.004</td>
<td>.15**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Family History of Drinking</td>
<td>.09**</td>
<td>.11**</td>
<td>.03</td>
<td>-.05</td>
<td>.07*</td>
<td>.17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Age first Used Alcohol</td>
<td>-.21**</td>
<td>-.20**</td>
<td>-.15**</td>
<td>.04</td>
<td>-.18**</td>
<td>-.22**</td>
<td>-.07*</td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)

**Correlation is significant at the 0.01 level (2-tailed)

**Institutional Level Variables**

Descriptive statistics for institutional level predictor variables are summarized below in Table 4.
Table 4: Descriptive Statistics for Campus Level Variables (n = 1148)

<table>
<thead>
<tr>
<th>Variable</th>
<th>M</th>
<th>SD</th>
<th>Skew</th>
<th>Kurtosis</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institutional Investment</td>
<td>3.39</td>
<td>1.26</td>
<td>-.16</td>
<td>-1.00</td>
<td>1-5</td>
</tr>
<tr>
<td>Enrollment*</td>
<td>18,196</td>
<td>10,461</td>
<td>0.75</td>
<td>0.421</td>
<td>2,115-44,126</td>
</tr>
<tr>
<td>Percent Urban/Suburban</td>
<td>54.8%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent North East or North Central US</td>
<td>51.6%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*A transformed version of this was used for analysis

Correlations were also conducted to examine the multicollinearity between institutional level variables used in the analyses and are listed in Table 5. Correlations ranged from -0.36 to 0.38. The largest correlation among institutional level variables was between institutional investment and natural log of enrollment (r = 0.38, p < 0.05).

Table 5: Correlations among Institutional Level Variables

<table>
<thead>
<tr>
<th>Measure</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Institutional Investment</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Enrollment (LN)</td>
<td>0.38*</td>
<td>--</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Urban/Suburban</td>
<td>-.01</td>
<td>-.36*</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>4. North East and North Central US</td>
<td>0.02</td>
<td>0.24</td>
<td>0.03</td>
<td>--</td>
</tr>
</tbody>
</table>

* Correlation is significant at the 0.05 level (2-tailed)
**Analyses Testing Hypotheses**

*Random vs. Fixed Effects:* There are several different approaches for constructing HLM models. In particular there was not a clear theory about which individual covariates were likely to vary across schools. As such an empirical process was employed to determine which covariates significantly varied across schools. This required running an HLM model with all of the individual level covariates unconstrained, or the slopes allowed to vary across schools (see Appendix D). For all variables with significant variance components, the slopes were kept unconstrained, and the rest were constrained or not allowed to vary across schools (see Appendix E). In addition we compared the models’ deviance statistics using Chi Squares to compare the goodness of fit between the unconstrained and constrained models. Across the models there were no significant differences in the goodness of fit for any of the dependent variables: (a) drinking frequency ($\chi^2 = 9.28 \ df= 25, p > 0.50$), (b) drinking related consequences ($\chi^2 = 10.52 \ df=22, p > 0.50$), and (c) positive alcohol expectancies ($\chi^2 = 12.51 \ df=18, p > 0.50$). Further, the pattern of findings remained the same in both the unconstrained and constrained models.

*Hierarchical Linear Models*

**Hypothesis 1a:** Students' (a) drinking frequency will be significantly related to institutional investment.

Based on HLM analysis of this model, this hypotheses was not supported ($T=-1.02, df=29, p=0.317$). As such, there were no significant relationship between drinking frequency and campus level of institutional investment, see Table 6.
Table 6  HLM of institutional investment impact on Drinking Frequency

<table>
<thead>
<tr>
<th>Fixed Effects</th>
<th>Coefficient</th>
<th>SE</th>
<th>T-Ratio</th>
<th>Df</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept2, G_{00}</td>
<td>10.88</td>
<td>0.43</td>
<td>25.22</td>
<td>29</td>
<td>0.000</td>
</tr>
<tr>
<td>Institutional Investment, G_{01}</td>
<td>-0.34</td>
<td>0.33</td>
<td>-1.02</td>
<td>29</td>
<td>0.317</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Random Effects</th>
<th>SD</th>
<th>Variance Component</th>
<th>Df</th>
<th>( \chi^2 )</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept1, U0</td>
<td>2.29</td>
<td>5.25</td>
<td>29</td>
<td>215.23</td>
<td>0.000</td>
</tr>
<tr>
<td>Level 1, R</td>
<td>4.86</td>
<td>23.65</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Hypothesis 1b:** Students' drinking frequency will be significantly related to institutional investment, after controlling for the individual level variables of: residence, social norm, sensation seeking, positive alcohol expectancies, family history, and age first used alcohol, and the institutional level variables of enrollment, region, and urbanicity.

As with the base model, this hypothesis was not supported (T= -0.53, df=26, p=0.599). There was no significant relationship between drinking days and institutional investment controlling for individual level covariates, see Table 7.

These results are consistent with similar analyses using drinking measures (i.e., BAC and Binge Drinking).
Table 7  HLM of institutional investment impact on Drinking Frequency controlling for Individual Institutional Level Risk Factors

<table>
<thead>
<tr>
<th>Fixed Effects</th>
<th>Coefficient</th>
<th>SE</th>
<th>T-Ratio</th>
<th>df</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept2, G₀₀</td>
<td>11.01</td>
<td>0.31</td>
<td>35.07</td>
<td>26</td>
<td>0.000</td>
</tr>
<tr>
<td>Institutional Investment, G₀₁</td>
<td>-0.14</td>
<td>0.27</td>
<td>-0.53</td>
<td>26</td>
<td>0.599</td>
</tr>
<tr>
<td>Enrollment</td>
<td>-0.37</td>
<td>0.53</td>
<td>-0.70</td>
<td>26</td>
<td>0.487</td>
</tr>
<tr>
<td>Urban/Rural</td>
<td>0.49</td>
<td>0.62</td>
<td>0.79</td>
<td>26</td>
<td>0.438</td>
</tr>
<tr>
<td>Region</td>
<td>0.55</td>
<td>0.57</td>
<td>0.97</td>
<td>26</td>
<td>0.344</td>
</tr>
<tr>
<td>Residence, G₁₀</td>
<td>0.46</td>
<td>0.40</td>
<td>1.16</td>
<td>30</td>
<td>0.257</td>
</tr>
<tr>
<td>Social Norms G₂₀</td>
<td>1.66</td>
<td>0.18</td>
<td>9.32</td>
<td>1137</td>
<td>0.000</td>
</tr>
<tr>
<td>Sensation Seeking, G₃₀</td>
<td>8.16</td>
<td>0.98</td>
<td>8.31</td>
<td>1137</td>
<td>0.000</td>
</tr>
<tr>
<td>Positive Alcohol Expectancies, G₄₀</td>
<td>0.43</td>
<td>0.08</td>
<td>5.38</td>
<td>1137</td>
<td>0.000</td>
</tr>
<tr>
<td>Age First Used Alcohol G₅₀</td>
<td>-0.15</td>
<td>0.05</td>
<td>-3.21</td>
<td>1137</td>
<td>0.002</td>
</tr>
<tr>
<td>Family History of Drinking G₆₀</td>
<td>0.62</td>
<td>0.34</td>
<td>1.84</td>
<td>1137</td>
<td>0.066</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Random Effects</th>
<th>SD</th>
<th>Variance Component</th>
<th>df</th>
<th>χ²</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept1, U₀</td>
<td>1.60</td>
<td>2.56</td>
<td>22</td>
<td>93.48</td>
<td>0.000</td>
</tr>
<tr>
<td>Residence, G₁₀</td>
<td>1.48</td>
<td>2.19</td>
<td>26</td>
<td>47.65</td>
<td>0.006</td>
</tr>
<tr>
<td>Level 1, R</td>
<td>4.40</td>
<td>19.37</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Hypothesis 2a:* Students' drinking related consequences will be significantly related to institutional investment.

Based on HLM analysis of this model, this hypotheses was supported (T= -2.15 df=29, p=0.040), demonstrating that higher levels of institutional investment in campus
resources are related to lower levels of drinking related consequences among students, see Table 8. The 95% confidence interval for coefficient was 3.83 and 11.51.

Table 8  HLM of institutional investment impact on Drinking Related Consequences

<table>
<thead>
<tr>
<th>Fixed Effects</th>
<th>Coefficient</th>
<th>SE</th>
<th>T-Ratio</th>
<th>df</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept2, G_{00}</td>
<td>7.67</td>
<td>0.38</td>
<td>20.32</td>
<td>29</td>
<td>0.000</td>
</tr>
<tr>
<td>Institutional Investment, G_{01}</td>
<td>-0.63</td>
<td>0.29</td>
<td>-2.152</td>
<td>29</td>
<td>0.040</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Random Effects</th>
<th>SD</th>
<th>Variance Component</th>
<th>Df</th>
<th>( \chi^2 )</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept1, U0</td>
<td>1.96</td>
<td>3.84</td>
<td>29</td>
<td>196.85</td>
<td>0.000</td>
</tr>
<tr>
<td>Level 1, R</td>
<td>4.91</td>
<td>24.08</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

_Hypothesis 2b:_ Students' drinking related consequences will be significantly related to institutional investment, after controlling for the individual level variables of: residence, social norm, sensation seeking, positive alcohol expectancies, family history, and age first used alcohol and the institutional level variables of enrollment, region, and urbanicity.

The hypothesis that drinking related consequences would be significantly related to institutional investment in prevention controlling for individual risk factors was supported (T= -2.80, df=26, p=0.010). Therefore, after controlling for individual level risk factors there remains a negative relationship between the level of institutional investment in prevention and the level of drinking related consequences summarized in Table 9. In looking at the magnitude of this relationship, a one unit increase in the level of institutional investment in prevention resulted in a 0.6 decrease in alcohol related consequences. The confidence interval for the coefficient was 5.22 to 10.38.
<table>
<thead>
<tr>
<th>Fixed Effects</th>
<th>Coefficient</th>
<th>SE</th>
<th>T-Ratio</th>
<th>df</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept2, G₀₀</td>
<td>7.80</td>
<td>0.25</td>
<td>30.60</td>
<td>26</td>
<td>0.000</td>
</tr>
<tr>
<td>Institutional Investment, G₁₀</td>
<td>-0.60</td>
<td>0.22</td>
<td>-2.80</td>
<td>26</td>
<td>0.010</td>
</tr>
<tr>
<td>Enrollment</td>
<td>0.42</td>
<td>0.34</td>
<td>1.22</td>
<td>26</td>
<td>0.232</td>
</tr>
<tr>
<td>Urban/Rural</td>
<td>-0.07</td>
<td>0.51</td>
<td>-0.14</td>
<td>26</td>
<td>0.888</td>
</tr>
<tr>
<td>Region</td>
<td>0.25</td>
<td>0.44</td>
<td>0.58</td>
<td>26</td>
<td>0.568</td>
</tr>
<tr>
<td>Residence, G₁₀</td>
<td>0.51</td>
<td>0.21</td>
<td>2.51</td>
<td>1137</td>
<td>0.012</td>
</tr>
<tr>
<td>Social Norms G₂₀</td>
<td>1.16</td>
<td>0.17</td>
<td>6.66</td>
<td>1137</td>
<td>0.000</td>
</tr>
<tr>
<td>Sensation Seeking, G₃₀</td>
<td>5.37</td>
<td>1.11</td>
<td>4.83</td>
<td>30</td>
<td>0.000</td>
</tr>
<tr>
<td>Positive Alcohol Expectancies, G₄₀</td>
<td>0.92</td>
<td>0.08</td>
<td>10.93</td>
<td>1137</td>
<td>0.000</td>
</tr>
<tr>
<td>Age First Used Alcohol G₅₀</td>
<td>-0.12</td>
<td>0.05</td>
<td>-2.14</td>
<td>30</td>
<td>0.041</td>
</tr>
<tr>
<td>Family History of Drinking G₆₀</td>
<td>0.87</td>
<td>0.22</td>
<td>3.88</td>
<td>1137</td>
<td>0.000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Random Effects</th>
<th>SD</th>
<th>Variance Component</th>
<th>df</th>
<th>χ²</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept1, U₀</td>
<td>1.32</td>
<td>1.74</td>
<td>26</td>
<td>100.98</td>
<td>0.000</td>
</tr>
<tr>
<td>Sensation Seeking, G₃₀</td>
<td>2.74</td>
<td>7.52</td>
<td>30</td>
<td>42.90</td>
<td>0.060</td>
</tr>
<tr>
<td>Age First Used Alcohol G₅₀</td>
<td>0.14</td>
<td>0.02</td>
<td>30</td>
<td>50.91</td>
<td>0.010</td>
</tr>
<tr>
<td>Level 1, R</td>
<td>4.41</td>
<td>19.47</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

_Hypothesis 3a:_ Students' positive alcohol expectancies will be significantly related to institutional investment.
Based on HLM analysis of this model, this hypotheses was not supported (T=-1.41, df=29, p=0.160). As such, there was no significant relationship between the level of positive alcohol expectancies and campus level of institutional investment, see Table 10.

<table>
<thead>
<tr>
<th>Table 10</th>
<th>HLM of institutional investment impact on Positive Alcohol Expectancies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fixed Effects</strong></td>
<td>Coefficient</td>
</tr>
<tr>
<td>Intercept2, G₀₀</td>
<td>5.26</td>
</tr>
<tr>
<td>Institutional Investment, G₀₁</td>
<td>-0.08</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Random Effects</strong></th>
<th>SD</th>
<th>Variance Component</th>
<th>df</th>
<th>χ²</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept1, U₀₀</td>
<td>0.28</td>
<td>0.08</td>
<td>29</td>
<td>62.63</td>
<td>0.000</td>
</tr>
<tr>
<td>Level 1, R</td>
<td>1.59</td>
<td>2.53</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Hypothesis 3b:* Students' positive alcohol expectancies will be significantly related to institutional investment, after controlling for the individual level variables of: residence, social norm, sensation seeking, family history, and age first used alcohol and the institutional level variables of enrollment, region, and urbanicity.

