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Drinking Behavior from High School to Young Adulthood: Differences by College Education

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Abstract

Background: Recent serious alcohol-related events have raised public awareness of the prevalence of at-risk alcohol use among college undergraduates, but heavy alcohol consumption during late adolescence and young adulthood is not limited to college students. Alcohol consumption typically peaks in young adulthood regardless of education level, and risks related to alcohol misuse are shared by young adults, regardless of their educational choices. Differences in alcohol risk between college-attending and non-college-attending young adults are generally small, and emphasize the need for research examining the drinking patterns of both of these groups.

Methods: To better understand patterns of at-risk alcohol use and its association with education, this study compared at-risk alcohol use from 12th grade to young adulthood (age 24) in a sample of never-married young adults. Three groups were formed based on completed education when the survey was administered in young adulthood: high school or less, postsecondary education without a four-year college degree, and completed college.

Results: Men who completed college experienced the greatest increase in at-risk drinking from grade 12 to young adulthood; however, their at-risk alcohol use did not differ markedly from men in the other education groups in young adulthood. Men who did not complete college had high levels of alcohol risk in 12th grade and maintained or increased those levels in young adulthood, demonstrating a pattern of prolonged risk. Women whose completed education was high school or less experienced the fewest increases in at-risk alcohol use. Education group differences were not explained by place of residence or employment status.

Conclusions: These results emphasize the need to intervene early to prevent at-risk alcohol use, and emphasize that at-risk alcohol use is neither unique, nor necessarily the highest among individuals who complete college.

Keywords

At-Risk Drinking; Education Level; High School Drinking; College Drinking; Longitudinal; Young Adulthood

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ALCOHOL CONSUMPTION TYPICALLY peaks during young adulthood, and alcohol-related risks are shared by college undergraduates and their non-collegeattending age-mates. Irresponsible and inappropriate alcohol use (e.g., drink/driving [DD], drunkenness, drinking as part of hazing, drinking contests, binge drinking) by college undergraduates has recently led to several serious incidents that have heightened the public's awareness of college drinking. In addition, recent research has broadened our understanding of the extent and severity of alcohol risk behavior among college undergraduates (Engs et al., 1996; Hingson et al., 2003a; Hingson et al., 2003b; Knight et al., 2002; Wechsler et al., 1998; Wechsler et al., 2002).

Recent research has shown a consistently higher rate of at-risk drinking behaviors, including frequent and heavy drinking, among college undergraduates than their non-college-attending age-mates; however, these differences are often not large (Paschall, 2003; Paschall & Flewelling, 2002). For example, in a recent study only 6.3% more college undergraduates reported DD than did non-college attendees (Paschall, 2003), and the percentage of college undergraduates who reported consuming alcohol and drinking heavily were, respectively, only 7.3% and 1.2% more than non-college attendees (Gfroerer et al., 1997). When young adults who are living in their parents' homes are considered, college attendees have lower alcohol consumption than non-college attendees (7.2% versus 11.1%), but among young adults who live outside their parents' homes, college undergraduates have higher rates of heavy alcohol consumption (16.9% versus 12.5%) (Gfroerer et al., 1997).

Based on the results of extant research, it would be incorrect to assume that non-college-attending young adults are at lower alcohol-related risk than college under-graduates. This emphasizes that focusing only on college student alcohol misuse ignores the elevated alcohol-related health risk and need for intervention to reduce alcohol use that many subgroups of non-college-attendees experience. Past research brings to the forefront two key aspects of young adult at-risk drinking. First, overall, non-collegeattending young adults have only slightly lower rates of at-risk alcohol use than college undergraduates. Second, non-college-attending young adults do not have an appreciably lower risk for alcohol-related health problems than their college attending age-mates. Together, these points highlight the small difference in alcohol risk between college and non-college-attending young adults, point out that both college and non-college educated young adults are at high risk for alcohol misuse (Casswell et al., 2003), and emphasize the need for research examining both non-college and college attending young adults so that the picture of young adult at-risk drinking can gain both a broader scope and clearer resolution.

Despite the high levels of at-risk alcohol consumption among college undergraduates, lower education attainment and less prestigious occupations are associated with poorer health and a shorter lifespan (Droomers et al., 2004; Droomers et al., 1999). While this decrement in the health of individuals with lower compared to higher education may be due to many factors (Georgiou et al., 1997), high-risk alcohol consumption among people with lower education may be a contributor (Droomers et al., 2004; Droomers et al., 1999).

The mixed picture of at-risk alcohol use across subgroups of young adults suggests that different patterns of alcohol-risk development may be at play, and points to the need for longitudinal research comparing college-and non-collegeattendees during young adulthood, when life-long drinking patterns are becoming established. Research conducted to date, while greatly expanding our understanding of alcohol use and related high-risk behavior among adolescents, has not adequately addressed changes in alcohol use during the interval from the last year of high school to a point in early young adulthood. During this interval, basic education needed to pursue a career is typically completed and a primary work role is assumed,

nevertheless, research has not made clear comparisons among individuals who attend college, and those who make other education and work-related choices. This gap in the current literature on alcohol use during young adulthood is addressed by this study, which compared three groups of participants on their drinking behavior in 12th grade (pre-college) and at age 24 (when basic career-related education is typically completed and work roles are being assumed). The groups were: high school educated (HSE), whose completed education was high school graduation or less; postsecondary educated (PSE), including technical and trade school and some college without completion of a four-year college degree; and college completers (CC), whose highest level of education was at least a four-year college degree.

Based on prior research looking at college drinking, we hypothesized that the CC group would have the highest rate of at-risk drinking in young adulthood. We also examined sex differences, and hypothesized that men would have higher rates of consumption than women, and that the hypothesized education group differences would apply equally to men and women. No hypotheses were made regarding patterns of longitudinal change in drinking patterns, or sex and education group differences in these patterns.

