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New Evidence on the Link between Alcohol Use and College Outcomes*

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Abstract

This study explored the impact of binge drinking on a range of college outcomes and the extent to which academic engagement has a mediating effect on that relationship. Overall results suggest that a substantial portion of college students may not be achieving many of the intended outcomes of college due to their frequency of binge drinking. Our findings demonstrated that first-year students who binge three or more times a week make fewer gains in the first year of college than students who do not binge. Students who binge drink once or twice per week also make fewer gains than students who do not engage in binge drinking, although to a lesser extent than the deficit found among students binge drinking three or more times per week. On several measures of interpersonal relations and academic motivation, students who binge drink at any level fare worse than students who do not binge drink. In addition, time spent on academically purposeful activities and experiencing an academically engaging environment contributed to the gains in educational outcomes included in this study, but the extent to which they mediated the negative effects of binge drinking was very small or non-existent on most of the measures. On the whole, these findings indicate that the effects of binge drinking on educational outcomes tend to be negative and significant, even when we account for time spent on studying, co-curricular activities, reading for pleasure/enrichment, and working for pay as well as an academically challenging environment that encourages integrative thinking and allows for student-faculty contact.

New Evidence on the Link between Alcohol Use and College Outcomes

Binge drinking, typically defined as consuming five or more alcoholic beverages on one occasion, has concerned college educators for at least the past two decades (e.g. Presley, Meilman, Cashin, & Lyerla, 1996; Engs, Hanson, & Diebold, 1996; Murphy, Hoyme, Colby, & Borsari, 2006; Porter & Pryor, 2007; Wechsler, & Nelson, 2001; Wechsler, Dowdall, Maener, Gledhill-Hoyt, & Lee, 1998). Research has tried both to quantify college student drinking and to discern the consequences for drinkers (Perkins, 2002). Much of the literature has focused on what we would consider short-term negative consequences: personal injury; missing a class; experiencing a hangover; disruptions to the community; etc. (Wechsler & Nelson, 2008).

A handful of studies have looked at alcohol's longer-term effects, primarily focusing on grade point average (Rau & Durand, 2000; Porter & Pryor, 2007; Pascarella, Goodman, Seifert, Tagliapietra-Nicoli, Park, & Whitt, 2007; Paschall & Freisthler, 2003; Williams, Powell, & Wechsler, 2003; Wolaver, 2002; Wood, Sher, Erickson, & DeBord, 1997). There has also been some attempt to discern whether lower grades by frequent binge drinkers are related to reduced study time (Wolaver, 2002; Williams et al., 2003; Pascarella et al.). Most recently, researchers have begun to study the effects of drinking on broader outcomes, such as life satisfaction (Murphy, Hoyme, Colby, & Borsari, 2006), and college involvement, a common predictor of college success (Porter & Pryor).

This research extends the literature by examining the effects of binge drinking on a wide range of college outcomes and the extent to which those effects are mediated by academic engagement. On a practical level, the findings may contribute to the enhancement of drinking prevention programs which are designed to decrease drinking as well as the negative consequences associated with it. We begin with a review of research on college student binge

drinking. Then we provide a detailed description of our methods and findings. We conclude with implications for practice and future research.

Binge Drinking and Personal Harm

Much of what is known about binge drinking and its effects comes from two national longitudinal studies that spanned the 1980s and 1990s: the Student Alcohol Questionnaire (SAQ) (Engs, Hanson, & Diebold, 1996) and the College Alcohol Survey (Wechsler & Nelson, 2008). The number of college students who binge drink has remained fairly consistent from the early 1990s through 2002 (Hingson, Heeren, Winter, & Wechsler, 2005; Wechsler, Lee, Kuo, Seibring, Nelson, & Lee, 2002) and compared to individuals of the same age who do not attend college, students binge drink more frequently (Hingson et al.). Many studies have found that 40% of college students drink at the binge level of 5 or more drinks per occasion (Hingson et al.; Wechsler et al.; Wechsler & Nelson, 2008; Weitzman, Nelson, & Wechsler, 2003; U.S. Department of Health and Human Services, 2007). Approximately 20% of college students binge drink frequently, which is commonly defined as three or more times within two weeks (Dowdall & Wechsler; 2002; Weitzman et al.; U.S. Department of Health and Human Services).

These levels of drinking constitute what some have called a “major public health problem” (Wechsler & Nelson, 2008, p. 482) for colleges, resulting in considerable personal harm to those who drink and others in the vicinity. Binge drinking affects college students’ risk-taking behavior, health, relationships, and academic performance (Wechsler & Nelson, 2008). Students who are frequent binge drinkers, bingeing three or more times in a two-week period, report experiencing higher levels of alcohol-related problems (Wechsler & Nelson). Blackouts, throwing up, and hangovers are a few of the more common injuries that students experience from drinking (Perkins, 2002). Nearly 600,000 students are injured each year because of drinking and

approximately 1,700 students die each year due to alcohol-related injuries, including car accidents (Hingson et al., 2005).

The negative effects of drinking extend beyond the individual drinker, constituting what Wechsler has called “secondhand effects” (Wechsler & Nelson, 2008). These include physical and sexual violence, property damage, and disturbances that prevent sleeping or studying (Perkins, 2002; Wechsler & Nelson). Alcohol use is considered a major factor related to general campus general crime as well as sex crimes, which are common on college campuses and often associated with alcohol use (Dowdall & Wechsler, 2002). Studies have shown that 700,000 students per year are assaulted or hit by a college student who has been drinking (Hingson et al.). Another 97,000 experience alcohol-related date rape or sexual assault and nearly half a million students engaged in unprotected sex because of drinking (Hingson et al.).

Academic Consequences of Binge Drinking

Given that the central purpose of college is education, an analysis of the relationship between binge drinking and academic consequences is warranted. Students report that because of drinking they have missed classes, performed poorly on tests, or received lower grades (Engs, Hanson, & Diebold, 1996; Perkins, 2002; Presley et al., 1996). Researchers also demonstrate a clear association between heavy drinking habits and lower grade point average (Engs et al., 1996; Presley et al., 1996; Rau & Durand, 2000; The National Center on Addiction and Substance Abuse at Columbia University, 1994). For example, findings from a national multi-institutional survey indicate students with a grade point average of “A” drank an average of 3.3 alcoholic drinks per week, while students with a “D” or “F” drank 9 drinks per week (Presley et al.). Engs et al. found that students with lower grade point averages (GPAs) were more likely to be heavy drinkers.