Contrary to the base model this hypothesis was supported. There was a significant relationship between positive alcohol expectancies and institutional investment controlling for individual and institutional level covariates, (T= -2.11, df=26, p=0.045). Therefore, after controlling for individual and institutional level risk factors there was a negative relationship between the level of institutional investment in prevention and the level of positive alcohol expectancies, these findings are summarized in Table 11.
Table 11  HLM of institutional investment impact on Positive Alcohol Expectancies controlling for Institutional and Individual Risk Factors

<table>
<thead>
<tr>
<th>Fixed Effects</th>
<th>Coefficient</th>
<th>SE</th>
<th>T-Ratio</th>
<th>df</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept2, G_{00}</td>
<td>5.25</td>
<td>0.06</td>
<td>92.06</td>
<td>26</td>
<td>0.000</td>
</tr>
<tr>
<td>Institutional Investment, G_{01}</td>
<td>-0.08</td>
<td>0.04</td>
<td>-2.11</td>
<td>26</td>
<td>0.045</td>
</tr>
<tr>
<td>Enrollment LN</td>
<td>0.22</td>
<td>0.06</td>
<td>3.74</td>
<td>26</td>
<td>0.001</td>
</tr>
<tr>
<td>Urban/Rural</td>
<td>-0.47</td>
<td>0.098</td>
<td>-4.83</td>
<td>26</td>
<td>0.000</td>
</tr>
<tr>
<td>Region</td>
<td>-0.06</td>
<td>0.08</td>
<td>-0.81</td>
<td>26</td>
<td>0.426</td>
</tr>
<tr>
<td>Residence, G_{10}</td>
<td>-0.12</td>
<td>0.09</td>
<td>-1.41</td>
<td>1138</td>
<td>0.160</td>
</tr>
<tr>
<td>Social Norms G_{20}</td>
<td>0.48</td>
<td>0.096</td>
<td>5.01</td>
<td>30</td>
<td>0.000</td>
</tr>
<tr>
<td>Sensation Seeking, G_{30}</td>
<td>1.29</td>
<td>0.38</td>
<td>3.35</td>
<td>1138</td>
<td>0.001</td>
</tr>
<tr>
<td>Age First Used Alcohol G_{50}</td>
<td>-0.04</td>
<td>0.02</td>
<td>-2.70</td>
<td>1138</td>
<td>0.007</td>
</tr>
<tr>
<td>Family History of Drinking G_{60}</td>
<td>0.001</td>
<td>0.12</td>
<td>0.01</td>
<td>1138</td>
<td>0.990</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Random Effects</th>
<th>SD</th>
<th>Variance Component</th>
<th>df</th>
<th>$\chi^2$</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept1, U0</td>
<td>0.18</td>
<td>0.03</td>
<td>26</td>
<td>33.34</td>
<td>0.152</td>
</tr>
<tr>
<td>Social Norms G_{20}</td>
<td>0.35</td>
<td>0.12</td>
<td>30</td>
<td>49.23</td>
<td>0.015</td>
</tr>
<tr>
<td>Level 1, R</td>
<td>1.52</td>
<td>2.30</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Across the three full HLM models there were similarities in the covariates. In all three models, social norms, sensation seeking, and age of first alcohol use were significant predictors. Further, positive alcohol expectancies was a significant predictor in both the drinking frequency and drinking related consequences models.
Longitudinal Analysis of Institutional Investment

One limitation with the design of previous analyses is that a cross-section design is used with both the student drinking and institutional investment data collected concurrently in Fall of 2000. A potential problem with this is that it is likely that after implementing institutional investments there would be a lag before it would have an effect. For example if a school hires a substance abuse coordinator it may take as long as a school year to schedule and implement prevention programs, thus causing a delay between the initial investment and an expected impact on student behavior. One could argue that it is difficult to know in the previous analyses whether an institutional investment score represents a moving (either up or down) or stable estimate.

To address this concern a set of subanalyses were conducted using longitudinal data on a constricted 4-item institutional investment scale and a reduced sample of 23 schools. The scale represents 4 institutional investment items that were collected in both 1997 and 2000. The excluded item, first used in the 2000 survey, was: “Does your campus have a task force to address drug- and alcohol-related concerns?” For these analyses two measures of institutional investment were used. First the total score from 1997 and second a change score calculated by subtracting 2000 from 1997, representing the change in investment over the three year period. Between 1997 and 2000 there was considerable change in the overall institutional investment score. Nine schools had increases, five schools had decreases, and eight retained the same number of prevention elements between 1997 and 2000. A comparison of institutional investment at each school in 1997 and 2000 is included in Appendix F.
Analyses using 1997 Institutional Investment and the change score showed a similar pattern of results to the previous HLM models and are described below.

For drinking frequency the pattern of results were the same between the cross-sectional only and the longitudinal analyses. Institutional investment was not a significant predictor of drinking frequency ($T= -0.39$, df=17, $p=0.700$). Further, with the exception of fraternity residence ($T= 1.36$, df=22, $p=0.189$), all of the individual level covariates were significant predictors of drinking frequency (see Table 12).
Table 12  HLM of change in institutional investment on Drinking Frequency controlling for Institutional and Individual Risk Factors

<table>
<thead>
<tr>
<th>Fixed Effects</th>
<th>Coefficient</th>
<th>SE</th>
<th>T-Ratio</th>
<th>df</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept2, G₀₀</td>
<td>11.21</td>
<td>0.35</td>
<td>31.96</td>
<td>17</td>
<td>0.000</td>
</tr>
<tr>
<td>1997 Institutional Investment, G₀₁</td>
<td>-0.164</td>
<td>0.42</td>
<td>-0.39</td>
<td>17</td>
<td>0.700</td>
</tr>
<tr>
<td>Change in Inst. Investment, G₀₂</td>
<td>0.07</td>
<td>0.41</td>
<td>0.16</td>
<td>17</td>
<td>0.873</td>
</tr>
<tr>
<td>Enrollment, G₀₃</td>
<td>0.08</td>
<td>0.50</td>
<td>0.16</td>
<td>17</td>
<td>0.872</td>
</tr>
<tr>
<td>Urban/Rural, G₀₄</td>
<td>-0.04</td>
<td>0.69</td>
<td>-0.05</td>
<td>'17</td>
<td>0.958</td>
</tr>
<tr>
<td>Region, G₀₅</td>
<td>0.09</td>
<td>0.72</td>
<td>1.26</td>
<td>17</td>
<td>0.225</td>
</tr>
<tr>
<td>Residence, G₁₀</td>
<td>0.62</td>
<td>0.46</td>
<td>1.36</td>
<td>22</td>
<td>0.189</td>
</tr>
<tr>
<td>Social Norms G₂₀</td>
<td>1.66</td>
<td>0.20</td>
<td>8.31</td>
<td>846</td>
<td>0.000</td>
</tr>
<tr>
<td>Sensation Seeking, G₃₀</td>
<td>7.76</td>
<td>1.10</td>
<td>7.03</td>
<td>846</td>
<td>0.000</td>
</tr>
<tr>
<td>Positive Alcohol Expectancies, G₄₀</td>
<td>0.47</td>
<td>0.09</td>
<td>5.05</td>
<td>846</td>
<td>0.000</td>
</tr>
<tr>
<td>Age First Used Alcohol G₅₀</td>
<td>-0.13</td>
<td>0.05</td>
<td>-2.41</td>
<td>846</td>
<td>0.016</td>
</tr>
<tr>
<td>Family History of Drinking G₆₀</td>
<td>0.18</td>
<td>0.33</td>
<td>0.56</td>
<td>846</td>
<td>0.578</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Random Effects</th>
<th>SD</th>
<th>Variance Component</th>
<th>df</th>
<th>χ²</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept1, U₀</td>
<td>1.69</td>
<td>2.87</td>
<td>13</td>
<td>59.84</td>
<td>0.000</td>
</tr>
<tr>
<td>Residence, G₁₀</td>
<td>1.56</td>
<td>2.43</td>
<td>18</td>
<td>34.37</td>
<td>0.011</td>
</tr>
<tr>
<td>Level 1, R</td>
<td>4.33</td>
<td>18.77</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In the longitudinal analysis for drinking related consequences institutional investment in 1997 was not a significant predictor (T= -2.03, df=17, p=0.058). However, the change in institutional investment variable was a significant predictor (T= -2.24, df=17, p=0.039).
Positive changes in institutional investment were associated with fewer negative consequences in 2000. The pattern of significance was the same for the institutional and individual level covariates with the exception of Age First Used Alcohol which was not significant in the longitudinal model ($T = -1.22$, $df=22$, $p=0.236$), the full results are summarized in Table 13 below.
Table 13  HLM of change in institutional investment on Drinking Related Consequences controlling for Institutional and Individual Risk Factors

<table>
<thead>
<tr>
<th>Fixed Effects</th>
<th>Coefficient</th>
<th>SE</th>
<th>T-Ratio</th>
<th>df</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept2, G_{00}</td>
<td>7.89</td>
<td>0.27</td>
<td>28.93</td>
<td>17</td>
<td>0.000</td>
</tr>
<tr>
<td>1997 Institutional Investment, G_{01}</td>
<td>-0.67</td>
<td>0.33</td>
<td>-2.03</td>
<td>17</td>
<td>0.058</td>
</tr>
<tr>
<td>Change in Inst. Investment, G_{02}</td>
<td>-0.81</td>
<td>0.36</td>
<td>-2.24</td>
<td>17</td>
<td>0.039</td>
</tr>
<tr>
<td>Enrollment, G_{03}</td>
<td>0.54</td>
<td>0.39</td>
<td>1.39</td>
<td>17</td>
<td>0.183</td>
</tr>
<tr>
<td>Urban/Rural, G_{04}</td>
<td>-0.59</td>
<td>0.60</td>
<td>-0.99</td>
<td>17</td>
<td>0.337</td>
</tr>
<tr>
<td>Region, G_{05}</td>
<td>0.17</td>
<td>0.56</td>
<td>0.30</td>
<td>17</td>
<td>0.770</td>
</tr>
<tr>
<td>Residence, G_{10}</td>
<td>0.48</td>
<td>0.24</td>
<td>1.95</td>
<td>846</td>
<td>0.050</td>
</tr>
<tr>
<td>Social Norms G_{20}</td>
<td>1.18</td>
<td>0.20</td>
<td>5.79</td>
<td>846</td>
<td>0.000</td>
</tr>
<tr>
<td>Sensation Seeking, G_{30}</td>
<td>4.43</td>
<td>1.35</td>
<td>3.28</td>
<td>22</td>
<td>0.004</td>
</tr>
<tr>
<td>Positive Alcohol Expectancies, G_{40}</td>
<td>0.80</td>
<td>0.07</td>
<td>11.21</td>
<td>846</td>
<td>0.000</td>
</tr>
<tr>
<td>Age First Used Alcohol G_{50}</td>
<td>-0.07</td>
<td>0.06</td>
<td>-1.22</td>
<td>22</td>
<td>0.236</td>
</tr>
<tr>
<td>Family History of Drinking G_{60}</td>
<td>0.80</td>
<td>0.28</td>
<td>2.87</td>
<td>846</td>
<td>0.005</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Random Effects</th>
<th>SD</th>
<th>Variance Component</th>
<th>df</th>
<th>(\chi^2)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept1, U0</td>
<td>1.27</td>
<td>1.62</td>
<td>17</td>
<td>73.92</td>
<td>0.000</td>
</tr>
<tr>
<td>Sensation Seeking G_{30}</td>
<td>3.20</td>
<td>10.24</td>
<td>22</td>
<td>33.26</td>
<td>0.058</td>
</tr>
<tr>
<td>Age First Used Alcohol G_{50}</td>
<td>0.11</td>
<td>0.01</td>
<td>22</td>
<td>36.36</td>
<td>0.025</td>
</tr>
<tr>
<td>Level 1, R</td>
<td>4.33</td>
<td>18.78</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For the longitudinal analyses of positive alcohol expectancies institutional investment was not a significant predictor (T= -1.41, df=17, p=0.177). However, the pattern of
institutional and individual level covariates were similar between the two analyses except for age of first alcohol use which was not significant in the longitudinal model (T = -1.72, df=847, p=0.085), the full results are summarized below in Table 14.

Table 14  HLM of change in institutional investment on Positive Alcohol Expectancies controlling for Institutional and Individual Risk Factors

<table>
<thead>
<tr>
<th>Fixed Effects</th>
<th>Coefficient</th>
<th>SE</th>
<th>T-Ratio</th>
<th>df</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept2, G_{00}</td>
<td>5.26</td>
<td>0.07</td>
<td>70.76</td>
<td>17</td>
<td>0.000</td>
</tr>
<tr>
<td>1997 Institutional Investment, G_{01}</td>
<td>-0.08</td>
<td>0.05</td>
<td>-1.41</td>
<td>17</td>
<td>0.177</td>
</tr>
<tr>
<td>Change in Inst. Investment, G_{02}</td>
<td>-0.07</td>
<td>0.08</td>
<td>-0.81</td>
<td>17</td>
<td>0.430</td>
</tr>
<tr>
<td>Enrollment, G_{03}</td>
<td>0.27</td>
<td>0.08</td>
<td>3.61</td>
<td>17</td>
<td>0.002</td>
</tr>
<tr>
<td>Urban/Rural, G_{04}</td>
<td>-0.52</td>
<td>0.12</td>
<td>-4.30</td>
<td>17</td>
<td>0.001</td>
</tr>
<tr>
<td>Region, G_{05}</td>
<td>-0.12</td>
<td>0.14</td>
<td>-0.86</td>
<td>17</td>
<td>0.405</td>
</tr>
<tr>
<td>Residence, G_{10}</td>
<td>-0.15</td>
<td>0.11</td>
<td>-1.33</td>
<td>847</td>
<td>0.183</td>
</tr>
<tr>
<td>Social Norms G_{20}</td>
<td>0.45</td>
<td>0.11</td>
<td>4.15</td>
<td>22</td>
<td>0.001</td>
</tr>
<tr>
<td>Sensation Seeking, G_{30}</td>
<td>1.05</td>
<td>0.47</td>
<td>2.22</td>
<td>847</td>
<td>0.027</td>
</tr>
<tr>
<td>Age First Used Alcohol G_{50}</td>
<td>-0.03</td>
<td>0.02</td>
<td>-1.72</td>
<td>847</td>
<td>0.085</td>
</tr>
<tr>
<td>Family History of Drinking G_{60}</td>
<td>0.02</td>
<td>0.13</td>
<td>0.18</td>
<td>847</td>
<td>0.857</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Random Effects</th>
<th>SD</th>
<th>Variance Component</th>
<th>df</th>
<th>χ²</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept1, U0</td>
<td>0.27</td>
<td>0.07</td>
<td>17</td>
<td>31.81</td>
<td>0.016</td>
</tr>
<tr>
<td>Social Norms G_{20}</td>
<td>0.31</td>
<td>0.09</td>
<td>22</td>
<td>30.49</td>
<td>0.111</td>
</tr>
<tr>
<td>Level 1, R</td>
<td>1.52</td>
<td>2.31</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER 4: DISCUSSION

Heavy drinking is not a new issue on college campuses. However there is a growing challenge to the perception that college drinking is a benign right of passage. Over 44 percent of college students are considered heavy drinkers and over 22 percent can be classified as heavy frequent drinkers (Substance Abuse and Mental Health Services Administration, 2005; Wechsler et al., 2004). High risk, heavy drinking groups are much more likely to experience the negative consequences of drinking (Engs, Diebold, & Hanson, 1996; Wechsler et al., 1994). Fraternity members are significantly overrepresented among this heavy frequent drinking group, and account for about 40 percent of binge drinking and about 60 percent of frequent binge drinking among college students.