METHODS

Sample and Surveys

The sample for this study was initially recruited to participate in the Alcohol Misuse Prevention Study (AMPS; Shope et al., 1996). AMPS participants were recruited when they were in either 5th or 6th grade and were subsequently followed up several times, including in 12th grade and again in young adulthood when they averaged 24 years of age. The data for these analyses came from the 12th grade school survey (average age 17.9 ± 0.5) conducted in 1991-1992 and the young adulthood telephone interview (average age 23.5 ± 0.8) in 1997 and 1998. The AMPS participants were recruited from six school districts in southeastern Michigan and the majority of students in those districts enrolled in the study. Parental consent was obtained for all participants, and questionnaires were administered by trained project staff in regular classrooms (Shope et al., 1996;1992). The school surveys measured demographic characteristics, and psychosocial and behavioral variables, including substance use, and various aspects of peer and family relationships. The young adult follow-up telephone interview attempted to reach all AMPS participants. Participants in the 12th grade survey who had a current Michigan driver license (n = 10,481) were considered for inclusion in the young adult assessment. Of these, 101 were ineligible for a telephone interview (70 were out of the country; 15 were deceased; nine had serious mental or physical limitations; and seven were incarcerated), yielding a final eligible sample of 10,380.

In the fall of 1997, efforts to track telephone numbers began. Intensive tracking efforts were employed. Driver licensure records were obtained from the office of the Michigan Secretary of State. These records provided addresses needed to send advance letters to participants that requested an updated telephone number and offered a monetary incentive for the update and a completed survey. In addition, a matching service, directory assistance, CD-ROM and Internet database searches, and a national change-of-address vendor were used to identify new addresses and phone numbers. Finally, participants who were the hardest to contact (e.g., unpublished telephone numbers, only an answering machine was reached, or another person had answered and refused the respondent's cooperation) were sent an additional letter offering $15 for a completed interview.

Despite the extensive tracking effort, interviews could not be completed with a number of participants. For 24% of the eligible participants, a correct phone number could not be obtained, or the correct person (or their representative) could not be reached. Fifteen percent of eligible participants had unpublished phone numbers and no additional contact information could be

obtained, and telephone numbers were obtained but contact resulting in an interview could not be made with 14%. Of the eligible participants contacted, 94% agreed to participate in the survey, resulting in completed interviews with 3,184 AMPS participants (30.4% of total eligible).

Attrition bias was tested by comparing the 3,439 respondents, refusals, and noncontacts on their 12th grade survey measures (Table 1). Some significant differences were found, but the effect sizes were small and of questionable substantive interest. As expected, men and those with more problem behaviors were harder to contact. However, the content areas related to this study, namely alcohol use/misuse, did not differ among respondent groups. Based on this information we concluded that attrition was probably not a serious threat to the validity of this research.

The telephone survey included measures of socio-demographic characteristics, problem behavior, alcohol use, and markers of the transition to adulthood (i.e., school, work, romantic partnership and marriage, and parenthood). Some of the items and scales from the school survey measures were included in the telephone survey in their original form. Others were altered slightly to be age-appropriate (i.e., does their alcohol consumption interfere with their school attendance [12th grade] and with their job [in young adulthood]).

The drinking patterns of participants who were married/cohabitating or who were parents differed significantly from the participants who were single and not parents. The sample for this study was restricted to AMPS participants who were not married/cohabitating or parents at the time of the telephone survey. This restriction was made because: 1) the differences in alcohol use suggested that married/cohabitating/parenting young adults represented a separate population having distinct drinking behaviors and potentially distinct influences on that behavior; 2) there were too few participants in the highest education group examined in this study who were married/cohabitating/parents to allow moderating effects of these groups to be examined. Following these exclusions, the sample included, 1987 participants and was 51.0% male, 84.3% white, 5.1% Black, 2.1% Hispanic, 0.6% American Indian/Alaskan Native, 3.1% Asian/Pacific Islander with 4.8% from other races.

Measures

Alcohol, Cigarettes and Marijuana. The quantity/ frequency of drinking alcohol (QF), frequency of drunkenness, and binge drinking were measured at 12th grade and in young adulthood. In 12th grade, participants reported the number of times they had drunk alcoholic beverages/gotten drunk/had five or more drinks on one occasion in the previous 12 months. Responses were coded on a zero-to-five scale, where 0 = “never,” 1 = “once,” 2 = “two or three times,” 3 = “four or five times,” 4 = “six or more times.” At the young adult follow-up, participants were asked how many times in the previous 12 months they had drunk alcoholic beverages/ gotten drunk/binged (i.e., five or more [men] or four or more [women] drinks on one occasion), and responses were coded as raw frequencies. The raw frequencies collected in young adulthood were divided by 12 and recoded into the same zero-to-five scale used at 12th grade. At both surveys, participants reported how many drinks they typically consumed per occasion, and QF scores at 12th grade and at young adulthood were calculated as the product of the frequency and quantity of alcohol use.

Drink/driving was measured only in the young adult survey using five items developed by Donovan (1993): “In the past 12 months, how many times did you: 1) drive within one hour after drinking one or two beers or other alcoholic beverages; 2) drive within one hour after drinking three or more beers or other alcoholic beverages; 3) drive when you felt high or lightheaded from drinking; 4) drive when you knew your drinking may already have affected your coordination; 5) drink in the car while you were driving?” The items were scored as raw

frequencies, and recoded into a 14-point scale for analysis, where 0 = “never,” 1 = “once,” 2 “twice,” 3 = “three times,” 4 = “four times,” 5 = “five times,” 6 = “six to nine times,” 7 = “10 to 14 times,” 8 = “15 to 19 times,” 9 = “20 to 24 times,” 10 = “25 to 29 times,” 11 = “30 to 49 times,” 12 = “50 to 99 times” and 13 = “100 or more times.” Internal consistency was $\alpha = 0.89$ (Donovan, 1993; Shope and Bingham, 2002).