Many of the earlier studies about alcohol and grades tended to be correlational (Perkins, 2002) or simply account for alcohol-related academic problems (e.g. miss a class due to drinking, attend class with a hangover, etc.) without studying the academic consequences (Paschall & Freisthler, 2003). More recently, researchers have used regression techniques to look at the relationship between alcohol and grades, and have found mixed results. At least two studies concluded that alcohol use does not affect grades when you account for background characteristics such as high school grades (Paschall & Freisthler; Wood et al., 1997). Others have found that binge drinking does negatively influence college GPA, even when controlling for background characteristics (Pascarella et al., 2007; Porter & Pryor, 2007; Williams et al., 2003; Wolaver, 2002).

Several studies have hypothesized that the negative effects of alcohol on academic performance is related to study time, assuming that drinking takes time away from studying. Wolaver (2002) concluded that drinking has both direct and indirect effects on grade point average because it leads to a decrease in study hours. Williams et al. (2003) also concluded that alcohol consumption has a negative effect on GPA and that is primarily due to a reduction in study hours. However, two additional studies found that although there is a negative relationship between binge drinking and grades or academic consequences, it cannot be primarily attributed to study time (Pascarella et al., 2007; Powell, Williams, and Wechsler, 2004). So far the research is fairly consistent in suggesting that the negative effect of binge drinking on academic performance is similar for both males and females (Pascarella et al.; Perkins, 2002; Porter & Pryor) and the more often a student binge drinks, the greater the negative impact on grades (Pascarella et al.; Porter & Pryor; Williams et al.).

Murphy et al. (2006) suggested that just because a student's alcohol use leads to negative *incidents* such as missing classes or damaging property, that does not necessarily result in negative *outcomes*, such as failing school or being arrested. Therefore, they examined the effects of drinking and negative drinking-related incidents on several satisfaction and quality of life scales which they considered to be "global" outcomes. They found that in general, increased levels of drinking does not negatively affect life satisfaction and quality of life but experiencing alcohol related problems (e.g. getting into a fight, drunk driving, or missing a class) has a negative effect on general satisfaction with life (Murphy et al.).

Porter and Pryor (2007) extended the research on alcohol use and outcomes by examining the effects of binge drinking on both college involvement and time spent on student activities. Both involvement and time-use have been associated with gains made in college, yet research on the impact of binge drinking on those activities has been lacking (Porter and Pryor). They replicated the finding that the probability of a higher GPA decreases as the number of binge drinking episodes increase (Porter & Pryor). They also found that, in general, involvement in college and time spent on academic and extracurricular pursuits decrease as the number of binge drinking episodes increase, though the extent to which this happened depended on institutional type (Porter & Pryor).

Alcohol Prevention and Reduction Programs

The overwhelming negative personal and academic effects of high risk drinking found in the literature suggests the importance of focused efforts on alcohol prevention and reduction programs on college and university campuses. We turn our attention to a synthesis of the literature on the impact of current programs used by campus practitioners designed to prevent and reduce drinking, and thereby reduce the negative consequences of drinking. The broad range

of prevention practices spans the gamut from social norms to population prevention to individual interventions and screening to total environment approaches. The focus of each program, including which population to focus on, where to implement programs, and how to do it, differs based on the institution's goals. These goals are informed by research that highlights the negative consequences of drinking and the best means to prevent it.

Social norms campaigns. "Social norms campaigns" have become popular harm reduction approaches implemented on college campuses. This method focuses on providing students with accurate information about drinking norms and identifying discrepancies of students' perceptions regarding peers alcohol use (Hagman, Clifford, & Noel, 2007). Social norms may be a popular approach, but the research shows mixed results regarding the effectiveness of these campaigns (DeJong, et al., 2006; Hagman, Haines, Barker, & Rice, 2006; Clifford, & Noel, 2007; Neighbors, Lee, Lewis, Fossos, & Larimer, 2007; Thombs, et al., 2007). Studies have also cautioned the use of social norms in particularly high risk environments (Granfield, 2005) and questioned long-term change as a result of social norms (Campo, Cameron, Brossard, & Frazer, 2004).

Population level prevention. The foundation of population level intervention is the notion that culture and social change can result when a significant number of students shift their behavior and attitudes. A typical population level program, *AlcoholEdu for College*, has shown success in reducing negative consequences, incidents of high risk drinking, and risky behavior (Wall, 2007).

Motivational interventions. Brief motivational enhancement interventions have shown to be effective in reducing alcohol consumption and negative consequences (Baer, Kivlahan, Blume, McKnight, & Marlatt, 2001; Marlatt, et al, 1998; NIAAA, 2002). One motivational

program cited for its success is BASICS, a two session individual intervention that provides feedback to students regarding their own behavior.

Environmental approaches. Although the prevention practices described have shown some success, there is no one solution or ‘one-size-fits-all’ approach to reduce high risk alcohol use on college campuses (National Institute of Alcohol Abuse and Alcoholism, 2002; Wechsler, Molnar, & Davenport, 1999). Environmental approaches may be the most effective in addressing high risk alcohol use (DeJong, 1998; Toomey & Wagenaar, 2002; Toomey, Lenk, & Wagenaar, 2007; NIAAA, 2002, 2007; Wechsler, 1998; Wechsler, Kelley, Weitzman, San Giovanni, & Seibring, 2000; U.S. Department of Health and Human Services, 2007). The environmental approach is comprehensive and integrated program with multiple components designed to address high risk alcohol use through culture and social change (NIAAA, 2002). Dimensions may include enforcement of the minimum legal drinking age, creating campus and community coalitions, zoning, server training and responsible beverage service, media message campaigns, and target education, to name a few (DeJong, 1998; Toomey & Wagenaar, 2002; Toomey, Lenk, & Wagenaar, 2007; NIAAA, 2002, 2007; U.S. Department of Health and Human Services, 2007; Wechsler, 1998; Wechsler, Kelley, Weitzman, San Giovanni, & Seibring, 2000; Wechsler, Lee, Nelson, & Kuo, 2002).

