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College Student Binge Drinking and Academic Achievement:  
A Longitudinal Replication and Extension\*

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Excessive alcohol consumption by college students is a ubiquitous problem with potentially negative consequences, both academic and otherwise, for many students. National samples of college students demonstrate that two-thirds of all students report consuming alcohol within the past month (O'Malley & Johnston, 2002). Of these students, more than half report heavy or binge drinking within the prior two weeks (O'Mally & Johnston). Binge drinking is often defined as consuming five or more drinks in one setting for males and four or more drinks for females (Wechsler & Isaac, 1992), although this may be somewhat arbitrary. According to Harvard's College Alcohol Study (CAS), half of the students who binge drink, do so more than once a week (Wechsler, Nelson, & Weitzman, 2000).

The evidence concerning the amount of binge drinking behavior that occurs based on year in college is inconclusive. One study found 13.9% of first-year students reported having only one binge drinking episode in a two-week period, while 14.8% of seniors reported the same behavior (Presley, Meilman, Cashin, & Lyerla, 1996). On the other end of the continuum, 3.8% of both first-year students and seniors reported having between six and nine binge drinking episodes in a two-week period (Presley et al.). Engs, Hanson, and Diebold (1996) found, however, fewer binge drinkers among seniors than among first-year students.

Although the studies on the amount of binge drinking occurring during college are not conclusive, research is consistent on the negative results of this behavior. Educational difficulties, psychosocial problems, physical harm including overdoses, high-risk behaviors including sexual, and alcohol impaired driving are some of the negative consequences of student drinking (Perkins, 2002; The National Center on Addiction and Substance Abuse at Columbia

University, 1994; Wechsler et al., 2002). These consequences impact between 10% and one-third of the college population (Perkins), affecting both men and women and students across all class years (e.g., Engs, Hanson, & Diebold, 1996; Presley et al., 1996).

#### *Student Alcohol Use and Academic Performance*

The National Center on Addiction and Substance Abuse at Columbia University (1994) has stated that “alcohol is implicated in as many as 41% of academic problems and 28% of all dropouts” (p. 21). Indeed, there appears to be a dominant assumption that academic problems and alcohol use are highly related (e.g., Powell, Williams, & Wechsler, 2004; Rau & Durand, 2000). To date, however, only a relatively small body of evidence has systematically addressed the potential negative impact of excessive alcohol consumption on student academic performance in college.

Research reports and campus prevention efforts refer to, and rely on, information gathered from several national, longitudinal studies focused on college student alcohol use. Data gathered from the Core Alcohol and Drug Survey (CORE), the Harvard School of Public Health College Alcohol Study (CAS), and the Study Alcohol Questionnaire (SAQ) document the pattern of alcohol use and consequences for thousands of college students over the past two decades. Within these surveys, a few questions measure academic problems associated with alcohol use. One-fifth of students reported performing poorly and nearly 30% reported missing a class due to alcohol or drug use on the CORE survey (Presley et al., 1996). The SAQ also measured academic problems by asking students whether they had missed a class or received a lower grade due to drinking (Engs et al., 1996). They found that while males tended to experience higher numbers of academic and non-academic problems due to drinking, females were more likely to miss classes due to hangovers (Engs et al.).

These studies 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). Findings from the CORE survey indicate students with a grade point average of “A” drank an average of 3.3 alcoholic drinks per week, while students with a “B” drank 4.8 drinks, students with a “C” drank 6.1 drinks, and students with a “D” or “F” drank 9 drinks (Presley et al.). Results from the SAQ also suggest that students who had low grade point averages were more likely to be heavy drinkers (Engs et al.).

At least three studies posited that alcohol affects academic performance because drinking takes time away from studying. All of these studies used the longitudinal data from CAS to test this hypothesis. Wolaver (2002) concluded that drinking has both a direct effect on grade point average and an indirect effect because it leads to a decrease in study hours. In a second study, the same researchers found “that the net total effect of alcohol consumption on grade point average is negative for the sample of college students, and that the main effect is via a reduction in the hours spent studying” (Williams, Powell, & Wechsler, 2003, p. 1227). Additionally, Powell, Williams, and Wechsler (2004) tested the effect of alcohol use on adverse study habits, defined as missing a class or getting behind in school. While they found no significant effects for freshmen, for upper level students they found that each additional drink a student consumes increases the likelihood of missing a class by 9% and getting behind in school work by 5.4%. The multi-institutional sample and longitudinal design are clear strengths of these studies. At the same time, the fact that they were unable to control for individual-level precollege influences on academic achievement, such as ACT or SAT scores and secondary school grades, is a clear

threat to the internal validity of the findings. Similarly, the CAS data is also limited in its use of student self-reported rather than actual grades.

Rau and Durand (2000) also looked at the relationship between drinking and studying and the effect on grade point average, though they did not set up a total and direct effects model. They hypothesized that a student's worldview regarding academic performance includes a drinking factor. They concluded that students dedicated to daily study and little or no drinking receive higher grades than students who cram at the last minute and drink heavily.