The 10-item Alcohol Use Disorders Identification Test (AUDIT) was measured only in young adulthood (Babor, et al., 1992; Claussen et al., 1993; McRee and Babor, 1991; Saunders et al., 1993). All 10 AUDIT items were scored on a scale of 0 to 4. Eight of the items were scored on a five-point scale ranging from 0 to 4. Two items were scored on a three-point scale, with the values of 0, 2, and 4. A total scale score was obtained by calculating the sum across the 10 items.

Different measures of drinking consequences were used in 12th grade and in young adulthood. This difference was necessary due to age-related differences in the alcohol use behaviors of the participants at these two points in their lives. In the 12th grade survey, the following 10 questions were asked. “During the past 12 months, how many times did you: 1) drink more than you planned to; 2) feel sick to your stomach after drinking; 3) get talked into doing something you didn't want to do after drinking; 4) get into trouble with your friends because of drinking; 5) have a friend of the same sex complain because of your drinking; 6) have a friend of the opposite sex complain because of your drinking; 7) have someone you were dating complain about your drinking; 8) get into trouble with your parents because of your drinking; 9) get into trouble with teachers, school counselors, or the principal because of your drinking; and 10) get into trouble with the police because of your drinking?” Item responses were 0 = “never,” 1 = “once,” 2 = “twice,” 3 = “three or more times.” Internal consistency for this scale was $\alpha = 0.80$.

Drinking consequences were measured in young adulthood using 11 questions. “In the past 12 months, how many times did you: 1) have a hangover, headache, or upset stomach the morning after you had been drinking; 2) get physically sick or pass out after drinking; 3) have difficulties with your spouse or partner (close friend if no spouse/partner) because of your drinking; 4) have problems on the job because of your drinking; 5) get into trouble with the police or get arrested because of your drinking; 6) have any accidents at home or at work that may have been due to your drinking?” These six items were scored as 0 = “never,” 1 = “once,” 2 = “2-3 times,” 3 = “4-5 times,” 4 = “6-9 times,” and 5 = “10 or more times.” Five items were included from the AUDIT, “How often during the past 12 months have you: 7) found that you were not able to stop drinking once you had started; 8) failed to do what was normally expected of you because of drinking; 9) been unable to remember what happened the night before because you had been drinking; and 10) have you or someone else even been injured as a result of your drinking in the past 12 months; and, 11) has a relative, friend, doctor or other health worker been concerned about your drinking or suggested that you should cut down in the past 12 months? Standard AUDIT scoring procedures were used for these five items (Babor et al., 1992; Saunders et al., 1993). Internal consistency for this scale was $\alpha = 0.78$.

For repeated measure analyses examining alcohol consequences, all items from the 12th grade and young adult surveys were individually standardized to a mean of zero and a standard deviation of one before calculating scale scores. This was done to accommodate the variety of response categories/ranges represented among the consequence items. Because some of the items were distinct, a confirmatory factor analysis tested the equivalence between constructs indicated by the 10 items from the 12th grade measure and the 11 items measured in young adulthood. The model had χ^2 (186) = 728.35, $p < 0.000$), a Goodness of Fit Index of0.94, and the Adjusted Goodness of Fit Index of 0.93. Based on these results, it was concluded that the consequence measures used at the two time-points were measuring a common construct.

Cigarette smoking and marijuana use were measured at each survey, and were included in the analyses to provide non-alcohol substance use behavior comparisons to alcohol use. The items for both substances asked how often the participant had smoked cigarettes/used marijuana in the previous 12 months. Responses for both substances were coded as 0 = "never," 1 = "a few times a year or less," 2 = "once or twice a month," 3 = "once or twice a week," 4 = "three or four times a week," and 5 = "every day."

Education Groups

Education information was collected in the young adulthood telephone interview. Participants were asked to report their highest completed grade in school. Based on their sex and educational level, participants were divided into the following six groups: high school or less (HSE) men, HSE women, some postsecondary education (i.e., trade school or college but not a four-year college degree) (PSE) men, PSE women, and completed college (included professional and postgraduate degrees) (CC) men, and CC women.

Analyses

Alcohol use was hypothesized to vary as a function of education level; however, the exact pattern of variation over time was not certain. It was also anticipated that patterns of cigarette smoking and marijuana use would mirror the observed patterns of alcohol use, suggesting that influences on patterns of alcohol-related behaviors were not specific to alcohol, but were general to substance use. Repeated measures analysis of variance was used to test these hypotheses. Examination of the distributions of the outcome variables showed them to be highly skewed to the right. To accommodate these distributions in the analyses, generalized estimating equations using a Poisson distribution and log link were used to test the study hypotheses. Single degree of freedom contrasts were employed to examine group differences when a significant overall effect of group was found. Effect sizes in the form of likelihood ratios were calculated by exponentiating the parameter estimates (i.e., e^x where x = parameter estimate) for these models, and are reported in the results. The outcome measures for these analyses included QF, frequency of drunkenness, frequency of binge drinking, drinking consequences, frequency of cigarette smoking and frequency of marijuana use. The three education groups were compared on DD and the AUDIT, which were only measured in young adulthood, using analysis of variance with a Poisson probability distribution and a log link. Once again, significant main effects were followed up with single degree of freedom contrasts, and likelihood ratios were calculated by exponentiating the parameter estimates.