Research Purpose

The present study builds on Porter and Pryor’s (2007) reasoning, which suggested that there may be a relationship between binge drinking, engagement and use of time in college, and the eventual outcomes of college. There is a large body of research suggesting that students who are engaged in their college experience are more likely to stay in college and gain more from that experience (for a summary of the evidence see Astin, 1993; Pascarella & Terenzini, 1991, 2005).

Much work in higher education is based on the relationship between involvement, academically-purposeful use of time, and positive outcomes of college as evidenced by widespread use of CSEQ and NSSE surveys to guide education practice (Chickering & Gamson, 1999).

Accordingly, this research examines the impact of binge drinking on college outcomes, and whether academic engagement has a mediating effect on that relationship. In other words, if students are academically engaged, is that enough to mediate what we hypothesize will be negative effects of binge drinking on college outcomes?

This line of reasoning is supported by the current research on college student binge drinking which indicates that “students with more involvement in productive college activities...were less likely to be binge drinkers” (Wechsler & Nelson, 2008, p. 485). Activities such as community involvement (U.S. Department of Health and Human Services, 2007) and campus commitment to volunteering (Weitzman & Kawachi, 2000) are associated with lower drinking levels. One hypothesis is that students with ample leisure time have more time to drink, whereas students engaged in academic, professional, and service activities have less time to drink (Murphy et al., 2006).

The current study adds to prior research on the effects of binge drinking on college outcomes, which has primarily focused on GPA, by extending the examination of the effects of binge drinking to a wide range of college outcomes not previously considered. The study estimates the effects of binge drinking on 30 measures of seven different college outcomes, including professional aspirations, leadership, well-being, intercultural effectiveness, inclination to inquire, reasoning and problem-solving, and moral reasoning. Additionally, it adds to the literature by exploring whether academic engagement can act as a mediating factor to reduce the negative effects of binge drinking. Because academic engagement is a two-sided endeavor,

requiring effort by both students and educators, we take into account how the student spends his or her time and the extent to which the environment encourages academic engagement. Two questions guide the study: 1) How does binge drinking affect a broad range of outcomes associated with college attendance at the end of the first year of college? 2) Does academic engagement mediate the effects of binge drinking on college outcomes during the first year of college?

Methods

Sample and Data Collection

This research is part of the Wabash National Study of Liberal Arts Education (WNSLAE), a longitudinal investigation of the effects of liberal arts colleges and experiences on outcomes associated with undergraduate education. The sample consists of first-year students at 19 colleges and universities located in 11 states from four regions of the United States: Northeast, Southeast, Midwest, and Pacific Coast. Characteristics such as institutional type and control, selectivity, size, location, and patterns of student residence vary among the institutions. Liberal arts colleges are purposefully over-represented to reflect the study's primary concern. Three of the participating institutions are research universities, three are regional universities, two are two-year community colleges, and eleven are liberal arts colleges. The students in the sample were first-year, full-time undergraduates.

Initial data were collected in Fall 2006 from 4,501 students. Data collection lasted between 90-100 minutes and students received a stipend of \$50 each for their participation. In Spring 2007, as students neared the end of their first year of college, 3,081 students participated in the follow-up data collection, making our response rate 68.5%. These 3,081 students

represented 16.2% of the total population of incoming first-year students at the 19 participating institutions.

During the first data collection, we gathered demographic and background data, as well as pre-test information related to the outcomes. This second data collection took about two hours and participating students were paid an additional stipend of \$50 each. Types of data collected included extensive information on students' experiences of college and several posttest measures of the instruments used to assess cognitive and psychosocial development. Due to the time it took students to complete two of the longer assessment instruments, the CAAP Critical Thinking Test was assigned randomly to half of the sample and the other half took the Defining Issues Test (DIT). Of the 3,081 students participating in both data collections, 1,485 completed the CAAP critical thinking test and 1,584 completed the DIT.

We created a weighting algorithm to approximate each institution's first-year undergraduate population by sex, race, and ACT (or equivalent score). We expect this to mitigate some response bias and create a sample more closely resembling the population from which it was drawn.

Dependent Variables

Over the past two decades, several taxonomies have been created to represent the varied outcomes typically associated with attending college (for example, Astin, 1993; Kuh, 1993; and Pascarella & Ternzini, 1991, 2005). For this study, we used several outcomes representing life and career goals (HERI, n.d.), as well as several outcomes associated with liberal arts education (King, Kendall Brown, Lindsay, & VanHecke, 2007). Altogether, the dependent variables in these analyses include 30 vetted measures that represent seven college outcomes: professional aspirations; leadership skills; psychological well-being; intercultural effectiveness; inclination to

inquire; reasoning and problem-solving; and moral reasoning. For items that are scaled, we report the Cronbach alpha measure of reliability in the current study, except for the DIT and CAAP Critical Thinking assessments where we report alpha reliability ranges from prior studies.

Professional aspirations. WNSLAE received permission to use 21 questions concerning career and life orientations from the Cooperative Institutional Research Program (CIRP) Survey developed by the Higher Education Research Institute at the University of California at Los Angeles. To create measures of professional aspirations, we ran a principle components factor analysis on these questions. Then we created four scales: Commitment to Contributing to the Arts (Cronbach alpha = .69); Commitment to Contributing to Science (Cronbach alpha = .76); Commitment to Political and Social Involvement (Cronbach alpha = .83); and Commitment to Professional Success (Cronbach alpha = .75). We also included a single item measuring whether the student aspires to a graduate degree as part of the professional aspiration outcomes.