Other studies, however, have found that heavy alcohol use does not affect academic performance. In a cross-sectional, single institution study, Paschall and Freisthler (2003) concluded that when high school grade point average and demographic variables were taken into account, heavy drinking did not have a significant effect on grade point average. Wood, Sher, Erickson, and DeBord (1997) also found alcohol use has no impact on academic performance once additional student characteristics such as high school grade point average, high school class rank, engagement in college, and participation in deviant behaviors (e.g., skipping school, stealing, engaging in sexual intercourse, starting fights) before age 15 were taken into account. They concluded that much of the research which finds an association between alcohol use and academic problems does so because it fails to control for salient student background characteristics (Wood et al., 1997).

The overall body of evidence concerning the impact of excessive alcohol consumption on college academic performance is decidedly mixed. This may in part be due to inconsistencies in the strength of the research or analytical designs across existing studies. Not all studies were able to introduce controls for important confounding influences, and the findings of several of the studies that did suggest that heavy alcohol consumption may not have a reliable negative impact

on college achievement (e.g., Paschall & Freisthler, 2003; Wood, Sher, Erickson, & DeBord, 1997). Understanding the influence of excessive alcohol consumption on academic performance in college is an issue of considerable importance. As suggested by Williams, Powell, and Weschler (2003), to the extent that excessive alcohol consumption interferes with or inhibits academic performance in college, such behavior has negative implications that extend beyond one's time as an undergraduate student. Other things being equal, undergraduate grades are not only significant predictors of attaining graduate and professional degrees, they are also positively linked to measures of labor market success such as job mobility and earnings [see Pascarella & Terenzini (1991, 2005) for a summary of this evidence].

### *Research Questions*

This study sought to determine if previous findings suggesting a negative, net influence of excessive alcohol consumption on student academic performance in college were replicable. Accordingly, the study had two purposes. First, it attempted to address some of the major methodological problems in the current research by analyzing longitudinal data that permitted a more adequately specified prediction model than most of the existing evidence. The data we analyzed included a broad array of salient precollege and collegiate influences on college grades such as actual ACT scores and high school grades, family background, work responsibilities and place of residence during college, academic major, and time spent preparing for class. The significance of publishing replications in the social sciences is clearly established—though somewhat uncommon. Pascarella (2006) points out that the vast majority of college impact studies have yet to be replicated, even though independent replication is essential to confirming the robustness and external validity of findings.

The second purpose of the study was to extend our understanding of any potential causal link between excessive alcohol consumption and academic performance by addressing three additional questions:

1. How early in the postsecondary experience are the impacts of excessive alcohol consumption on academic performance detectable?
2. To what extent is the impact of excessive alcohol consumption on academic performance indirect or mediated by a reduction in study time or time spent preparing for class?
3. Is the effect of excessive alcohol consumption on academic performance the same for all students or does it differ for different kinds of students?

### *Conceptual Framework*

The conceptual model of college academic performance guiding the study was based on an extensive body of evidence and is illustrated in Figures 1 and 2. Figure 1 models the total effects of binge drinking behavior on college academic performance. It assumes that academic performance (grade point average) is a function not only of excessive alcohol consumption, but also of student background characteristics and high school experiences, as well as other college experiences. Background characteristics would include such influences as tested academic ability, race, sex, and family social origins (e.g., Astin, 1971, 1977, 1993), while high school experiences would include influences such as high school grades and social involvement (Astin, 1971, 1993; Pascarella & Terenzini, 1991, 2005). Other college experiences would include such factors as work during college, major field of study, and place of residence (Pascarella & Terenzini, 1991, 2005). According to the conceptual model shown in Figure 1, it was anticipated that, with statistical controls in place for student background characteristics, high school

experiences, and other college experiences, frequency of binge drinking during college would have a negative total effect on college academic performance (Alwin & Hauser, 1975).

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Figure 1 about here

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The hypothesized direct and indirect effects of binge drinking on college academic performance are modeled in Figure 2. According to this conceptual model, we anticipated that when a measure of time spent preparing for class was added to the total effects mode shown in Figure 1 two things would happen. First, net of all other influences, time spent preparing for class would positively influence college academic performance; and second, the direct negative influence of binge drinking on academic performance would become small and non-significant. This would indicate a negative indirect effect of binge drinking on academic performance, mediated through the inhibiting influence of binge drinking on time spent preparing for class (Alwin & Hauser, 1975; Pascarella, 2006).

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Figure 2 about here

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## Research Methods

### *Institution and Sample*

The study was conducted at a large (30,000 students) public research university located in a small Midwestern city. The institution is a member of the Association of American Universities and has an extensive graduate and professional school emphasis as well as a large undergraduate program. The sample for the study was students who responded to a web-based survey instrument that took about 30-35 minutes to complete. The survey was sent to all undergraduate first-year and senior students in late March 2006 and asked an extensive series of questions about their high school and college experiences. Students were told if they completed the survey, their names would be entered in a drawing for an iPod. After two follow-up

reminders, completed surveys were received from 3,153 students (1,477 first-year students and 1,676 seniors), approximately 36.5% of the students to whom the survey was sent.