Despite the small observed attrition bias, weighted models were tested using response propensity scores to adjust for differential drop-out. Before calculating the weights, the participants were organized into four strata, based on their grade in school at the most recent previous contact. Weights were then calculated within each of the four strata using two-stage propensity modeling (Groves and Couper, 1999; Raghunathan et al.,1996). In the first stage, all variables available from the prior survey were used to contrast participants who were contacted for the young adult survey with those who were not. In the second stage, the same variables were used to contrast response versus refusal groups, conditional on contact. Weights from stage one and two were represented as: the inverse of the probability that the respondent was contacted (stage one) and responded (stage two). The product of these two weights was then defined as the final weight within each stratum, which was normalized to the corresponding full sample sizes of each stratum. The results presented here are based on weighted analyses.

RESULTS

Repeated Measures of Alcohol Use

Quantity-Frequency of Alcohol Consumption. The group effect for quantity/frequency (QF) was significant ($\chi^2(5) = 49.64$, $p<0.001$). HSE and PSE men had significantly higher QF than CC men (likelihood ratios [LR] = 1.91 and 1.49, respectively), HSE women had higher QF than CC women (LR = 1.88), HSE men had higher QF than HSE (LR = 1.88), PSE (LR = 2.90), and CC (LR = 3.54) women, PSE men had higher QF than PSE (LR = 2.26) and CC women (LR = 2.75), and CC men had higher QF than PSE (LR = 1.52) and CC (LR = 1.85) women. QF increased significantly overall from 12th grade to young adulthood (LR = 1.45) ($\chi^2(1) = 109.26$, $p < 0.001$), with a significant group by time interaction ($\chi^2(5) = 49.64$, $p = 0.050$). Group by time interactions resulted from QF increasing more for HSE men than both PSE (LR = 2.18) and CC women (LR = 2.30), and more for PSE men than for PSE women (LR = 1.57) (Table 2, Fig. 1).

Frequency of Drunkenness. A significant overall group effect was found ($\chi^2(5) = 24.65$, $p<0.001$), resulting from differences between men and women. HSE men reported more drunkenness than PSE (LR = 1.18) and CC women (LR = 1.35), PSE men reported more drunkenness than CC women (LR = 1.27), and CC men had higher frequencies of drunkenness than CC women (LR = 1.30). The frequency of drunkenness increased from 12th grade to young adulthood for all groups except HSE men and women (LR = 1.22) ($\chi^2(1) = 29.56$, $p<0.001$). Significant time by group effects ($\chi^2(5) = 18.56$, $p = 0.002$) were found due to different amounts of change from 12th grade to young adulthood in drunkenness of men and women. Drunkenness increased more for CC men than HSE men (LR = 1.34) and PSE men (LR = 1.28), more for CC women than HSE women (LR = 1.53), more for CC women than HSE men (LR = 1.34) and PSE men (LR = 1.32), and more for CC men than HSE women (LR = 1.95). The general pattern of change was for lower education groups to have higher levels of drunkenness in 12th grade, and to remain at nearly the same level, while CC men and women showed the greatest increases in drunkenness, either catching (CC women) or surpassing (CC men) the other education groups of the same sex (Table 2, Fig. 2).

Frequency of Binge Drinking. An overall group effect ($\chi^2(5) = 38.31$, $p < 0.001$) was found for binge drinking, resulting from significantly more frequent binge drinking for HSE women than for CC women (LR = 1.27), more for PSE than CC women (LR = 1.19), more for HSE men than PSE (LR = 1.25) and CC women (LR = 1.49), more for PSE men than PSE (LR = 1.18) and CC women (LR = 1.40), and more for CC men than CC women (LR = 1.35). Binge drinking increased in frequency overall (LR = 1.37) ($\chi^2(1) = 69.11$, $p < 0.001$), and binge drinking changed differently over time for the six groups ($\chi^2(5) = 17.54$, $p = 0.004$). Binge drinking increased in frequency more for CC than PSE men (LR = 1.21), CC women increased more than HSE women (LR = 1.48), PSE women increased more than PSE men (LR = 1.26), and CC men increased more than PSE women (LR = 1.43). CC men and women and PSE women increased at nearly the same rate, while PSE men increased at a slightly slower rate, and HSE men and women remained at nearly the same level (Table 2, Fig. 3).

Drinking Consequences. Overall group comparisons were significant ($\chi^2(5) = 21.07$, $p < 0.001$), due to greater consequences for HSE than CC men (LR = 1.12), more for HSE men than HSE (LR = 1.15), PSE (LR = 1.15) and CC women (LR = 1.20), more consequences for PSE men than for PSE (LR = 1.09) and CC women (LR = 1.13), and more for CC men than women (LR = 1.07). There was an overall increase in consequences from 12th grade to young adulthood (LR = 1.06) ($\chi^2(1) = 5.10$, $p = 0.025$). All of the groups reported increasing consequences over time. The group by time interaction was not significant ($\chi^2(5) = 3.40$, $p = 0.638$). HSE men reported more drinking consequences in 12th grade and in young adulthood than any other group, but only differed significantly from CC women in young adulthood. CC

men and women experienced an increase in consequences, but each had the least consequences of any group of the same sex (Table 2, Fig. 4).

Alcohol Use in Young Adulthood

Drink-driving and the AUDIT were measured only in young adulthood. Results from cross-sectional comparisons of the six groups on these measures are summarized in Table 3, and reported below.

In young adulthood a significant group effect for the AUDIT ($\chi^2(5) = 847.52$, $p < 0.001$) resulted from HSE men having significantly higher AUDIT scores than PSE (LR = 1.10) and CC (LR = 1.10) men, HSE women having a lower AUDIT than PSE women (LR = 0.93) and higher AUDIT than CC (LR = 1.13) women, PSE men reporting a higher AUDIT than CC women (LR = 1.21), HSE men reporting a higher AUDIT than HSE (LR = 1.53), PSE (LR = 1.43), and CC women (LR = 1.73), PSE men having a higher AUDIT than HSE (LR = 1.39), PSE (LR = 1.30), and CC women (LR = 1.57), and AUDIT scores for CC men exceeding those of HSE (LR = 1.40), PSE (LR =1.30), and CC women (LR = 1.58) (Table 3). HSE men scored highest on the AUDIT out of all six groups.