Campuses have struggled to identify and implement effective strategies to reduce these behaviors. Several recent reports have suggested that campuses have a growing legal exposure from adverse consequences of drinking, such as student deaths (Hingson et al., 2005) and have taken insufficient steps to reduce drinking among students (Task Force of the National Advisory Council on Alcohol Abuse and Alcoholism, 2002, Vicary and Karshin, 2002). As such, campuses have begun to embrace comprehensive prevention strategies to change the culture of alcohol use on campus and in the surrounding communities (DeJong et al., 1998; Task Force of the National Advisory Council on Alcohol Abuse and Alcoholism, 2002; Task Force of the National Advisory Council on Alcohol Abuse and Alcoholism, 2002b). However, there has been little examination of the degree to which institutional infrastructure supporting such initiatives is related to student outcomes.
This study was focused on examining the relationship between campus institutional investment in prevention and student drinking and related consequences, controlling for individual level covariates: (i.e., residence, social norms, sensation seeking, positive alcohol expectancies, family history of alcohol use, age first used alcohol) and institutional level covariates (i.e., enrollment, region. urban/rural).

Summary of Main Results

This study examined two hypotheses for each of two dependent variables: (a) drinking frequency and (b) drinking related consequences. Prior to examining the hypotheses a set of preliminary analyses were conducted to determine if an HLM approach was appropriate. The null model examined if there was sufficient between school variation in each dependent variable to warrant the use of a nested analysis. Both null models showed that there was significant institutional level variance for each of the dependent variables. As indicated by Intraclass Correlation Coefficients (ICC’s), 18.91 percent of the variance in drinking days and 15.71 percent of the variance in drinking related consequences were accounted for by campus-level variables.

For each dependent variable we tested two models, a base model that examined the relationship between the dependent variable and the level of institutional investment, and a full model that included both individual and institutional level covariates. In addition, a third model was run in a smaller sample examining these relationships using institutional investment data from 1997 and a change score representing the change in institutional investment between 1997 and 2000.
In the main analyses for drinking frequency institutional investment was not a significant predictor in either model. These same results emerged in the analyses using the 3-year change data as well.

In contrast, institutional investment was a significant predictor of drinking related consequences in both models. This indicates that higher levels of institutional investment were associated with fewer drinking related consequences among fraternity members. Specifically an increase of one unit of additional investment in alcohol prevention resulted in an average 0.6 decrease in number of alcohol related consequences. This finding was robust and remained when adding both individual and institutional level covariates in the cross-sectional analysis. This is particularly impressive given that the institutional investment measure represents a rather distal and nonspecific predictor of drinking related consequences.

Confidence in these results is strengthened by the analyses examining 3-year changes in the institutional investment measure. Although institutional investment in 1997 was not significant in this model ($T = -2.03$, $df=17$, $p=0.058$), as it was in the cross-sectional analysis the direction of the relationship was still negative. Further, the 3-year change measure (1997 – 2000) was a significant predictor of drinking related consequences ($T = -2.24$, $df=17$, $p=0.039$).

While the effect of institutional investment found in this study is small, a cumulative effect across a campus-wide population could be more significant. In particular, the drinking consequences measure asked about adverse events in the past 30 days. As such over a four month semester this represents a reduction of about two alcohol related events. Taken cross the fraternity population this could amount to a dramatic reduction in number of alcohol
related consequences, some of which (e.g., fights) can on occasion have serious impacts on students. Additional research needs to be done to better understand the scope of the impact, in particular if institutional investments lead to reductions in specific consequences (e.g. fights or academic problems), and secondly if the reduction in alcohol related consequences is sustained over time.

**Individual Level Predictors of Drinking and Drinking Related Consequences**

In looking across the analyses there were some patterns among the individual and institutional level covariates. The strongest predictors across the three models for both dependent variables were social norms, sensation seeking, and positive alcohol expectancies. The associations were all positive and consistent with the literature on these predictors. At the bivariate level, these variables correlated .25 or above with the dependent variables of drinking frequency and drinking related consequences. Social norms more accepting of excessive alcohol use have been related to greater levels of drinking behavior and drinking related consequences. Further, at the individual level, students with higher levels of sensation seeking and higher positive alcohol expectancies report higher levels of both drinking and drinking related consequences.

An additional set of analyses was conducted using positive alcohol expectancies as a dependent variable. This set of analyses was added to examine if institutional investment would have an impact on positive alcohol expectancies as a potential pathway in influencing drinking or drinking-related consequences. In the full model with the 2000, which controlled for institutional and individual level predictors institutional investment was a significant predictor of positive alcohol expectancies. Institutional investment was not a significant
predictor in the 3-year change model. Thus, it still remains to be seen whether increases institutional investment have an impact through the formation of alcohol expectancies.

The age of first alcohol use was also significant, but only in the crossectional analysis using 2000 institutional investment sample. To some extent, the wording of the question may have introduced some ambiguity in the degree to which first use represented experimentation and/or misuse.

Both family history of drinking and fraternity residence were significant predictors in the drinking related consequences models but not for the drinking frequency models. There is a large body of research indicating the importance of family history of drinking as a predictor of drinking (Baer, 2002). Finally, there is empirical evidence that living in a fraternity house is a risk factor for heavy drinking beyond Greek membership (Borsari & Carey, 1999; Wechsler Kuh, & Davenport, 1996). However, most of these studies are focused on the general student population and are comparing drinking rates between fraternity house residents and non-fraternity house residents who include non-fraternity members (Wechsler Kuh, & Davenport, 1996).

*Level 2 Predictors of Student Outcomes*

In addition to institutional investment, the three institutional level covariates of enrollment, region of the country, and urban or rural location of school were also examined. None of these covariates were significant predictors in any of the models. These findings are contrary to research that has found significant differences in drinking frequency based on school size, location and region of the country (Wechsler, Kelley et al., 2000). It is quite possible that the small size of this sample at the college level makes it difficult to detect such
effects. In addition, recent examinations of drinking rates in substate regions from National Survey of Drug Use and Health data show that there can be quite dramatic variations within regions with regard to drinking rates (Office of Applied Studies, 2006).

**Contrasting findings with regard to Drinking Frequency and Drinking Consequences**

A key question raised by the findings from this study is why was there a relationship between institutional investment and drinking related consequences, but not drinking frequency. To confirm these results, the full HLM analyses were replicated using average Blood Alcohol Concentration (BAC) and binge drinking as dependent variables. Similar patterns of results emerged. Institutional investment in prevention infrastructure was not significantly associated either of these drinking measures.

This significant relationship between institutional investment and drinking related consequences may in part be due to the increasing use of harm reduction strategies in Universities’ intervention efforts, which may have an influence on the consequences of drinking rather than drinking frequency levels. A recent study by Martens et al (2004), for example, suggests that greater use of protective behaviors can decrease negative consequences even while drinking frequencies remain constant. This study examined the use of protective behavioral strategies (PBS) students can use while drinking (e.g., alternate non-alcoholic with alcoholic beverages; determine, in advance, not to exceed a set number of drinks; eat before and/or during drinking) Martens et al (2004) found that more frequent use of PBS was related to fewer self-reported alcohol-related consequences.

In addition, the nature of the institutional investment measure may have contributed to the failure to discover relationships between this variable and drinking frequency. The
items chosen to represent institutional investment for this study did not specifically address alcohol related restrictions (e.g. keg bans, or restrictions camps based alcohol advertising) that might be more likely to influence access to alcohol. The inclusion of such items might have increased the ability to detect impacts on levels of drinking frequency.

Strengths of Study

Despite some conceptual and design issues, this study has several strengths. First the focus on fraternity members and the multi-chapter perspective make this dataset unique. While Greek membership is consistently identified as a risk factor for high risk drinking, few studies have focused exclusively on this group, and only a handful of studies have done cross campus comparisons. It is increasingly important to work closely with this group of students in particular since there is such a high level of use among fraternity members and strong interpersonal ties which could accentuate the impact of an effective intervention. The drinking data were collected using the timeline followback technique through Audio-CASI interviews, very robust techniques that maximize the quality of the drinking data.

The next real strength of this study is the hierarchical analysis that was used to address the nested nature of the data. While this technique is widely used in educational research, it has been less frequently used in college drinking research. These techniques statistically control for the variance both within and across campuses. Much of the college drinking research either focuses on a single campus or has used multiple or logistic regression techniques which do not adequately address the differences between campuses.
Another analytical strength of this study was the robustness of the findings of the institutional investment and drinking related consequences analyses. Regardless of the model we constructed this finding was significant, suggesting that higher levels of institutional investment in prevention are related to lower levels of drinking related consequences. This provides a modest level of support for the use of environmental approaches on college campuses. It will be important in future research to examine a broader range of institutional investments to see if there are similar influences on drinking frequency.

Limitations of the Study

Despite it contributions, the study suffered from limitations in measurement, design, and statistical power.

First, although patterned after the measure reported by Wechsler et al (2000), the institutional investment measure used here represents only one possible approach to assessing institutional investment. The 5 item measure was based primarily on two previous studies (Wechsler, Kelley et al., 2000; Wechsler et al., 2004), but the psychometric foundation for this measure has not been established. The institutional investment measure could have been strengthened by including a broader range of prevention investments. In addition, the use of yes-no items probably reduces the sensitivity of the measure to true variations in an institution’s institutional investments.

A second major limitation is the distal nature of the “effect” of institutional investment on student outcomes. For example, the “investment” of an administration in a task force to address drug- and alcohol- related concerns might provide a forum to bring together key constituencies and increase coordination of efforts across a campus. Such
activities might expand the reach and effectiveness of programs. However, this study did not assess such mediating processes. There is no way of determining the extent to which institutional investments actually resulted in policies, practices, and programs that are presumed to result from increased investment. Studies with stronger measures of institutional investment as well as measures that examined the direct impact of policies on students (e.g. exposure to policies or programming, sanctions, or reductions in access to alcohol) are called for. Given the “distance” between institutional investment and student outcomes, the presence of a significant relationship between institutional investment and drinking related consequences seems quite promising.

Third, an additional limitation is that a cross-section design is used with both the student drinking and institutional investment data collected concurrently in Fall of 2000. As mentioned earlier, it is quite plausible that there would be a time lag before newly implemented institutional investments would have an effect. For example if a school hires a substance abuse coordinator it may take as long as a school year to schedule and implement prevention programs, thus causing a delay between the initial investment and an expected impact on student behavior. Therefore, if institutional investments at a school were not constant, the cross-sectional design would not detect the effects of institutional investment. Analyses with a smaller sample of schools demonstrated that changes in investment from 1997-2000 were associated with decreased negative drinking consequences. However, there is no assurance that the three year period between 1997 and 200 represents the optimal period for examining the lagged effects of institutional investment. It is unclear what an appropriate time lag might be for expecting changes in student outcomes as a result of institutional
investment in prevention infrastructure. The study would have been strengthened by a longitudinal design including investment and student drinking measures at multiple time points.

A fourth potential limitation is that the study used a convenience sample with only 31 schools. With the use of HLM, power is influenced by sample sizes at both the individual and group level. There would have been greater power to detect changes in drinking levels with a larger sample.

Finally, student outcome data was restricted to chapters of a single national fraternity. It is unclear how representative this fraternity is of other national groups and of other fraternities on the campuses included in this study.

**Future Research**

First, future research on this topic should be conducted on a general student sample to see if the results hold up. To improve this research in future studies, prospective tracking of alcohol policies along with measures of drinking related consequences and drinking frequencies would provide a much clearer perspective to measure the impact of campus changes to student level outcomes. To facilitate this it would be useful to develop and validate a measure of alcohol policies for administrators that go beyond simple identification of programs for specific studies, such as a survey that could be used with administrators or campus police to examine policy and program. This seems essential because of the considerable variation in what types of programs schools are implementing (DeJong & Langford, 2002). In particular, research on campus alcohol policies could really be strengthened by an in depth mixed method (qualitative and quantitative) study of several
campuses alcohol policies and programming. The goal of such an effort would be to develop a taxonomy that would facilitate future research and campus wide evaluations on the impact of institutional investment in prevention infrastructure. Based on this study it seems that future research could benefit from examining a broader set of policies and programs and triangulating such efforts with surveys from several key administrators across campus. Further it will be important in future research to get a stronger timeline of when policies were implemented to facilitate developing more accurate understanding of policy impacts on student level behaviors.

Future research should also begin to explore the mechanisms that are necessary to support successful campus level policies and programs to address student level drinking and related consequences. This study is a first step in demonstrating that investments in institutional infrastructure do seem to be related to important student drinking outcomes, even among high risk groups.
REFERENCES


Other Drug Use on College Campuses. Newton, MA: The Higher Education Center for Alcohol and Other Drug Prevention.


U.S. Department of Health and Human Services`.


APPENDICES
## Appendix A: Summary of Variables by Dataset

### Summary of Variables by Dataset

#### Dependent Variables

<table>
<thead>
<tr>
<th>Drinking Related Consequences</th>
<th>RAPI total score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drinking frequency</td>
<td>number of days a person drank in the last 28 days</td>
</tr>
<tr>
<td>Positive Alcohol Expectancies</td>
<td>Alcohol Expectancy Questionnaire Positive Expectancy Scale Score</td>
</tr>
</tbody>
</table>

#### Independent Variables

**Campus Level Variables (Anderson & Gadelto, 2001)**

<table>
<thead>
<tr>
<th>Institutional Investment in Prevention</th>
<th>Does your campus have an individual to serve as its Alcohol/Substance Abuse Educator or Specialist?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Does your campus have a task force to address drug- and alcohol-related concerns?</td>
</tr>
<tr>
<td></td>
<td>drinking behavior of students</td>
</tr>
<tr>
<td></td>
<td>In the last several years, has your campus conducted a formal assessment of the effectiveness of its drug and alcohol prevention program?</td>
</tr>
<tr>
<td></td>
<td>Does your campus have a task force or partnership with the surrounding community to address drug- and alcohol-related concerns?</td>
</tr>
</tbody>
</table>

**Campus Enrollment/Size**

<table>
<thead>
<tr>
<th>Number of undergraduates enrolled at each school</th>
</tr>
</thead>
</table>

**Individual Risk Factors (Caudill, Crosse et al., 2001)**

<table>
<thead>
<tr>
<th>Residence</th>
<th>What type of residence do you currently live in?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Norm</td>
<td>How often does an average male college student residing in a fraternity drink?</td>
</tr>
<tr>
<td>Sensation Seeking</td>
<td>Total scale score reflecting overall level of sensation seeking from 40 items</td>
</tr>
<tr>
<td>Positive Alcohol Expectancies</td>
<td>Two scale scores reflecting positive and negative expectations about alcohol from 41 items.</td>
</tr>
<tr>
<td>Family History of Alcohol Use</td>
<td>Composite from two questions: How would you categorize the drinking behavior of your mother/father?</td>
</tr>
<tr>
<td>Age First used Alcohol</td>
<td>How old were you the first time you used alcohol?</td>
</tr>
</tbody>
</table>
Appendix B: Percentages and Chi-Square Analysis for Race, Year in School, Fraternity Residence, and Parent Problem Drinking