Although the first-year and senior samples were essentially representative of their respective populations by race/ethnicity, there was a statistically significant response bias by sex and ACT composite score. Women and individuals with high ACT scores were overrepresented among both the first-year and senior respondents. To adjust for this response bias, an algorithm was developed to weight the respective first-year and senior student samples up to population values by sex and ACT composite score quartile. While such a procedure cannot correct for non-response, it does make the first-year and senior samples more representative of the respective populations from which they were drawn.

Useable data for the analyses we conducted in the study were available for 2,956 respondents. This weighted sample was 53.1% seniors and 46.9% first-year students, 46.2% male versus 53.8% female, and 88.8% Caucasian versus 11.2% students of color. Transfer students were 18.8% of the sample (all among the seniors), and 76.2% of respondents were receiving financial aid. Approximately 55% of the sample had fathers who held a bachelor's degree or higher, while about 50% of mothers had at least a bachelor's degree. The average ACT composite score (or SAT equivalent) was 24.90 (SD = 3.64), the mean high school grade point average was 3.55 (SD = .43), and the mean university grade point average was 3.04 (SD = .60). For 74.6% of the sample, the university was their top college choice.

### *Background Characteristics*

The literature on predicting college academic performance is reasonably consistent in suggesting the importance of the individual characteristics that students bring to postsecondary education (Astin, 1971, 1993; Pascarella & Terenzini, 1991, 2005). Consistent with this

literature, we included the following student background characteristics in our conceptual model: ACT composite score, sex, race, and mother's and father's educational attainment. ACT composite score, sex, and race were obtained from official university records held by the office of the university registrar. Mother's and father's formal education were obtained from the survey.

### *High School Experiences*

The literature on predicting collegiate academic performance also underscores the importance of high school academic performance (Astin, 1971; Pascarella & Terenzini, 1991, 2005). We obtained high school grades from the university registrar. However, we wanted a somewhat more complete portrayal of high school experiences than just academic performance. Consequently, in the survey first-year and senior students were asked to retrospectively provide information on their involvement in high school-related activities (e.g., studying, doing homework, extracurricular activities, out-of-class conversations with teachers), the perceived impact of their high school program in such areas as developing thinking and problem-solving skills, developing self-confidence, and developing time-management skills, and their work responsibilities during high school. (Detailed operational definitions, and where appropriate, psychometric characteristics of all high school experience variables, are available in the appendix.)

### *Other College Experiences*

It is clear that academic performance in college is influenced not just by student background characteristics and high school experiences, but also by the experience of college itself (Astin, 1993; Pascarella & Terenzini, 1991, 2005). For example, there is strong evidence indicating different grading practices across academic major (Barnes, Bull, Campbell, & Perry,

1998; Cheng & Chen, 1999; Thompson & Smart, 1998). Similarly, Astin's (1993) analyses of a national sample of undergraduates suggests that heavy work responsibilities during college can have a net negative impact on collegiate grades, presumably by reducing the time one has to devote to academic studies (e.g., Pascarella, Bohr, Nora, Desler, & Zusman, 1994). The survey, therefore, collected information on students' academic major field of study (intended major for first-year students) and the number of hours they were employed both on- and off-campus. The survey also provided additional direct or indirect measures of students' college experiences that we included in the model. These were place of residence during the current year, graduate degree plans, and whether or not the institution was a student's first choice for a college. The latter two variables (degree plans and college choice) are normally considered potentially salient precollege characteristics. However, since they were measured during college, we included them in the model as indicators of continuing academic motivation and commitment to the institution, respectively. Finally, since a substantial minority of students transfer to the institution after the first year of college, we included a variable indicating whether or not a senior student had transferred to the university (there were no transfers among first-year students). Transfer information was obtained from the office of the university registrar. (Detailed operational definitions of all other college experience variables are available in the appendix.)

### *Binge Drinking Behavior*

The major independent variable in the study was a measure of excessive alcohol consumption. It was a single item taken from survey data and adapted from a vetted measure of what has been termed "binge drinking" (e.g., Wechsler, Dowdall, Davenport, & Castillo, 1995; Wechsler, Dowdall, Maener, Gledhill-Hoyt, & Lee, 1998). Students were asked to indicate the number of times having five or more alcoholic drinks on one occasion during a typical two-week

period in college. An alcoholic drink was defined as “a 12-ounce can of beer, a 4-ounce glass of wine, 1 wine cooler, 1 shot of liquor, or 1 mixed drink.” The response options, and the percent of the samples within each response option, were: 0 = None (first-year students = 30.7, seniors = 21.1), 1 = One time (first-year students = 15.4, seniors = 16.2), 2 = Two times (first-year students = 17.9, seniors = 19.8), 3 = Three to five times (first-year students = 25.4, seniors = 29.5), 4 = Six or more times (first-year students = 10.5, seniors = 13.4).