A significant group effect was found for DD ($\chi^2(5) = 847.52$, $p < 0.001$). This effect resulted from HSE men reporting less DD than PSE men (LR = 0.89), PSE men reporting more DD than CC men (LR = 1.17), and HSE (LR = 1.58) and PSE (LR = 1.45) women had a higher frequency of DD than CC women. HSE men reported more DD than HSE (LR = 1.35), PSE (LR = 1.47), and CC women (LR = 2.13). PSE men reported more DD than HSE (LR = 1.51), PSE (LR = 1.65), and CC women (LR = 2.38), and the frequency of DD for CC men exceeded those of HSE (LR = 1.29), PSE (LR = 1.40), and CC women (LR = 2.03) (Table 3). PSE men had the highest frequency of DD out of all six groups.

Repeated Measures of Other Drug Use

Frequency of Cigarette Smoking Overall, the groups differed significantly in frequency of cigarette smoking ($\chi^2(5) = 186.54$, $p < 0.001$). HSE men reported more smoking than PSE (LR = 1.85) and CC (LR = 3.47) men, and PSE men smoked more than CC (LR = 1.87) men. Similarly, HSE women smoked more than PSE (LR = 1.36) and CC (LR = 3.73) women, and PSE women smoked more than CC (LR = 2.74) women. HSE men reported more smoking than PSE (LR = 1.26 and CC women (LR = 3.44), PSE men smoked less than HSE (LR = 0.50) and PSE (LR = .68) women, but more than CC women (LR = 1.85), and CC men smoked less than HSE (LR = 0.27) and PSE men (LR = 0.36). Although there was not an overall effect of time ($\chi^2(1) = 2.47$, $p < 0.116$), there was a significant time by group interaction ($\chi^2(5) = 14.07$, $p = 0.015$). Cigarette smoking increased more over time for HSE than CC men (LR = 1.95), and more for HSE women than CC women (LR = 2.00). HSE men increased their smoking more than PSE (LR = 2.14) or CC women (LR = 1.95), PSE men increased their smoking while CC women decreased slightly (LR = 2.05), and HSE women increased their smoking more than CC men (LR = 1.44). HSE men and women reported the highest frequencies of smoking in 12^{th} grade and young adulthood, and also had the greatest increase over time. PSE men and women showed very little change over time, while CC men and women had the lowest levels of smoking at both time points and showed very little change over time (Table 2).

Frequency of Marijuana Use. The effect of group was significant for marijuana use ($\chi^2(5) = 72.74$, $p < 0.001$). HSE men reported more marijuana use than PSE (LR = 1.63) and CC (LR = 2.41) men, and PSE men had greater use than CC men (LR = 1.48). HSE women reported more marijuana use than PSE women (LR = 2.35), and PSE women reported more than CC women (LR = 2.13). HSE men reported more marijuana use than PSE (LR = 1.61) and CC (LR = 3.43) women, PSE men reported more than CC women (LR = 2.11), and CC men reported

less marijuana use than HSE (LR = 0.60) and PSE women (LR = 0.67), but more than CC women (LR = 1.42). The main effect of time was not significant ($\chi^2(1) = 3.49$, $p = 0.062$), but there was a significant time by group interaction ($\chi^2(5) = 12.59$, $p = 0.028$). From 12th grade to young adulthood, CC men increased their use of marijuana more than HSE (LR = 1.63) or PSE men, PSE women reported a greater increase than PSE men (LR = 1.71), and CC men reported a greater increase in marijuana use than PSE women (LR = 1.70) (Table 2).

Follow-up Analyses

The sample consisted entirely of individuals who are single and not parents. Therefore, the observed changes in at-risk drinking could not be attributed to the effects of marriage or parenthood, both of which are markers of the transition to adulthood and likely to moderate at-risk drinking. Two other markers of the transition to adulthood that are also associated with changes in drinking behavior and that are applicable to this sample are student/work status and residence outside the parental home. The transition from being a student to working, and the transition from residing with one's family of origin to another location could both partially explain differences in patterns of change across education groups. Other research has shown that young adult college students who are living in their parental homes have lower alcohol consumption than non-college-attendees (7.2% versus 11.1%), while young adults who are attending college and living outside their parent's home have higher rates of heavy alcohol consumption(16.9% versus 12.5%) (Paschall, 2003; Paschall and Flewelling, 2002). The effects of residence and student/work status were tested in this sample, using contingency table analysis. The three education groups were each divided into participants who were students or were working at the time of the young adult survey. Participants who were working and attending school were classified as students. The six groups were compared on binge drinking (ever/never), alcohol consequences (high/low using a median split), alcohol QF (high/low using a median split), DD (ever/never), and frequency of drunkenness (high/low using a median split). Similar classifications and comparisons were made using residence (i.e., living with parents versus living elsewhere).

Comparisons of working versus student status consistently indicated that young adults in this sample who were working were significantly more likely to be involved in at-risk alcohol use. Compared to participants who were students, those who were working were 1.5 times more likely to binge drink (χ^2 (5) = 18.10, $p < 0.003$), 1.3 times more likely to be in the high drunkenness group (χ^2 (5) =13.71, $p < 0.018$), and 1.5 times more likely to be in the high QF group (χ^2 (5) = 17.00, $p < 0.005$). Student versus working status was not associated with alcohol consequences or DD, nor did it appear to moderate the association between education group and alcohol use.