<table>
<thead>
<tr>
<th>Variable</th>
<th>Dissertation Sample ( n = 1215 )</th>
<th>Original Study ( n = 2101 )</th>
<th>( \chi^2 ) (1)</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>95.1%</td>
<td>95.2%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>1.7%</td>
<td>1.5%</td>
<td>0.97</td>
<td>ns</td>
</tr>
<tr>
<td>Asian</td>
<td>2.1%</td>
<td>2.1%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>1.0%</td>
<td>1.1%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year in School</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freshmen</td>
<td>18.8%</td>
<td>14.9%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sophomore</td>
<td>28.1%</td>
<td>27.7%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Junior</td>
<td>26.7%</td>
<td>27.9%</td>
<td>10.67</td>
<td>.031</td>
</tr>
<tr>
<td>Senior</td>
<td>18.6%</td>
<td>20.6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5\textsuperscript{th} Year or Greater</td>
<td>7.8%</td>
<td>9.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residence</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fraternity House</td>
<td>50.3%</td>
<td>65.7%</td>
<td>77.96</td>
<td>.000</td>
</tr>
<tr>
<td>Other Residence</td>
<td>49.7%</td>
<td>34.3%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family History of Drinking</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Problem Drinker</td>
<td>22.0%</td>
<td>21.9%</td>
<td>0.001</td>
<td>ns</td>
</tr>
<tr>
<td>Non-problem Drinker</td>
<td>78.0%</td>
<td>78.1%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix C: Means, Standard Deviations, and One-Way Analyses of Variance (ANOVA’s) for age and analysis variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Dissertation Sample</th>
<th>Original Study</th>
<th>ANOVA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Age</td>
<td>20.26</td>
<td>1.63</td>
<td>20.35</td>
</tr>
<tr>
<td>Drinking Related Consequences</td>
<td>7.82</td>
<td>5.36</td>
<td>6.89</td>
</tr>
<tr>
<td>Drinking Days</td>
<td>10.98</td>
<td>5.24</td>
<td>10.40</td>
</tr>
<tr>
<td>Positive Alcohol Expectancies</td>
<td>5.29</td>
<td>1.62</td>
<td>5.17</td>
</tr>
<tr>
<td>Social Norms</td>
<td>4.64</td>
<td>0.79</td>
<td>4.52</td>
</tr>
<tr>
<td>Sensation Seeking</td>
<td>0.56</td>
<td>0.14</td>
<td>0.56</td>
</tr>
<tr>
<td>Age First Used Alcohol</td>
<td>14.05</td>
<td>3.39</td>
<td>13.93</td>
</tr>
</tbody>
</table>
Appendix D  Unconstrained and Constrained Models for All Dependent Variables

Drinking Frequency Unconstrained Model

The Level 1 Model was:

\[ Y_{ij} = \beta_{0j} + \beta_{1j} \text{(residence)} + \beta_{2j} \text{(age of first use)} + \beta_{3j} \text{(family history)} + \beta_{4j} \text{(positive expectancies)} + \beta_{5j} \text{(social norms)} + \beta_{6j} \text{(sensation seeking)} + r_{ij} \]

The Level 2 model was:

\[ \beta_{0j} = \gamma_{00} + \gamma_{01} \text{(institutional investment)} + \gamma_{02} \text{(enrollment)} + \gamma_{03} \text{(region)} + \gamma_{04} \text{(urbanicity)} + u_{0j} \]

\[ \beta_{1j} = \gamma_{10} + u_{0j} \]
\[ \beta_{2j} = \gamma_{20} + u_{0j} \]
\[ \beta_{3j} = \gamma_{30} + u_{0j} \]
\[ \beta_{4j} = \gamma_{40} + u_{0j} \]
\[ \beta_{5j} = \gamma_{50} + u_{0j} \]
\[ \beta_{6j} = \gamma_{60} + u_{0j} \]

Where:

\( Y_{ij} \) is the outcome of participant i in school j (j = 1, …, 31 schools);

\( \beta_{0j} \) is the mean outcome (drinking frequency or drinking related consequences in school j); and

\( r_{ij} \) is the Level-1 error of participant i in school j;
Drinking Frequency Constrained Model

The Level 1 Model was:

\[ Y_{ij} = \beta_{0j} + \beta_{1j} \text{ (residence)} + \beta_{2j} \text{ (age of first use)} + \beta_{3j} \text{ (family history)} + \beta_{4j} \text{ (positive expectancies)} + \beta_{5j} \text{ (social norms)} + \beta_{6j} \text{ (sensation seeking)} + r_{ij} \]

The Level 2 model was:

\[ \beta_{0j} = \gamma_{00} + \gamma_{01} \text{ (institutional investment)} + \gamma_{02} \text{ (enrollment)} + \gamma_{03} \text{ (region)} + \gamma_{04} \text{ (urbanicity)} + u_{0j} \]

\[ \beta_{1j} = \gamma_{10} + u_{0j} \]
\[ \beta_{2j} = \gamma_{20} \]
\[ \beta_{3j} = \gamma_{30} \]
\[ \beta_{4j} = \gamma_{40} \]
\[ \beta_{5j} = \gamma_{50} \]
\[ \beta_{6j} = \gamma_{60} \]

Where:

\( Y_{ij} \) is the outcome of participant \( i \) in school \( j \) (\( j = 1, \ldots, 31 \) schools);

\( B_{0j} \) is the mean outcome (drinking frequency or drinking related consequences in school \( j \)); and

\( r_{ij} \) is the Level-1 error of participant \( i \) in school \( j \);
Drinking Related Consequences Unconstrained Model

The Level 1 Model was:

\[ Y_{ij} = \beta_{0j} + \beta_{1j} \text{(residence)} + \beta_{2j} \text{(age of first use)} + \beta_{3j} \text{(family history)} + \beta_{4j} \text{(positive expectancies)} + \beta_{5j} \text{(social norms)} + \beta_{6j} \text{(sensation seeking)} + r_{ij} \]

The Level 2 model was:

\[ \beta_{0j} = \gamma_{00} + \gamma_{01} \text{(institutional investment)} + \gamma_{02} \text{(enrollment)} + \gamma_{03} \text{(region)} + \gamma_{04} \text{(urbanicity)} + u_{0j} \]

\[ \beta_{1j} = \gamma_{10} + u_{0j} \]

\[ \beta_{2j} = \gamma_{20} + u_{0j} \]

\[ \beta_{3j} = \gamma_{30} + u_{0j} \]

\[ \beta_{4j} = \gamma_{40} + u_{0j} \]

\[ \beta_{5j} = \gamma_{50} + u_{0j} \]

\[ \beta_{6j} = \gamma_{60} + u_{0j} \]

Where:

\( Y_{ij} \) is the outcome of participant \( i \) in school \( j \) \( (j = 1, \ldots, 31 \text{ schools}) \);

\( B_{0j} \) is the mean outcome (drinking frequency or drinking related consequences in school \( j \)); and

\( r_{ij} \) is the Level-1 error of participant \( i \) in school \( j \);
Drinking Related Consequences Constrained Model

The Level 1 Model was:

\[ Y_{ij} = \beta_{0j} + \beta_{1j} \text{(residence)} + \beta_{2j} \text{(age of first use)} + \beta_{3j} \text{(family history)} + \beta_{4j} \text{(positive expectancies)} + \beta_{5j} \text{(social norms)} + \beta_{6j} \text{(sensation seeking)} + r_{ij} \]

The Level 2 model was:

\[ \beta_{0j} = \gamma_{00} + \gamma_{01} \text{(institutional investment)} + \gamma_{02} \text{(enrollment)} + \gamma_{03} \text{(region)} + \gamma_{04} \text{(urbanicity)} + u_{0j} \]

\[ \beta_{1j} = \gamma_{10} \]
\[ \beta_{2j} = \gamma_{20} + u_{0j} \]
\[ \beta_{3j} = \gamma_{30} \]
\[ \beta_{4j} = \gamma_{40} \]
\[ \beta_{5j} = \gamma_{50} \]
\[ \beta_{6j} = \gamma_{60} + u_{0j} \]

Where:

\[ Y_{ij} \] is the outcome of participant i in school j (j = 1,…,31 schools);
\[ B_{0j} \] is the mean outcome (drinking frequency or drinking related consequences in school j; and
\[ r_{ij} \] is the Level-1 error of participant i in school j;
Positive Alcohol Expectancies Unconstrained Model

The Level 1 Model was:

\[ Y_{ij} = \beta_{0j} + \beta_{1j} \text{(residence)} + \beta_{2j} \text{(age of first use)} + \beta_{3j} \text{(family history)} + \beta_{4j} \]

(social norms) + \beta_{5j} \text{(sensation seeking)} + r_{ij}

The Level 2 model was:

\[ \beta_{0j} = \gamma_{00} + \gamma_{01} \text{(institutional investment)} + \gamma_{02} \text{(enrollment)} + \gamma_{03} \text{(region)} + \gamma_{04} \]

(urbanicity) + u_{0j}

\[ \beta_{1j} = \gamma_{10} + u_{0j} \]

\[ \beta_{2j} = \gamma_{20} + u_{0j} \]

\[ \beta_{3j} = \gamma_{30} + u_{0j} \]

\[ \beta_{4j} = \gamma_{40} + u_{0j} \]

\[ \beta_{5j} = \gamma_{50} + u_{0j} \]

Where:

\[ Y_{ij} \] is the outcome of participant i in school j ( j = 1, ..., 31 schools);

\[ B_{0j} \] is the mean outcome (positive alcohol expectancies) in school j; and

\[ r_{ij} \] is the Level-1 error of participant i in school j;
Positive Alcohol Expectancies Constrained Model

The Level 1 Model was:

\[ Y_{ij} = \beta_{0j} + \beta_{1j} \text{(residence)} + \beta_{2j} \text{(age of first use)} + \beta_{3j} \text{(family history)} + \beta_{4j} \text{(social norms)} + \beta_{5j} \text{(sensation seeking)} + r_{ij} \]

The Level 2 model was:

\[ \beta_{0j} = \gamma_{00} + \gamma_{01} \text{(institutional investment)} + \gamma_{02} \text{(enrollment)} + \gamma_{03} \text{(region)} + \gamma_{04} \text{(urbanicity)} + u_{0j} \]

\[ \beta_{1j} = \gamma_{10} \]
\[ \beta_{2j} = \gamma_{20} \]
\[ \beta_{3j} = \gamma_{30} \]
\[ \beta_{4j} = \gamma_{40} + u_{0j} \]
\[ \beta_{5j} = \gamma_{50} \]

Where:

\[ Y_{ij} \] is the outcome of participant i in school j ( \( j = 1, \ldots, 31 \) schools);
\[ B_{0j} \] is the mean outcome (positive alcohol expectancies) in school j; and
\[ r_{ij} \] is the Level-1 error of participant i in school j;
### Appendix E: Estimation of Variance Components

#### Drinking Days Final estimation of variance components:

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## Appendix F: Comparison of 1997 and 2000 Institutional Investment in Prevention

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EXECUTIVE SUMMARY

National estimates suggest that at least 85 percent of undergraduates drink with about 20 percent reporting episodic heavy drinking and 20 percent reporting frequent heavy drinking (Berkowitz & Perkins, 1986; Pendergast, 1994; Wechsler et al., 1998). The negative consequences associated with alcohol use among college students are much greater than it appears, with an estimated 1,700 deaths, 70,000 rapes, and 600,000 assaults directly related to alcohol use (Hingson et al., 2002). Further, students who drink frequently and heavily are at a much higher risk of experiencing alcohol related consequences personally, such as assaults, academic, and social problems. (Wechsler, Lee et al., 2000).

Fraternities and sororities represent a subgroup within the University community that is at particularly high risk for alcohol abuse and alcohol-related negative consequences. Among fraternity or sorority members, about 14 percent report episodic heavy drinking and about 61 percent report frequent heavy drinking (Caudill, Crosse et al., 2001; Wechsler et al., 1998; Wechsler, Lee, Kuo et al., 2002). With an estimated 17 percent of college students involved in fraternities and sororities this group accounts for nearly 60 percent of frequent heavy drinking among college students. This suggests the need for campus interventions to reduce drinking among this population.

Heavy drinking among college students is not a new phenomena. However, a number of recent high profile tragedies, coupled with the publication of several national studies and Federal reports examining the impact of college drinking has propelled this issue back onto the agendas of policy makers, campus administrators and researchers. Campuses efforts to manage alcohol problems have used a combination of alcohol policies, alcohol treatment, and preventative interventions (Davidson & DeJong, 2004; Vicary & Karshin, 2002). Recent
national expert panels have called for more comprehensive, more ecological and more empirically based approaches to developing campus based programming to reduce drinking and drinking related problems among college students (Task Force of the National Advisory Council on Alcohol Abuse and Alcoholism, 2002a, 2002b).

These comprehensive ecological approaches work simultaneously at campus, community, state, and national levels to change the physical, social, economic, and legal contexts that surrounds the binge drinking behavior of college students (DeJong & Langford, 2002; Wagenaar, 1994). One implicit assumption underlying comprehensive, ecological approaches is that there would be sufficient institutional investment to make such programming feasible. However, there has been no systematic examination of the relationship between institutional investment in prevention infrastructure and student drinking outcomes, such as drinking level and drinking related consequences. There has been no examination of the institutional investment in prevention infrastructure and student drinking outcomes among high-risk groups such as fraternity members.

This study will contribute to the literature by improving our understanding of the influence of institutional level investments on individual drinking behavior. This dissertation will improve on previous research by analyzing data from fraternity members at 31 campuses, using a robust measure of alcohol use, and controlling for individual level risk-factors of alcohol use. Statistically the study will also control for individual respondents being nested within institutions by using hierarchical linear modeling (HLM).

Specifically, this study will examine the following research questions:

1a. Are students’ levels of drinking related to campus institutional investment in prevention infrastructure?
1b. Are students’ levels of drinking related to campus institutional investment in prevention infrastructure after controlling for individual risk factors of (a) residence, (b) sensation seeking, (c) positive alcohol expectancies, (d) negative alcohol expectancies, (e) social norm, (f) family history of alcohol, and (g) age first used alcohol?

2a. Are students’ levels of drinking related consequences related to campus institutional investment in prevention infrastructure?

2b. Are students’ levels of drinking related consequences related to campus institutional investment in prevention infrastructure after controlling for individual risk factors of (a) residence, (b) sensation seeking, (c) positive alcohol expectancies, (d) negative alcohol expectancies, (e) social norm, (f) family history of alcohol, and (g) age first used alcohol?

3a. Are students’ levels of positive alcohol expectancies related to campus institutional investment in prevention infrastructure?

3b. Are students’ levels of positive alcohol expectancies related to campus institutional investment in prevention infrastructure after controlling for individual risk factors of (a) residence, (b) sensation seeking, (c) social norm, (d) family history of alcohol, and (e) age first used alcohol?