Leadership. We used the 68-item, revised version of the Socially Responsible Leadership Scale (SRLS), which was developed specifically to measure leadership in college students. The SRLS measures the eight dimensions of Astin's Social Change Model of leadership development (Astin, A., Astin, H., Boatsman, Bonous-Hammarth, Chambers, Goldberg, et al., 1996). The following scales represent the eight dimensions:

- Consciousness of Self -- awareness of one's own values, emotions, attitudes, and beliefs
- Congruence -- thinking and acting consistently with one's beliefs and values
- Commitment – motivation and drive for the collective benefit of the group
- Collaboration -- working with others in a common effort
- Common Purpose – the aims and values shared by a group working together
- Controversy with Civility -- approaching differences directly, with respect and courtesy

- Citizenship – recognition of the interdependence and mutual responsibility among individuals, groups, and the community
- Change -- to strive to improve society for self and others

The Cronbach alphas for the eight subscales of the SRLS ranged from .78 to .88.

Psychological well-being. We used the 54-item, theoretically-grounded Ryff Scales of Psychological Well-Being to measure six dimensions of psychological well-being (Keyes, Shmotkin, & Ryff, 2002; Ryff, 1989; Ryff & Keys, 1995). The following scales represent the six dimensions:

- Self-Acceptance -- positive attitudes of oneself
- Personal Growth – sense of development and openness to new experiences
- Purpose in Life – sense of directedness and meaning in life
- Positive Relations with Others – satisfying relationships and concern about others
- Environmental Mastery -- capacity to effectively manage one's life and surroundings
- Autonomy -- sense of self-determination

We also used a Ryff total score, which is a scale based on the mean of the scales measuring each of the six dimensions. These scales have internal consistency reliabilities ranging from .79 to .88.

Intercultural effectiveness. We measured this outcome using five scales. Four of the scales derived from the 15-item, short form of the Miville-Guzman Universality-Diversity Scale (M-GUDS), which measures openness and awareness of similarities and differences between people (Miville, Gelso, Pannu, Liu, Touradji, Holloway, & Fuertes 1999; Fuertes, Miville, Mohr, Sedlacek, & Gretchen, 2000). The instrument has a total scale score and three subscale scores measuring the following dimensions:

- Diversity of Contact – appreciation of, and desire to participate in, diverse social and cultural activities
- Relativistic Appreciation -- recognition of similarities and differences between people and the impact of these on self-understanding and personal growth
- Comfort with Differences – ability to be comfortable with diverse individuals

Reliabilities for the three subscales ranged from .78 to .80 and the Cronbach alpha for the total M-GUDS score was .85 in this study.

The final scale used to assess student growth in intercultural effectiveness was the seven-item Openness to Diversity/Challenge (ODC) scale that measures one's openness to cultural and racial diversity, as well as the extent to which one enjoys being challenged by different perspectives, values, and ideas (Pascarella, Edison, Nora, Hagedorn, & Terenzini, 1996). The ODC scale has a Cronbach alpha of .87.

Inclination to inquire. We measured this outcome using three scales: Academic Motivation; Positive Attitude toward Literacy, and Need for Cognition. The first is an eight-item scale that represents enjoyment of academic challenge, a willingness to work hard to learn material even if it doesn't lead to a higher grade, reading more for a class than is required, and the importance of academic experiences in college, including getting good grades. The Academic Motivation scale has a Cronbach alpha of .74. The Positive Attitude toward Literacy Scale assesses students' enjoyment of reading poetry and literature, expressing ideas in writing, and reading scientific and historical material. It has a Cronbach alpha of .71. The Need for Cognition scale measures an individual's "tendency to engage in and enjoy effortful cognitive activity" (Cacioppo, Petty, Feinstein, & Jarvis, 1996, p. 197); it has an alpha reliability of .90.

Reasoning and problem solving. We used the critical thinking module of the Collegiate Assessment of Academic Proficiency (CAAP) developed by the American College Testing Program (ACT) to measure reasoning and problem solving. The 32-item instrument measures a student's ability to clarify, analyze, evaluate, and extend arguments. The internal consistency reliabilities for the CAAP critical thinking test range between .81 and .82 (ACT, 1991).

Moral reasoning. We employed the Defining Issues Test 2 (DIT2) to measure moral reasoning (Rest, Narvaez, Thoma, & Bebeau, 1999). Specifically, we used the N2-score which reflects the extent to which one exhibits higher order moral reasoning as well as the extent to which one rejects ideas because they are simplistic or biased (Bebeau & Thoma, 2003). In prior studies, the internal Cronbach alpha for the N2-score ranged from .77 to .81 (Rest, et al., 1999; University of Minnesota, n.d.).

Independent Variables

Control variables. Control variables in these analyses included student background characteristics and college experiences known to influence many college outcomes (Astin, 1993; Pascarella & Terenzini, 2005). The background characteristics we used were Male (vs. Female), White (vs. non-White), and High School Ability Test Score (based on ACT and SAT scores). We also included 3 dichotomous variables to control for the type of institution the student attended – Regional, Research, or Community College – with Liberal Arts College as the reference category. Most importantly, we included a pretest for each outcome. Pretests – the same items and assessment as the outcomes -- were administered during the first data collection at the beginning of students' freshman year. Statistical controls and pre-test measures of the outcome being measured are the best means to separate the effects of the student's personal characteristics

and experiences from the effects of college experiences when randomized experiments are not possible (Astin & Lee, 2003; Pascarella, 2006).

Although we could have specified a more detailed model accounting for additional background characteristics and college experience, we did not for two reasons. First, we found that of all the variables, pretests consistently predicted the outcomes at significant levels with substantive effect sizes ranging from .35 to .72. One could think of the pretest as taking into account students' experiences and background. For example, if a characteristic such as high school curriculum were going to affect the outcome, it would affect the pretest too. Including both in the model would add very little to the variance explained. Second, in order to account for clustering (the fact that we had samples of students nested within samples of institutions) the number of we could include was limited. This is because degrees of freedom, which are used to calculate standard errors and t-values, are based on the number of clusters, which in this case was 19, the number of institutions in our sample. We decided to choose a more parsimonious model which accounts for clustering (vs. a more specified model which would prevent us from accounting for clustering), because students within institutions are more similar than those between institutions. We thought it was important to use the best statistical tool at our disposal to account for the potential bias created by those similarities.