Comparisons of participants who lived with their parents versus those living outside the parental home also showed consistent overall differences. Participants not living at home were 1.7 times more likely to binge drink (χ^2 (5) = 22.80, $p < 0.001$), 1.5 times more likely to be in the high drunkenness group (χ^2 (5) = 19.29, $p < 0.002$), 1.3 times more likely to be in the high QF group (χ^2 (5) = 13.33, $p < 0.0205$), and 1.6 times more likely to drink/drive (χ^2 (5) = 19.61, $p < 0.002$). No effects were found for alcohol consequences. When the combined effects of education group and residence were examined, higher at-risk drinking was uniform across all education levels for binge drinking, and drunkenness. However, the effects of residence on QF resulted in higher QF among participants in the HSE and PSE groups who were living outside the parental home. The effect of residence on DD was entirely attributable to participants in the PSE group who were not living with their families of origin.

DISCUSSION

This study examined six groups of young adults that differed in sex and the amount of education they had completed by their mid-twenties (i.e., average age 24). The groups represented men and women with a high school education or less, those with postsecondary education not including college graduation, and individuals who had at least graduated college. These groups were compared on several measures of at-risk drinking in 12th grade and/or in young adulthood.

The results of these analyses highlight several patterns of at-risk drinking. First, CC men demonstrated the largest increases in at-risk drinking from grade 12 to young adulthood. CC men reported low levels of drunkenness and binge drinking and QF in grade 12, but by young adulthood had increased substantially, so that they had the highest rates of any group (differing from all groups except HSE men in drunkenness, but only differing significantly from CC women in binge drinking). Similar patterns of change in QF were also observed for HSE and PSE men. Not surprisingly, CC men, along with HSE and PSE men, also had the highest AUDIT scores and most frequent drink-driving in young adulthood. These findings support previous research (Gfroerer et al., 1997; Paschall, 2003; Paschall & Flewelling, 2002).

Second, women who did not complete more than a high school education transitioned from having one of the highest levels of at-risk drinking in grade 12, to having one of the lowest in young adulthood. This change resulted from the HSE women showing the least increase in at-risk drinking of any group. In the case of binge drinking, they reported the smallest increase in at-risk drinking, while CC and PSE men and women increased more rapidly. HSE men decreased their binge drinking from 12th grade to young adulthood. For drunkenness and consequences of drinking, the HSE women showed essentially no change, and while their QF increased, it did so more slowly than any other group.

Finally, CC women consistently reported the lowest levels of at-risk drinking of all the groups, though they were not always significantly lower than one or both of the other groups of women. This was especially true in grade 12, where they had the lowest levels of QF, and the least frequent drunkenness and binge drinking and consequences of all groups. In young adulthood CC women continued to have lower QF, binge drinking, and consequences than any of the groups, and also had the lowest AUDIT scores and least frequent DD than any group in young adulthood.

The three patterns of change appeared to be unique to alcohol use and related behaviors, such as drink-driving. Patterns of non-alcohol-specific substance use differed from the patterns of change seen in at-risk drinking. Men and women who completed college had the lowest levels of cigarette use in 12th grade and young adulthood. Similar to alcohol use, levels of cigarette smoking increased from grade 12 to young adulthood for HSE men and women, but not for PSE or CC men and women. Marijuana use increased markedly for CC men and women, but the other groups showed only slight increases (PSE men and women) or remained nearly the same (HSE men and women).

The results also identify four patterns of alcohol-related risk. First, in 12th grade, individuals who would not complete college had the highest levels of at-risk alcohol use behavior for their sex. This is true of men and women, though the levels of alcohol risk behaviors were higher among 12th grade men, and particularly among those men who would not complete any more education beyond high school.

The second consistent pattern of alcohol-related risk relates to women who do not complete more education after high school. These women have higher levels of alcohol-related risk in grade 12, but these levels do not remain the highest. The amount of at-risk drinking by these women typically either increases the least of any group, remains steady or declines. Also,

women who complete college have the lowest alcohol-related risk of any group in 12th grade and in young adulthood. Other research indicates that women who attend college experience an increased level of alcohol consumption while completing their undergraduate degrees. The results of this study suggest that the elevation in alcohol-related risk experienced during college does not last, and has essentially completely abated by the time these women reach their mid-twenties.

The third alcohol-risk pattern is that men who complete college experience a greater increase in their alcohol risk behavior than do the other groups of men and women. In 12th grade they have one of the lowest levels of alcohol risk behavior, but by age 24 they demonstrate a considerable increase in these behaviors. Other studies examining college student samples have documented the elevated alcohol-related risk experienced by college students, particularly men, but this research highlights the sizeable increase in risk and provides important evidence that this risk does not subside following the completion of college for men as it apparently does for women.

Finally, the last pattern of at-risk alcohol use is that men who do not attend college, and especially those who complete only a high school education are at highest alcohol-related risk in high school and typically either maintain the same level of risk or increase it so that they remain either at highest or second highest risk in young adulthood. This elevated level of risk is apparent in binge for PSE men, and in QF, consequences, drink/driving, and the AUDIT scores for PSE and HSE men. This suggests that, of the groups studied, men who do not attend college are at greater alcohol-related risk than their college attending counterparts.

Transition events leading from adolescence to adulthood have been cited in other studies for their association with changes in various health-risk behaviors, including alcohol use. Because this sample included relatively few participants who were college completers and were married or had children, parenthood and marriage could not be examined as moderators of the association between education and changes in alcohol use. However, two other transition events were examined. The transition from living with parents to living in other settings was associated with increased alcohol use, generally, and this effect was especially common in the group that had completed college. Similar results were found for the transition from being a student to working.

These results have implications for intervention into drinking behavior in adolescence and young adulthood. Regarding young adults who complete college, these data demonstrate the need for interventions to reduce/prevent the development of alcohol misuse and dependence during college, especially among men. College drinking has long been a concern for the threat it presents to the physical health and well-being of college students (Engs et al., 1996; Hingson et al., 2003a; Hingson et al., 2003b; Knight et al., 2002; Wechsler et al., 1998; Wechsler et al., 2002). These results suggest that for many college graduates, in particular male graduates, alcohol misuse continues to be a serious concern. Furthermore, though these data could not pinpoint the interval of increased alcohol use in these young men, given compelling findings in college samples it is likely that the patterns of alcohol misuse observed in young adult CC men developed while they were undergraduate students. This strengthens existing concerns about alcohol use by college students, reinforces the need to intervene to prevent the development of alcohol misuse before it begins, and to aggressively push for changes in policy and practice to reform the “party-hearty” image of undergraduate university life.