#### *Time Spent Preparing for Class*

The measure of “time spent preparing for class,” was taken from a single item in the survey. The item asked students to indicate the number of hours in a typical week period that they spent preparing for class (e.g., studying, reading, doing library research, writing, rehearsing, or other activities related to one’s academic program). The response options and the percent of the combined first-year and senior student samples within each response option were: 0 = 0 hours (.2), 1 = 1-5 hours (11.6), 2 = 6-10 hours (24.1), 3 = 11-15 hours (27.3), 4 = 16-20 hours (18.2), 5 = 21-25 hours (8.8), 6 = 26-30 hours (5.7), and 7 = More than 30 hours (4.2).

#### *Dependent Measure*

The major dependent measure in the study was student academic performance. This was operationally defined as cumulative grade point average (grades) achieved during the Spring 2006 academic semester (ending in May, 2006). This was the same semester in which the survey was administered in late March. Thus, the measure of binge drinking behavior taken from the survey was obtained prior to the measure of academic performance. Spring 2006 semester grades were obtained from the university registrar’s office during the early summer of 2006.

#### *Data Analyses*

The first step in the data analyses was to estimate the total effects of binge drinking on semester grades. For this, we used reduced form regression specifications (Alwin & Hauser, 1975; Pascarella & Terenzini, 1991). Semester grades were regressed on four dummy variables representing the different levels of binge drinking (versus none) and all student background characteristics, high school experiences, and other college experiences (see Figure 1). To determine the direct and indirect (or mediated) effects of binge drinking on grades, we added time spent preparing for class to the reduced form (total effects) specification described above (Figure 2). According to our conceptual model, we expected that time spent preparing for class would have a positive net effect on grades and that the negative total effect of binge drinking on grades would be reduced to nonsignificance. Thus, a reduction in time spent preparing for class would mediate the negative impact of binge drinking on academic performance. Since we were also interested in how early in college one could detect a negative influence of binge drinking on academic performance, we conducted separate analyses for the first-year and senior student samples.

The second step in the analyses sought to determine if the impact of binge drinking on semester grades was the same for all students (general effects) or differed in magnitude for different types of students (conditional effects). For this set of analyses, we regressed semester grades on all the variables shown in the direct effects model (Figure 2) plus sets of cross-product terms that incorporated sex, race, and ACT composite score on the one hand and each of the four dummy variables representing the five binge drinking categories on the other. Statistically significant increases in the explained variance in semester grades would indicate the presence of conditional effects based on sex, race, and/or precollege tested academic preparation (ACT score).

All the findings we report are based on weighted sample estimates. These estimates were adjusted to the unweighted sample sizes to obtain correct standard errors for tests of significance.

### Results

The primary purpose of this study was to determine the replicability of evidence suggesting that excessive alcohol consumption has a negative net influence on student academic performance in college. Columns 1 and 2 in Table 1 summarize our estimates of the net effects of binge drinking frequency on semester grade point average for first-year and senior students. As columns 1 and 2 show, binge drinking two or more times in a typical two-week period was linked to significantly lower semester grades for both the first-year and senior student samples. Given the percent of students in each level of binge drinking frequency reported earlier, this meant that, on average, 53.9% of first-year students and 62.7% of seniors were at risk of lower semester grades than their respective peers who did not binge drink.

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Table 1 about here

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As further shown in columns 1 and 2 of Table 1, the deficit in semester grades (relative to students who did not binge drink) tended to increase in magnitude with each successive increase in binge drinking frequency. Based on the effect sizes (numbers in parentheses) in columns 1 and 2, first-year and senior students who binge drank twice in a typical two-week period had respective semester grades that were  $-.17$  and  $-.15$  of a standard deviation lower on average than their non-binge drinking peers. For first-year and senior students who binge drank three to five times in a typical two-week period, the respective semester academic performance deficits were  $-.19$  and  $-.26$  of a standard deviation. Finally, for those students who reported binge drinking six or more times in a typical two-week period (10.5% of the first-year students and 13.4% of seniors), the semester academic achievement deficit relative to non-binge drinking peers was  $-.53$

of a standard deviation for first-year students and  $-.35$  of a standard deviation for seniors. Perhaps most important, these estimated negative effects of binge drinking on semester grades persisted in the presence of statistical controls for an extensive battery of potential confounding influences such as sex, race, family background, tested precollege academic preparation (ACT scores), high school grades and other high school experiences, educational aspirations, and college experiences other than drinking behavior (e.g., work responsibilities, place of residence, transfer status, and academic major). Such findings unambiguously support existing studies suggesting a negative impact of excessive alcohol consumption on academic performance in college (e.g., Presley et al., 1996; Williams, Powell, & Wechsler, 2003; Wolaver, 2000).