CHAPTER 1: INTRODUCTION

Level of Drinking Among College Students

A primary focus of the college student drinking literature is the identification of heavy, high-risk, or problematic drinkers. Over the last 15 years, national estimates show that approximately 80 percent of college students report drinking (Berkowitz & Perkins, 1986; Pendergast, 1994; Wechsler et al., 1998). While there are several different measures of heavy drinking, most are a combination of frequency of drinking and quantity consumed
when drinking. Currently, the most commonly used measure is “binge drinking” which is
defined for men as five or more drinks in one setting over the last two weeks, and for women
as four or more drinks in one setting over the last two weeks. Frequent binge drinkers, are
defined as binge drinking three or more times in a two week period (Wechsler, Dowdall,
Davenport, & Rimm, 1995). Across studies, about 45 percent of drinkers have been
identified as non-binge drinkers, about 30 percent as binge drinkers and about 25 percent as
frequent binge drinkers (Berkowitz & Perkins, 1986; Pendergast, 1994; Wechsler et al.,
1998).

Analyses of data collected between 1993 and 2001 suggests that the percentage of
binge drinkers has remained at about 44 percent while there have been increases in the
percentage of frequent binge drinkers between 1993 (19.7%) and 2001 (22.8%). Students
abstaining from alcohol use increased from 16.4 percent in 1993 to 19.3 percent in 2001
(Wechsler et al., 1998; Wechsler, Lee, Kuo et al., 2002). In addition, Wechsler, Molnar,
Davenport, & Baer (1999) estimated that “binge drinkers consumed 68 percent of all the
alcohol that students reported drinking, and they accounted for the majority of alcohol-
related problems” (p. 247). Complementing these findings, recent research has also shown
that the risk of experiencing alcohol related consequences increases in relation to the
individual level of drinking as well as the level of drinking on campus (Jennison, 2004;
Wechsler, Davenport, Dowdall, Moeykens, & Castillo, 1994; Wechsler, Molnar, Davenport,
& Baer, 1999). For example, Jennison (2004) found that 22% of college students were
frequent binge drinkers and that they experienced 40% of the alcohol-related consequences,
such as blackouts.

Consequences Associated with Drinking Among College Students
The negative impact of college drinking is largely seen through the negative consequences impacting drinkers, non-drinking students, campuses, and surrounding communities. Negative consequences from drinking in college are much more serious and more prevalent than generally acknowledged (Baer & Carney, 1993; Hingson, Heeren, Winter, & Wechsler, 2005; Hingson et al., 2002). This research has also begun to separate the impact of alcohol-related consequences to individual drinkers and alcohol related-consequences to other students and the surrounding community (Wechsler et al., 1994; Wechsler, Lee, Hall, Wagenaar, & Lee, 2002; Wechsler, Moeykens, Davenport, Castillo, & Hansen, 1995).

Alcohol-related consequences experienced by drinkers themselves have been examined in three ways. First, investigators have used self-report measures to assess how frequently a person has experienced a variety of consequences over a specified time period. Secondly, several studies have examined the details of a specific issue, such as sexual assault. Finally, two recent studies have combined datasets to generate national mortality and morbidity estimates among college students. The literature has also begun to expand from a focus on consequences to individual drinkers into examining the consequences on non-drinking students and the surrounding communities. However, the primary focus of the literature remains the direct consequences to individual drinkers such as: (a) death, (b) impaired driving, (c) violence and injury (d) sexual assault, (e) health and sexual behavior, (f) legal and interpersonal problems.

Two recent studies examined the magnitude of alcohol-related mortality and morbidity among college students. These studies estimated that in 2001 there were about 1,700 alcohol related deaths among college students, up from 1,600 in 1998 (Hingson et al.,
2005; Hingson et al., 2002), or one death per year on about 40 percent of campuses. According to this study, about 79 percent of the alcohol related deaths among college students are caused by driving while drunk or impaired.

Impaired driving among college students has received an increasing amount of attention. The Hingson et al. (2002) study estimated that each year about 2.1 million college students drove under the influence of alcohol and 3.1 million rode with a driver under the influence of alcohol at least once. In three national surveys, about 30 percent of students report driving while under the influence of alcohol over the last year (Paschall, 2003; Presley, Meilman, Cashin, & Lyerla, 1996; Wagenaar, Murray, & Toomey, 2000; Wechsler, Lee et al., 2000).

Violence on college campuses remains a significant problem. One study concluded that the “typical college campus community is potentially hazardous to the health and well-being of its members” (Engs & Hanson, 1994; Pezza & Bellotti, 1995). The remaining 21 percent of alcohol related deaths among college students come from unintentional injuries such as fights, falls, and alcohol poisoning (Hingson et al., 2005). An estimated 633,000 students were assaulted pushed or hit in the year prior to the survey (Hingson et al., 2002). Further, an estimated 504,000 college students were hurt or injured while drinking (Hingson et al., 2002). One study found that 23 percent of frequent binge drinkers reported being hurt or injured compared to 9 percent of binge drinkers and 2 percent of nonbinge drinkers (Wechsler et al., 1994).

Another significant problem facing college students is the level of sexual violence. Hingson et al (2002) estimated that 71,000 students were sexually assaulted or date raped; while 109,000 had sexual intercourse while being so intoxicated they were unable to consent.
There is a large body of research examining the relationship between alcohol and sexual assault among women. Studies estimate that at least half of the sexual assaults on campus involve alcohol consumption of perpetrator, victim, or both (Abbey, 2002). Further, many studies have found that preassault alcohol use increases the risk of sexual victimization and increases the severity of sexual assault outcomes (Parks & Falls-Stewart, 2004; Ullman, Karabatsos, & Koss, 1999).

Alcohol consumption has also been tied to high risk behaviors and health consequences. Students who drink report an increase in high risk sexual behavior including engaging in unplanned sexual activity and not using protection when having sex (Cooper, 2002; Wechsler et al., 1994). An estimated 400,000 students have unprotected sex each year, putting them at risk of STD or unintended pregnancies (Hingson et al., 2002). Further, an estimated 152,000 reported past year health problems because of alcohol. Binge drinkers and frequent binge drinkers report experiencing a number of health problems such as hangovers (75% and 90% respectively) and blackouts (26% and 54% respectively) compared to nonbinge drinkers (30%, 8%) (Wechsler et al., 1994). Another health outcome is alcohol abuse and dependence during and after college. Hingson et al (2002) estimated that about 98,000 students were receiving alcohol or drug treatment. Jennison (2004) examined longitudinal drinking data from the National Longitudinal Study of Youth to examine long-term (10 years) impact of binge drinking in college. The data demonstrated that for a significant proportion of college students high-risk drinking in college contributed to development of DSM-IV criteria for alcohol dependence and abuse (see Table 1). However, the authors note that the majority of students who were heavy drinkers in college tended to reduce consumption after college.
### Table 15: Alcohol Dependence & Abuse After College Among High Risk Drinkers

<table>
<thead>
<tr>
<th>DSM-IV Criteria</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol Dependence</td>
<td>22%</td>
<td>14%</td>
</tr>
<tr>
<td>Alcohol Abuse</td>
<td>24%</td>
<td>19%</td>
</tr>
<tr>
<td>Alcohol Tolerance (3+ symptoms)</td>
<td>10%</td>
<td>8%</td>
</tr>
<tr>
<td>Alcohol Withdrawal (1+ symptoms)</td>
<td>16%</td>
<td>29%</td>
</tr>
</tbody>
</table>

*Jennison, 2004 p. 670

Finally, students also experience a number of alcohol related legal, interpersonal and academic problems. An estimated 112,000 students were arrested for an alcohol-related offense each year (Hingson et al., 2002). Interpersonal problems include arguing with friends and doing something they regretted. As with other consequences frequent binge and binge drinkers were more likely than non binge drinkers to argue with friends (42%, 22%, 8% respectively) and do something they regret (63%, 37%, 14% respectively). In examining academic problems frequent binge and binge drinkers are significantly more likely to miss a class (61%, 30%) and get behind in school work (46%, 21%) than nonbinge drinkers (8%, 6%) (Wechsler et al., 1994). However, there is evidence that some of the association between academic problems and alcohol use can be attributed to precollege student differences, such as drinking behavior in high school (Wood, Sher, Erickson, & DeBord, 1997).
### Table 16: Alcohol Related Consequences Among College Students

<table>
<thead>
<tr>
<th>Alcohol Related Consequences</th>
<th>% of Students who Drink</th>
<th>Estimated Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car crash deaths (1998)</td>
<td>&lt; 1.0%</td>
<td>1,138</td>
</tr>
<tr>
<td>Non-traffic deaths (1998)</td>
<td>&lt; 1.0%</td>
<td>307</td>
</tr>
<tr>
<td>Driving under influence</td>
<td>26.0%</td>
<td>2,106,998</td>
</tr>
<tr>
<td>Riding with driver who had been drinking</td>
<td>38.9%</td>
<td>3,113,041</td>
</tr>
<tr>
<td>Hurt or Injured</td>
<td>10.6%</td>
<td>504,415</td>
</tr>
<tr>
<td>Assaulted, pushed, or hit</td>
<td>13.3%</td>
<td>632,899</td>
</tr>
<tr>
<td>Sexual assault or data rape</td>
<td>1.5%</td>
<td>71,379</td>
</tr>
<tr>
<td>Sex when so intoxicated you were unable to consent</td>
<td>2.3%</td>
<td>109,448</td>
</tr>
<tr>
<td>Unprotected Sex</td>
<td>8.4%</td>
<td>399,725</td>
</tr>
<tr>
<td>Health Problems</td>
<td>1.9%</td>
<td>152,128</td>
</tr>
<tr>
<td>Alcohol or drug treatment</td>
<td>1.2%</td>
<td>98,584</td>
</tr>
<tr>
<td>Arrest for an alcohol-related offense</td>
<td>1.4%</td>
<td>112,000</td>
</tr>
</tbody>
</table>

*Hingson, Heeren, Zackocs, Kopstein, and Wechsler, 2002*

Beyond the consequences to individual drinkers, the adverse impact of college student alcohol use to other students and the surrounding community has become clearer.

One study surveyed a nationally representative sample of colleges and examined the percentage of students who report experiencing secondary effects from other students’ drinking (Wechsler, Moeykens et al., 1995). Students at schools with high level of heavy drinking were more likely to experience adverse consequences than students at schools with lower levels of heavy drinking.
Heavy drinkers were significantly more likely to experience each of the secondary consequences than students with lower levels of drinking. Further, this relationship held when examining the level of drinking at the school. Students at heavy drinking schools, with high percentage of binge drinkers (over 50% of students), experienced significantly more alcohol related consequences, than students at school with lower levels of binge drinking (1-35% of students) (Wechsler, Moeykens et al., 1995). Table 3 summarizes the percentage of students who experienced each impact based on level of drinking at the school.

<table>
<thead>
<tr>
<th>Table 17:</th>
<th>Adverse Consequences by Schools Level of Heavy Drinking</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lower Level (1-35% of students)</td>
</tr>
<tr>
<td>Pushed, hit or assaulted</td>
<td>7%</td>
</tr>
<tr>
<td>Property damaged</td>
<td>6%</td>
</tr>
<tr>
<td>Unwanted sexual advance</td>
<td>15%</td>
</tr>
<tr>
<td>Study/sleep interrupted</td>
<td>42%</td>
</tr>
<tr>
<td>Had serious argument</td>
<td>13%</td>
</tr>
<tr>
<td>Babysat drunken student</td>
<td>31%</td>
</tr>
<tr>
<td>Insulted/humiliated</td>
<td>21%</td>
</tr>
<tr>
<td>At least one problem</td>
<td>62%</td>
</tr>
</tbody>
</table>

(Wechsler, Moeykens et al., 1995)

The secondhand effects of student alcohol use are also felt by the neighbors of college campuses. In a study on the secondhand effects of student alcohol use adults from 4,661
households were interviewed about the quality of neighborhood life. The study compared responses from participants living near to a college campus to those who lived a mile or more away. The study also compared responses from residents living near colleges with high rates of binge drinking and residents near colleges with lower rates of drinking. Respondents living near colleges (within 1 mile) were significantly more likely to report community problems such as loitering, underage drinking, and crime as well as vandalism, vomit or urination and noise. These respondents were also more likely to report observing four or more community or secondhand effects than respondents living more than one mile from a college campus. Respondents who lived near high binge drinking schools were significantly more likely to report litter and noise or disturbance than those living near low binge drinking schools. However, a path analysis suggested that the impact of living within one mile of a college is really related to the presence and density of alcohol outlets, although it is unclear if the presence of a college promotes establishment of alcohol outlets (Wechsler, Lee, Hall et al., 2002).

Risk Factors for Heavy Drinking Among College Students

A primary focus of the college drinking literature has been the identification of individual, familial, social, and environmental risk factors for heavy drinking. A brief summary of the impact of various factors is provided in Table 3.

Demographic Characteristics: There are several demographic characteristics that have been consistently identified as risk factors: (a) sex, (b) race, and (c) religious background. Analytically, while these are important considerations, Wechsler concluded that they “had only modest effects and contributed relatively little to an understanding of binging” (Wechsler, Dowdall, Davenport, & Castillo, 1995).
**Sex**—Overall about 80 percent of both male and female students drink. However, research shows that females do not drink as heavily as males (Brennan, Walfish, & AuBuchon, 1986; Engs, Diebold, & Hanson, 1996; Wechsler, Lee, Kuo et al., 2002). Females are more likely to be light or non-binge drinkers (40.4%) than men (31.3%); conversely men are more likely to be binge drinkers (23.4%) and frequent binge drinkers (25.2%) than women (40.9%, 20.9% respectively) (Wechsler, Lee, Kuo et al., 2002). In an effort to account for the differential impact of alcohol on men and women, such as body weight and metabolism of alcohol, Wechsler, Dowdall, Davenport, and Rimm (1995) proposed sex specific definitions of binge drinking. In particular the definition of binge drinking for men is 5 drinks in a row while for women it is only 4 in a row (Wechsler, Dowdall, Davenport, & Rimm, 1995). Using these sex specific definitions of binge drinking provides an equivalent measure of alcohol-related consequences among men and women (Wechsler, Lee, Kuo et al., 2002). Despite this measure, men remain at a higher risk of heavy drinking across measures of alcohol consumption.

**Race**—Consistently across studies, white students are heavier drinkers than non-white students (OR = 2.96) (Brennan et al., 1986; Engs et al., 1996; Wechsler, Lee, Kuo et al., 2002). Consistently about 50 percent of white students report binge drinking. While about 40 percent of students with Hispanic or “Other” ethnicities report binge drinking, only 23 percent of Asian Americans and 16 percent of African American report binge drinking (Wechsler, Lee et al., 2000).

**Religious Background:** There have also been consistent significant differences based on students’ religious background. Several studies have found that Catholic students report the highest levels of drinking compared to students with Protestant or Jewish backgrounds.
(Brennan et al., 1986; Engs et al., 1996). Beyond religious affiliation, studies have found that students who feel that religion is “very important” are significantly less likely to binge drink than students where religion is “not very important” (OR = 3.57) (Wechsler, Dowdall, Davenport, & Castillo, 1995).