The results of this research also point to another group that is at high risk of suffering the negative effects of alcohol misuse, specifically, men and women who do not obtain any additional schooling following high school, as well as men who gain some postsecondary education, but do not complete a college degree. The alcohol-related risk experienced by these

individuals has gone predominantly unnoted in recent years, as the attention of researchers, and society as a whole, increasingly focused on the negative alcohol-related incidents and health threats among university undergraduates. Young men who did not complete college, and especially young women who do not continue their education after high school, have the highest levels of alcohol-related risk in 12th grade. While this risk decreases for the women in these groups, it remains high for men. This pattern of alcohol-related risk reinforces the need for early intervention to prevent alcohol misuse in high school, and this need is especially great for students who are not likely to complete college.

While this study provides new information regarding the development of alcohol use from high school to young adulthood, there are several potential limitations that should be considered when interpreting the results. First, the sample was limited to individuals who were unmarried, and had not had children by age 24. The number of CC men and women who were parents or had married was too small to allow the moderating/confounding effects of these transitions to be examined. Rather than risk bias, these groups were eliminated from the sample. Consequently, the results of this paper are not generalizable to 24-year-olds who are parents or have been married. Second, the original sample for this study was school-based, not epidemiologic in nature. Although the large majority of students in the target schools participated, making this sample representative of those schools, their representativeness of other populations is not known. Third, sample attrition may have contributed to bias in the sample for this study. Although evidence of bias is lacking and weights were calculated to account for any bias that might have occurred, it is still a consideration in the interpretation of the results. Finally, although substantial evidence supports the validity of self-reports of substance use, including illicit substances and alcohol, it is likely that some under or over-reporting may have occurred (Babor et al., 2000; Darke et al., 1991; O'Malley et al.,1983).

In conclusion, it is clear that alcohol misuse during the late teenage and early young adult years is not limited to college undergraduates, and the concerns of the scientific and health intervention communities regarding alcohol misuse by individuals in their late teens and early twenties should not be limited to those youth who attend college. Instead the focus on alcohol misuse by young people needs to be broad, recognizing the potential threat of alcohol misuse to all individuals in their late teenage and early young adulthood years. However, if intervention efforts are to be effective, they must also be sensitive to the many characteristics that define social subgroups. Non-collegecompleting young adults represent a highly heterogeneous group of young people. Some never obtain any additional education after high school; others attend trade schools and obtain other non-collegiate postsecondary education. Some begin college but do not obtain a degree, and others enter military service. The heterogeneity of this group challenges the assumption that college non-completers have lower at-risk alcohol use, and suggests that such an assumption is an over-generalization of the recent research. More seriously, the adoption of this assumption potentially ignores the diversity of this group of young people, and differences in risk that may exist among some subgroups. Overall, lower education attainment, and less prestigious occupations are associated with poorer health and a shorter lifespan (Droomers et al., 2004; Droomers et al., 1999). This decrement in the health of individuals with lower compared to higher SES is attributable to many things, including dietary and exercise habits and the added strain that physical labor places on the body (Georgiou et al., 1997); however, the association between poorer health and education/occupation may also be partially attributable to alcohol consumption (Droomers et al., 2004; Droomers et al., 1999).

The heterogeneity of social context and background, as well as attitudes and socialization, among college nonattendees also indicates the considerably greater difficulty in reaching this group of individuals with the alcohol interventions they need. Tailoring intervention messages to the needs, characteristics, attitudes and behaviors of individuals who live in distinct social

contexts is essential if efforts to change alcohol use behavior among late teenage and young adult men and women, college completing or not, are to be effective.

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Fig. 1.
Quantity/frequency of alcohol consumption from the 12th grade to young adulthood.

Fig. 2.
Frequency of drunkenness from 12th grade to young adulthood.

Fig. 3.
Frequency of binge drinking from 12th grade to young adulthood.

Fig. 4.
Consequences of drinking from 12th grade to young adulthood.

Table 1.

Means and *p*-Values Comparing Driver History Data for Telephone Survey Respondents, Refusals, and Non-Contacts [a]

Variables in Response Model	Respondents (*n* = 1528)	Refusals (*n* = 528)	Non- Contacts (*n* = 1383)	*p*-value
Age in years	17.10	17.14	16.97	0.0004
Proportion male	0.47	0.60	0.53	<.0001
Proportion living with single parent	0.20	0.21	0.27	<.0001
Proportion living with step/other parent	0.16	0.15	0.22	<.0001
Alcohol use/misuse[b]	2.75	2.80	2.83	0.3423
Alcohol availability[c]	3.38	3.37	3.33	0.5293
Intent to drink/next two years[d]	2.75	2.71	2.71	0.2535
Intent to drink/age 21[d]	2.83	2.79	2.77	0.1247
Cigarette use[e]	1.40	1.29	1.60	0.0003
Marijuana use[e]	0.58	0.61	0.78	0.0004
School grades[f]	8.28	8.15	8.00	<.0001
Proportion with serious crash	0.28	0.31	0.31	0.6197
Proportion with serious offense	0.41	0.48	0.48	0.0074
Proportion with offense prior to licensure	0.02	0.05	0.06	<.0001

[a] For 3,439 of the 4,230 study subjects, 12th grade questionnaire data were available.

[b] Scale: 1 = no alcohol use, to 4 = alcohol misuse two or more times.

[c] Scale: 1 = very hard to get, to 4 = very easy to get.