A second question asked by the study was how early in the post-secondary experience are the negative effects of excessive alcohol consumption on academic performance discernible. As clearly indicated by columns 1 and 2 in Table 1, the negative effects of binge drinking on semester grades for first-year students tended to mirror those for senior students. Indeed, tests for the difference between first-year and senior student metric regression coefficients in columns 1 and 2 were not statistically significant—indicating only chance differences in the magnitudes of the negative effects of binge drinking between first-year and senior samples. Thus, our findings suggest, not only that the negative effects of excessive alcohol consumption on academic performance are discernible as early as the second semester of the first year of college, but also that the magnitude of the negative effects for first-year students are essentially the same as those for seniors.

Although prior research has suggested that the negative impact of excessive alcohol consumption on college academic performance is largely mediated by a reduction in the time spent studying or preparing for class (e.g., Williams, Powell, & Wechsler, 2003), this did not

replicate in our analyses. Columns 3 and 4 in Table 1 summarize our findings with respect to the direct (and indirect or mediated) effects of binge drinking on semester grades. When time spent preparing for class (e.g., study, reading, doing library research, writing) was added to the total effects equations, it had a net positive and statistically significant effect on semester grades for both first-year and senior students. However, even with class preparation time added to the equations, the estimated negative total effects of binge drinking on semester grades shown in columns 1 and 2 were reduced only slightly (mean reductions of 15% for first-year students and 10% for seniors). Furthermore, the negative total effects of binge drinking (columns 1 and 2) remained statistically significant in the direct effects equations (columns 3 and 4). Thus, in our samples of first-year and senior students, any reduction in class preparation time linked to binge drinking did not fully account for the negative impact of binge drinking on academic performance. Rather, binge drinking two or more times in a typical two-week period continued to exert a significant negative influence on grades irrespective of the time a student spent preparing for class.

The final question of the study was concerned with the extent to which the negative effects of binge drinking might differ in magnitude for different kinds of students. Our analyses estimated such conditional effects based on sex, race, and precollege tested academic preparation (ACT composite score). The addition of conditional effects cross-product terms to the direct effects equations were associated with only very small and statistically non-significant increases in the explained variance in semester grades for both first-year and senior students. Thus, our findings suggest that the net negative effects of binge drinking on grades were general in nature. That is, they tended to be essentially similar in magnitude for men and women, for Caucasian students and students of color, and for students at all levels of precollege academic preparation.

### Summary and Conclusions

This study sought to address some significant methodological limitations in existing research to determine if existing evidence suggesting a net negative influence of excessive alcohol consumption on college academic performance would replicate. The study had a number of strengths. First, it was longitudinal in nature and employed actual rather than self-reported measures of college grades. Second, it collected extensive data on students' background characteristics and college experiences. This permitted us to control for numerous alternative courses not always taken into account in the existing evidence. Third, because the study data contained samples of both first-year and senior students, it permitted us to determine how early in the postsecondary experience any deleterious influence of excessive alcohol consumption on academic performance manifest itself. Finally, the study sought to determine if the effects of excessive alcohol consumption on academic performance were generally the same for all students, or if they differed in magnitude for students with different characteristics.

Our findings unambiguously support the results of previous research suggesting that excessive alcohol consumption has negative implications for academic performance in college. Both first-year and senior students who reported binge drinking two or more times in a typical two-week period had semester grades that were significantly lower than their peers who reported never binge drinking. As the reported frequency of binge drinking increased, so too did the size of the deficit in academic performance. At the highest level of binge drinking (six or more times in a two-week period), the deficits were of considerable magnitude, averaging  $-.53$  of a standard deviation in semester grades for first-year students and  $-.35$  of a standard deviation for seniors. (Over 10% of the first-year students and over 13% of the seniors reported binge drinking at this level.) Significantly, negative effects could not be explained away by differences between binge

drinkers and their peers who did not binge drink on a wide array of alternative causes or explanations. These included: sex, race, family educational background, ACT composite scores, actual high school grades and other high school experiences, educational aspirations, transfer status, work responsibilities and place of residence during college, and intended or actual major field of study in college. Such evidence lends considerable additional support for the hypothesis that the negative link found between excessive alcohol use and college academic achievement is causal.

The clear weight of evidence indicates that collegiate academic performance influences bachelor's degree attainment, admission to graduate or professional school, and some measures of labor market success, such as earnings (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.

Somewhat surprisingly, our findings failed to replicate previous evidence suggesting that most of the negative impact of excessive alcohol consumption is accounted for by a reduction in study time. For both first-year and senior students in our analyses, amount of class preparation time had a significant positive influence on semester grades, but only marginally reduced the negative total effects of binge drinking. Irrespective of time spent preparing for class, binge drinking two or more times in a typical two-week period continued to exert a significant negative effect on semester grades for both first-year students and seniors. This suggests that while a reduction in the actual time spent preparing for class does inhibit academic performance, what may count more in terms of mediating the negative influence of binge drinking is an erosion of efficiency in the use of study time. For example, there is evidence that binge drinking negatively affects such areas of intellectual functioning as cognitive task orientation, short-term memory,

and executive-type cognitive functioning (e.g., Brown, Tapert, Granholm, & Delis, 2000; Townshend & Duka, 2005; Weissenborn & Duka, 2003). Unfortunately, our data had no measure of study time efficiency by which to test this hypothesis.