Beyond demographic characteristics there are several risk factors for heavy drinking among college students including: (a) family history, (b) sensation seeking, (c) alcohol expectancies, (d) pre college drinking patterns, (e) perceived social norms and (f) Greek membership.

**Family History:** Another construct related to drinking among college students has been family history of drinking. This construct has been examined by assessing level of use by parents and alternatively by examining parental abuse or alcoholism. A review of student factors by Baer (2002) found conflicting data on the impact of parental drinking on student drinking among studies comparing the drinking behavior of Children of Alcoholics (COA) compared to non-COAs. Baer (2002) concluded that “[a]lthough it appears likely that COAs within college populations may be at some increased risk for alcohol-related problems, the inconsistency of the research evidence suggests that it may be a smaller or more variable risk factor than when studied in other populations.” (Baer, 2002). However, a review of 10 studies examining parental reports of drinking found small but positive effect on the drinking behavior of students, concluding the parental approval of drinking impacted the students’ attitudes (Brennan et al., 1986). Recent studies have found that positive family history of alcohol abuse was related to underestimating drunkenness, which related to increases in binge drinking and driving after drinking (Turrisi & Wiersma, 1999) and stronger positive expectations from alcohol use (Lundahl, Davis, Adesso, & Lukas, 1997; Van Voorst &
Quirk, 2003). Further, one study found that parental expectations about alcohol did influence students alcohol use, their association with peers who drink, and their self-efficacy for avoiding alcohol use (Nash, McQueen, & Bray, 2005). While there is still some confusion about the impact of a family history of alcohol abuse on a student's drinking and alcohol related problems, it remains an important variable. Some of the more recent studies seem to suggest that family history has its impact indirectly through alcohol expectancies.

**Pre College Drinking Pattern:** In addition to family history of alcohol use, the students' drinking pattern before college is an important risk factor. In particular, the earlier the age at which an individual first used alcohol is significantly related to the level of alcohol consumption and the number of alcohol-related problems (Prendergast, 1994). At a more general level, students who reported binge drinking in high school were significantly more likely to binge in college compared to students who did not binge in high school (OR=4.86) (Wechsler, Dowdall, Davenport, & Castillo, 1995).

**Sensation Seeking:** There have been several studies that examined the relationship between personality characteristics and drinking behavior in college students. The personality trait of sensation seeking has been characterized as a person's desire for novelty and intensity of sensory stimulation (Arnett, 1994). Sensation seeking is much higher among adolescents than adults, possibly accounting for some of the differences in reckless behavior among adolescents and adults (Arnett, 1996). Sensation seeking has been related to several high risk behaviors among college students including high-risk drinking, (Arnett, 1996; Baer, 2002; Brennan et al., 1986).

Some research has suggested that the relationship between sensation seeking and drinking could be exaggerated due to some limitations of the Zuckerman Sensation Seeking
Scale such as forced choice answers, focus on strenuous physical activities (e.g. mountain climbing), and the use of some outdated words (e.g. “jet set”) (Darkes, Greenbaum, & Goldman, 1998). However, studies using a new sensation seeking scale, which corrects for the limitations, have found the relationships described in previous research (Arnett, 1994, 1996).

*Alcohol Expectancies:* Predictors of alcohol expectancies have come from cognitive and social learning models of alcohol use (Palfai & Wood, 2001). “Alcohol expectancies are generally defined as a person’s beliefs about the effects of consuming alcohol” (Neighbors, Walker, & Larimer, 2003). The general construct of expectancy is used by several theories as a cognitive mediator of behavior (Darkes & Goldman, 1998; Leigh & Stacy, 1993). While expectancies can be positive (alcohol makes me attractive) or negative (alcohol will make me sick), research has demonstrated that utilizing both positive and negative expectancies are important for predicting drinking behavior (Lee, Greely, & Oei, 1999; Leigh & Stacy, 1993; Stacy, Widaman, & Marlatt, 1990). Research has demonstrated that utilizing both positive (alcohol makes me attractive) and negative (alcohol will make me sick) expectancies are important for predicting drinking behavior (Lee et al., 1999; Leigh & Stacy, 1993; Stacy et al., 1990).

While the basic relationship between alcohol expectancies and drinking behaviors is well established, some studies have begun to tease out the interaction of alcohol expectancies with other constructs. Neighbors, Walker and Larimer (2003) found that the effect of alcohol expectancies may be more pronounced in individuals with lower levels of self-determination.

An additional line of research has begun examining the differential impact of positive and negative expectancies on drinking behavior. Palfia and Wood (2001) examined the
impact of expectancy strength and expectancy accessibility on drinking behavior.

Expectancy strength refers to the intensity of a like or a dislike for alcohol, using a likert scale (0=not at all to 4=a lot). Expectancy accessibility refers to the behavioral responses to alcohol which depends on the degree of association between alcohol use and expectancies about alcohol (Palfai & Wood, 2001). This study was designed to examine some of the memory processes involved in expectancies effect on behavior. They found that expectancy rating and expectancy associations significantly increased prediction of heavy drinking ($\beta = .21, p<.001$, and $\beta = .14, p<.05$, respectively) and alcohol-related problems ($\beta = .47, p < .001$, and $\beta = .13, p< .01$, respectively). As such the relationship between expectancy strength and alcohol frequency was stronger for individuals who associated positive outcomes with drinking behavior. Further, the strength of alcohol expectancies as a predictor of alcohol use depends on the accessibility of the expectancies. Students with more accessible positive expectancies would be more likely to drink when evaluating their drinking options (Palfai & Wood, 2001).

**Social Norms:** In the last 10-years there have been several studies examining the impact of social norms on drinking behavior. While this has been a component of college drinking research since the 1950s (Perkins, 2002), it has received increasing attention because of its use as a mechanism for prevention programming (Haines, 1996). It has been well documented that college students misperceive the actual level of alcohol use among their peers (Baer, 1994; Baer & Carney, 1993; Borsari & Carey, 2001; Perkins, 2002; Perkins, Meilman, Leichliter, Cashin, & Presley, 1999). Specifically studies have shown that students overestimate the drinking norms of their peers (Baer, Stacy, & Larimer, 1991; Dorsey, Scherer, & Real, 1999; Perkins et al., 1999) and underestimate how much they drink.
(A.M. White et al., 2005; A.M. White, Kraus, McCracken, & Swartzwelder, 2003), as well as underestimate their risk of experiencing alcohol related consequences (Baer & Carney, 1993; Borsari & Carey, 2001). These studies have also demonstrated that students who harbor such misperceptions are more likely to drink heavily (Haines & Spear, 1996; Perkins, 2002). As such, several prevention and intervention programs have begun using a social norming approach to correct students’ misperceptions about drinking norms (DeJong, 2002; Haines, 1996; Haines & Spear, 1996). Most studies have found significant reductions in the percentage of students classified as heavy drinkers (Haines & Spear, 1996). However, one study using a national sample of campuses found an increase in light drinking and no reduction in heavy drinking among students (Wechsler et al., 2003). This study cautioned that additional research is necessary to demonstrate the effectiveness of the social norms approach. However, the study simply compared the level of student binge drinking among schools that reported conducting or NOT conducting a social norms program (Wechsler et al., 2003).

**Greek Membership:** Across studies the most consistently cited risk factor for heavy drinking is membership in a fraternity or sorority (Baer, 2002; Presley, Meilman, & Leichliter, 2002; Wechsler, Dowdall, Davenport, & Castillo, 1995). Greek membership has been associated with transition from non-binge to binge drinking in college (Weitzman, Nelson, & Wechsler, 2003), an increase in quantity and frequency of drinking among students (Caudill, Crosse et al., 2001; Prendergast, 1994), as well as increased level of drinking related consequences (Caudill, Luckey, & Kong, 2001; Wechsler & et al., 1996). Further, students living in Fraternity or Sorority houses have the highest levels of drinking among college students (Wechsler & et al., 1996). Taken together it seems important to
better understand the impact of fraternity and sorority membership on drinking among college students.

The odds ratios for the major risk factors of drinking among college students are summarized in Table 4.

<table>
<thead>
<tr>
<th>Study Construct</th>
<th>Variable</th>
<th>OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Male</td>
<td>1.55</td>
</tr>
<tr>
<td>Race</td>
<td>White</td>
<td>2.96</td>
</tr>
<tr>
<td>Religious Background</td>
<td>Religion is not very important</td>
<td>3.57</td>
</tr>
<tr>
<td>Sensation Seeking</td>
<td>Has used marijuana in last month</td>
<td>7.13</td>
</tr>
<tr>
<td></td>
<td>Two or more sex partners in a month</td>
<td>2.80</td>
</tr>
<tr>
<td>Alcohol Expectancies</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>Family History</td>
<td>Parent was not an abstainer</td>
<td>2.15</td>
</tr>
<tr>
<td></td>
<td>Family approved of alcohol use</td>
<td>1.42</td>
</tr>
<tr>
<td>Social Norms</td>
<td>Parties are very important or important</td>
<td>5.38</td>
</tr>
<tr>
<td>High School Drinking</td>
<td>Binged in High School</td>
<td>4.86</td>
</tr>
<tr>
<td>Greek Membership</td>
<td>Fraternity residence</td>
<td>6.96</td>
</tr>
</tbody>
</table>

(Wechsler, Dowdall, Davenport, & Castillo, 1995)

*Fraternity Members as high-risk drinkers*

Fraternity and sorority membership is considered a major risk factor for binge drinking and drinking related consequences (Wechsler, Dowdall, Davenport, & Castillo, 1995). However, despite these findings very little research has been conducted that examines the characteristics of fraternities and sororities that might relate to this behavior (Caudill,
Crosse et al., 2001; Caudill, Luckey et al., 2001; Wechsler & et al., 1996). Surprisingly, few studies even attempted to get more than a convenience sample of fraternity and sorority members (Caudill, Crosse et al., 2001; Caudill, Luckey et al., 2001; Wechsler & et al., 1996). Research in substance abuse prevention has also failed to integrate research examining the values, organization, and culture of fraternities and sororities into prevention interventions (Borsari & Carey, 1999; Buchanan, 2000).

Use by fraternity members

Nationally about 18 percent of students are involved in Greek organizations. Membership in a fraternity or sorority has consistently been identified as a major correlate for binge drinking and experiencing drinking related consequences. Fraternity and sorority members consistently drink more heavily and more frequently than their college peers (Danielson, Taylor, & Hartford, 2001; Pace & McGrath, 2002; Wechsler & et al., 1996). While 44% of the national college population binge drinks (Wechsler, Lee et al., 2000), between 65% to 86% of fraternity member binge drink (Caudill, Crosse et al., 2001; Meilman, Leichliter, & Presley, 1999; Wechsler, Lee et al., 2000), and as many as 65% report frequent binge-drinking (Caudill, Crosse et al., 2001). Extrapolating from these percentages the Greek population could account for as much as 38 percent of student binge drinking and about 59 percent of frequent binge drinking nationally.

Longitudinal research suggests that college drinking patterns do not persist after graduation among large numbers of fraternity and sorority members. In the post-college years there is a considerable drop in alcohol use with the heaviest drinkers significantly reducing consumption to a reasonable level of consumption (Caron, Moskey, & Hovey, 2004; Sher, Bartholow, & Nanda, 2001). Further, one study found that Greek membership
did not predict postcollege heavy drinking levels (Sher et al., 2001). However, this study only accounted for one-year post-college. Since fraternity and sorority members constitute such a high percentage of high-risk drinkers during college, it is likely that they would also represent a higher percentage of individual with alcohol abuse or alcohol related problems later in life.

Risk factors associated with fraternities

In addition to the general risk factors listed for college students, there are several specific risk factors for drinking among members of fraternities including (a) level of fraternity involvement, (b) involvement in athletics, (c) living in fraternity house and (d) pre-college drinking.

Two related risk factors among fraternity members are level of involvement in the fraternity and in college athletics. Cashin, Presley, and Meilman (1996) found that a significantly higher percentage of fraternity leaders and actively involved members drank more and reported more alcohol related problems than members who were not involved or only attended events (Cashin, Presley, & Meilman, 1998). Similarly, one study examined the level of drinking among Greeks, athletes, and general students. They found that about 72 percent of students who were both Greek and athletes were binge drinkers compared to 62 percent of Greeks, 49 percent of athletes, and 31 percent of general students. Further, a significantly higher percentage of Greek athletes reported alcohol related consequences than athletes or general students. (Meilman et al., 1999).

A third significant risk factor for fraternity members is living in the fraternity house. Research has shown that fraternity members living in the fraternity house report even higher levels of binge drinking, frequent binge drinking, and drinking related problems (Borsari &
Carey, 1999; Wechsler, Dowdall, Davenport, & Castillo, 1995; Wechsler & et al., 1996). Further, fraternities with reputations for high alcohol use, generally report more positive perceptions of high alcohol use (Larimer, Irvine, Kilmer, & Marlatt, 1997). This culture of drinking can set very high norms for individual members to live up to and tend to increase members expectancies about the value of alcohol in fraternity life (Borsari & Carey, 1999; Workman, 2001). From a community perspective, fraternities and sororities also have a prominent role in promoting the perception of college as a time and place for heavy drinking with few consequences (Borsari & Carey, 1999; Buchanan, 2000; West, 2001). However, fraternity members experience significantly more consequences related to binge drinking (Caudill, Luckey et al., 2001; Wechsler & et al., 1996; Wechsler & Kuo, 2000). Of particular concern, fraternity members living in the fraternity house report even higher levels drinking related consequences than other members (Wechsler, Dowdall, Davenport, & Castillo, 1995; Wechsler & et al., 1996).

While pre-college drinking is a general risk factor for heavy drinking in college, there are also strong correlations between heavy alcohol use in high school and joining a fraternity in college (Borsari & Carey, 1999; O'Connor, Cooper, & Thiel, 1996; Read, Wood, Davidoff, McLacken, & Campbell, 2002). Male high school students who are heavy drinkers already may be self-selecting at higher rates into fraternities because of the compatibility with drinking norms (O'Connor et al., 1996; Read et al., 2002). For example in a study of 121 freshmen interested in pledging a fraternity, 76.2 percent of heavy drinking students actually pledged compared to 48.1 percent of light and 43.8 percent of medium drinking students (O'Connor et al., 1996).

**Methodological challenges in doing research with fraternities**

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Despite the consistent findings that fraternity membership is a risk factor for high-risk drinking and alcohol related consequences, relatively few of the articles on college alcohol use or intervention since 1990 have focused on fraternities or sororities per se (Alva, 1998; Arnold & Kuh, 1992; Borsari & Carey, 1999; Cashin et al., 1998; Caudill, Crosse et al., 2001; Caudill, Luckey et al., 2001; Harrington, Brigham, & Clayton, 1997; Kuh & Arnold, 1993; Larimer et al., 1997; Larimer et al., 2001; Meilman et al., 1999; Moscato et al., 2001; O'Connor et al., 1996; Pace & McGrath, 2002; Thombs & Briddick, 2000; Workman, 2001; Zirkel & Tsai, 1990). For example, many prospective studies start with a sample of freshman students and then compare students who select into Greek organization with those who did not (Sher et al., 2001). These fail to examine the effects of fraternities across the full range of fraternity members.