Binge drinking variables. Our primary variables of interest in these analyses included a series of dichotomous variables representing how frequently a student drank alcohol at the binge level in the past week. Although some surveys define binge drinking as four drinks on one occasion for females and five for males, our survey defined binge drinking as consuming five or more alcoholic beverages on one occasion, which is also common. Students were asked if they had five or more drinks in one sitting, once, twice, or three or more times in the past week. We

divided the question into four variables: Binge Drank 0 Times in Past Week; Binge Drank 1 Time in Past Week; Binge Drank 2 Times in Past Week; Binge Drank 3 or More Times in Past Week. Binge Drank 0 Times in the Past Week is the reference category in the regressions. Table 1 shows the number and percent of students in each category for all of the outcomes except CAAP Critical Thinking and DIT-2. Twenty percent of students drank at the binge level once in the past week, 12% drank at the binge level twice in the past week, and 8% drank at the binge level three or more times in the past week. Similar frequencies are reported in Tables 2 and 3, representing our analytic samples for students who took the CAAP Critical Thinking and the DIT2 assessments, respectively. Approximately 40% of the students in our samples reported drinking at binge levels, which is consistent with national statistics on student binge drinking in the past decade (Hingson et al., 2005; Wechsler et al., 2002; Wechsler & Nelson, 2008; Weitzman et al., 2003; U.S. Department of Health and Human Services, 2007). Furthermore, approximately 20% of our sample reported binge drinking two or more times per week which is consistent with findings that 20% of students are frequent binge drinkers who binge drink three or more times in a two week period (Dowdall & Wechsler, 2002; Weitzman et al.; U.S. Department of Health and Human Services).

Variables representing academic engagement. Based on our theoretical model, we chose eight independent variables as indicators of academic engagement. Our assumption, based on prior research (Murphy et al., 2006; Porter & Pryor, 2007; Williams et al., 2003; U.S. Department of Health and Human Services, 2007; Weitzman & Kawachi, 2000), was that these variables may mediate the effect of alcohol on the outcomes. Therefore, we chose several scales representing how students spend their time and several variables representing an academically engaging environment.

Five of the variables represent different ways students spend their time. Study and Class Prep Time and Time on Cocurricular Activities, both estimates of weekly time spent on these activities, had responses ranging from 0 to 32.5 hours. Books Read for Enjoyment/Enrichment, an indication of the number of non-assigned books that a student reads in a year, had a range of 0 to 23. Time Working for Pay, an estimate of total time spent working on or off campus in a week, had responses ranging from 0 to 65 hours. Has Done/Plans to Do Volunteer Work is a dichotomous variable, coded yes or no, representing a student's inclination to do volunteer work.

We included an additional three variable representing environmental characteristics that indicate a climate that encourages academic engagement. Challenging yet Supportive Environment is a scale concerning the extent to which the institution encourages study, diverse interactions, and attending campus events while providing social and academic support. The Cronbach alpha for this scale is .77. Non-class Interactions with Faculty is a scale with 11 constituent items that indicate the extent to which a student thinks faculty are supportive, available for informal interactions and discussions, and have had a positive influence on the student's development. The Cronbach alpha is .86. Environment Encourages Integrative Thinking is a scale created from 9 items that measure the extent to which the environment encourages students to integrate and synthesize ideas and apply ideas from the classroom to non-classroom experiences. The Cronbach alpha is .75.

Analyses

We used ordinary least squares regression to analyze the effects of binge drinking on each of our 30 outcomes. We ran each analysis in two stages, first regressing the dependent variable on student background characteristics, institutional type, and binge drinking frequencies. In the second stage, we added the variables representing academic engagement to ascertain

whether they would mediate any negative effects of binge drinking. Because students in the sample were aggregated at 19 institutions, we used statistical means to account for the clustering or nesting effect (e.g. that students within institutions are more likely to be similar than those from different institutions) (Groves, Fowler, Couper, Lepkowski, Singer, & Tourangeau, 2004). Additionally, we standardized (converted to z scores) the dependent variables and all continuous independent variables. Therefore, the b coefficients indicate the amount of change in standard deviation of each outcome score for each change in one standard deviation of the continuous independent variables.

Results

Table 4 shows the coefficients for three different categories of binge drinking on each of 30 college outcomes. We indicated significant effects where the significance level is $p < .10$. Though reporting coefficients at the $p < .05$ in college impact studies is more common, we used a slightly more lenient standard ($p < .10$) because our sample sizes in some of the categories are relatively small (see Tables 1, 2, and 3) which reduces power. That being said, two-thirds of our significant results met the more stringent standard of $p < .05$. Several conclusions can be drawn from the results.

With very few exceptions, the significant effects were negative, suggesting that binge drinking prevents students from achieving the same outcomes in college as non-binge drinkers. Binge drinking at lower levels (once or twice per week) had positive effects on five measures: Commitment to Contributing to the Arts; Commitment to Contributing to Science; Commitment to Professional Success; Change; and Personal Growth. It is apparent that when it comes to professional aspirations, binge drinkers are either not significantly different from non-drinkers or they have higher aspirations than the non-drinkers. Yet, those same binge drinkers are gaining

less on the outcomes such as leadership, well-being, intercultural effectiveness, inclination to inquire, and moral reasoning – the skills that would help them achieve their professional aspirations.

Six of the 30 measures showed no significant results for binge drinking at any level: Consciousness of Self and Controversy with Civility (leadership measures); Self-Acceptance and Autonomy (well-being measures); Need for Cognition (a measure of inclination to inquire); and CAAP Critical Thinking (a measure of reasoning and problem solving). On the other hand, five measures showed significant negative effects at all three levels of binge drinking, compared to non-binge drinking. One of those measures was Common Purpose within the leadership outcome, three of the measures were MGUDS scores within the intercultural effectiveness outcome, and the final one was Academic Motivation, within the inclination to inquire outcome. Four of these measures (Common Purpose and three MGUDS scores) have to do with getting along with other people.