Our analyses also found that the net negative effects of binge drinking on semester grades for first-year students closely mirrored those for seniors. Indeed, not only was the pattern of negative effects the same, but the actual magnitudes of the effects for first-year and senior students differed in only chance ways. This suggests that the negative consequences of binge drinking for academic performance may manifest themselves by the second semester of the initial year of college, if not sooner. Therefore, interventions designed to reduce the frequency of excessive alcohol use during college might provide their greatest return if implemented as early as possible in a student's undergraduate experience.

A final major finding of our study was that the negative effects of binge drinking on semester grades were general rather than conditional. That is, binge drinking did not discriminate. Rather, it had the same deleterious consequences irrespective of student sex, race, or precollege tested academic preparation (ACT composite score). As far as we know, this is the first study to systematically test for the presence of conditional effects in the link between alcohol consumption and collegiate academic performance. To the extent the finding is replicated and extended, it would have ominous connotations. Specifically, there may be no easily identifiable group of students who are most at risk academically from binge drinking. Rather, the negative influence of binge drinking on academic performance may hold for a broad spectrum of undergraduates.

#### Limitations

Clearly, this study is limited in at least two ways that should be kept in mind when interpreting the results. Foremost is the fact that only 36.5% of the population completed the web survey. Although our weighting algorithm yielded first-year and senior student samples that were quite similar to the populations from which they were drawn, there is no way to determine if non-respondents would have responded in the same way as those who did respond to the survey. Weighed against this is the fact that the study was primarily concerned with testing some theoretical expectations about the academic consequences of binge drinking. Thus, sample representativeness may be somewhat less critical than in other types of studies. Second, the study was conducted at a single institution. While there is no obvious reason to suspect that the negative impact of binge drinking on academic achievement in college would not generalize to other institutional settings, the need for empirical replication is obvious.

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## Appendix Operational Definitions of All Variables

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### *Dependent Variable*

Spring 2006 semester grades: A single index obtained from the university registrar's office.

### *Control Variables – Student Background Characteristics*

ACT composite score: A single index obtained from the university registrar's office.

Student's sex was male: A single item obtained from the university registrar's office, and coded: 1 = Male, 0 = Female.

Student's race is Caucasian: A single item obtained from the university registrar's office and coded 1 = Caucasian, 0 = Person of color.

Father has a bachelor's degree or higher: A single item taken from survey data and coded: 1 = Bachelor's degree or higher, 0 = Less than a bachelor's degree.

Mother has a bachelor's degree or higher: A single item taken from survey data and coded: 1 = Bachelor's degree or higher, 0 = Less than a bachelor's degree.

### *Control Variables – High School Experiences*

High school grades: A single index of one's secondary school cumulative grade point average. Obtained from the university registrar's office.

High school involvement scale: An 11-item scale obtained from survey data that asked students to indicate their extent of involvement in high school in activities such as: studying or doing homework, talking with teachers outside of class, participating in extracurricular activities, and the like. Response options were: 5 = Very often to 1 = Never. Alpha reliability = .67

High school work: A single item taken from survey data that asked students how often they engaged in working for pay during high school. Response options were: 5 = Very often to 1 = Never.

Impact of high school scale: A 36-item scale taken from survey data that asked students to indicate how much their high school experience had contributed to their growth in such areas as: thinking and reasoning skills, speaking effectively, developing problem-solving skills, developing self-confidence, developing time-management skills, and the like.

Response options were: 5 = Very great to 1 = None. Alpha reliability = .96

#### *Control Variables – College Experiences*

Plan to obtain a graduate degree: A single item taken from survey data and coded: 1 = Plan to obtain a master's, doctorate, or professional degree (e.g., law, medicine, business), 0 = Plan to obtain no more than a bachelor's degree.

This institution was a first choice for college: A single item taken from survey data and coded 1 = First choice, 0 = Second or lower choice.

Transferred to this institution: A single item obtained from the university registrar's office and coded: 1 = Transferred to the institution, 0 = Did not transfer.

Actual (seniors) or intended (first-year students) academic major: Eight dummy variables (coded: 1 or 0) taken from survey data and indicating a student's actual or intended academic major: natural or mathematical sciences, social sciences, nursing, engineering, education, business, journalism/communications, other. The comparison group was always fine arts and humanities.

Place of residence: Three dummy variables (coded: 1 or 0) taken from survey data and indicating a student's place of residence during college: fraternity or sorority, off campus

but within three miles of campus, off campus and more than three miles from campus. The comparison group was always students living in university housing.

Hours Employed On Campus: A single item taken from survey data that asked students how many hours they work on campus for pay during a typical week in the current semester. Response options were: 0 = 0 hours to 7 = More than 30 hours. Variable was recoded using the midpoints of each category.