At a practical level the lack of empirical literature likely stems from a number of methodological challenges in studying drinking among fraternity members: (a) adequate sample of fraternities, (b) adequate sample of fraternity members within fraternity units, (c) representative sample of fraternity members, (d) inadequacy of common alcohol assessment tools with fraternity members, and (e) nesting of fraternity members within universities, requiring multi-level analyais techniques.

The first challenge is obtaining an adequate sample of fraternities or chapters in terms of size, so that multivariate statistical analyses can be performed. In order to collect data from fraternity chapters it can be necessary to get permission to collect data from National headquarters, individual chapters, as well as campus administration, and campus institutional review boards. Many National fraternities are reluctant to allow their chapters and members to participate in such studies because of the potential legal liability as well as potentially
negative publicity from findings of heavy drinking or drug use. This reluctance on the part
of National Fraternity organizations likely stems from investigators’ attention on negative
rather than positive aspects of fraternity membership (Eberly, 2002).

The second challenge is getting an adequate sample of fraternity members within
each fraternity that can be aggregated to the fraternity chapter level. If the response rate is
low and/or biased within a fraternity chapter, the results may not be a valid representation of
that fraternity. Several difficulties emerge in getting a valid representation of a fraternity
chapter. At the campus level it can be difficult to construct an accurate estimate of the Greek
membership. Further, once the samples have been identified, it can be difficult to access the
individuals, particularly by phone (Stackhouse, 2003, Personal communication). Of studies
on Greek organizations response rates are generally based on number of chapters responding,
with average percentage of individual respondents across chapters. However, it is often
unclear how the total number of eligible individuals or eligible chapters is calculated. For
example one study examined the effectiveness of an alcohol-risk reduction program among
14 fraternity chapters and 8 sorority chapters, with a mean response rate of 63.4%. The final
sample was 1,342 students with an average chapter size of 106 members.

Third, there is a considerable challenge in getting a representative sample of fraternity
chapters which will allow generalizability of the findings beyond the specific fraternity
organizations in a particular study. Few of the college drinking studies have attempted to get
more than a convenience sample of fraternity and sorority members and only one has
collected data from a national sample (Caudill, Crosse et al., 2001; Caudill, Luckey et al.,
2001). The majority of studies that include fraternity membership have used Greek
membership as a covariate in analysis rather than primary focus of the studies.
Fourth, there are challenges associated with adapting commonly used alcohol assessment measurement tools to the study of heavy-drinking among fraternity members. Across the literature examining college student alcohol use there is a common focus on identifying heavy, high-risk, or problematic drinkers. While there are several different measures of heavy drinking, most focus on some combination of the quantity and frequency of use. A few continuous measures used by researchers are the quantity of alcohol per event, frequency of drinking over a specified period of time (e.g. past month) and blood alcohol content (BAC). However, the most commonly used measures are based on cutpoints which separate students into discrete categories based on their drinking level. The most common measure currently is “binge drinking” which is defined for men as five or more drinks in one setting over the last two weeks, and for women as four or more drinks in one setting (Wechsler, Dowdall, Davenport, & Rimm, 1995). Another common measure is the Quantity Frequency Index which classifies students drinking behavior into four categories: (a) heavy, (b) moderate, (c) light and (d) infrequent (Cahalan, Cisin, & Crossley, 1969; Caudill, Crosse et al., 2001; Caudill, Luckey et al., 2001).

One problem with the above assessment tools is that these discrete categories are useful for identifying general risk factors related to drinking, but limit the variability in drinking behavior, particularly among heavy drinkers. For example it is estimated that 44 percent of students and 65 percent of fraternity members binge drink, however there is no distinction between the students who have 5 drinks per setting compared to those who have 8 or 10 drinks. Further, with the identification of these discrete categories many researchers have moved away from quantity frequency questions to specific items. For example binge drinking in often measured using a single item: “How many times in the last two weeks have
you had five or more drinks in one setting.” While this is effective for categorizing students into binge drinking categories, the richness of the quantity and frequency data is lost.

In addition to losing the variability in quantity and frequency, these single item measures also tend to underestimate the overall level of drinking in heavy drinking populations (Caudill, Crosse et al., 2001; Sobell & Sobell, 1995). Thus the ceiling is set at 5 drinks, although there can be considerable variability among heavy drinkers.

One additional problem with these 1 or 2 item measures of binge drinking is that they may be vulnerable to problems of telescoping and social desirability (Fowler, 1993). With telescoping the students include events that happened outside of the identified range. For example a student may include a night they were drinking from three weeks ago, when the question is focused on the past two weeks. With social desirability, the students may report a lower or higher level of drinking in response to perceived expectations of investigator or testing situation. Students often do not consider the size of the drinks they have when counting the number of drinks. This can lead to an underestimation of the number of drinks since many times drink sizes are larger than standard measures (A.M. White et al., 2005). While research has generally supported the reliability and validity of self-report drinking data among college students (Turner et al., 1998), estimates may be more problematic for heavy drinkers. Further, for heavy drinkers it is likely that they do not accurately count the overall number of drinks, particularly late at night and accounting for the depressive effects of alcohol that could also distort recall.

Some of these issues impacting reliability can be addressed by the use of the timeline follow-back technique. This technique utilizes several memory aides, including a calendar, to help individuals remember their activities over a specified period of time. To aid with
recall, the participant is asked to identify important events, such as holidays or birthdays, as well as regular events (e.g., exams, trips, happy hours, etc) so that each day has some triggering event which should help the individual in reporting behavioral data (Sobell, Brown, Leo, & Sobell, 1996). The participant is presented with a “filled-in” calendar, and then asked to complete a daily inventory of their drinking frequency using daily events as “triggers” to their recall. The use of this technique helps reduce telescoping through the use of the calendar. Further, the structured environment and memory cues seem likely to reduce response biases such as social desirability. Further, by providing standard definitions for drink sizes it is possible that it could increase the accuracy of the level of drinking.

Although timeline followback techniques represent the “gold standard” in self-report assessment of alcohol use, they are much more time-consuming to use than the use of a 2 or 3 item self-report scale.

The reliability of the self-report data can be enhanced by using audio computer assisted survey interviewing (Audio-CASI) as well as timeline followback techniques. A survey conducted using Audio-CASI is completed using a computer where questions are presented to the participant both written and verbally through the computer. The participant can reply to each question using either a mouse or keyboard, providing a measure of confidentiality. The audio CASI has been shown to improve levels of self-reported high risk behaviors (Sobell & Sobell, 1992, 1995).

Fifth, it is important to statistically account for the nested relationships between individual fraternity members, chapters, schools and national fraternity organizations. Because of the overlap between the school, fraternity, and chapter characteristics it is expected that members in the same school and local chapter are more likely to be similar to
within-group peers than students in other at other schools and in different campus fraternities. Therefore, individuals’ scores do not represent independent observations violating an assumption required by many statistical techniques. Examining multilevel data in a variety of fields, researchers have found that using the individual as the unit of analysis will often underestimate the error term and can overestimate the effect of an intervention or group membership (Murray, 1998). One way to address this problem is to use Hierarchical Linear Modeling, a form of mixed level modeling (Raudenbush & Bryk, 2002).

**Campus Based Interventions to Reduce Drinking**

Research findings regarding alcohol use and alcohol related problems among college students has prompted a debate about the effectiveness of campus based alcohol related policies and programs. Concurrently, there is also a legal debate about what level of responsibility campuses have to manage the conduct of students, specifically their drinking behavior. Over the last 30 years the pendulum has swung between the extremes of in loco parentis (surrogate parenthood) and no legal responsibility (Bickel & Lake, 1999; Hennessy & Huson, 1998). While it is unlikely that the legal responsibility will ever return to in loco parentis, it is clear that colleges and universities have some legal obligation to protect students, although, at this time it is still unclear how far the responsibility extends (DeJong & Langenbahn, 1997).

Historically, campuses efforts to manage alcohol problems have used a combination of alcohol policies, alcohol treatment, and preventative interventions. The primary goals of these efforts have been to prevent alcohol misuse, reduce alcohol related harms, and treat alcohol abuse (Davidson & DeJong, 2004; Vicary & Karshin, 2002). However, recent
research has begun to question whether campuses have done an adequate job addressing alcohol use and alcohol related problems.

A stimulus for many campus alcohol related policies, treatment programs and preventative interventions has been the Drug Free Schools and Campuses Act, codified as Part 86 of the Education Department General Administrative Regulations (EDGAR) (34 CFR Part 86) (DeJong & Langenbahn, 1997). This act establishes the minimum level of interventions (see Table 5), related to alcohol and illicit drugs, that campuses must conduct in order to receiving federal funding, including participation in the federal student loan programs.

<table>
<thead>
<tr>
<th>Table 19: EDGAR Reporting Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>A description of the health risks associated with the use of alcohol and illicit drugs;</td>
</tr>
<tr>
<td>A description of any drug or alcohol counseling, treatment, or rehabilitation programs available to students and employees</td>
</tr>
<tr>
<td>Standards of conduct that clearly prohibit the unlawful possession, use, or distribution of alcohol and illicit drugs by students and employees on school property or as part of any school activities;</td>
</tr>
<tr>
<td>A description of the applicable legal sanctions under local, state, or federal law for the unlawful possession, use, or distribution of alcohol and illicit drugs;</td>
</tr>
<tr>
<td>A clear statement that the school will impose disciplinary sanctions on students and employees who violate the standards of conduct;</td>
</tr>
<tr>
<td>A description of the sanctions, up to and including expulsion, termination of employment, and referral to local law enforcement.</td>
</tr>
<tr>
<td>Written review of the program every two year to determine its effectiveness, implement needed changes, and ensure school’s sanctions are being consistently enforced.</td>
</tr>
</tbody>
</table>

(DeJong & Langenbahn, 1997)

The majority of these requirements are educational in nature, and many campuses (Wagenaar, 1994; Wagenaar, Gehan, Jones-Webb, Toomey, & Forster, 1999), local communities (Wagenaar, 2000), and states (Wechsler et al., 1998; Wechsler, Lee, Kuo et al.,
Campus Alcohol Policies

Campus alcohol policies typically include a range of formal and informal mechanisms including the student code of conduct, judicial sanctions, use regulations (e.g. dry dorms), organizational practices, campus enforcement, prevention and treatment program operations, as well as the allocation of resources and money (Mitchell, Toomey, & Erickson, 2005). As such, alcohol policies have become a very important mechanism for setting standards for alcohol use on campus and in campus related events. Campuses have used alcohol policies to regulate a wide range of behavior relating to alcohol use on campus such as: (a) limits on alcohol advertising, (b) regulating/monitoring parties on campus (e.g. fraternities), (c) limit alcohol during sporting events or tailgate parties, and (d) designating where alcohol can be sold on campus. Alcohol policies have also specifically focused on limiting access to alcohol through: (a) banning kegs on campus, (b) prohibiting use at special events, (c) providing alcohol-free dorms, (d) prohibiting Greek alcohol use, and (e) prohibiting alcohol ads on campus radio station or newspaper. Campus policies also impact the campus environment, sending a message about the campuses’ support of alcohol use: (a) presence of on-campus bar, (b) accepting alcohol sponsorship, (c) scheduling Friday classes, and (d) sponsoring on-campus alcohol-free activities (Walters & Neighbors, 2005).

Campus Alcohol Treatment and Prevention Programs

Treatment efforts have included individual and group treatments, support groups such as Alcoholics Anonymous, as well as on campus housing (dorms or floors) for students in recovery. One successful approach for treatment being used and evaluated on several
One example of a preventative intervention being used on college campuses is social norms marketing campaigns. This intervention uses a media campaign on campus to correct student misperceptions about the campuses is motivational interviewing. Motivational interviewing is a client-centered approach that is designed to help at-risk students reduce their alcohol use by helping them “clarify ambivalence, build discrepancy, and increase motivation for change” (Walters & Neighbors, 2005). These interventions rely on presenting students with discrepant information such as their drinking profile, risk factors, and normative comparisons in order to facilitate a change in their drinking behavior. Students typically complete a brief questionnaire about drinking behavior, risk factors, perceptions of peer drinking behavior, alcohol related problems and/or other related issues. This information is then relayed back to the student highlighting areas of concern, such as high level of drinking or several risk factors, and providing normative information to counteract misperceptions among the individual students. This is commonly called feedback, which has been provided through various formats including face to face, mail, e-mail, and computer interactions. Further, some interventions have used feedback within individual or group counseling sessions (Perkins, 2002). In a review of 13 studies, 11 studies found a significant reduction in drinking, compared to control or comparison groups, despite differences in population, follow-up period, and format of feedback (face to face, mail or e-mail) (Perkins, 2002). The primary limitation of treatment based approaches is the focus on a small number of students.
level of drinking among their peers. These misperceptions have been shown to increase individual students’ level of drinking to keep up with a perceived norm which is typically much higher than the actual level of drinking among students.

“The basic idea [of the social norms approach] is simply to communicate the truth about peer norms in terms of what the majority of students actually think and do concerning alcohol consumption. Thus the message to students is a positive one—that the norm is one of safety, responsibility and moderation because that is what the majority of students think and do in most student populations.” (Task Force of the National Advisory Council on Alcohol Abuse and Alcoholism, 2002a; Vicary & Karshin, 2002)

Social norms programs can be used with whole campuses or targeted populations, such as Greek or fraternities. A baseline survey is conducted to identify the drinking norms of the students on campus. These norms are then communicated through a variety of media avenues including orientation, ads in the student newspaper, posters, and other public venues.

**Limitations in Campus Based Interventions to Reduce Drinking**

Of particular concern to campus and community leaders, between 1993 and 2001 there was little change in the overall level of drinking among college students (Vicary & Karshin, 2002; Wechsler, Lee, Kuo et al., 2002). This study compared data from four surveys (1993, 1997, 1999, and 2001) of student alcohol use among nationally representative sample of colleges and universities (Wechsler, Lee et al., 2000; Wechsler, Lee, Kuo et al., 2002). Even with the limitations of this method, these findings have raised a substantial number of questions about the overall effectiveness of campus alcohol policies and programs nationally. These trends are also supported through data from the National Survey of Drug
Use and Health, showing binge drinking rates of 43.4 percent among 18-22 year olds enrolled in full-time college. Further there were no significant changes in the rates of binge drinking among this same population between 2003 and 2004 (Substance Abuse and Mental Health Services Administration, 2005).