Binge Drinking Once or Twice Per Week

Students who binge drink once per week score lower than students who do not binge drink on eight measures, representing four outcomes (leadership, well-being, intercultural effectiveness, and inclination to inquire). The effect sizes are relatively small for this group, ranging from .04 of a standard deviation to .17. Students who binge drink twice per week also fare worse than the non- binge drinkers, scoring from .10 to .30 standard deviations lower on seven measures representing four of the outcomes – leadership, intercultural effectiveness, inclination to inquire, and moral reasoning. The effect sizes at this level of binge drinking are higher, indicating that this group of students is slightly more disadvantaged, when compared to non-drinkers, than the group that binge drinks once per week.

Binge Drinking Three or More Times Per Week

Students who binge drink three or more times per week experience the greatest disadvantages, when compared to non-drinkers. They score from .15 to .32 of a standard deviation lower on 16 measures representing five outcomes: leadership, well-being, intercultural effectiveness, inclination to inquire, and moral reasoning. None of the measures within the professional aspirations and reasoning/problem-solving outcomes were significant.

For the leadership outcome category, students who binge three or more times a week compared to students who do not binge drink, scored between .19 and .29 of a standard deviation lower on measures of Congruence, Commitment, Collaboration, Common Purpose, and Citizenship. Under the rubric of well-being, students who binge three or more times a week compared to students who do not binge drink, scored between .09 and .17 of a standard deviation lower on measures of Life Purpose, Personal Growth, Environmental Mastery, and Ryff Total, which is the overall score for psychological well-being. In the category of intercultural effectiveness, scores for Relativistic Appreciation, Diversity of Contact, Comfort with Diversity, and MGUDS Total were between .14 and .30 of a standard deviation lower for students who binge drink three or more times per week compared to those who do not binge drink. On the measure of Academic Motivation, a measure within the inclination to inquire outcome, students who binge drink three or more times per week scored .26 to .32 of a standard deviation lower than those who do not binge drink. Finally, on the DIT2 N2 measure, representing moral reasoning, students who binge three or more times per week scored .19 of a standard deviation lower than non-binge drinking students.

Academic Engagement as a Mediating Factor

The variance explained (R^2) for our Model 1 on each of the outcome measures ranged from .30-.70. When we added the variables representing academic engagement in Model 2, the variance explained increased from .01 to .15, suggesting that the additional variables do have an effect on the outcomes. The change in R^2 was significant for all 30 measures of the outcomes except Commitment to Contributing to the Arts. For the remaining 29 measures, the change in R^2 was significant at $p < .01$ except for Commitment to Professional Success, which was significant at $p < .05$.

While it is not the intent of this paper to examine the effects of the academic engagement variables on the outcomes, complete tables of all regression coefficients are available from the first author for readers interested in the full details. In general all eight variables (Study and Class Prep Time, Time on Cocurricular Activities, Books Read for Enjoyment/Enrichment, Time Working for Pay, Has Done/Plans to Do Volunteer Work, Challenging yet Supportive Environment, Non-class Interactions with Faculty, Environment Encourages Integrative Thinking) had significant effects on multiple measures of the outcomes. The significant effect sizes ranged from .03-.25. The three scales representing an academically engaging environment tended to be significant more often, and have larger effect sizes, than the variables representing how students spend their time. The Environment Encourages Integrative Thinking scale seemed to be the best predictor across all of the outcomes.

Since Model 2 introduced the variables representing academic engagement in addition to the control and binge drinking variables, we would expect the effects of binge drinking to disappear completely or reduce significantly, if being academically purposeful mediated the effects of binge drinking on college outcomes. However, that was not the case. The effect sizes in Model 1, which included control variables and binge drinking variables, decreased only

slightly in Model 2, for most of the significant results. This indicates that the effects of binge drinking on educational outcomes tend to be negative and significant, even when we account for time spent on studying, cocurricular activities, reading for pleasure/enrichment, and working for pay as well as an academically challenging environment that encourages integrative thinking and allows for student-faculty contact.

Limitations

As with any research, the present study has several limitations that should be considered when interpreting these findings. First, while the schools in our study covered a wide range of institutional types, only 19 institutions were included in the study and these institutions were not randomly selected. Therefore, care should be taken in attempts to generalize these findings to all two- and four-year institutions.

Second, not all students who participated in the initial fall data collection chose to participate in the follow-up data collection in the spring. Although our 68.5% return rate is consistent with other longitudinal studies that require participants to make a significant commitment of time and effort (see for example, the National Study of Student Learning, Pascarella, Edison, Nora, Hagedorn, and Terenzini, 1998), the attrition of participants between the two data collections remains an important limitation of the study. We have weighted our sample by race/ethnicity, sex, pre-college academic achievement, and institutional type to account for selection bias. However, these weighting procedures cannot account for nonresponse bias. In other words, we cannot determine whether or not those students who dropped out of the study after the initial data collection would respond in a similar manner as those who remained in the study through the follow-up data collection.

Finally, while we have employed controls for background characteristics, pre-college scores on each outcome measure, and institutional type, our study does not take into account other important factors that may influence students' growth on educational outcomes such as targeted policies, educational efforts to thwart high-risk drinking, and campus drinking culture for each institution. Despite these limitations, we believe the findings are significant and warrant attention.

Discussion

The results of this study suggest the possibility that a substantial portion of college students may not be achieving many of the intended outcomes of college due to their frequency of binge drinking. The negative effects we found persisted even in the presence of controls for a wide range of confounding influences, including a pretest measure of each outcome. This study demonstrated that first-year students who binge three or more times a week make fewer gains in the first year of college than students who do not binge. Students who binge drink once or twice per week also make fewer gains than students who do not binge, but this does not hold true across as many measures of the outcomes. However, on several measures of interpersonal relations and academic motivation, students who binge drink at any level fare worse than students who do not binge drink. In our sample, 40% of students binge drink and 8% binge drink three or more times per week, indicating that a considerable portion of students are disadvantaged on college outcomes because of their drinking patterns. It is possible that even larger percentages of students may be experiencing these disadvantages, because students typically underestimate the quantity they drink and what they report about their drinking on surveys (White et al., 2005). Furthermore, while time spent on academically purposeful activities and experiencing an academically engaging environment did contribute to the outcomes, the

extent to which they mediated the negative effects of binge drinking was very small or non-existent on most of the measures. These findings are important for several reasons.