Hours Employed Off Campus: A single item taken from survey data that asked students how many hours they work off campus for pay during a typical week in the current semester. Response options were: 0 = 0 hours to 7 = More than 30 hours. Variable was recoded using the midpoints of each category.

### *Independent Variables*

Binge drinking frequency: Four dummy variables (coded: 1 or 0) taken from survey data and indicating the number of times having five or more alcoholic drinks on one occasion in a typical two-week period during college: Once, Twice, Three to five times, and Six or more times. The comparison group was always “None.”

Time spent preparing for class: A single index taken from survey data and indicating the number of hours in a typical week period during college that one spends preparing for class (e.g., studying, reading, doing library research, writing, rehearsing, or other activities related to one’s academic program). Response options were: 0 = 0 hours to 7 = More than 30 hours. Variable was recoded using the midpoints of each category.

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TABLE 1

Estimated Net Effects of “Binge Drinking” on Semester Academic Performance for First-Year and Senior Students<sup>a, b</sup>

Binge Drinking Frequency and Time Spent Preparing for Class	Model I		Model II	
	Estimated Total Effects		Estimated Direct Effects	
	(1) <u>First-Year Students</u>	(2) <u>Senior Students</u>	(3) <u>First-Year Students</u>	(4) <u>Senior Students</u>
Binge Drinking Frequency:				
Once vs. none	-.029	-.065	-.025	-.063
Twice vs. none	-.111** (-.171)	-.079* (-.149)	-.085* (-.131)	-.069* (-.130)
Three to five times vs. none	-.125** (-.193)	-.137** (-.259)	-.106** (-.163)	-.121** (-.229)
Six or more times vs. none	-.343** (-.528)	-.183** (-.346)	-.318** (-.490)	-.176** (-.332)
Time Spent Preparing for Class			.017** (.191)	.008** (.121)
R <sup>2</sup> Total Model	.368**	.464**	.401**	.477**

<sup>a</sup> Regression models also include controls for: ACT composite score, high school grades, sex, race/ethnicity (Native American, African American, Latino, Asian American, or International vs. Caucasian), high school work, high school involvement scale, impact of high school scale, father has bachelor’s degree or higher, mother has bachelor’s degree or higher, university was first

TABLE 1 (continued)

choice for college, graduate degree plans, off-campus work during college, on-campus work during college, transfer status (senior students only), intended or actual major (natural or mathematical sciences, social science, nursing, engineering, education, business, journalism/communications, other vs. arts and humanities), and place of residence in college (fraternity or sorority, off-campus within three miles of campus, off-campus more than three miles from campus vs. university housing).

<sup>b</sup> The top number is the metric regression coefficient, or the change in grade point average for every one unit increase in the predictor variable, net of the influence of all other predictors in the equation. In column 1, for example, first-year students who report binge drinking 6 or more times in a typical two-week period have statistically adjusted semester grade point averages that are .343 of a grade point lower than their peers who report never binge drinking. The number in parentheses is the estimated effect size. For each category of “binge drinking,” the effect size is the metric regression coefficient divided by the standard deviation of grade point average for each sample. For time spent preparing for class, the effect size is the standardized regression coefficient, or beta weight. Only statistically significant effect sizes are shown. All others are considered zero.