Other research has found that many of the programs actually used by campuses have limited empirical support (Moskowitz, 1989, Larimer and Conce, 1989, Vicary and Karshin, 2002). Despite the availability of evidence based programs for reducing drinking among college students, many schools rely heavily on educational approaches which are necessary but insufficient for reducing alcohol use and alcohol related problems among college students (American Medical Association, 2003; Hingson & Howland, 2002; Toomey & Wagenaar, 2002).

An Ecological Approach to Alcohol Prevention

In many ways alcohol abuse on college campuses has become such a widespread concern that it has become “everyone’s problem…and no one’s responsibility” (Busteed, 2002). Given the variation in alcohol policies and treatment or prevention programs being used, limited change in student drinking from 1993 to 2001, increased legal pressure, and increased media attention to alcohol related problems, campus administrators, researchers, and policy makers have begun reexamining their prevention paradigms. Many researchers and policy makers have promoted a movement towards using a social ecological approach to alcohol prevention. In general this approach seeks to reduce alcohol consumption, and alcohol related problems, by working simultaneously at campus, community, state, and national levels to change the physical, social, economic, and legal contexts that surrounds the binge drinking behavior of college students (DeJong & Langford, 2002). The overarching
goal is to establish and maintain an environment that discourages student substance abuse (DeJong & Langenbahn, 1997); in contrast to programs that target specific causes of drinking, which do not effectively remove the social and cultural influences that encourage college students to drink (Wagenaar et al., 1999; Wagenaar, Murray, Gehan et al., 2000; Wagenaar, Murray, & Toomey, 2000).

The ecological approach has been used successfully to reduce substance use among adolescents (Toomey & Wagenaar, 2002; Weitzman, Nelson, Lee, & Wechsler, 2004; Ziemelis et al., 2002). And while this approach holds promise for reducing drinking among college students, there are only a handful of studies examining comprehensive approaches and none have systematically tested this approach with college populations (DeJong & Langford, 2002; DeJong et al., 1998; Wagenaar, 1994; Wagenaar & Toomey, 2002).

The predominant ecological model being promoted for college campuses is the Environmental Management Approach (DeJong et al., 1998). The environmental management approach has three spheres of action: (a) campus, (b) local community, and (c) state. At the campus level this approach emphasizes the development of a task force to oversee the alcohol programming and policies across campus. At the local community level campuses are advised to develop campus-community coalitions, focusing largely on increased enforcement and revision of alcohol related ordinances/laws. Finally, at the state level this approach suggests the cooperation of colleges and universities to advocate for state level laws and programs to reduce underage drinking and alcohol related problems (DeJong et al., 1998). Ideally the efforts at each of these levels would complement each other, working towards significant change across the state. At each level the goal is to identify ways that the environment can be altered to reduce use of alcohol among students (DeJong et
al., 1998). By working simultaneously at these three levels, campuses are more likely to facilitate sustainable change in the campus alcohol culture (DeJong et al., 1998). Overall the Environmental Management approach provides a framework for schools to identify and address foreseeable hazards and risks in their environment, thus addressing the largest problems and reducing legal liability (DeJong & Langenbahn, 1997).

Evaluations of Ecological Approaches on College Campuses

While several campuses have adopted the environmental management approach to organize their alcohol related polices and programming, only two multi-campus efforts have been evaluated.

The first study examined the effectiveness of prevention programs in changing student drinking behavior on campuses that received grants from the Fund for the Improvement of Post-Secondary Education (FIPSE). This exploratory study was designed to answer the question: “to what extent do prevention programming variables, student variables, substance use, use-related variables, and/or institutional variables explain changes in student drinking at campuses participating in the FIPSE-sponsored drug prevention programs” (Ziemelis et al., 2002)? Data from a sample of 94 colleges and universities were used, combining data from FIPSE reports on prevention initiatives and a common data set. The drinking data was used to identify pre-post changes in binge drinking among students at each campus; 34 campuses showed increases and 60 showed decreases in student binge drinking between pre and post tests. Analyses found that only the prevention elements revealed significant associations with institutional changes in binge drinking. Overall, schools with decreases in binge drinking had a higher mean number of prevention elements. Using a series of factor analysis and logistic regression this study identified three prevention
constructs, using 24 of 86 prevention elements: (a) student participation and involvement, (b) educational and informational processes, and (c) campus regulatory and physical change efforts. These three constructs explained 20 percent of the variance in binge-drinking change and improved the accuracy of predicting a decrease in binge drinking by 21.2 percent, 33.2 percent above the base rate. The tests of this prevention model support the idea that “in the aggregate, particular types of prevention approaches and related activities may underlie decreases in binge drinking” (Weitzman et al., 2004). However, this study only provides a very general framework for identifying which prevention approaches are most effective and should be included as part of comprehensive prevention program. Further, it is important to note that this may not reflect a representative sample of schools. Schools were selected because they had received FISPE grants, collected ongoing survey data, and establish comprehensive institution wide drug- and alcohol-prevention programs.

The second study examined the impact of the American Medical Association prevention program, A Matter of Degree. The AMOD program used a community coalition model that brought campuses and communities together to reduce alcohol consumption and alcohol-related harms (Weitzman et al., 2004). This program provided funding to 10 schools where more than 50 percent of the students reported binge drinking. Each of these schools agreed to develop a college-community partnership and implement environmental strategies to respond to the heavy drinking on campus. In addition, outcome data was collected from a sample of 32 referent schools to examine the impact of the AMOD program. Initial results showed that the program had no impact on drinking compared to the referent schools. Additional analyses were able to divide the AMOD schools into high (n=5) and low (n=5) implementation based on the number of interventions that were implemented (high=186,
The high implementation group showed significant declines in six of the seven consumption outcome measures, nine of the eleven alcohol-related harms measures, and five of the nine second hand effect measures compared to the 32 referent schools (Knight et al., 2003). As with the FISPE study, this study found that implementing a wider range of programming was related to decreases in both consumption and alcohol-related harms.

**Importance of Institutional Infrastructure to Support Ecological Approaches**

An important aspect of the FIPSE and AMOD studies was the assumption of an institutional infrastructure that would support the proposed programming. FIPSE campus grantees were required to establish comprehensive institution wide drug- and alcohol-prevention programs; and AMOD grantees agreed to develop a college-community partnership and implement environmental strategies to respond to the heavy drinking on campus. In addition grantees in both programs received funding to hire program and evaluation staff and conduct surveys of drug and alcohol use.

DeJong and colleagues suggest that the implementation of an ecological strategy will require: (a) strong presidential leadership, (b) engagement of administration, faculty, staff, and students, (c) engagement of leaders in the surrounding community, and (d) active participation of campus official in state policy (DeJong & Davidson, 2000; The Higher Education Center for Alcohol and Other Drug Prevention, 1997). In addition there are several practical components including hiring of program and evaluation staff, creating task forces, conducting needs assessments or evaluation survey, and staff to conduct a comprehensive reviews of alcohol policies and programs. However, it is unclear that Universities and Colleges are investing the level of resources needed to make such comprehensive initiatives feasible.
DeJong and colleagues conducted a study in 1998, designed to better understand “the extent to which colleges and universities have installed the infrastructure they need to develop, implement and evaluate a comprehensive program that includes prevention strategies with an environmental management focus” (DeJong & Langford, 2002; DeJong et al., 1998; Larimer & Cronce, 2002). Surveys were mailed to senior administrators responsible for alcohol and other drug-related problems at 365 schools, with a 76.9 response rate (n=280). The survey examined eight components of campus prevention infrastructure: (a) changes in funding, (b) number of staff, (c) campus-wide task force, (d) community coalition, (e) state-level association, (f) formal assessment of AOD policies and programs, (g) student alcohol/drug use, knowledge, and attitude survey, and (h) review of campus security reports. The results from this study, as summarized in Table 6, suggests that few campuses have the institutional elements in place that would support a comprehensive approach to alcohol programming, such as Campus Wide Task Force (39.8%), Part of Local Coalition on AOD issues (28.5%), Part of State–Level Association (32.6%). Further, while 81.1 percent of in institutions report having hard money for prevention, campuses only report an average of 1.2 full-time staff. Further, only 37.3 percent conducted a survey on student AOD use, knowledge and attitudes and less than 20 percent conducting a formal assessment of AOD policies and programs. This suggests that most campuses have not yet put in place the basic infrastructure needed to develop, implement, or evaluate a comprehensive approach such as (19.8%) (DeJong and Langford, 2002).
Table 20: Percentage of Schools with Components of Prevention Infrastructure

<table>
<thead>
<tr>
<th>Initiative</th>
<th>Overall</th>
<th>4-Year schools</th>
<th>2-Year schools</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Comprehensive Approaches</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part of Campus-wide Task Force</td>
<td>39.8%</td>
<td>51.5%</td>
<td>29.6%</td>
</tr>
<tr>
<td>Part of Local Coalition on AOD issues</td>
<td>28.5%</td>
<td>37.9%</td>
<td>18.9%</td>
</tr>
<tr>
<td>Part of State-Level Association</td>
<td>32.6%</td>
<td>41.3%</td>
<td>23.3%</td>
</tr>
<tr>
<td><strong>Institutional Infrastructure</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hard money for prevention</td>
<td>81.1%</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Funding increase</td>
<td>9.4%</td>
<td>16.8%</td>
<td>1.8%</td>
</tr>
<tr>
<td>Funding decrease</td>
<td>9.4%</td>
<td>9.2%</td>
<td>9.7%</td>
</tr>
<tr>
<td>FTE Staff</td>
<td>1.2</td>
<td>&lt;1 = 38.5%</td>
<td>&lt;1 = 57.8%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1-2 = 40.4%</td>
<td>1-2 = 24.8%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2+ = 21.2%</td>
<td>2+ = 17.4%</td>
</tr>
<tr>
<td>Formal Assessment of AOD policies/programs</td>
<td>19.8%</td>
<td>25.2%</td>
<td>13.9%</td>
</tr>
<tr>
<td>Survey of Student AOD use/knowledge/attitudes</td>
<td>37.3%</td>
<td>58.3%</td>
<td>17.7%</td>
</tr>
<tr>
<td>Review of Incident from Campus Security</td>
<td>66.3%</td>
<td>72.1%</td>
<td>62.2%</td>
</tr>
</tbody>
</table>

*Prevention initiatives from nationally representative sample of schools (DeJong & Langford, 2002).

Two studies by Wechsler and his colleagues also demonstrated the variability across Universities and colleges in the degree of institutional investment in prevention infrastructure (Wechsler, Kelley et al., 2000; Wechsler et al., 2004). Nationally representative samples of
presidents at 4-year colleges and universities were contacted in 1999 (Wechsler, Kelley et al., 2000) and 2002 (Wechsler et al., 2004). Both studies were designed: (a) “to take stock of current efforts and trends in alcohol prevention nationally and (b) to assess if administrators’ perception of drinking problems impacted implementation of prevention programs (Wechsler, Kelley et al., 2000; Wechsler et al., 2004). In 1999, approximately 60% of schools had a “task force to deal with on-campus abuse”, 54.6% measured the extent of binge drinking occurring at their schools, and 39.7% had a cooperative agreement with local community agencies. Only 40% reported any effort to assess program impact (Wechsler, Kelley et al., 2000). In repeating this study in 2002, Wechsler and colleagues found some small increase in investment in prevention infrastructure (Wechsler, Seibring, Liu, & Ahl, 2004). The percentage of schools reporting cooperative agreements with community agencies increased from 39.7% to 48.1%, and the percentage of schools with a campus Task force for alcohol abuse increased from 53.4% to 54.2%. Thus, a considerable number of Universities and colleges had few of the elements suggested as important in supporting comprehensive approaches to prevention of alcohol misuse.

The level of institutional investment in prevention infrastructure was related to both the size of the school (enrollment) and the administrators’ perception of alcohol problems on campus (See Table 7). Both studies found that schools in which administrators’ perceived as an alcohol use as a more serious problem were more likely to have made greater institutional investments. However, administrators’ perceptions of the seriousness of campus alcohol abuse may be influenced by a variety of factors other than student outcomes, e.g., prominent alcohol-related events, legal challenges, and so on (Wechsler, Kelley et al., 2000; Wechsler et al., 2004).
Table 21: Prevention Initiatives by Size and Perceived Severity of Alcohol Problems

<table>
<thead>
<tr>
<th>Initiative</th>
<th>Year</th>
<th>All</th>
<th>Size</th>
<th>Perceived Severity of Alcohol Problems</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>&lt;5K</td>
<td>5-10K</td>
<td>&gt;10K</td>
</tr>
<tr>
<td>Substance Abuse Officer</td>
<td>1999</td>
<td>76.9%</td>
<td>71.9%</td>
<td>88.1% 87.0%</td>
</tr>
<tr>
<td></td>
<td>2002</td>
<td>81.0%</td>
<td>77.9%</td>
<td>89.5% 91.5%</td>
</tr>
<tr>
<td>Task force for on campus abuse</td>
<td>1999</td>
<td>60.0%</td>
<td>54.2%</td>
<td>68.3% 79.5%</td>
</tr>
<tr>
<td></td>
<td>2002</td>
<td>60.5%</td>
<td>53.4%</td>
<td>74.3% 91.5%</td>
</tr>
<tr>
<td>Measure extent of binge drinking</td>
<td>1999</td>
<td>54.6%</td>
<td>46.8%</td>
<td>69.0% 77.9%</td>
</tr>
<tr>
<td></td>
<td>2002</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Evaluates program impact</td>
<td>1999</td>
<td>40.3%</td>
<td>46.8%</td>
<td>69.0% 77.9%</td>
</tr>
<tr>
<td></td>
<td>2002</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Coop agreement with community agencies</td>
<td>1999</td>
<td>39.7%</td>
<td>34.3%</td>
<td>53.5% 52.1%</td>
</tr>
<tr>
<td></td>
<td>2002</td>
<td>48.1%</td>
<td>43.8%</td>
<td>60.0% 62.2%</td>
</tr>
</tbody>
</table>

The implicit assumption underlying comprehensive, ecological approaches is that there would be sufficient institutional investment to make such programming feasible. However, there has been no systematic examination of the relationship between institutional investment in prevention infrastructure and student drinking outcomes, such as drinking level and drinking related consequences. There has been no examination of the institutional investment in prevention infrastructure and student drinking outcomes among high-risk groups such as fraternity members.
By investing in these infrastructure resources, campuses are presumably taking significant steps to change their approach to alcohol prevention. Given this shift in attention it is possible that this preliminary investment could reduce drinking among students, by sending the message that such behavior is not an acceptable part of campus life. However, there has been no systematic examination of the relationship between institutional investment in prevention infrastructure and student drinking outcomes, such as drinking level and drinking related consequences. There has been no examination of the institutional investment in prevention infrastructure and student drinking outcomes among high-risk groups such as fraternity members.

This study will contribute to the literature by improving our understanding of the influence of institutional level investments on individual drinking behavior. This dissertation will improve on previous research by analyzing data from fraternity members at 31 campuses, using a robust measure of alcohol use, and controlling for individual level risk-factors of alcohol use. Statistically the study will also control for individual respondents being nested within institutions by using hierarchical linear modeling (HLM).
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