First, the central purpose of college is to provide students with experiences that lead to expected outcomes. Assuming that college educators are concerned with equity in education – serving all students and helping them achieve the benefits of college – our results serve as a warning. A substantial portion of students are reducing their benefits due to frequency of binge drinking. Furthermore, binge drinking at any level, even just once per week, is associated with decreased Academic Motivation which in turn will have an impact on grades, engagement, and retention.

Second, the educational outcomes that we strive for in college are associated with degree attainment, graduate school attendance, and future earning (Pascarella & Terenzini, 1991; 2005). Consequently, students who binge drink during college may be making a lifestyle choice that has potential negative implications for their subsequent educational attainment and occupational mobility. Moreover, students who binge drink at any level, make fewer gains on interpersonal outcomes such as common purpose and intercultural effectiveness, which are skills employers expect college graduates to have (AAC&U, 2007).

Third, involving students in academically purposeful activities is not enough to mediate the negative effects of binge drinking. While engaging students in good practices has become somewhat of a one-size-fits-all solution for educators (and indeed, there is plenty of evidence which suggests engagement helps students achieve more in college) – this approach will not significantly improve college outcomes for binge drinkers. Other solutions must be considered. Additionally, the negative impact of binge drinking, even while experiencing academically purposeful activities and an engaging environment, may signal that alcohol is impacting the

students' cognitive and neurological abilities. There is some evidence that drinking in early adolescence has long term effects on the brain's normal functioning because it is still developing (U.S. Department of Health and Human Resources, 2007; De Bellis et al., 2000; Tapert, Caldwell, & Burke, 2004/2005; Weitzman, 2005).

Implications

Research. Currently, research has not provided enough information concerning the effects of binge drinking on consequential outcomes of college using multi-institutional data, adequate controls, and pre-test – post-test measures of outcomes using vetted instruments, as opposed to self-reports. Any additions to the field will help paint a more complete picture which in turn should help guide practitioners.

While past research has documented the negative experiences of binge drinking, this is one of very few studies to explore the long-term impacts of binge drinking on a wider range of college outcomes. The findings from this research warrant further investigation and replication. Although replication is not a norm in college impact research, it is the best means to verify that results were not chance findings (Pascarella, 2006). In this case, a replication of the findings would add weight to the concern that college students may be disadvantaging themselves on college outcomes, which would further warrant a change in alcohol-use prevention programs and policies. Extending the research, by ascertaining the effects of binge drinking on other outcomes such as retention and occupational attainment could provide evidence supporting (or refuting) the seriousness of the current findings.

Although prior research indicates that academic engagement is associated with lower drinking rates (Wechsler & Nelson, 2008; Weitzman & Kawachi, 2000), this study suggests that academic engagement cannot make up for the negative effects of binge drinking. Further

hypotheses regarding potential mediating factors of the negative effects of binge drinking on college outcomes should be analyzed.

Finally, in an effort to close the loop between practice and research, we suggest more studies on alcohol reduction and prevention programs. As discussed in our literature review, the efficacy of the various approaches still needs to be determined. Currently, the reviews are mixed and have not been studied extensively. Additional research can shed light on which programs work best under which conditions and with which populations.

Practice. Since this is one of the few analyses concerning binge drinking and college outcomes, administrators may want to use this information when deciding which alcohol prevention and reduction methods to use on their campuses. From the perspective that education is the central purpose of college, this study may indicate that focusing on the population of frequent binge drinkers may be the most effective. However, prior research points out that the greatest personal harms and damage might be perpetrated by students who drink in the low to moderate range (Weitzman, 2005), thereby suggesting that is the population on which to focus prevention efforts.

The strategies suggested by the Surgeon General and the NIAAA are environmental approaches which may affect students who drink at any level. These plans are comprehensive, focusing on policies and practices, enforcement, community, and culture. Wechsler and his colleagues, indisputable leaders in research on college student drinking, have strongly advocated for comprehensive approaches for over a decade (Wechsler & Nelson, 2008). Their data show that binge drinking levels vary from 1% to 76% of students at different institutions, which suggests environmental factors may play a role in student drinking patterns (Wechsler & Nelson). We agree that comprehensive, environmental approaches are more likely to have an

impact on college students, thereby reducing both short term consequences such as personal harm or property damage and long term consequences such as lower grades or reduced attainment of college outcomes.

Conclusion. While studies demonstrating the personal injuries and damage caused by drinking have dominated the research concerning drinking and college students, the current study provides evidence that the costs of binge drinking are even greater than we first thought. If the personal injuries, illnesses, short-term academic consequences, risk-taking, assaults, fighting, property damage, deaths, and second-hand effects of alcohol were not enough to encourage campuses to take an environmental approach to alcohol prevention, the current study adds weight to the argument by demonstrating that binge-drinking also undermines the central purposes of college.

Though it may be argued that students who choose to drink at levels which reduce their benefits of college are responsible for those choices, there are reasons to believe that colleges are equal partners in the matter. Adolescents and young adults may act impulsively and inappropriately judge risks because the human brain does not fully develop until the mid-20s (Department of Health and Human Services, 2007; Weitzman, 2005). Given that the majority of students enrolled in two- and four-year colleges are younger than 25 years old (Chronicle of Higher Education Almanac, 2008), developing a strong anti-alcohol culture, policies, and sanctions regarding alcohol use may be warranted to counteract their lack of judgment. Furthermore, while it has long been acknowledged that students are responsible for their actions, an accepted corollary has prevailed: colleges and universities are responsible for creating environments that encourage students to make the best of their educational pursuits (Blimling, Whitt, & Associates, 1999; Chickering & Gamson, 1987; Kuh, 1995; Kuh, Kinzie, Schuh, Whitt,

& Associates, 2005; Kuh, Schuh, Whitt, & Associates, 1991; Pascarella & Terenzini, 1991, 2005).