$p < .05$ .  $**p < .01$

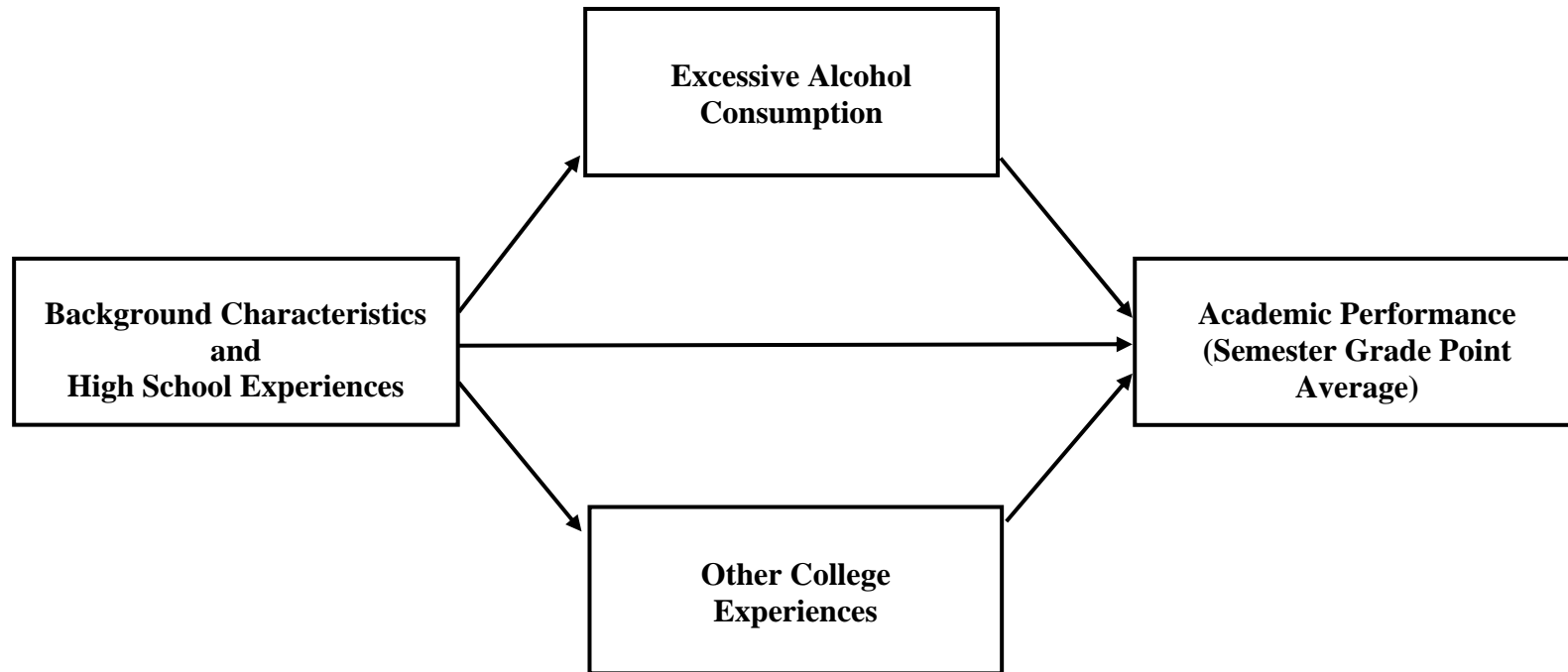


Figure 1. Total Effects Model

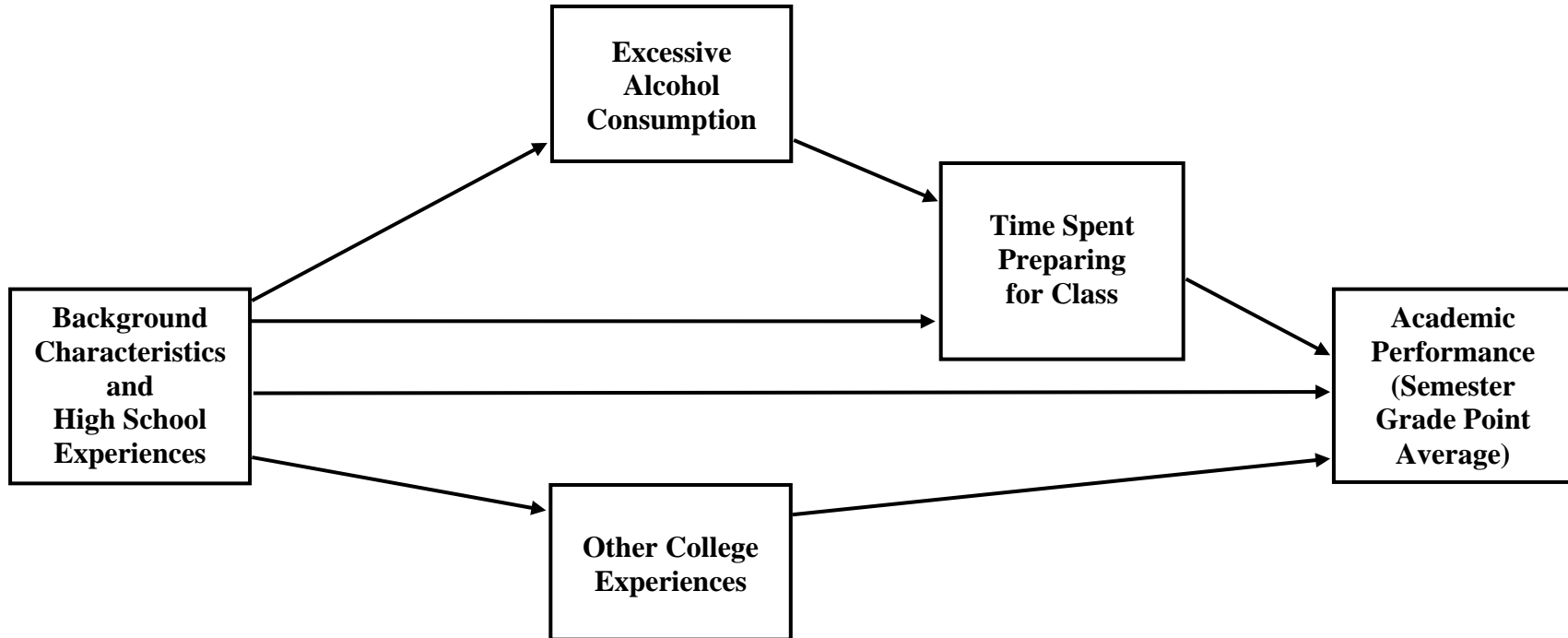


Figure 2. Direct and Indirect Effects Model