[d] Scale: 1 = definitely not, to 4 = definitely will.

[e] Scale: 0 = no use, to 5 = use every day.

[f] Scale: 1 = mostly F's, to 9 = mostly A's.

Table 2.

Means (Standard Errors), Group Differences, and Significance Tests of Repeated Measures Analysis of Variance

		HSE				PSE				CC				
		1 Men *n* = 249		2 Women *n* = 111		3 Men *n* = 421		4 Women *n* = 348		5 Men *n* = 445		6 Women *n* = 485		χ^2values
Q-F of alcohol consumption	12th grade	80.2[4,5,6]	(1.25)	42.7[6]	(1.54)	53.0[4,5,6]	(1.18)	18.7[1,3]	(1.16)	27.6[1,3]	(1.23)	16.4[1,2,3]	(1.22)	Time[1] 109.3***
	Young adulthood	221.6[2,4,5,6]	(1.10)	117.4[1,3,5]	(1.18)	202.5[2,4,6]	(1.08)	112.6[1,3,5,6]	(1.08)	175.5[1,2,4,6]	(1.06)	86.6[1,3,4,5]	(1.06)	Group[2] 49.6*** TXG[3] 11.1
Frequency of drunkenness	12th grade	1.9[4,6]	(1.10)	1.7[6]	(1.12)	1.7[6]	(1.07)	1.5[1]	(1.08)	1.6[6]	(1.07)	1.2[1,2,5]	(1.08)	Time[1] 29.6***
	Young adulthood	2.0[6]	(1.06)	1.7[5]	(1.10)	1.9[5]	(1.05)	1.9[5]	(1.05)	2.3[2,3,4,6]	(1.04)	1.8[1,5]	(1.04)	Group[2] 24.7 TXG3 18.6
Frequency of binge drinking	12th grade	2.3[4,6]	(1.09)	2.0[6]	(1.13)	2.2[4,6]	(1.07)	1.7[1,3,6]	(1.09)	2.0[6]	(1.07)	1.3[1,2,3,4,5]	(1.09)	Time[1] 69.1***
	Young adulthood	2.9[2,4,6]	(1.05)	2.3[1]	(1.10)	2.6[6]	(1.04)	2.5[1]	(1.05)	2.8[6]	(1.04)	2.2[1,3,5]	(1.04)	Group[2] 38.3*** TXG[3] 17.5
Consequence of drinking	12th grade	1.1[4,6]	(1.07)	0.9	(1.08)	1.0[4,6]	(1.04)	0.9[1,3]	(1.04)	1.0	(1.05)	0.9[1,3]	(1.04)	Time[1] 5.10*
	Young adulthood	1.1[6]	(1.04)	1.0	(1.05)	1.0[6]	(1.03)	1.0	(1.03)	1.0	(1.02)	1.0[1,3]	(1.02)	Group[2] 21.07*** TXG[3] 3.7
Frequency of smoking	12th grade	2.3[3,5,6]	(1.10)	2.5[3,5,6]	(1.13)	1.3[1,2,4,5,6]	(1.10)	2.1[3,5,6]	(1.08)	0.8[1,2,3,4]	(1.12)	0.8[1,2,3,4]	(1.11)	Time[1] 2.5
	Young adulthood	3.0[3,4,5,6]	(1.06)	3.2[3,4,5,6]	(1.08)	1.5[1,2,4,5,6]	(1.08)	2.1[1,2,3,5,6]	(1.07)	0.7[1,2,3,4]	(1.13)	0.7[1,2,3,4]	(1.12)	Group[2] 186.5*** TXG[3] 14.1
Frequency of marijuana use	12th grade	1.9[3,4,5,6]	(1.10)	1.7[5,6]	(1.12)	1.7[1,5,6]	(1.07)	1.5[1,5,6]	(1.08)	1.6[1,2,3,4]	(1.07)	1.2[1,2,3,4]	(1.08)	Time[1] 3.5
	Young adulthood	2.0[4,5,6]	(1.06)	1.7[6]	(1.10)	2.0[5,6]	(1.05)	1.9[1,3,6]	(1.05)	2.3	(1.04)	1.8[1,2,3,4,5]	(1.04)	Group[2] 72.7*** TXG[3] 12.6

Groups that differ significantly are indicated by superscripts above the means.

*$p < 0.05$

** $p \leq 0.01$

*** $p \leq 0.001$.

1, Main effect of time

2, Mean Effect of Group

3, Interaction of Time Group.

Table 3.

Results of the Analysis of Variance on Drink/Driving and the AUDIT in Young Adulthood: Means (Standard Error)

	HSE				PSE				CC				
	1 Men (*n* = 108)		**2 Women (*n* = 85)**		**3 Men (*n* = 226)**		**4 Women (*n* = 206)**		**5 Men (*n* = 256)**		**6 Women (*n* = 276)**		***F*-values**
Frequency of drinking/ driving	$1.66^{2,3,4,6}$	(1.03)	$1.23^{1,3,5,6}$	(1.06)	$1.86^{1,2,4,5,6}$	(1.02)	$1.13^{1,3,5,6}$	(1.03)	$1.59^{2,3,4,6}$	(1.03)	$0.78^{1,2,3,4,5}$	(1.04)	566.77^{***}
AUDIT score	$5.61^{2,3,4,5,6}$	(1.02)	$3.65^{1,3,5,6}$	(1.03)	$5.10^{1,2,4,6}$	(1.01)	$3.92^{1,3,5,6}$	(1.02)	$5.12^{1,2,4,6}$	(1.01)	$3.24^{1,2,3,4,5}$	(1.02)	847.52^{***}

Groups that differ significantly are indicated by superscripts above the means.

† the weighted mean

‡ the weighted standard error

* $p < 0.05$

** $p \leq 0.01$

*** $p \leq 0.001$.