We contend that existing evidence concerning the effects of college student drinking, brain development, alcohol prevention strategies, and the current findings suggesting that binge drinking disadvantages students on college outcomes point in one direction. Colleges and universities must seek out new ways to reduce the level of binge drinking among college students and strengthen their efforts towards this end. The health, well-being, development, and future professional attainment for a considerable portion of college students are at stake.

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Table 1: Binge Drinking Frequency¹, Wabash National Study of Liberal Arts Education (n=2,825)

	Frequency	Percent
Binge Drank 0 Times in Past Week	1681	60%
Binge Drank 1 Time in Past Week	568	20%
Binge Drank 2 Times in Past Week	342	12%
Binge Drank 3 or More Times in Past Week	232	8%
	2823	100%

¹ For regressions on all outcomes except CAPP and DIT

Table 2: Binge Drinking Frequency¹, Wabash National Study of Liberal Arts Education (n=1,340)

	Frequency	Percent
Binge Drank 0 Times in Past Week	814	61%
Binge Drank 1 Time in Past Week	265	20%
Binge Drank 2 Times in Past Week	165	12%
Binge Drank 3 or More Times in Past Week	95	7%
	1339	100%

¹ For regressions on CAPP Critical Thinking

Table 3: Binge Drinking Frequency¹, Wabash National Study of Liberal Arts Education (n=1,462)

	Frequency	Percent
Binge Drank 0 Times in Past Week	859	59%
Binge Drank 1 Time in Past Week	295	20%
Binge Drank 2 Times in Past Week	172	12%
Binge Drank 3 or More Times in Past Week	135	9%
	1461	100%

¹ For regressions on DIT N2 Score

Table 4: Regression Coefficients for the Estimated Effects of Binge Drinking on College Outcomes, Wabash National Study of Liberal Arts Education

	Binge 1 vs. 0		Binge 2 vs. 0		Binge 3 or more vs. 0		R ²	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Professional Aspirations								
Commitment to Contributing to Arts	.02	.02	.07	.08 *	.02	.01	.55	.56
Commitment to Contributing to Science	.08	.09 *	.01	.04	.05	.05	.42	.43
Commitment to Political and Social Involvement	-.01	.01	-.03	.00	-.06	-.05	.50	.56
Commitment to Professional Success	.08 *	.08 **	.09	.10	.03	.03	.57	.58
Aspires a Graduate Degree	-.04	-.04	.00	.01	.04	.05	.43	.44
Leadership								
Consciousness of Self	-.07	-.04	-.06	-.03	-.07	-.04	.38	.43
Congruence	-.07 *	-.05	-.15	-.15	-.29 **	-.29 **	.29	.34
Commitment	-.09	-.06	-.15	-.13	-.27 **	-.26 **	.26	.32
Collaboration	-.05	-.02	-.04	-.03	-.19 **	-.19 **	.28	.36
Common Purpose	-.09 **	-.06 *	-.22 **	-.21 **	-.24 **	-.24 **	.30	.36
Controversy with Civility	-.03	.01	-.08	-.03	-.15	-.12	.32	.38
Citizenship	-.06	-.04	-.06	-.06	-.24 **	-.24 ***	.42	.47
Change	-.01	.00	.09 *	.10 **	-.00	-.00	.39	.44
Psychological Well-being								
Self-Acceptance	-.05	-.02	-.03	-.00	-.08	-.06	.49	.52
Life Purpose	.01	.03	-.14	-.12	-.15 **	-.15 **	.40	.44
Positive Relations with Others	.01	.02	.11 *	.13 *	-.00	-.00	.41	.46
Personal Growth	-.12 **	-.09 *	-.13	-.13	-.18 **	-.17 *	.35	.40
Environmental Mastery	.01	.03	-.03	-.00	-.09 *	-.08	.48	.52
Autonomy	-.07	-.06	-.07	-.07	-.09	-.09	.49	.51
Ryff Total Score	-.04	-.02	-.04	-.03	-.12	-.11 *	.50	.54

continued on next page

Table 4 continued

	Binge 1 vs. 0		Binge 2 vs. 0		Binge 3 or more vs. 0		R ²	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Intercultural Effectiveness								
MGUDS Total score	-.13 ***	-.09 **	-.10 *	-.06	-.30 ***	-.26 ***	.48	.52
MGUDS Relativistic Appreciation	-.08 *	-.04	-.16 **	-.10	-.18 **	-.14 *	.31	.37
MGUDS Diversity of Contact	-.07 **	-.04 **	.02	.04	-.30 ***	-.29 ***	.53	.56
MGUDS Comfort with Difference	-.16 **	-.12 **	-.14 **	-.11 **	-.21 **	-.16 **	.27	.29
Openness to Diversity	-.03	.02	-.01	.04	-.09	-.05	.41	.48
Inclination to Inquire								
Academic Motivation	-.17 ***	-.09 *	-.30 ***	-.23 ***	-.32 **	-.26 *	.31	.46
Positive Attitude toward Literacy	-.09	-.06	-.15 *	-.11	-.08	-.07	.56	.59
Need for Cognition	.00	.03	-.05	-.02	-.06	-.05	.56	.59
Reasoning and Problem Solving								
CAAP critical thinking	.06	.06	-.07	-.06	-.10	-.12	.70	.71
Moral Reasoning								
DIT2 N2 score	-.04	-.03	-.20 **	-.19 **	-.19 *	-.18	.57	.58

Notes:

*** p<0.01, ** p<0.05, * p<0.1

All coefficients can be interpreted as the part of a standard deviation change in the outcome.

Model 1 includes controls for a parallel Pretest at time 1, Sex, Race, HS Tested Ability, Institutional Type, and the clustering effect.

Model 2 includes Model 1 controls as well as Study and Class Prep Time, Time on Cocurricular Activities, Books Read for Enjoyment/Enrichment, Time Working for Pay, Challenging yet Supportive Environment, Non-class Interactions with Faculty, and Environment Encourages Integrative Thinking.

Change in R2 from Model 1 to Model 2 is significant at p<.01 for all outcomes except Commitment to Contributing to the Arts (NS) and Commitment to Professional Success (p<.05).